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# SPECIFICATIONS

## Interdisciplinary Science Building- Issue for Bid Building No. 734

Contract No. 160068  
Project/Specification No. 11733

Volume 1 – Divisions 0 – 14

April 9, 2010

ESH&Q Risk Level (A3-Minor)







He & Ni 4/9/2010



# Brookhaven National Laboratory

## Interdisciplinary Science Building – (ISB)

### Issue for Bid Technical Specifications

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April 9, 2010



HDR Architecture / Engineering, Inc.



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**HDR**

**D I V I S I O N    0 0**

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**PROCUREMENT AND CONTRACTING  
REQUIREMENTS**

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Y-103B.1 SPECIAL SYSTEMS PENTHOUSE – AREA B – ALT  
Y-601.1 FIRE ALARM SYSTEM ON-LINE DIAGRAM – ALT  
Y-701.1 ACCESS CONTROL SYSTEM DOOR SCHEDULE – ALT

**END OF SECTION**



**SECTION 00 72 10**  
**GENERAL CONDITIONS**

**PART 1 - GENERAL**

**1.1 GENERAL CONDITIONS**

- A. Where any article, paragraph or subparagraph in said documents is supplemented by one of the following paragraphs, the provisions of such article, paragraph or subparagraph shall remain in effect and the supplemental provisions shall be considered as added thereto.
- B. Where any article, paragraph, or subparagraph in said documents is amended, voided or superseded by any of the following paragraphs, the provisions of such article, paragraph or subparagraph not so amended, voided, or superseded shall remain in effect.

**1.2 EXECUTION AND CORRELATION**

- A. All work mentioned or indicated in the Contract Documents shall be performed by the Contractor as part of this Contract unless it is specifically indicated in the Contract Documents that such work is to be done by others.
- B. Should the Drawings or the Specifications disagree in themselves, with regard to quality or quantity, the Contractor shall provide the better quality or greater quantity of work and/or materials unless otherwise directed by written modifications to the Contract in accordance with applicable provisions of these Conditions.
- C. The Contractor, and all Subcontractors, shall refer to all of the Drawings, including those showing primarily the work of the mechanical, electrical and other specialized trades, and to all of the Sections of the Specifications, and shall perform all work reasonably inferable therefrom as being necessary to produce the indicated results.
- D. All indications or notations which apply to one of a number of similar situations, materials or processes shall be deemed to apply to all such situations, materials, or processes wherever they appear in the Work, except where a contrary result is clearly indicated by the Contract Documents.

**1.3 DEFINITIONS**

- A. As used in these Specifications, the following have the meaning shown opposite each:
  - 1. BSA Brookhaven Science Associates, operator of Brookhaven National Laboratory, and its authorized representatives of various Divisions and Departments.
  - 2. F&O BNL's Facilities & Operations Directorate.
  - 3. MPO BNL's Modernization Project Office and its authorized representative.
  - 4. BNL Site Land occupied by Brookhaven National Laboratory, in Brookhaven Township, Suffolk County, New York.
  - 5. Site Immediate area of BNL Site assigned to Contractor for performance of work.
  - 6. Work or Project Includes but is not limited to all labor, materials, tools, and equipment required and reasonably inferred by Contract to complete all construction.
  - 7. Contractor Person or entity identified in Lump Sum Contract and responsible for completion of all work.

8. Subcontractor Person or entity directly contracting with Contractor including one who furnishes material worked to a special design according to Drawings and Specifications, but not including one who merely furnishes materials not so worked.
- B. Wherever the terms “shown on drawings” are used in the Specifications, they shall mean “noted”, “indicated”, “scheduled”, “detailed”, or any other diagrammatic or written reference made on the drawings.
- C. Wherever the terms “Provide” or “Provided” are used in these Specifications, they shall mean “FURNISH AND INSTALL”. The term “Furnish” shall mean “to fit out and/or supply” material required for project use. The term “INSTALL” shall mean “set”, “connect”, “erect”, “apply” or to “otherwise fix into position for use”.
- D. Wherever the terms “material” or “materials” are used in the Specifications, they shall mean any “product”, “equipment”, “device”, “assembly” or “item” required under the contract, as indicated by trade or brand name, manufacturers' name, standard specification reference or other description.
- E. The terms “approved” or “approval” shall mean the written approval of MPO.
- F. The terms “directed”, “required”, “permitted”, “ordered”, “designated”, “prescribed” and similar words shall mean the direction, requirement, permission, order, designation or prescription of MPO; the terms “approved”, “acceptable”, “satisfactory” and similar words shall mean approved by, acceptable or satisfactory to MPO; and the terms “necessary”, “reasonable”, “proper”, “correct” and similar words shall mean necessary, reasonable, proper, or correct, in the judgement of MPO and/or BNL.
- G. “Piping” includes in addition to pipe or tubing, all fittings, flanges, unions, valves, strainers, drains, hangers and other accessories relative to such piping.
- H. “Concealed” means hidden from sight in chases, furred spaces, shafts, hung ceiling, embedded in construction or in crawl spaces.
- I. “Exposed” means not installed underground or “concealed” as defined above.
- J. “Invert Elevations” means the inside bottom of pipe.
- K. “New” shall mean manufactured within the past twenty-four (24) months and never before used.

#### **1.4 REVIEW AND INTENT OF CONTRACT DOCUMENTS**

- A. The Contractor shall, prior to starting the work on any single portion and at frequent intervals during the progress of the work, carefully study and compare the General Documents, General Conditions, Drawings, Specifications, Addenda and other Contract Documents and shall at once report to MPO any error, inconsistency or omission he may discover.
- B. Should Contractor proceed with the work, without such notice to MPO, having discovered such errors, inconsistencies or omissions, all costs arising therefrom shall be borne by the Contractor.

#### **1.5 SPECIFICATIONS AND STANDARDS**

- A. Applicable codes and standards for material furnished and work installed shall include all state laws, local ordinances, requirements of governmental agencies having jurisdiction, and applicable requirements of the latest editions of the following codes and standards including but not limited to:

|          |   |
|----------|---|
| ADA      | Americans with Disabilities Act   |
| BNL ES&H | BNL Standards-Based Management System; ES&H Standards   |
| BNL RCM  | BNL Radiation Control Manual  |
| NYSDOT   | New York State Department of Transportation, Office of Engineering, Standard Specification, Construction and Materials. |

|         |   |
|---------|---|
| NEC     | National Electrical Code  |
| OSHA    | Occupational Safety & Health Administration                     |
| EPA     | Environmental Protection Agency                                 |
| CFR     | Code of Federal Regulations                                     |
| FED-STD | Federal Standard  |
| FS      | Federal Specification   |
| ASSE    | American Society of Sanitary Engineers                          |
| NFPA    | National Fire Protection Association NFPA-101.                  |
| NYSBC   | Building Code of New York State                                 |
| NYCRR   | New York State Codes, Rules and Regulations                     |
| UL      | Underwriter's Laboratories                                      |
| NEMA    | National Electric Manufacturers Association                     |
| ASHRAE  | American Society of Heating, Refrigeration and Air Conditioning |
| ASME    | American Society of Mechanical Engineers                        |
| ANSI    | American National Standards Institute                           |
| ASA     | American Standards Association                                  |
| AWWA    | American Water Works Association                                |
| NBS     | National Bureau of Standards                                    |
| FM      | Factory Mutual  |
| SCDH    | Suffolk County Department of Health                             |
| ASTM    | American Society for Testing and Materials                      |

- B. In case of conflict, MOST STRINGENT codes will govern.
- C. Where specific performance requirements are listed herein, it is the intent of this Specification that all manufacturers, fabricators, suppliers, installers, contractors, subcontractors, specialty and sub-subcontractors will provide services satisfying these requirements whether mentioned by trade or manufacturer's name or submitted for approval as a substitute.
- D. Where no explicit quality or standards for materials or workmanship are established for work, such work shall be of such quality consistent with industry standards and of the construction quality established for the Project generally. Conform to specified manufacturer's published specifications and installation instructions unless otherwise specified or indicated.
- E. Meet requirements of BNL Standards-Based Management System; ES&H Standards and other applicable SBMS standards, and all other codes and standards specified. In cases of conflict, the standard providing the greater protection shall govern.
- F. BNL is an ISO 14001 certified laboratory. It shall be the duty and the responsibility of the Contractor and his subs to comply with the BNL standards and procedures in the area of environmental control, hazardous waste generation, spill prevention, and all other standards specified herein.
- G. Volatile Organic Compounds (VOC's) and their emissions are controlled under the New York Codes, Rules and Regulations of the State of New York. Architectural surface coatings must comply with 6NYCRR Part 205 and 228:
  - 1. For the purpose of the BNL location, Nassau, Suffolk, Westchester and Rockland Counties fall under the compliance rules of the New York City metropolitan area.
  - 2. All coatings and coated products to be used in the work, shall comply with the appropriate rules and regulations.
- H. Federal agencies, to the extent practicable, are required to amend procurement practices so as to minimize the purchase of products manufactured with ozone depleting substances. The Contractor shall, therefore, provide materials that use low or non-ozone depleting substances during their manufacture and/or installation. Materials that do not comply shall be identified in the contractor's submittal for approval.

- I. Federal agencies, to the maximum extent possible, are required to use recovered materials in construction products and manufactured materials. Specific products using recovered materials are covered within the applicable Specification sections.
- J. This Project is designed to be a high-performance, sustainable facility to receive LEED certification, the criteria will be designated in a separate Specification Section 01 35 36.

## **1.6 DRAWINGS**

- A. Drawings are generally done to scale as noted. Contractor shall not, however, scale the drawings for establishing dimensions and/or layout. Scaling of drawings by Contractor shall be at Contractor's own risk. Dimensions indicated on the documents shall be used. Request clarification if discrepancies noted.
- B. Drawings of existing buildings and building site are available for reference at MPO office.
- C. The Contractor shall not perform any portion of the Work at any time without Contract Documents or, where required, approved Shop Drawings, Product Data or Samples.
- D. Should the Contractor elect to release work for purchase, fabrication or installation without these submittal approvals, it shall be at his own risk and expense should the work be subsequently disapproved.
- E. The Contractor shall give MPO timely notice of any additional design drawings, specifications, or instructions required to define the Work in greater detail, or to permit the proper progress of the Work and MPO will provide such information with reasonable promptness so as to cause no delay in the Work.
- F. Whenever the Contractor proposes a substitution for a specified item of the work, MPO may require said Contractor to produce reasonable evidence that a material meets such requirements, such as certified reports of past tests by qualified testing laboratories, reports of studies by qualified experts, or other evidence which, in the opinion of MPO, would lead to a reasonable certainty that any material used, or proposed to be used, in the Work meets the requirements of the Contract Documents. All such data shall be furnished at said Contractor's expense. Coordinate with Section 01 25 13 "Product Substitutions".
- G. The Contract Documents are intended to produce a facility of consistent character and quality of design. All components of the project including visible items of mechanical and electrical equipment have been selected to have a coordinated design in relation to the overall appearance of the project. MPO shall judge the design and appearance of proposed substitutes on the basis of their suitability in relation to the overall design of the project.

## **1.7 BIOPREFERRED PROGRAM**

- A. Clause FAR 52.223.2 – Affirmative Procurement of Biobased Products Under Service and Construction Contracts applies to the work performed under this Contract. In the performance of this Contract, the Contractor shall make maximum use of biobased products that are United States Department of Agriculture (USDA)-designated items. These items can be found on the USDA Web site <http://www.biopREFERRED.gov/DesignationItemList.aspx>.

## **1.8 WORK PERMITS**

- A. The work of this Contract is controlled by the requirements of BNL Standards-Based Management System; "Work Planning and Control for Experiments and Operations," latest edition.
- B. A Work Permit covering all aspects of the project will be prepared and signed by MPO and the Contractor. Additional Work Permits may be prepared for specific high hazard activities. The permits shall be posted or on hand at the project site.

## **1.9 NOTICE TO PROCEED**

- A. The Contractor shall not knowingly, without a formal Notice to Proceed letter from MPO, prematurely commence operations on the BNL Site. The Notice to Proceed will not be issued by MPO prior to receipt, by Procurement and Property Management, of all required bonds and insurance documents, and prior to receipt, and acceptance by BNL, of the required Health and Safety Plan.
- B. A BNL Integrated Safety Management (ISM) Flowdown letter template will be transmitted with the Notice to Proceed. This letter template shall be completed by every Subcontractor to be used on this Project to acknowledge their responsibility for safety, and returned to MPO, by the Contractor.
- C. Work may proceed, prior to receipt of Notice to Proceed, however, in the preparation and submittal of required submissions and the ordering of materials and equipment that do not require prior approval by MPO.

## **1.10 USE OF SITE**

- A. The right of possession of the premises and the improvements made thereon by the Contractor shall remain at all times with BNL. The Contractor's right to entry and use thereof arises solely from the permission granted by BNL under the Contract Documents.
- B. The Contractor shall confine the use of the premises for all purposes, to the areas occupied by the construction and related storage areas as and if shown.
- C. The Contractor shall repair or replace any existing trees, shrubbery or other planting damaged by operations and/or workmen employed in performance of the contract.
- D. It shall be the responsibility of the Contractor to provide necessary and required security measures to safeguard the construction site and materials, both stored and installed, from theft, vandalism and intrusion of unauthorized persons during all working hours, non-working hours, weekends and holidays.

## **1.11 WORK HOURS**

- A. The Contractor shall perform all work on weekdays, excluding BNL holidays, between 8:00 a.m. and 5:00 p.m., unless otherwise specified or approved. The BNL holiday list is available upon request.
- B. Notify MPO 24 hours in advance to request approval to work outside of the above working hours. Advise MPO of all planned activities and submit a list of all contractor and subcontractor employees who are expected on-site during the off-hour period. All employees working during off-hours must possess a valid BNL contractor employee photo identification badge.
- C. If off-hours work request is approved, MPO will notify BNL Police Headquarters and the Main Gate of the days and hours that work is planned. Failure to notify MPO will be cause for BNL Police to deny access to the job-site.

## **1.12 CONTRACTOR TRAINING REQUIREMENTS**

- A. All Contractor and Subcontractor employees are required to attend BNL's Contractor/Vendor Orientation Training on their first day on-site.
- B. Contractor/Vendor Orientation Training is a one and one-half (1-1/2) hour overview of BNL and OSHA safety requirements. The orientation is offered 8:30 a.m. weekdays in Building 938. Upon completion of the orientation, a card will be issued that must be signed by Construction Inspection, Bldg. 650T. The Contractors' employee (U.S. citizens as well as foreign nationals) information must then be entered in the BNL Guest Information System (GIS). To facilitate this process, the following personnel are trained to enter data in GIS: Donna Pfeiffer in Building 185, and Claudia Hatton, Cindy Klemm and Denise Bingham-Miesell in Building 134C. The employee must then return to the Badging Office, Bldg. 400, to obtain the employee

identification badge. This safety orientation will be valid for a period of one year. Satisfactory completion will be indicated by issue of employee identification badge.

- C. Contractor and Subcontractor employees who have not attended the Safety Orientation will be directed to stop work until they have done so.
- D. All Contractor and Subcontractor employees who may be required to “Work On or Near” electrical circuits within the BNL electrical distribution system are required to complete BNL’s Electrical Safety I training course. This course is available on the Web at <http://training.bnl.gov/electsaf1> , and is valid training for one (1) year.
- E. In addition to completing the course, each organization’s electrical work Foreman/Supervisors must discuss NFPA 70E requirements and specific hazard and risk information with their staff. This job briefing should discuss specific electrical work procedures, protective equipment requirements and departmental contacts at the local application level. BNL can provide a document that can be used as guidance for this discussion. This job level discussion can be informal but a record of this briefing shall be documented.
- F. Contractor shall provide a list of workers that he authorizes to “Work On or Near” and perform Lock-Out/Tag-Out (LOTO) (See Section 00 73 10, “Supplementary Conditions”). Contractor and Subcontractor employees who may be required to “Work On or Near” electrical circuits and who have not completed the Web-based BNL Electrical Safety 1 training and NFPA 70E briefing will not be allowed to perform such work until they have done so.
- G. All Contractor and Subcontractor employees who may be required to “Work On or Near” electrical circuits must complete an approved NFPA 70E training seminar. Contractor can provide equivalent “in house” NFPA 70E training to his/her employees in lieu of taking “outside” training from an authorized company. Contractor’s program shall follow the guidelines of NFPA 70E and thoroughly demonstrate that all employees have been properly trained in all facets associated with NFPA 70E. If the Contractor decides to provide his/her own NFPA 70E training, Contractor’s program shall be submitted to BNL for approval. All Contractor and Subcontractor employees that “Work On or Near” electrical circuits shall have taken and passed a CPR training program that has been approved by BNL.

### **1.13 PRE-CONSTRUCTION MEETING**

- A. MPO will set up a Pre-Construction Meeting, at which time the ES&H issues, Safety Awareness issues, Submittal procedures, and Site Organization procedures will be addressed. The Contractor’s Superintendants, Supervisors and Foreman are required to attend the Pre-Construction Meeting.

### **1.14 CONSTRUCTION SCHEDULE AND NOTIFICATION**

- A. Within three (3) weeks after signed Contract, submit, directly to MPO, a detailed work schedule showing the work being completed by the Contract completion date. Coordinate with Section 01 30 00 “Submittal Procedures” and Section 01 31 00 “Construction Progress Documentation”.
- B. MPO must be notified and made aware of all construction work in progress. MPO will provide appropriate telephone extension numbers for notifications.
- C. When construction has not been previously scheduled, notify MPO Construction Inspector each day before 8:30 a.m. of planned activities.
- D. Special scheduling, when appropriate, will be agreed upon at a meeting, set up by MPO, to prepare a rough work schedule. The Contractor shall respond, within one (1) week, with a formal work schedule.
- E. When work falls behind schedule due to Contractor’s fault or negligence, increase all labor and overtime to assure completion within schedule.
- F. Do not utilize men or materials which would cause work stoppage on BNL Site:

1. Radiation Generating Devices are of special concern. The following industrial equipment, known to contain radiological sources or able to generate radiation, if brought to the BNL Site, require the Contractor to notify the Project Manager, in advance, and require a Radiological Work Permit to be approved prior to their use on site. RWPs require Health Physics review:
  - a. Radiography Equipment.
  - b. Moisture Density Gauges.
  - c. Soil Density Gauges.
  - d. X-Ray Equipment.
- G. BNL's presence is required during all off hour work. For off hour work not specified, the Contract will be backcharged on an hourly rate based on BNL's published "Standard Rates Distributed Technical Services" schedule of direct expense recovery rate for engineering construction services. The rate schedule is available through MPO. This backcharge includes off hour work directed by BNL due to the Contractor's failure to meet schedule completion dates.
- H. BNL will utilize all available contractual remedies to enforce schedule compliance. Should the Contractor encounter delays caused by BNL, it is the Contractor's responsibility to promptly notify the BSA Contractual Representative and to request an extension to the contract completion date.

#### **1.15 SUBCONTRACTOR APPROVAL**

- A. BNL reserves the right to approve or disapprove Subcontractors. No later than two (2) weeks after signed Contract, submit directly to MPO, a complete list of proposed Subcontractors for approval. Coordinate with Section 01 30 00 "Submittal Procedures".

#### **1.16 COORDINATION**

- A. Arrange and coordinate work, be responsible for acts and omissions of all parties involved in the work, be responsible for satisfactory performance of all work, ensure that each trade is fully informed of full extent of work required. Work of a trade is not necessarily limited to the Drawing or Specification page describing the work to be done by that trade.
- B. Coordinate installation of all equipment and shop fabricated material, including that supplied by BNL. BNL assumes no responsibility for contractual relations between Contractor and other parties.
- C. Coordinate and schedule all work with all BNL activities and operations through MPO.

#### **1.17 TRANSPORT AND TRAFFIC**

- A. Schedule, confine, and perform work, as directed, so as not to interfere with BNL traffic on existing roads, walks, parking and other paved areas. Park all vehicles in designated parking areas. Load and unload vehicles where directed. Comply with all BNL traffic regulations. Violations will be backcharged from the Contract amount.
- B. In transporting materials and equipment, use designated roads and railroad on BNL Site. Obtain information concerning these facilities from MPO. When necessary to maintain work schedule, ship all materials, including Subcontractors' items, from point of origin to BNL Site by direct means equal to, or better than, express service.
- C. Obtain property pass through MPO for removal of Contractor's materials and equipment from BNL Site. Schedule removals during specified work hours.

### **1.18 OPEN FLAME OPERATIONS**

- A. It shall be the duty and responsibility of the Contractor performing any cutting or welding to comply with the provisions of BNL Standards-Based Management System; ES&H Standards, and the National Fire Protection Association's National Fire Codes pertaining to such work. The Contractor shall read and be familiar with the provisions of these standards and codes. The Contractor shall be responsible for all damages resulting from failure to so comply.
- B. Notify MPO forty-eight (48) hours in advance of cutting, welding, or similar open flame operations.
- C. Provide any required fire watch and take all required precautions where directed.
- D. MPO will make arrangements for a Cutting/Welding Permit. No open flame operations shall proceed prior to the issuance of the written Cutting/Welding Permit nor shall work continue after expiration date of permit.

### **1.19 PROTECTION OF PROPERTY**

- A. Contractor shall be responsible for the security of property within the Work Site.
- B. Protect, with whatever means and methods required, all new and existing property from damage by and as a result of work in this Contract as approved, including disappearance.
- C. Repair, refinish, replace and otherwise correct all damage, and replace any missing materials, as directed and approved by MPO.

### **1.20 SERVICE AND SYSTEM INTERRUPTIONS**

- A. Do not interrupt service until directed. Notify MPO two (2) weeks in advance of all proposed service interruptions unless otherwise specified or directed.
- B. Keep all interruptions to a minimum. Complete all possible prior work and prefabrication, and have all labor and materials on Site, as approved, prior to interruption.
- C. Do not modify, disconnect and, in any way, impair fire protection and detection systems without approval.
- D. Notify MPO forty-eight (48) hours in advance of all work on fire protection systems.

### **1.21 CUTTING, PATCHING, AND PENETRATIONS**

- A. Cut, drill, alter, remove, and replace all existing construction as required for performance of work. Patch and finish all changed and damaged work to match existing construction as approved.
- B. Seal all penetrations through fire rated systems with an approved fire and/or smoke stop material, Hilti North American Fire Stopping Systems, or equal as approved by MPO, capable of maintaining the level of fire protection of the wall, partition, floor or ceiling penetrated:
  - 1. Systems selected shall be appropriate for the joint and/or penetration involved, such as floor to floor, wall to wall, floor to wall, head of wall, and whether there is movement or no movement capability.

### **1.22 JOB MEETINGS**

- A. Job meetings will be held at the job site at least monthly unless otherwise designated by MPO.
- B. The Contractor and his field superintendent, and the subcontractors or vendors whose presence is necessary, shall attend job meetings.
- C. Decisions, instructions and interpretations agreed upon at such meetings will be recorded in a "Memorandum of Meeting" prepared by MPO and furnished to the Contractor and each attendee for necessary action.

### **1.23 SALVAGE**

- A. Salvage is that material and equipment, as defined in the Specifications, to be removed by the Contractor from the Project facility, but is to remain the property of BNL.
- B. Remove all specified salvageable material and equipment and pass it through the vehicle radiation monitor. Place, where directed by, and turn over to, MPO, on the BNL Site.
- C. Remove all non-salvageable material and equipment and legally dispose of same off the BNL Site.
- D. All removed salvageable material and equipment, as defined in the Specifications, shall remain property of BNL.
- E. All removed non-salvageable materials and equipment shall pass through the vehicle radiation monitor prior to exiting the BNL site.

### **1.24 CONSTRUCTION WASTE MANAGEMENT**

- A. Waste and demolition materials shall be segregated into disposal categories:
  - 1. Hazardous waste is any refuse, solid or liquid, that is a by-product of processes/activities that can pose a hazard to health or environment that must be managed for its hazardous nature (usually listed by EPA).
  - 2. Non-hazardous waste is any refuse, other than construction debris, that is considered industrial or special in nature (oil, anti-freeze, etc.). The BNL Standards-Based Management System (SBMS) contains the full descriptions.
  - 3. Universal waste is any battery containing hazardous constituents such as mercury/lithium/lead/nickel cadmium, certain pesticides, as well as mercury-containing thermostats and fluorescent lamps and tubes.
  - 4. Construction rubbish and debris is any refuse as a result of the normal construction or earth clearing activity such as packing and shipping materials, discarded lumber and wood materials, metals, insulation, gypboard, piping, electrical scrap, tree branches, roots, and sweepings.
- B. Hazardous , universal, and non-hazardous waste shall be disposed of by the Contractor. The waste shall be disposed of at an approved off-site facility coordinated by the MPO Waste Management Representative.
- C. Construction rubbish and debris shall be disposed per Section 01 74 19.

## **PART 2 - PRODUCTS – NOT USED**

## **PART 3 - EXECUTION – NOT USED**

### **END OF SECTION**



**SECTION 00 73 10**  
**SUPPLEMENTARY CONDITIONS**

**PART 1 - GENERAL**

**1.1 PROJECT COMPLETION**

- A. This project is one where the contract completion date shall be adhered to. Failure to be “substantially complete” by the completion date established in the signed contract will be considered by BNL as being non-responsive and could lead to the barring of the Contractor from bidding future projects at BNL for a period of one (1) year.
- B. Substantial Completion is the stage in the progress of the Work when the Work or a designated portion thereof is sufficiently complete, as determined by MPO in accordance with the Contract Documents, so as to be able to be occupied or utilized for its intended use.

**1.2 SAFETY REQUIREMENTS**

- A. All Contractor and Subcontractor employees are required to attend BNL’s Contractor/Vendor Orientation Training.
- B. All Contractor and Subcontractor employees who work on or near energized parts as defined in NFPA 70E shall complete the Electrical Safety 1 Training Course. The course is available on the Web at <http://training.bnl.gov/course/elecsaf1>, and is valid for one (1) year. In addition to completing this course, each organization’s Electrical Work Supervisor must discuss the “Standard for Electrical Safety in the Workplace” (NFPA 70E) requirements and specific electrical hazard(s) and risk information with their staff. This job briefing should discuss specific electrical work procedures, protective equipment requirements, and departmental contacts at the local application level. This job level discussion can be informal; however, a record of this briefing shall be documented. All Contractor and Subcontractor employees that “Work On or Near” electrical circuits shall have taken and passed a CPR training program that has been approved by BNL.
- C. MPO will arrange and ESH&Q Division will provide additional safety instructions, as required. All personnel shall conform to special requirements for wearing TLD’s, personal protective equipment, protective clothing, respirators, and other safety measures as required. TLD’s, only, will be provided by BNL at no charge, unless otherwise specified.

**1.3 INDUSTRIAL HYGIENE MONITORING**

- A. All work on this Project with regard to, and of, the conditions listed must be done within the occupational exposure limits for Industrial Hygiene hazards set in OSHA 29CFR1926, 29CFR1910, and ACGIH Threshold Limit Values®. Compliance with the OSHA Permissible Exposure Limits and American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Values® shall be determined by representative personnel exposure monitoring and dosimetry conducted by the Contractor and his Industrial Hygienist. Monitoring shall be continuously performed during the total duration of the hazardous condition. The details of the project’s exposure monitoring equipment, methods, and monitoring strategy shall be included in the Contractor’s Environmental, Health and Safety Plan. Conditions that require industrial hygiene monitoring include, but are not limited to:
  - 1. Asbestos.
  - 2. Beryllium.
  - 3. Working with Chemicals, Adhesives, or Lead.
  - 4. Release of Silica (grinding, drilling, core boring, jackhammering of concrete, masonry, mortar, etc.).
  - 5. Confined Spaces.

6. Heat Stress.
  7. Carcinogens.
  8. Noise and Hearing Conditions.
  9. RF/Microwave/Non-Ionizing Radiation.
  10. Static Magnetic Fields.
- B. The Contractor is required to provide qualified monitoring and hazard assessment personnel (per DOE G440.1-3 Occupational Exposure Assessment) to conduct all Industrial Hygiene monitoring.
- C. The Contractor is required to conduct monitoring with calibrated equipment using NIOSH or OSHA approved methods, and to have analysis conducted by an American Industrial Hygiene Association (AIHA) Proficiency Analytical Testing certified laboratory or by National Institute of Standards and Technology (NIST) traceable calibrated direct reading instrumentation. All instrumentation used for surveys shall have been calibrated in compliance with the manufacturer's specification prior to use in the field.
- D. Copies of all equipment calibration, field sampling sheets, laboratory analysis reports, and hazard assessment evaluation reports are to be provided to MPO.

#### **1.4 WELDING INSPECTIONS**

- A. Radiographic examination of welds shall not be performed by the Contractor.
- B. BNL reserves the right to perform radiographic (x-ray) welding inspections on any welds performed by the Contractor under this contract that appear, after visual inspection, not to comply with the Specifications.

#### **1.5 WILDFIRE DANGER**

- A. This work will be performed in a wildland area of BNL, where brush fires are a real concern. The Contractor shall ensure that the conduct of operations minimizes the potential of the occurrence of wildland fires.
- B. Preventing the parking of vehicles on grassy areas with engines running, and control of disposal of smoking materials, is the responsibility of the Contractor's Safety Representative.
- C. Ensure gasoline-engine-driven portable generators and air compressors are equipped with spark arresters and that personnel are aware of fire break names if calls to the Fire Department [Ext. 2222 or (631) 344-2222] become necessary.

#### **1.6 SCHEDULE OF VALUES**

- A. Successful Offeror shall submit no later than 3 weeks after contract signing the following Schedule of Values breakdown:
1. Breakdown to be constructed by CSI Division.
  2. Under General Requirements, at a minimum, separate construction safety related costs from general and special conditions as indicated below:
    - a. General and Special Conditions.
    - b. Insurance and Contractor Controlled Insurance Program (CCIP) program.
    - c. Bond.
    - d. Occupational Medicine Program.
    - e. Construction Safety.

#### **1.7 LEED CERTIFICATION**

- A. This project is to be LEED certified. Refer to Section 01 35 36 LEED REQUIREMENTS and Section 01 30 00 SUBMITTAL PROCEDURES for type, required submittals, credits, options and other guidance that will support certification of this project.

## **1.8 SERVICE INTERRUPTIONS**

- A. Notify MPO two (2) weeks in advance of all proposed service interruption unless otherwise specified or directed.
- B. All materials, prefabricated where directed, and labor must be on Site before a shutdown will be permitted.
- C. Increase labor force, use overtime or both, as directed, to insure completion of work in specified time. Include all overtime costs required to complete installation.
- D. Work requiring a power shutdown, must be completely installed, tested, and ready for use in a period not to exceed time specified by MPO.

## **1.9 SURVEYS AND STAKEOUT**

- A. MPO will establish base lines and bench marks at the site of the work from which the Contractor shall complete the layout of the work to be performed under the Contract. From the basic data established by MPO, the Contractor shall establish reference control points and complete the layout of the work.
- B. In addition, MPO will mark and/or stake out all known underground utility locations. Locations are approximate. Contractor shall be responsible to maintain the markings and/or the stakeouts for as long as they are required. Any excavating near these locations shall be by hand to locate utilities exactly.
- C. The Contractor shall be responsible for all measurements that may be required for execution of the work to the exact position and elevation as prescribed in the specifications, shown on the drawings, or as the same may be modified at the direction of MPO to meet changed conditions or as result of modification to the Contract.
- D. Further, the Contractor shall be responsible for the establishment of points, wall and partition lines required by the Subcontractors in laying out their work.
- E. The Contractor shall furnish such stakes and other required equipment, tools and materials, and all labor as may be required in laying out any part of the work from the base lines and bench marks established by MPO.
- F. If, for any reason, bench marks and/or utility location markings, monuments are disturbed, it shall be the responsibility of the Contractor to re-establish them, without cost to BNL, as directed by MPO. MPO may require that construction work be suspended at any time when location and limit marks established by the Contractor are not reasonably adequate to permit checking completed work or the work in progress.
- G. MPO will back charge the Contractor for any re-establishment of stakeouts performed by BNL that were disturbed by the Contractor.

## **1.10 CONSTRUCTION SAFETY**

- A. The Contractor is solely responsible for Construction Safety for the duration of this Contract. Prepare and submit a Construction Health and Safety Plan within two (2) weeks of the Contract signing and before the commencement of any work on site. A Safety Plan Outline with an Occupational Medicine Program example is available from MPO and copies will be handed out at the Pre-Bid meeting. This plan will be reviewed and accepted by BNL and shall include the following:

1. Specific assignment of an individual, employed by the Contractor and named in the Plan, as well as one (1) alternate, as Safety Representative, who will be responsible for job site construction safety. The Safety Representative must demonstrate, with verification of completion of the “30-Hour OSHA Compliance for the Construction Industry” construction safety courses, familiarity with 29 CFR 1926, and the ability of the Safety Representatives to supervise the type of work for which they will be responsible. Sources for training can be obtained from MPO. A Safety Representative shall be on the Project Site whenever construction activities are being performed.
2. A letter or certificate of compliance indicating that the Contractor is aware of, and has reviewed, and will comply with the safety regulations of both the OSHA Standards (29 CFR 1926/1910) and BNL Standards-Based Management System; Standard for Electrical Safety in the Workplace (NFPA 70E) and 10 CFR 851, ES&H Standards (available for reference at MPO).
3. A descriptive outline of the Contractor’s safety program indicating:
  - a. Provisions for emergency aid.
  - b. Specific Identification of “Competent Person” for each activity requiring a competent person in accordance with OSHA 29 CFR 1926, his/her qualifications including relevant length of experience and training, including, but not limited to, Construction Safety Awareness Courses taken applicable to the nature of this project.
  - c. A comprehensive occupational medicine program, under the direction and control of an occupational medicine physician, that provides these services in full compliance with all provisions of Section 8 (“Occupational Medicine”) of Appendix A of the Federal Regulations 10 CFR 851 (“the Rule”), including the following provisions:
    - 1) Plans and implements the occupational services.
    - 2) Is, or is under the direction of, a physician licensed in the state of New York.
    - 3) Is staffed by health care professionals with valid New York State licenses in their respective professions.
    - 4) Determines the content of the worker health evaluations in accordance with current sound and acceptable medical practices and all pertinent statutory and regulatory requirements.
  - d. A program for training employees in the recognitions and avoidance of unsafe conditions and in the safety regulations applicable to this project. The construction trades shall conduct weekly “tool box” safety and health discussions for on going work with affected employees on the worksite. Additionally, as each new phase of construction begins or change in personnel, a pre-job safety awareness meeting shall be held for all personnel and subcontractors involved in that aspect of the work to review the specific hazards and control measures. The meetings shall emphasize the following:
    - e. Changes in scope of work:
      - 1) Recognized hazards.
      - 2) Identified inspection deficiencies.
      - 3) Future phases of work.
      - 4) Potential problem areas.
      - 5) Coordination of crafts.
    - f. A job specific phase-hazard analysis for this project that identifies all phases of the work, the anticipated hazard and planned prevention/control measure.
    - g. A program certifying that all service, maintenance, and/or construction of electrical equipment is performed in strict compliance with NFPA 70E. All Contractors and service providers must be trained in NFPA 70E and wear the appropriate PPE. See Section 00 72 10 General Conditions, for Contractor training requirements.

- h. A program certifying that all temporary staging, platforms, scaffolding, planking, bracing, scaffold towers and walkway work is to be designed, erected, used and maintained, and dismantled in accordance with OSHA 29 CFR 1926, BNL SBMS and Modernization Project Office ES&H-802. The Contractor's Competent Person shall have been formally OSHA-trained in scaffolds standards and safety and shall assure that all personnel engaged in the erection and/or dismantling of scaffolding have been OSHA-trained in the proper scaffold procedures and precautions. The Contractor's Competent Person shall also assure, through Tool Box training at the Site, that all personnel working on or from the scaffolds have been trained in the proper procedures and precautions while using the scaffolding.
  - i. A program to provide for the frequent and regular inspection and reporting of job site conditions relating to safety.
  - j. A program certifying the safe operating condition and assuring the proper maintenance of earth moving equipment, cranes, vehicles and other such equipment, including an environmental protection spill prevention plan. A Rigging Plan shall be submitted in accordance with the conditions noted in the Supplementary Conditions clause, "SHOP DRAWINGS, MANUFACTURERS DATA, AND SAMPLES", above, whenever this equipment is to be used on Site.
  - k. A program certifying the safe operating condition and assuring the proper maintenance of permanent and/or temporary light, power and electrical equipment, including protective devices (GFCI) for portable electric tools.
  - l. Upon approval of the Health and Safety Plan by ESH&Q, the Contractor shall make any revisions noted and resubmit five (5) copies of the Plan to MPO for distribution.
  - m. Prior to subcontractors beginning potentially hazardous activities, prepare and submit to MPO for acceptance, a phase hazard analysis for each work activity.
- B. All workers shall be able to comprehend the scope of work and safety instructions required to perform the job. All workers employed by the Contractor and the Sub-Contractor shall acknowledge, in writing, that they have read and understood the Project Safety Plan. If workers cannot read or speak English or are hearing impaired, an interpreter shall be provided by the contractor to ensure that the scope of work, information regarding hazards associated with the work-site, and safety requirements are relayed to them in a manner in which they can understand. The interpreter shall sign that he has explained the plan, and shall be at the work-site whenever these workers are on the job. The approved Health and Safety Plan shall be available at the job site to all Contractor and Sub-Contractor employees.
- C. When Confined Space Entry is required, the Contractor shall have a written Confined Space Entry Program which complies with OSHA and BNL standards:
- 1. The program will require the Competent Person (as defined by OSHA) to:
    - a. Establish procedures and practices for safe entry and to determine if a permit is required.
    - b. Have air monitors to check concentration of oxygen, explosive/flammable gases and the specific contaminants of concern (e.g. hydrogen sulfide in sewer utility holes).
    - c. Test and monitor conditions to identify and evaluate hazards.
    - d. Prevent unauthorized entry.
    - e. Station an attendant outside permit spaces during entry.
    - f. Post procedures to summon rescuers and prevent unauthorized personnel from attempting rescue.
    - g. Develop a system for preparing, issuing, using, and canceling entry permits.
  - 2. Permits are required to include an identification of the confined space, its hazards, a list of authorized entrants, the purpose of their entry, and the date and duration of their permits; the current attendants and entry supervisor; and both the results of tests performed and any measures necessary to isolate the permit space and eliminate or control the hazards. The permit must also describe the acceptable entry conditions, emergency equipment and the means to summon rescue and emergency services.

3. Authorized entrants into confined spaces and their attendants and entry supervisors must be trained to be aware of any hazards they may face and be able to recognize signs and symptoms of exposure.
- D. The Contractor shall be required to include the applicable safety requirements in all contracts with all tiers of subcontractors.
  - E. Prior to the start of construction, a pre-construction meeting shall be scheduled with the outside contractor to review specific safety requirements of the project.
  - F. Lock-Out/Tag-Out (LOTO) is the required method of control when performing service, maintenance, or construction around any machinery where personnel could be injured by startup of the equipment or release of stored energy. A Lock-Out/Tag-Out program shall be included in the Construction Safety Plan that complies with OSHA and is tailored to BNL's LOTO program. Sources of energy shall be, but not limited to, mechanical (kinetic/potential), electrical, electromagnetic, chemical, thermal, hydraulic, and pneumatic. Contractor shall provide his own locks (types specified by BNL), lockout devices, and red tags for Lock-Out/Tag-Out of energy sources(s). A logbook shall also be maintained and kept in a designated area assigned by BNL:
    1. It is BNL Policy that working on or near energized electrical circuits will only be allowed when all methods available to perform the work in a de-energized state have been evaluated and determined to be infeasible. Working on or near energized conductors is subject to the restrictions and provisions of the Standard for Electrical Safety in the Workplace (NFPA 70E), and BNL Procedure MPO-ESH-102 Electrical Safety.
    2. In order to comply with this Policy, the Contractor shall ensure that all employees who may be required to "Work On or Near" electrical circuits within the BNL AC Distribution System and all associated equipment shall be authorized employees. An authorized employee is deemed as an individual who has been qualified in the skills and knowledge related to the service, maintenance, construction and/or operation of electrical equipment and installations, and has received safety training on the hazards involved, including the wearing of the appropriate personal protective equipment (PPE).
    3. BNL shall have the ability to request the Contractor to provide the appropriate documentation, which will clearly indicate the qualifications and training of any and/or all employees performing such work.
    4. Contractor will arrange for the issuance of a "Working On or Near" Permit as required by the above stated Policy and MPO-ESH-102 Electrical Safety. The Contractor shall give BNL a minimum of 48 hours notice of any requirement to "Work On or Near" to allow time for the BNL permitting process. Working on or near operations that only involve testing, diagnostic work, and/or service tasks on equipment for voltages less than 600 Volts AC to ground may be covered by a testing, troubleshooting, and voltage monitoring energized work permit, which may cover the entire project period. Operations involving "Working On or Near" for voltages greater than 50 Volts AC to ground may require a specific "Working On or Near" Permit for each work situation required. Work will proceed when the "Working On or Near" Permit is completed and all parties performing the work have been informed of the hazards involved and what PPE is to be worn. An authorized Supervisor from the Contractor who is performing the work and a BNL designated Line Manager must sign the permit before any work can be performed.
  - G. Concrete and/or Masonry Penetrations are of specific safety concern at BNL. It is BNL policy that the Contractor ensure safe penetration into or through any existing concrete or masonry surface:
    1. BNL Standards-Based Management System, ES&H Standards and Facilities and Operations Policies and Procedures shall be followed, including the completion of appropriate Penetration Permits and the provision and use of utility locating/detecting equipment.

2. In order to comply with these guides, the Contractor shall provide trained “Authorized Employees” and shall submit, for MPO review and approval, the name and type of the utility locating/detecting equipment to be used, as well as the specific names of the trained personnel who will perform the locating task with this equipment and who will execute the penetration work.
  3. Non-aggressive penetrations cannot be executed without first using utility locating/detecting equipment and obtaining approval by MPO.
  4. Aggressive penetrations cannot be executed without first using utility locating/detecting equipment followed by the completion and approval of a MPO Aggressive Penetration Permit.
- H. No work at the Site will be permitted to proceed and no payment requisitions will be authorized until the Construction Safety Plan is submitted and approved. Contractor shall proceed, however, with ordering of equipment and materials upon Contract signing, as specified in Section 013000.
- I. BNL will not tolerate non-adherence to safety requirements under this Contract. These requirements shall include, but not be limited to, all applicable OSHA Safety requirements, the BNL Standards-Based Management System; ES&H Standards, all applicable codes and regulations, and the approved Safety Plan. Failure to comply will result in BNL’s direction to stop work. Non-compliance could also mean the barring of the violating individuals from the BNL Site.

**PART 2 - PRODUCTS – NOT USED**

**PART 3 - EXECUTION – NOT USED**

**END OF SECTION**



**HDR**

**D I V I S I O N    0 1**

**GENERAL REQUIREMENTS**



**SECTION 01 10 00**  
**SUMMARY OF WORK**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Works to be performed are as indicated in the Contract Documents that consist of the Drawings, Form of Contract, General Terms and Conditions, the Division 00 - General and Supplementary Conditions, the Division 01 - General Requirements, and the Technical Sections of the Contract Specifications.
- B. In case of discrepancies within the terms of the specifications themselves, the matter shall be promptly submitted to the Contracting Officer.

**1.2 PROJECT DESCRIPTION**

- A. The Project consists of a research laboratory building, as shown on the Contract Drawings dated February 12, 2010 and Specifications dated February 12, 2010.

**1.3 SCOPE**

- A. In general, the Work consists of, but is not limited to, the construction of a two-story concrete building. Exterior enclosures, interior finishes, laboratory casework and systems, cleanroom construction, mechanical and electrical systems, paving and site improvements are required as part of the Work.
- B. Alternates to the Work are shown in Section 01 23 00.
- C. A separate contract issued by BNL for the following packages:
  - 1. "Early Site Preparation Package" to consist of site demolition of paving, building foundations subsurface and rough grading of the site.

**1.4 CONTRACTOR USE OF PREMISES**

- A. During construction the Contractor shall have full use of the premises for construction operations, including use of the site. The Contractor's use of the premises shall comply with the Contract Conditions, but is otherwise limited only by BNL's right to perform construction operations or employ separate Contractors on portions of the Project.
- B. Confine operations to areas within Contract limits indicated. Portions of the site beyond areas in which construction operations are indicated are not to be disturbed.
- C. Keep driveways and entrances clear at all times. Do not use these areas for parking or storage of materials. Schedule deliveries to minimize requirements for storage of materials.

**1.5 PARTIAL OCCUPANCY**

- A. BNL reserves the right to occupy and place and install equipment in completed areas prior to Substantial Completion provided such occupancy does not interfere with completion of the Work. Placing of equipment and partial occupancy shall not constitute acceptance of the total Work.
- B. Partial Occupational Readiness Review will be executed for each portion of the Work to be occupied prior to total BNL occupancy.

- C. Prior to partial BNL occupancy, mechanical and electrical systems shall be fully operational. Required inspections and tests shall have been successfully completed. Upon occupancy, BNL will provide operation and maintenance of mechanical and electrical systems in occupied portions of the building.

**PART 2 - PRODUCTS – NOT USED**

**PART 3 - EXECUTION – NOT USED**

**END OF SECTION**

**SECTION 01 23 00**  
**ALTERNATES**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. This Section identifies each Alternate by number and describes basic changes to be incorporated into Work, only when that Alternate is made a part of Work by specific provisions in Construction Contract.
- B. This Section includes only nontechnical descriptions of Alternates. Refer to specific Sections of Specifications and Drawings for technical description of Alternates.
- C. Coordinate pertinent related Work, and modify surrounding Work as required to properly integrate Work under each Alternate and to provide complete construction required by Contract Documents.

**1.2 DESCRIPTION**

- A. Work includes:
  - 1. Indicate Alternate prices on Bid Form.
  - 2. Alternates will be selected after bids are evaluated.
  - 3. Selected Alternates will be made a part of Contract and final Contract Amount will be adjusted accordingly.

**1.3 ALTERNATES**

- A. Add Alternates:
  - 1. Alternate # 1: West Wing Building Envelope -to construct and enclose space west of column line 5:
    - a. Civil / Landscape:
      - 1) Re-grading and drainage to reflect the addition of west wing.
    - b. Structural:
      - 1) Complete all construction west of column line 5.
    - c. Architectural:
      - 1) Construct space west of column line 5.
      - 2) Omit exterior materials west of column line 5 and walls around stair #2. Finish exterior enclosures – exterior walls, insulation, windows, exterior doors and curtain walls.
      - 3) Provide curb and fall prevention at slab opening.
      - 4) Provide appropriate fire extinguishers at shelled space in lieu of FEC.
      - 5) Provide temporary partition to separate egress corridor and shelled space. Provide temporary door into the shelled space.
    - d. Interior: None.
    - e. HVAC:
      - 1) Install permanent heating and ventilation system for Penthouse area west of column line 5.
      - 2) Install temporary heating in shell spaces on first and second floors West Wing.
    - f. Plumbing:
      - 1) Provide sleeves for plumbing lines. Provide fire stop all holes that are penetrated.
      - 2) Install pressure services in hallway, with valve and cap on branches for future extension to labs.
      - 3) Install below slab piping with stub ups for future connections.

- g. Electrical:
    - 1) Provide limited Electrical, IT, Fire Alarm and Security to support the warm shell. This would include: electrical support to other discipline equipment, egress lighting / exist signage, sleeves for future fit out.
    - 2) Provide grounding and lightning protection for the west wing including stub-ups for instrument reference grounds.
  - h. Fire Protection:
    - 1) Install upright sprinklers through out West Wing in all locations not having ceilings.
  - i. Process System:
    - 1) Extend pressure services in hallway with valve and cap on branches for future extension to labs.
  - j. Laboratory Furnishings: None.
2. Alternate # 2: West Wing Penthouse; complete mechanical and electrical systems in penthouse to serve West Wing:
- a. Civil: None.
  - b. Structural: None.
  - c. Architectural:
    - 1) Enclose Mechanical shaft after installation of the vertical duct.
  - d. Interior: None.
  - e. HVAC:
    - 1) Install lab AHU-6, office AHU-7 and heat recovery HRU-3 in Penthouse mechanical room.
    - 2) Install EF-4 & 4A serving labs in the west wing.
    - 3) Install all ductwork associated with AHU-6 & 7, HRU-3 and EF-4 & 4A in Penthouse mechanical room.
    - 4) Install supply, return and exhaust air duct risers in West Wing first and second floor shell spaces.
    - 5) Install piping connections associated with AHU-6 & 7 and HRU-3 to building chilled water, heating water, pre-heat steam and energy recovery glycol systems in Penthouse mechanical room.
    - 6) Install building management and control infrastructure and connection to building automation system.
  - f. Plumbing:
    - 1) Provide capped stub-outs for future extension to laboratories upon fit out of spaces. Provide floor drains at penthouse level for Mechanical Equipment.
    - 2) Extend pressure service mains along entire length of Service Corridor of West Wing. Provide branches extending just into labs with valve and cap on branches for future extension to outlets within lab.
  - g. Electrical: Provide hook up of mechanical equipment installed in this alternate.
  - h. Fire Protection: None.
  - i. Process System:
    - 1) Extend pressure service mains along entire length of Service Corridor of West Wing. Provide branches extending just into labs with valve and cap on branches for future extension to outlets within lab.
  - j. Laboratory Furnishings: None.
3. Alternate # 3: West Wing 1st and 2nd Floor – Fit out West Wing lab and offices functions at both first and second floor:
- a. Civil: None.
  - b. Structural: None.
  - c. Architectural:
    - 1) Finish all interior partitions, doors, windows and ceiling.
    - 2) Finish all FEC per drawing locations.
    - 3) Remove temporary partition and door.

- d. Interior:
    - 1) Provide all finishes for West Wing.
    - 2) Patch and repair the connection to existing space.
  - e. HVAC:
    - 1) Install office HVAC system including terminal units complete with connections to heating infrastructure and controls installed as a part of the base bid.
    - 2) Install laboratory HVAC system including terminal units complete with connections to heating infrastructure and controls installed as a part of the base bid.
    - 3) Install laboratory HVAC system including exhaust air valves complete with connections to exhaust air duct riser installed as a part of the alternate #2.
    - 4) Install building management and control infrastructure and connection to building automation system.
    - 5) Install air devices such as diffusers and grilles for offices and laboratories.
  - f. Plumbing:
    - 1) Install pressure and drainage piping to all lab and safety equipment requiring services.
  - g. Electrical:
    - 1) Provide all Electrical, IT, Fire Alarm and Security for the west wing fit out.
  - h. Fire Protection:
    - 1) Install sprinkler heads and associated piping, coordinated with ceiling plan.
  - i. Process System:
    - 1) Install pressure and drainage piping to all lab equipment requiring services.
  - j. Laboratory Furnishings:
    - 1) Provide fixed laboratory casework, fume hoods, fixtures and fittings at West Wing.
- 4. Alternate # 4: Moveable Laboratory Furniture:
    - a. Provide and install moveable lab cabinets (MB) and tables (MT) in laboratory. Refer to Lab drawings (QL series).
  - 5. Alternate # 5: Building Furniture:
    - a. Provide all building furniture in the building. Refer to drawings IF-001, IF-100, and IF-102.
- B. Deduct Alternates:
- 1. Alternate # 6: Ground and Roof Coverings:
    - a. Eliminate landscaping in its entirety, provide grass seed for all ground surface. Please refer to Sheet L-100.
    - b. Replace Spec Section 07 54 25 - Fully Adhered TPO Roofing System with Spec Section 07 53 25 – Fully Adhered EPDM Roofing.
    - c. Eliminate all concrete pavers and concrete walk paving.
  - 2. Alternate # 7: Interior Finish Changes:
    - a. Replace interior finishes where carpet tiles and terrazzo flooring to vinyl tiles.
    - b. Substitute door frame type B, C, and D to type A.
    - c. Eliminate lobby wood paneling (PWP-1) and related substrate. Smooth finish exposed concrete with reveals.
    - d. Replace perforated metal ceiling to 2 x 4 acoustical ceiling tiles.
  - 3. Alternate # 8: Redundant Exhaust Fans:
    - a. Eliminate redundancy exhaust fans EF-3A from penthouse roof.
    - b. Eliminate redundancy exhaust fans EF-6A & 7A from cleanroom mechanical room roof.
  - 4. Alternate # 9: West Acoustical Chamber:

- a. Defer west ULV experimental chamber, 8 air springs and concrete pedestals under the inertial block, concrete inertial block and RF shielding and associated work. Refer to drawing A-440 and A-441.
  - b. Cap process cooling water for any equipment.
  - c. Cap N2 and CDA lines into west pump room.
5. Alternate # 10: Metal Panel Changes:
- a. Replace foam filled Metal Wall Panels (Section 07 42 13) to Preformed Metal Siding (Section 07 42 16).

**PART 2 - PRODUCTS - NOT USED**

**PART 3 - EXECUTION - NOT USED**

**END OF SECTION**

**SECTION 01 25 13**  
**PRODUCT SUBSTITUTIONS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. Requests for changes in products, materials, equipment, and methods of construction required by Contract Documents proposed by the Contractor after award of the Contract are considered requests for "substitutions." The following are not considered substitutions:
1. Substitutions requested during the bidding period, and accepted by Addendum, prior to award of Contract.
  2. Revisions to Contract Documents requested by BNL.
  3. Specified options of products and construction methods included in Contract Documents, including products and methods of optional manufacturers as defined in Section 01 30 00 "Submittals Procedures".

**1.2 SUBMITTAL**

- A. Requests for substitution will be considered if received within 60 days after commencement of the Work. Requests received more than 60 days after commencement of the Work may be considered or rejected at the discretion of BNL.
1. Submit 3 copies of each request for substitution in the form and in accordance with procedures for Change Order proposals.
  2. Identify the product, or installation method to be replaced in each request. Include related Specification Section and Drawing numbers. Document compliance with requirements for substitutions, and the following information, as appropriate:
    - a. Product Data, including Drawings and descriptions of products, fabrication and installation procedures.
    - b. Samples, where applicable or requested.
    - c. A comparison of significant qualities of the proposed substitution with those specified.
    - d. A list of changes or modifications needed to other parts of the Work and to construction performed by BNL and separate Contractors that will be necessary to accommodate the proposed substitution.
    - e. A statement indicating the substitution's effect on the Construction Schedule compared to the Schedule without approval of the substitution. Indicate the effect of the proposed substitution on overall Contract Time.
    - f. Cost information, including a proposal of the net change, if any, in the Contract Sum.
    - g. Certification that the substitution is equal to or better in every respect to that required by Contract Documents, and that it will perform adequately in application indicated. Include Contractor's waiver of rights to additional payment or time that may be necessary because of the substitution's failure to perform adequately.

**1.3 BNL ACTION**

- A. Within one week of receipt of the request for substitution, MPO will request additional information necessary for evaluation. Within 2 weeks of receipt of the request, or one week of receipt of additional information, whichever is later, MPO will notify the Contractor of acceptance or rejection. If a decision on use of a substitute cannot be made within the time allocated, use the product specified. Acceptance will be in the form of a Change Order.

## **1.4 SUBSTITUTIONS**

- A. The Contractor's substitution request will be received and considered by BNL when one or more of the following conditions are satisfied, as determined by MPO; otherwise requests will be returned without action except to record noncompliance with these requirements.
1. Extensive revisions to Contract Documents are not required.
  2. Proposed changes are in keeping with the general intent of Contract Documents.
  3. The request is timely, fully documented and properly submitted.
  4. The request is directly related to an "or equal" clause or similar language in the Contract Documents.
  5. The specified product or method of construction cannot be provided within the Contract Time. The request will not be considered if the product or method cannot be provided as a result of failure to pursue the Work promptly or coordinate activities properly.
  6. A substantial advantage is offered BNL, in terms of cost, time, energy conservation or other considerations of merit, after deducting offsetting responsibilities that BNL may be required to bear. Additional responsibilities for BNL may include additional compensation to an outside A/E Consultant, for redesign and evaluation services, increased cost of other construction by BNL or separate contractors, and similar considerations.
  7. The specified product or method of construction cannot be provided in a manner that is compatible with other materials, and where the Contractor certifies that the substitution will overcome the incompatibility.
  8. The specified product or method of construction cannot be coordinated with other materials, and where the Contractor certifies that the proposed substitution can be coordinated.
  9. The specified product or method of construction cannot provide a warranty required by the Contract Documents and where the Contractor certifies that the proposed substitution provide the required warranty.
- B. The Contractor's submittal and MPO's acceptance of Shop Drawings, Product Data or Samples that relate to construction activities not complying with the Contract Documents does not constitute an acceptable or valid request for substitution, nor does it constitute approval.

## **PART 2 - PRODUCTS – NOT USED**

## **PART 3 - EXECUTION – NOT USED**

**END OF SECTION**

## SUBSTITUTION REQUEST

PROJECT: Interdisciplinary Science Building - Issue for Bid

PROJECT NUMBER: \_\_\_\_\_ REQUEST NO.: \_\_\_\_\_

TO: Office of the Architect:  
HDR Architecture, Inc.  
1101 King Street, Suite 400  
Alexandria, VA 22314-2944  
Attention: May Yang

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### SPECIFIED PRODUCT:

Substitution request for: \_\_\_\_\_  
Specification Section number: \_\_\_\_\_  
Article(s)/paragraph(s): \_\_\_\_\_

### REASON FOR SUBSTITUTION:

- |  |   |
|--|---|
| <input type="checkbox"/> Fails to comply with building code requirements   | <input type="checkbox"/> Not available                    |
| <input type="checkbox"/> Unavailable to meet Project schedule              | <input type="checkbox"/> Reduce Project construction time |
| <input type="checkbox"/> No qualified installer for specified item         | <input type="checkbox"/> Project cost savings             |
| <input type="checkbox"/> Supplier refuses to warrant item or installation  | <input type="checkbox"/> Unsuitable for application       |
| <input type="checkbox"/> Supplier, Subcontractor or Contractor convenience | <input type="checkbox"/> Constructability issue           |
| <input type="checkbox"/> Other:  |   |

Explanation in Detail:  See attached: \_\_\_\_\_

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### REASON FOR NOT GIVING PRIORITY TO SPECIFIED ITEMS:

See attached:

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### SUPPORTING DATA:

Attach product description, specifications, drawings, photographs, performance data, test data, environmental criteria, and any additional data or information for evaluation of the proposed substitution in accord with requirements of Section 01640.

Sample is attached: Yes  No   
Sample will be sent if requested: Yes  No   
Maintenance Service Available: Yes  No

If yes, location: \_\_\_\_\_

Spare Parts Source: \_\_\_\_\_



**REFERENCES:**

LIST MINIMUM OF FIVE PREVIOUS INSTALLATIONS, WHICH PROPOSED PRODUCT HAS BEEN INSTALLED FOR AT LEAST FOUR YEARS:

Project: \_\_\_\_\_  
Address: \_\_\_\_\_  
Architect (name & phone): \_\_\_\_\_  
Owner (name & phone): \_\_\_\_\_  
Contractor: \_\_\_\_\_  
Date Installed: \_\_\_\_\_  
Dollar Value this Work: \$ \_\_\_\_\_

Project: \_\_\_\_\_  
Address: \_\_\_\_\_  
Architect (name & phone): \_\_\_\_\_  
Owner (name & phone): \_\_\_\_\_  
Contractor: \_\_\_\_\_  
Date Installed: \_\_\_\_\_  
Dollar Value this Work: \$ \_\_\_\_\_

Project: \_\_\_\_\_  
Address: \_\_\_\_\_  
Architect (name & phone): \_\_\_\_\_  
Owner (name & phone): \_\_\_\_\_  
Contractor: \_\_\_\_\_  
Date Installed: \_\_\_\_\_  
Dollar Value this Work: \$ \_\_\_\_\_

Project: \_\_\_\_\_  
Address: \_\_\_\_\_  
Architect (name & phone): \_\_\_\_\_  
Owner (name & phone): \_\_\_\_\_  
Contractor: \_\_\_\_\_  
Date Installed: \_\_\_\_\_  
Dollar Value this Work: \$ \_\_\_\_\_

Project: \_\_\_\_\_  
Address: \_\_\_\_\_  
Architect (name & phone): \_\_\_\_\_  
Owner (name & phone): \_\_\_\_\_  
Contractor: \_\_\_\_\_  
Date Installed: \_\_\_\_\_  
Dollar Value this Work: \$ \_\_\_\_\_

Project: \_\_\_\_\_  
Address: \_\_\_\_\_  
Architect (name & phone): \_\_\_\_\_  
Owner (name & phone): \_\_\_\_\_  
Contractor: \_\_\_\_\_  
Date Installed: \_\_\_\_\_  
Dollar Value this Work: \$ \_\_\_\_\_

**EFFECT OF SUBSTITUTION:**

Substitution affects other parts of Work: No  Yes  (If yes, explain below)

Substitution requires dimensional revision or redesign of structure or mechanical and electrical Work: No  Yes  (If yes, explain below)

Same warrantee provided as specified base product: No  Yes  (If no, explain below)

Explanation: \_\_\_\_\_

Cost difference: \$ \_\_\_\_\_ (add / deduct).  
Total cost implications of substitution on Project: \$ \_\_\_\_\_ (add / deduct).  
Total time implications: \$ \_\_\_\_\_ (add / deduct) calendar days.

**STATEMENT OF CONFORMANCE OF REQUEST TO CONTRACT REQUIREMENTS:**

Supplier, Subcontractor and Contractor in making substitution request or in using an approved substitution represent:

- Has personally investigated the proposed substitution and determined it is equal or superior in all respects to specified product or system and will perform intended function, except as stated above.
- Is in full compliance with applicable code requirements.
- Will provide same warranty for substitute item as for product, system or method specified.
- Will coordinate installation of accepted substitution into Work, to include building modifications if necessary, making such changes as may be required for Work to be complete in all respects.
- Waive all claims for additional costs or time extensions related to substitution that subsequently become apparent or are caused by substitution.
- If a finish product, color wise and pattern wise complies with base specified items.
- Certifies cost data presented is complete and includes all related costs under this Contract, excluding Architect's review and redesign cost.
- Will pay Architect's review and redesign cost, special inspections, and other costs caused by substitution.
- Will pay additional costs to other contractors caused by substitution.
- Will modify other parts of Work as may be needed, to make all parts of Work complete and functioning.
- Acknowledge acceptance of these provisions.

**List of Attachments:** \_\_\_\_\_

**ACKNOWLEDGEMENTS:**

FOLLOWING FIRM HEREBY REQUESTS CONSIDERATION OF FOLLOWING PRODUCT OR SYSTEMS AS A SUBSTITUTION IN ACCORD WITH PROVISIONS OF CONTRACT DOCUMENTS:

Requested by (firm): \_\_\_\_\_

Acknowledged by (print & sign): \_\_\_\_\_ Date: \_\_\_\_\_  
Position: \_\_\_\_\_ Phone: \_\_\_\_\_

Subcontractor: \_\_\_\_\_

Acknowledged by (print & sign): \_\_\_\_\_ Date: \_\_\_\_\_  
Position: \_\_\_\_\_ Phone: \_\_\_\_\_

Contractor: \_\_\_\_\_

Acknowledged by (print & sign): \_\_\_\_\_ Date: \_\_\_\_\_  
Position: \_\_\_\_\_ Phone: \_\_\_\_\_

Distribution:  Architect  file

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**ARCHITECT'S ACTION / RECOMMENDATION:**

- Recommend Owner's approval.
- Submitted to Owner for authorization for Architect's as Change in service to further evaluate and make recommendation.
- Do not recommend (see comments below).
- Rejected:
  - Submitted after stipulated time period.
  - Not submitted in accordance with Section 01640.
  - Acceptance will require substantial revision of Contract Documents, building or systems.
  - Request does not indicate specific item which is being requested.
  - Requested for manufacturer acceptance only.
  - Request form is not properly executed and signed.
  - Subcontractor or supplier requested directly.
  - Insufficient information submitted.
  - Does not comply color wise or pattern wise with base specified items.
  - Insufficient information submitted to evaluate.
  - Does not appear to comply with requirements of specifications for base product.
  - Other:
- Additional information needed - Returned to CM/Contractor for providing following:

Comments: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Architect: \_\_\_\_\_  
By (print & sign): \_\_\_\_\_ Date: \_\_\_\_\_  
Position: \_\_\_\_\_  
Distribution:  Owner  CM/Contractor  file

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**OWNER ACTION:**

- Reject - Do not want to consider.
- Approved - Contractor may proceed with request as submitted.
- Approved – Architect directed as Change in Services to issue change document to incorporate substitution into contract Documents, adjust Contract Sum and/or Project time.
- Architect authorized as Change in Services to further evaluate and make recommendation.
- Additional information needed - Returned for providing following:

Comments: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Owner: \_\_\_\_\_  
By: (print & sign) \_\_\_\_\_ Date: \_\_\_\_\_  
Position: \_\_\_\_\_  
Distribution:  Architect  CM/Contractor

**END OF SUBSTITUTION REQUEST**



**SECTION 01 26 13**  
**REQUESTS FOR INFORMATION (RFI)**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section specifies administrative and procedural requirements for handling and processing Requests for Information (RFI).
- B. RFI is intended for requesting clarifications and interpretations of Contract Documents due to apparent inconsistencies, errors or omissions in Contract Documents, and due to unanticipated existing conditions.
- C. RFI is not intended for requesting substitutions, Contractor's proposed changes, resolution of nonconforming work or for general questions not related to Contract Documents.
- D. RFI process is intended to be a cooperative effort between Architect and Contractor to expedite responses to RFIs and maintain progress of Work without utilizing other lengthy procedures.
- E. BNL will use Primavera Contract Manager (formerly Expedition) to track and manage document flow including RFI's. The Contractor and the Architect/Engineer will be required to use this system as well. BNL will provide one software license to each. If additional licenses are needed by the Contractor or the Architect/Engineer, they must obtain the licenses at their own cost.

**PART 2 - PRODUCTS (NOT USED)**

**PART 3 - EXECUTION**

**3.1 REQUESTS FOR INFORMATION**

- A. Review of Contract Documents and Field Conditions:
  - 1. Contract Documents are complementary; therefore, before starting each portion of Work, carefully study and compare various Drawings, Specifications and any other Contract Documents, coordination drawings, shop drawings, prior correspondence or documentation relative to that portion of Work, as well as information furnished by BNL.
  - 2. Contractor and Subcontractors shall evaluate and take field measurements of any existing conditions related to that portion of Work and shall observe any conditions at site affecting Work.
  - 3. Contractor and subcontractors acknowledge that all documents pertaining to Work has been examined, have examined character of site and any existing conditions, and are satisfied with nature of Work, and all other matters which can in any way affect Work.
  - 4. In event of inconsistency between portions of Contract Documents or within Contract Documents; provide better quality or greater quantity of Work, and comply with more stringent requirement, either or both in accordance with Architect's interpretation.
  - 5. Any errors, inconsistencies or omissions discovered in Contract Documents shall be reported promptly to Architect as a properly prepared and timely RFI.
  - 6. Contractor and Subcontractors are not required to ascertain Contract Documents are in accordance with applicable laws, statutes, ordinances, codes, and rules and regulations, unless they bear upon construction means, methods, techniques or safety and health precautions, but any nonconformity discovered by or made known shall be reported promptly as a RFI.
  - 7. If Contractor or Subcontractor fail to give such notice, and knowingly proceeds with Work affected by errors or omissions in Contract Documents, Contractor shall correct any such errors, inconsistencies, or omissions at no additional cost.

- B. Contractor's and Subcontractor's Responsibilities:
1. When interpretation, clarification or explanation of portion of Construction Documents is needed by Contractor, Subcontractor, Vendor or Supplier, the request shall be processed through Contractor.
    - a. Review request for completeness, quality, proper referencing to drawing or specification section and reason submitted.
    - b. If request is not acceptable it shall be sent back to submitter with comments regarding reason for being returned.
    - c. Make every attempt to validate, resolve or respond to RFI by thoroughly researching and reviewing Contract Documents and field conditions.
    - d. Respond to RFI accordingly if review of RFI discloses a response or is related to coordination of construction or other issue not related to Contract Documents.
    - e. If unable to respond to request, it shall be restated in clear, concise, correct, complete and easily understood manner, and rewritten if necessary, additional information included if necessary, and only then submitted to Architect for response.
  2. Request for interpretation, clarification or explanation of Contract Documents shall be submitted to BNL in writing.
    - a. List specific Contract Documents reviewed when seeking information being requested.
    - b. Reference all applicable Contract Drawings by sheet number, section, detail, room number, door number, etc., Specifications by section and paragraph number, and reference any other relevant documents.
    - c. The field titled "Regarding" on attached RFI form must be clear for future reference in reports or correspondence.
    - d. Clearly state request and provide Contract Document references and any additional information needed so request can be fully understood, including sketches, photos or other reference material.
    - e. Fully assess issues, suggest any reasonable solutions and include various factors, including potential costs, schedule impacts, if any, and recommendations which will aid in determining a solution or response. If a reasonable solution can not be suggested, a statement to that effect should be so stated.
    - f. Indicate reason request is being submitted.
    - g. Any critical RFI's requiring a rapid response shall clearly indicate such with an explanation as to why RFI is critical.
    - h. Priority for responses shall be indicated when multiple RFI's are submitted within short period of time.
  3. Copies of responses to RFI's shall be distributed to all parties affected.
  4. A response to RFI shall not be considered a notice to proceed with a change that may revise the Contract Sum or Contract Time, unless authorized by BNL in writing.
  5. If response to RFI is determined incomplete, it shall be resubmitted with reason response is unacceptable and any necessary additional information within five (5) days of time of receipt of response to RFI.
  6. If determined or believed that additional cost or time is involved because of clarifications, interpretations or instructions issued by Architect in response to a RFI, resubmit RFI within five (5) days of receipt of response with reason and alternate solution or suggestion for performing work at no additional cost. If no other solution is possible or desirable, submit Claim in accordance with the Contract Documents with in twenty-one (21) days of receipt of response to the RFI.
- C. RFI Submittal Format:
1. Request for information shall be submitted to Architect on RFI form provided at end of this section, or form provided by Architect in electronic text file format, or in similar format acceptable to Architect.
    - a. RFI's shall be assigned unique numbers in sequential order (1, 2, 3, 4, etc.).
    - b. A resubmitted RFI or a previously answered RFI requiring revising or further clarification shall be submitted using original RFI number preceded by ".1" to indicate revision one of RFI (i.e.: RFI No. 34.1 for revision 1 to RFI No. 34).

- c. RFI form shall be electronically filled out and emailed to Architect's designated representative in text file format. Attachments shall be in electronic text or PDF file format. Photo attachments may be in JPG format.
- D. Architect's Response to Request for Information (RFI):
1. Clarifications, interpretations and decisions of Architect in response to RFI will be consistent with intent of and reasonably inferable from Contract Documents, and will be in writing, and if determined to be necessary by Architect, will be provided in form of drawings and other attachments or both.
  2. When making such interpretations and initial decisions, Architect will endeavor to secure faithful performance by both BNL and Contractor, will not show partiality to either and will not be liable for results of interpretations or decisions so rendered in good faith.
  3. Architect's decisions on matters related to aesthetic effects will be final if consistent with intent expressed in Contract Documents.
  4. Architect will not undertake to settle differences between Contractor, Subcontractors, trades suppliers, fabricator or manufacturer, or act as arbiter as to which Subcontractor, trade, supplier or manufacturer is to furnish or install various items indicated or required.
  5. Architect shall provide responses to RFI's with reasonable promptness, but will endeavor to respond within twenty-one (21) days from date of receipt.
    - a. If multiple RFI's are submitted on same day or within a five (5) day period, review time may be extended by mutual agreement of parties
    - b. Architect will provide a written response to RFI if Architect believes response only involves an interpretation, clarification, supplemental information or orders a minor change in Work not involving an adjustment in Contract Sum or extension of Contract Time, and is not inconsistent with intent of Contract Documents, and shall be binding.
    - c. If Architect believes response may result in a change to Contract Sum or Contract Time, response will indicate that a change document will be issued for the response, and appropriate change document will be issued indicating changes to Contract Documents.
    - d. Architect will provide any additional or supplemental drawings, specifications or other information as Architect may deem necessary to facilitate response.
  6. Architect may return RFI without response for following reasons:
    - a. Unclear.
    - b. Incomplete.
    - c. Detailed information not provided.
    - d. Is related to construction means, methods or techniques.
    - e. Is related to health or safety measures.
    - f. Is due to Contractor's lack of adequate coordination.
    - g. Is considered a "Substitution Request."
    - h. Is due to non-conformance.
    - i. Response is required by another party.
- E. If requested information is available from careful study and comparison of Contract Documents, field conditions, other BNL-provided information, coordination drawings, or prior Project correspondence or documentation, Architect may invoice BNL as a change in services for costs involved in Architect's review, analysis, responding and processing of such RFI.
1. Contractor shall reimburse BNL for such costs.

## END OF SECTION

## REQUEST FOR INFORMATION

**Project:** \_\_\_\_\_ **RFI Number:** \_\_\_\_\_  
**Project No.:** \_\_\_\_\_

**To:**  (Architect)  Action  Info Pages \_\_\_\_\_  
 (consultant?)  Action  Info Pages \_\_\_\_\_  
 (other?)  Action  Info Pages \_\_\_\_\_

**Regarding:** \_\_\_\_\_  
**References:** *(List specific Contract Documents researched when seeking the information being requested)*

**Spec. No.:** \_\_\_\_\_ **Dwg. No.:** \_\_\_\_\_

**Request:** *(Provide complete description of request with document references and sketches or photos if necessary, and present status of work)*

**Requester's Recommended Solution:** *(If RFI concerns a site or construction condition, provide a recommended solution, including cost & schedule considerations)*

**Response Priority:**  Normal  Rush (Work in progress)  
**Reason For Request:**  Existing Condition  Non-conformance  Clarification / Interpretation  Agency Generated  Other

**Subcontractor:** \_\_\_\_\_ **Date:** \_\_\_\_\_  
**CM/Contractor:** \_\_\_\_\_

**By:** \_\_\_\_\_ **Date:** \_\_\_\_\_

### Response:

- Above is considered a change. Following document will be used for processing: \_\_\_\_\_
- Above is consistent with intent of and reasonably inferable from Contract Documents, or makes minor changes in Work without change in Contract Sum or Contract Time. If Contractor does not agree, submit written notice substantiating claim in accordance with Contract Documents.
- This RFI is related to one of following and may be returned without response:
- |   |   |  |
|---|---|--|
| <input type="checkbox"/> Incomplete or lack of detailed information | <input type="checkbox"/> Related to "means and methods" | <input type="checkbox"/> Response required by others |
| <input type="checkbox"/> Lack of adequate Coordination Drawings     | <input type="checkbox"/> Is a "Substitution Request"    |  |

**From:** HDR Architecture, Inc.

**By:** \_\_\_\_\_ **Date:** \_\_\_\_\_

**END OF FORM**

**SECTION 01 30 00**  
**SUBMITTAL PROCEDURES**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. Extent:
1. This Section includes administrative and procedural requirements for submittals required for performance of the Work, including the following:
    - a. Contractor's Construction Schedule.
    - b. Submittal Schedule.
    - c. Daily Construction Reports.
    - d. Shop Drawings.
    - e. Product Data.
    - f. Samples.
    - g. Quality Assurance Submittals:
      - 1) Project Information.
      - 2) Contract Closeout Information.
    - h. LEED information.
- B. Administrative Submittals:
1. Refer to other Division 1 Sections and other Contract Documents for requirements for administrative submittals. Such submittals include, but are not limited to, the following:
    - a. Schedule of Values.
    - b. Applications for Payment.
    - c. Performance and Payment Bonds.
    - d. Insurance Certificates.
    - e. List of Subcontractors.
    - f. Unit Prices, if any.
    - g. Construction Safety Plan.
    - h. Rigging Plan, if any.
    - i. Product List.
    - j. Recycled Materials Reports.

**1.2 DEFINITIONS**

- A. Shop Drawings and Manufacturer's Data include installation drawings, setting diagrams, layouts, schematics, descriptive literature, illustrations, schedules, performance and test data, similar materials and samples furnished by Contractor to explain and show in detail, specific portions of work required by Contract.
- B. Coordination Drawings show the relationship and integration of different construction elements that require careful coordination during fabrication or installation to fit in the space provided or to function as intended.
- C. Field samples are full-size physical examples erected on-site to illustrate finishes, coatings, or finish materials. Field samples are used to establish the standard by which the Work will be judged.
- D. Mockups are full-size assemblies for review of construction, coordination, testing, or operation; they are not Samples.
- E. BNL: Use of the term "BNL" refers to Brookhaven Science Associates, operator of Brookhaven National Laboratory (BNL).
1. Owner or BNL are interchangeable terms with the same meaning.

- F. Architect: Use of the term “Architect” refers to the technical liaison of BNL’s Modernization Project Office (MPO) or other representative authorized by BNL to act in behalf of BNL.
  - 1. Architect and MPO are interchangeable terms with the same meaning.
- G. Acceptable manufacturers: Use of the term “Acceptable manufacturers” refers to manufacturers known to be acceptable and available manufacturers of a specific product.
  - 1. Acceptable manufacturers and available manufacturers are interchangeable terms with the same meaning.
  - 2. Acceptable manufacturers may be listed as “Base” and “Optional” manufacturers in the specifications.

### 1.3 SUBMITTAL PROCEDURES

- A. Coordination:
  - 1. Coordinate preparation and processing of submittals with performance of construction activities. Transmit each submittal sufficiently in advance of performance of related construction activities to avoid delay.
  - 2. Schedule submittals requiring color selection within 60 days of award of contract.
  - 3. Schedule Contract Closeout Information submittals during last quarter of construction period and prior to Completion.
  - 4. Submittals to MPO by Contractor, or through the Contractor from subcontractor, or any low tier subcontractor, pursuant to a construction contract, shall show in detail (i) the proposed fabrication and assembly of structural elements and (ii) the installation (i.e., layout, form, fit, setting, and attachment details) of materials or equipment.
  - 5. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
  - 6. Coordinate transmittal of different types of submittals for related elements of the Work so processing will not be delayed by the need to review submittals concurrently for coordination.
    - a. MPO reserves the right to withhold action on a submittal requiring coordination with other submittals until all related submittals are received.
  - 7. These contract conditions shall be included in all subcontracts hereunder at any tier.
- B. Processing:
  - 1. Before submitting any data for approval, the Contractor shall coordinate all such drawings and data, and check them for accuracy, completeness, and compliance with Contract requirements. The Contractor shall see that all work contiguous with and having bearing on the work indicated on drawings is accurately and distinctly illustrated and that work shown is in conformity with contract requirements.
  - 2. The Contractor shall indicate his approval on all submittals as evidence of the above coordination and review. Shop drawings and data submitted to BNL without evidence of Contractor's approval, may be returned for resubmission. Contractor's received stamp is not considered as approval.
    - a. Each submittal shall bear Contractor's approval stamp, indicating "*(Contractor's name)* REVIEWED FOR COMPLIANCE WITH THE CONTRACT DOCUMENTS AND APPROVED", and validated with signature of a Contractor's authorized representative.
    - b. Submittal transmittal indicates Contractor, Subcontractor and sub-subcontractors represent that they have:
      - 1) Reviewed for compliance with the Contract Documents.
      - 2) Determined and verified related materials, field measurements and quantities.
      - 3) Determined and verified related field construction criteria, performance criteria, installation requirements, catalog numbers and similar data.
      - 4) Checked, determined, verified and coordinated information contained within submittal with requirements of the Work, Contract Documents and other submittals.
      - 5) Certified that submittal is in compliance with Contract Documents.
      - 6) Approved submittal.

3. To avoid the need to delay installation as a result of the time required to process submittals, allow sufficient time for submittal review, including time for resubmittals.
    - a. Allow 10 working days for review. Allow additional time if MPO must delay processing to permit coordination with subsequent submittals.
    - b. If resubmittal is necessary, process the same as the initial submittal.
    - c. Allow 10 working days for reprocessing each submittal.
    - d. No extension of Contract Time will be authorized because of failure to transmit submittals to MPO sufficiently in advance of the Work to permit processing.
  4. The General Conditions portion of the Contractor's monthly payment requisitions may be reduced if required Shop Drawings, Manufacturers Data, Samples and any other required submissions are not received, or until they are received in a timely manner.
- C. Submittal Preparation:
1. Place a permanent label or title block on each submittal for identification. Indicate the name of the entity that prepared each submittal on the label or title block.
    - a. Provide a space approximately 4 by 5 inches (100 by 125 mm) on the label or beside the title block on Shop Drawings to record the Contractor's review and approval markings and the action taken.
  2. Include the following information on the label for processing and recording action taken.
    - a. Project Name and Building Number.
    - b. Job Number and Contract Number.
    - c. Date and Specification Section Reference.
    - d. Name and address of the Contractor, subcontractor, supplier and manufacturer.
- D. Submittal Transmittal:
1. Package each submittal appropriately for transmittal and handling. Transmit each submittal from the Contractor to MPO using a transmittal form. MPO will not accept submittals received from sources other than the Contractor.
  2. On the transmittal, record relevant information and requests for data. On the form, or separate sheet, record deviations from Contract Document requirements, including variations and limitations. Attach Contractor's Certification of Specification Compliance forms stating that information complies with Contract Document requirements.
    - a. Transmittal form: Attached to this section is a sample form that may be used for this Project.
      - 1) Contact Architect for copy made for Project.
      - 2) Submittal number:
        - a) Identify each submittal using applicable 6-digit specification Section number.
        - b) After Section number, indicate sequence number, e.g., first submittal of Section 03 31 10 series would be numbered "033110-1", next would be "033110-2", etc.
        - c) If returned for re-submission, add a designation character, e.g., second submission would be "033110-1A", third would be "033110-1B".
      - 3) Indicate Project name, description of submitted items or systems and manufacturer.
      - 4) Indicate approval and sign in appropriate space.
    - b. Contractor's standard transmittal form may be used if information included matches or is equivalent to, in BNL's opinion, information included on attached sample form.
  3. Address all submissions to:  
 Brookhaven National Laboratory  
 Peggy Caradonna, PMP  
 Building 134-C, Box 5000  
 Upton, New York 11973
  4. Mark all transmittal forms as follows:  
 JOB TITLE: Interdisciplinary Science Building I Phase I.  
 JOB NO. 11733, BLDG. NO. 734.

**1.4 CONTRACTOR'S CONSTRUCTION SCHEDULE**

- A. Copies of Contractor's current approved Construction Schedule shall be distributed to Subcontractors and other parties required to comply with scheduled dates, and shall be posted in the temporary field office.

**1.5 SUBMITTAL SCHEDULE**

- A. After development and acceptance of the Contractor's Construction Schedule, prepare a complete schedule of submittals. Submit the schedule within 10 days of the date required for submittal of the Contractor's Construction Schedule.

- 1. Required Submissions:

| Item  | Shop<br>Dwg. | Mfrs.<br>Data | Samples | Other<br>Data |
|---|--------------|---------------|---------|---------------|
| *1. Schedule of Values                                    |              |               |         | X             |
| *2. Unit Prices, if any                                   |              |               |         | X             |
| *3. List of Subcontractors                                |              |               |         | X             |
| *4. Construction Safety Plan                              |              |               |         | X             |
| 5. Construction Schedule                                  |              |               |         | X             |
| 6. Rigging Plan, if any                                   |              |               |         | X             |
| 7. Submittal Schedule                                     |              |               |         | X             |
| 8. Product List   |              |               |         | X             |
| 9. Recycled Materials Reports                             |              |               |         | X             |
| 10. Certification of Specification Compliance             |              |               |         | X             |
| 11. Preventative Maintenance Program Data                 |              |               |         | X             |
| 12., etc. Other Submittals as specified in other sections | X            | X             | X       | X             |

- 2. MPO reserves right to request additional data.
- 3. Critical Items:
  - a. Submit items marked with an asterisk within two (2) weeks after signed Contract.
  - b. No later than two (2) weeks after receiving approval, submit copies of purchase orders and vouchers showing final purchase agreement and promised delivery date.
- B. Coordinate Submittal Schedule with the list of subcontracts, Schedule of Values, as well as the Contractor's Construction Schedule.
- C. Prepare the schedule in chronological order. Provide the following information:
  - 1. Scheduled date for the first submittal.
  - 2. Related Section number and part of the Work covered.
  - 3. Submittal category (Shop Drawings, Product Data, or Samples).
  - 4. Name of the subcontractor.
- D. Distribution:
  - 1. Following response to the initial submittal, print and distribute copies to MPO, subcontractors, and other parties required to comply with submittal dates indicated. Post copies in the field office.
  - 2. When revisions are made, distribute to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in construction activities.

- E. Schedule Updating:
  - 1. If directed by MPO, revise the schedule after any meeting or activity where revisions have been recognized or made. Issue the updated schedule concurrently with the report of the meeting.

## **1.6 DAILY CONSTRUCTION REPORTS**

- A. Prepare a daily construction report recording the following information concerning events at the site, and submit duplicate copies to MPO at weekly intervals:
  - 1. List of subcontractors at the site.
  - 2. Approximate count of personnel at the site.
  - 3. High and low temperatures, general weather conditions.
  - 4. Accidents, occurrences, and unusual events.
  - 5. Meetings and significant decisions.
  - 6. Stoppages, delays, shortages, and losses.
  - 7. Emergency procedures.
  - 8. Services connected, disconnected.
  - 9. Equipment or system tests and startups.
  - 10. Partial Completions, occupancies.
  - 11. Substantial Completions authorized.

## **1.7 SHOP DRAWINGS**

- A. Submit newly prepared information drawn accurately to scale. Highlight, encircle, or otherwise indicate deviations from the Contract Documents. Do not reproduce Contract Documents or copy standard information as the basis of Shop Drawings. Standard information prepared without specific reference to the Project is not a Shop Drawing.
- B. Shop Drawings shall include the following information:
  - 1. All working and erection dimensions.
  - 2. Identification of products and materials included by sheet and detail number.
  - 3. Compliance with specified standards.
  - 4. Notation of coordination requirements, connections to other work and details.
  - 5. Notation of dimensions established by field measurement.
- C. Submit Shop Drawings on Ozalid transparencies of original Contractor's Drawings. Submit one (1) set of transparencies and five (5) sets of Ozalid prints for each submission until approved by MPO.
- D. When MPO takes no exception to the contents of the submittal, it shall not relieve Contractor from responsibility for any errors or omissions in such drawings and data, or from responsibility for complying with requirements of this Contract, except with respect to variations described and approved in accordance with the following:
  - 1. If Shop Drawings and data show variations from Contract requirements, Contractor shall describe such variations in writing separate from drawings at the time of submission. If MPO approves any such variation(s), it shall issue an appropriate Contract modification, except that, if variation is minor and does not involve a change in price or in time of performance, a modification need not be issued.
- E. Two (2) copies of the reviewed prints will be returned to the Contractor.
- F. No Work shall be fabricated or installed unless and until the appropriate Shop Drawings have been approved by MPO. Do not use Shop Drawings without an appropriate final stamp indicating action taken.

## 1.8 PRODUCT DATA

- A. Collect Product Data into a single submittal for each element of construction or system. Product Data includes printed information, such as manufacturer's installation instructions, Manufacturer's Safety Data Sheets (MSDS), catalog cuts, standard color charts, roughing-in diagrams and templates, standard wiring diagrams, and performance curves.
  - 1. Mark each copy to show applicable choices and options. Where printed Product Data includes information on several products that are not required, mark copies to indicate the applicable information. Include the following information:
    - a. Manufacturer's printed recommendations.
    - b. Compliance with trade association standards and with recognized testing agency standards.
    - c. Applications of testing agency labels and seals.
    - d. Notation of dimensions verified by field measurement and coordination requirements.
  - 2. Do not submit Product Data until compliance with requirements of the Contract Documents has been confirmed.
  - 3. Submittals:
    - a. Submit five (5) copies for each submission of manufacturer's cuts and data sheets until approved.
  - 4. Distribution:
    - a. Furnish copies of final submittal to installers, subcontractors, suppliers, manufacturers, fabricators, and others required for performance of construction activities. Show distribution on transmittal forms.
    - b. Do not proceed with installation until a copy of Product Data is in the Installer's possession.
    - c. Do not permit use of unmarked copies of Product Data in connection with construction.

## 1.9 SAMPLES

- A. Submit full-size, fully fabricated Samples cured and finished as specified or as scheduled and physically identical with the material or product proposed. Samples include partial sections of manufactured or fabricated components, cuts or containers of materials, color range sets, and swatches showing color, texture, and pattern.
  - 1. Mount or display Samples in the manner to facilitate review of qualities indicated. Include the following:
    - a. Specification Section number and reference.
    - b. Generic description of the Sample.
    - c. Sample source.
    - d. Product name or name of the manufacturer.
    - e. Compliance with recognized standards.
  - 2. Submit Samples for review of size, kind, color, pattern, and texture. Submit Samples for a final check of these characteristics with other elements and a comparison of these characteristics between the final submittal and the actual component as delivered and installed.
    - a. Where variation in color, pattern, texture, or other characteristic is inherent in the material or product represented, submit at least 3 multiple units that show approximate limits of the variations.
    - b. Refer to other Specification sections for requirements for Samples that illustrate workmanship, fabrication techniques, details of assembly, connections, operation, and similar construction characteristics.
- B. Submittals:
  - 1. Except for Samples illustrating assembly details, workmanship, fabrication techniques, connections, operation, and similar characteristics, submit 2 sets. MPO will return one set marked with the action taken.
  - 2. Maintain sets of Samples, as returned, at the Project Site, for quality comparisons throughout the course of construction.

- C. Distribution of Samples:
  - 1. Prepare and distribute additional sets to subcontractors, manufacturers, fabricators, suppliers, installers, and others as required for performance of the Work. Show distribution on transmittal forms.
- D. Field samples are full-size examples erected on-site to illustrate finishes, coatings, or finish materials and to establish the Project standard.
  - 1. Comply with submittal requirements to the fullest extent possible. Process transmittal forms to provide a record of activity.

#### **1.10 QUALITY ASSURANCE SUBMITTALS**

- A. Submit quality-control submittals, including design data, certifications, manufacturer's instructions, manufacturer's field reports, and other quality-control submittals as required under other sections of the Specifications.
- B. Quality Assurance Submittals include Project Information and Contract Closeout Information.
  - 1. Project Information submittals are items pertaining to quality control and BNL information, which are required during various stages of the Construction process, and do not require review or response by BNL or Architect, but retained for project record purposes.
    - a. Examples include but are not limited to:
      - 1) Product performance and construction test reports.
      - 2) Certifications.
      - 3) Design calculations.
      - 4) Coordination drawings.
  - 2. Contract Closeout Information submittals are items pertaining to quality control and BNL information, which are required at Substantial or Final Completion, and do not require review or response by BNL or Architect, but are retained for project record purposes.
    - a. Examples include but are not limited to:
      - 1) Pre-occupancy test reports.
      - 2) Warranties.
      - 3) Operation and maintenance data.
      - 4) BNL instruction reports.
      - 5) Extra materials or tools.
- C. Inspection and Test Reports: Requirements for submittal of inspection and test reports from independent testing agencies are specified in various other sections of the Specifications.
  - 1. Submit three (3) copies of the required reports.
- D. Packaged Equipment: Where packaged (factory assembled) mechanical and electrical equipment is furnished, a certificate shall be included with the submission of shop drawings or catalog data stating that the equipment complies with OSHA, National Electrical Codes, and applicable Underwriter's Laboratories Standards in respect to motor protection, grounding, and protection against hazards, and is approved by all Regulatory Agencies.

#### **1.11 LEED INFORMATION**

- A. Definitions:
  - 1. Resource Efficient Product Data:
    - a. Environmental Issues Data: Submit following information, including manufacturer's certifications, verifying information, and test data, where specification sections require data relating to environmental issues including but not limited to:
      - 1) Project Recyclability: Submit information to assist BNL and Contractor in recycling materials involved in shipping, handling, and delivery, and for temporary materials necessary for installation of products.
      - 2) Recycled Content: Submit information regarding product post-industrial and post-consumer recycled content according to requirements specified in Division 1 Section "Environmental Requirements."

- 3) Product Recyclability: Submit information regarding product and product's components recyclability including potential sources accepting recyclable materials.
  - 4) Provide certification for all wood products provided by a Forest Stewardship Council (FSC) accredited certifier.
  - 5) Provide final certification of well managed forest of origin to provide final documentation of certified sustainability harvested status: Acceptable wood "certified sustainably harvested" certifications shall include:
    - a) Wood Suppliers' certificate issued by one of the Forest Stewardship Council ([www.fscus.org](http://www.fscus.org)) accredited certifying agencies, such as the Smart Wood Program ([www.smartwood.org](http://www.smartwood.org)) or Scientific Certification Systems ([www.scs1.com](http://www.scs1.com)).
    - b) Suppliers invoice detailing the quantities of certified wood products for project.
    - c) Letter from a certifying agency corroborating that the products on the wood supplier's invoice originate from certified well-managed forests.
2. Indoor Air Quality Data:
- a. Environmental Issues: Submit emissions test data produced by acceptable testing laboratory listed in Quality Assurance Article for materials as required in each specific specification Section.
    - 1) Laboratory reports shall contain emissions test data on VOCs including total VOCs (TVOC), specific individual VOCs, formaldehyde and other aldehydes.
    - 2) In special cases it may be necessary to identify other specific chemical for listing based on known quantity present or on known odor, irritation or toxicity.
    - 3) Identify all VOCs emitted by each material as required in these specifications.
    - 4) Specific test conditions and requirements are set forth in this Project Manual. For required tests, submit documentation of sample acquisition, handling, and test specimen preparation, as well as test conditions, methods, and procedures. General test requirements include:
      - a) Tests consist of a ten-day conditioning period followed by a 96 hour test period.
      - b) Samples collected during the test period at 24, 48, and 96 hours shall be analyzed for TVOC and formaldehyde.
      - c) VOC samples collected at 96 hours shall be identified and quantified for all compounds that are Chemicals of Concern on lists identified in this Project Manual.
  - b. Cleaning and Maintenance Products: Provide data on manufacturers' recommended maintenance, cleaning, refinishing and disposal procedures for materials and products. These procedures are for final Contractor cleaning of the project prior to substantial completion and for provided materials and products as required by the specific specification Sections.
    - 1) Comply with product requirements specified in Division 1 Section "Cleaning".
3. Environmental Issues Certifications:
- a. Submit documentation certifying accuracy of post-industrial and post-consumer recycled content, and recyclability of product.
  - b. Prior to Final Completion, submit certificate signed by corporate office holder (i.e. Chairman of the Board, President, Vice President, Secretary, or similar position of authority) of contractor, subcontractor, supplier, vendor, installer or manufacturer, provided they are primarily responsible for manufacture of product, including:
    - 1) Post-industrial and post-consumer recycled content of materials installed are same as those required by Project requirements.
    - 2) Product recyclability of materials installed is same as those required by Project requirements.
    - 3) Indoor air quality requirements: Certification shall state products and materials provided are essentially the same, and contain essentially the same components as products and materials tested.

4. Environmental Closeout Submittals: Submit data relating to environmental issues, and environmental product certifications in two forms:
    - a. Electronic: Two CD-ROMs organized by CSI MasterFormat.
    - b. Hard Copy: Four three-ring binders organized by CSI MasterFormat, with Table of Contents and dividers for each Division.
- B. Submittals: Comply with additional LEED submittals requirements included in other sections of the Specifications.
1. LEED submittals are in addition to other submittals. If submitted item is identical to that submitted to comply with other requirements, submit duplicate copy as a separate submittal to verify compliance with indicated LEED requirements.
  2. Project Materials Cost Data: Provide statement indicating total cost for building materials used for Project. Include statement indicating total cost of mechanical and electrical components.
  3. LEED Action Plans: Provide preliminary submittals within 30 days of date established for the Notice to Proceed indicating how the following requirements will be met.
    - a. LEED Credit MR 2.1 and 2.2, Construction Waste Management: Waste management plan complying with Division 1 Section "Construction Waste Management."
    - b. LEED Credit MR 3.1 and 3.2: List of proposed salvaged and refurbished materials.
      - 1) Identify each material that will be salvaged or refurbished, its source, and cost.
    - c. LEED Credit MR 4.1 and 4.2, Recycled Content: List of proposed materials with recycled content.
      - 1) Indicate cost, post-consumer and pre-consumer (post-industrial) recycled content for each product having recycled content.
    - d. LEED Credit MR 5.1 and 5.2, Local/Regional Materials: List of proposed regionally manufactured materials and regionally extracted, harvested, or recovered materials.
      - 1) Identify each regionally manufactured material, its source, and cost.
      - 2) Identify each regionally extracted, harvested or recovered material, its source, and cost.
    - e. LEED Credit MR 7.0, Certified Wood: List of proposed certified wood products.
      - 1) Indicate each product containing certified wood, its source, and cost.
      - 2) Include statement indicating total cost for wood-based materials used for Project, including non-rented temporary construction.
    - f. LEED Credit EQ 3.1, Construction IAQ Management Plan: Construction indoor air quality management plan.
  4. LEED Progress Reports: Concurrent with each Application for Payment, submit reports comparing actual construction and purchasing activities with LEED action plan for the following:
    - a. LEED Credit MR 2.1 and 2.2, Construction Waste Management: Waste reduction progress reports complying with Division 1 Section "Construction Waste Management."
    - b. LEED Credit MR 3.1, Resource Reuse: Salvaged and refurbished materials.
    - c. LEED Credit MR 4.1 and 4.2, Recycled Content: Recycled content.
    - d. LEED Credit MR 5.1 and 5.2, Local/Regional Materials: Regionally manufactured materials and regionally extracted, harvested, or recovered materials.
  5. LEED Documentation Submittals:
    - a. LEED Credit SS 7.2, Reduction of Heat Islands, Energy Star Roof: Product Data for roofing materials indicating Energy Star Compliance.
    - b. LEED Credit SS 8.0, Light Pollution Reduction: Product Data for interior and exterior lighting fixtures that stop direct-beam illumination from leaving the building site.
    - c. LEED Credit WE 3.1, Water Use Reduction: Product Data for plumbing fixtures indicating water consumption.
    - d. Prerequisite EA 3.0: Product Data for new HVAC equipment indicating absence of CFC refrigerants. Phase-out plan to replace CFC refrigerants in HVAC&R systems with CFC-free refrigerants within the Construction Period.

- e. LEED Credit EA 4.0, Elimination of HCFCs and Halons: Product Data for new HVAC equipment indicating absence of HCFC refrigerants, and for clean-agent fire extinguishing systems indicating absence of HCFC and Halon.
- f. LEED Credit EA 5.0, Measurement and Verification: Product Data and wiring diagrams for sensors and data collection system used to provide continuous metering of building energy and water consumption performance over time.
- g. LEED Credit MR 2.1 and 2.2, Construction Waste Management: Comply with Division 1 Section "Construction Waste Management."
- h. LEED Credit MR 3.1, Resource Reuse: Receipts for salvaged and refurbished materials used for Project, indicating sources and costs for salvaged and refurbished materials.
- i. LEED Credit MR 4.1 and 4.2, Recycled Content: Product Data and certification letter indicating percentages by weight of post-consumer and pre-consumer (post-industrial-recycled content for products having recycled content. Include statement indicating costs for each product having recycled content.
- j. LEED Credit MR 5.1 and 5.2, Local/Regional Materials: Product Data indicating location of material manufacturer for regionally manufactured materials.
  - 1) Include statement indicating cost and distance from manufacturer to Project for each regionally manufactured material.
  - 2) Include statement indicating cost and distance from point of extraction, harvest, or recovery to Project for each raw material used in regionally manufactured materials.
- k. LEED Credit MR 6.0: Product data for rapidly renewable materials.
  - 1) Include statement indicating costs for each rapidly renewable material.
- l. LEED Credit MR 7.0, Certified Wood: Product Data and certificates of chain-of-custody for products containing certified wood.
  - 1) Include statement indicating costs for each product containing certified wood.
  - 2) Include statement indicating total cost for wood-based materials used for Project, including non-rented temporary construction.
- m. LEED Credit EQ 1.0, Carbon Dioxide Monitoring: Product Data and Shop Drawings for carbon dioxide monitoring system.
- n. LEED Credit EQ 3.1, Construction IAQ Management Plan:
  - 1) Construction indoor air quality management plan.
  - 2) Product Data for temporary filtration media.
  - 3) Product Data for filtration media used during occupancy.
  - 4) Construction Documentation: Six photographs at three different occasions during construction along with a brief description of the SMACNA approach employed, documenting implementation of the IAQ management measures, such as protection of ducts and on-site stored or installed absorptive materials.
- o. LEED Credit EQ 3.2, Construction IAQ Management Plan:
  - 1) Signed statement describing the building air flush-out procedures including the dates when flush-out was begun and completed and statement that filtration media was replaced after flush-out.
  - 2) Product Data for filtration media used during flush-out and during occupancy.
  - 3) Report from testing and inspecting agency indicating results of IAQ testing and documentation showing conformance with IAQ testing procedures and requirements.
- p. LEED Credit EQ 4.1, Low-Emitting Materials, Adhesives and Sealants: Product Data and material safety data sheets (MSDSs) for adhesive and sealant used on the interior of the building indicating VOC content of each product used. Indicate VOC content in g/L calculated according to 40 CFR 59, Subpart D (EPA method 24).
- q. LEED Credit EQ 4.2, Low-Emitting Materials, Paints and Coatings: Product Data and material safety data sheets (MSDSs) for paints and coating used on the interior of the building indicating chemical composition and VOC content of each product used. Indicate VOC content in g/L calculated according to 40 CFR 59, Subpart D (EPA method 24).

- r. LEED Credit EQ 4.3, Low-Emitting Materials, Carpet: Product Data for carpet products indicating VOC content of each product used.
- s. LEED Credit EQ 4.4, Low-Emitting Materials, Composite Wood and Agrifiber Products: Product Data for composite wood and agrifiber products indicating that products contain no urea-formaldehyde resin.
  - 1) Include statement indicating adhesives and binder used for each product.
- t. LEED Credit EQ 6.2, Controllability of Systems: Product Data and Shop Drawings for sensors and control system used to provide individual airflow and temperature controls for minimum 50 percent of non-perimeter, regularly occupied space.
- u. LEED Credit EQ 7, Thermal Comfort: Product Data and Shop Drawings for sensors and control system used to monitor and control room temperature and humidity.

## **1.12 RECORD DOCUMENT SUBMITTALS**

- A. Maintain a clean, undamaged set of black line white prints of Contract Drawings and Shop Drawings. Mark the set to show the actual installation where the installation varies substantially from the Work as originally shown. Mark which drawing is most capable of showing conditions fully and accurately. Where Shop Drawings are used, record a cross-reference at the corresponding location on the Contract Drawings. Give particular attention to concealed elements that would be difficult to measure and record at a later date.
  - 1. Mark record sets with red erasable pencil. Use other colors to distinguish between variations in separate categories of the Work.
  - 2. Mark new information that is important to BNL but was not shown on Contract Drawings or Shop Drawings.
  - 3. Particular attention shall be given to recording of the fire protection, fire alarm and fire detection system operations and maintenance manuals and record documents.
  - 4. Note related change-order numbers where applicable.
  - 5. Organize record drawing sheets into manageable sets. Bind sets with durable-paper cover sheets; print suitable titles, dates, and other identification on the cover of each set.
- B. Protect record documents from deterioration and loss in a secure, fire-resistant location. Provide access to record documents for MPO's reference during normal working hours.
- C. Refer to Specification Sections for requirements of miscellaneous record keeping and submittals in connection with actual performance of the Work. Immediately prior to the date or dates of Substantial Completion, complete miscellaneous records and place in good order. Identify miscellaneous records properly and bind or file, ready for continued use and reference. Submit to MPO for the permanent project records.

## **1.13 OPERATION AND MAINTENANCE DATA**

- A. To aid the continued instruction of operating and maintenance personnel, and to provide a positive source of information regarding the products incorporated into the Work, furnish and deliver the data described in this Section and in pertinent other Sections of these Specifications.
- B. Submit two (2) copies of data, bound in 8½" x 11" manuals, in 3-ring binders with section separators, complying with the requirements in the Shop Drawing section herein.
- C. Operating and Maintenance Instructions:
  - 1. Where Instruction Manuals are required to be submitted under other Sections of these Specifications, prepare in accordance with the provisions of this Section. Clearly identify the contents of each Manual on the front cover.
  - 2. Contents: Include at least the following:
    - a. Neatly typewritten index near the front of the Manual, giving immediate information as to location within the Manual of all emergency information regarding the installation.
    - b. Complete instructions regarding operation and maintenance of all equipment involved including lubrication, disassembly, and reassembly.
    - c. Complete nomenclature of all parts of all equipment.

- d. Complete nomenclature and part number of all replaceable parts, name and address of nearest vendor, and all other data pertinent to procurement procedures.
  - e. Copy of all guarantees and warranties issued.
  - f. Manufacturers' bulletins, cuts, and descriptive data, where pertinent, clearly indicating the precise items included in this installation and deleting, or otherwise clearly indicating, all manufacturers' data with which this installation is not concerned.
  - g. Such other data as required in pertinent Sections of these Specifications.
3. Revisions:
- a. Following the indoctrination and instruction of operation and maintenance personnel, review all proposed revisions of the Manual with MPO, and make the revisions in the Manual and resubmit.

#### **1.14 PREVENTATIVE MAINTENANCE PROGRAM**

- A. A program of scheduling preventative and routine maintenance covering all operating equipment shall be prepared by the General Contractor, Vendors, and Subcontractors and shall be assembled by the General Contractor in accordance with the requirements set forth in Section 01 77 00, "Contract Closeout".
- B. The preparation, submittal, and approval of this program are prerequisite to Final Acceptance of the work and resultant Final Payment.
- C. Each Respective Trade Contractor, Vendor, and Subcontractor shall furnish to the General Contractor for compilation, the pertinent data shown on the form attached to this Section 01 30 00 applicable to each piece of operating equipment.

#### **1.15 CERTIFICATION OF SPECIFICATION COMPLIANCE**

- A. Certification of compliance with specification performance standards and manufacturers' specifications and directions shall be furnished for any portion of this work for which specific performance requirements and/or manufacturers' specifications are listed.
- B. Submit a notarized certification from the manufacturer certifying that products, material, systems or installations comply with the Specifications.
- C. It shall be the responsibility of the General Contractor to secure two (2) copies of each certification, when required, and transmit the certifications to BNL.
- D. Certification shall be signed by an officer of the manufacturer, or other individual authorized to sign documents on behalf of the company, on the forms included in this Section.
- E. Sample Certification Form (2 pages) is attached to this Section 01 30 00. Each item requiring certification shall be so noted and affidavits shall be filed singly to cover each specified material, installation, application, and the like.
- F. Certification shall accompany each submittal.

#### **1.16 MPO REVIEW**

- A. Except for submittals for the record or information, where action and return is required, MPO will review each submittal, mark to indicate action taken, and return promptly.
  - 1. Compliance with specified characteristics is the Contractor's responsibility.
  - 2. Review or approval of a specific item shall not indicate approval of an assembly of which the item is a component.
  - 3. Items not submitted in accordance with provisions of this section may be returned, without action.
  - 4. Submittals may be returned by regular mail.
- B. Action Stamp: MPO will stamp each submittal with a uniform, action stamp. MPO will mark the stamp appropriately to indicate the action taken, as follows:

1. No Exception Taken: When MPO marks a submittal "NET," the Work covered by the submittal may proceed provided it complies with requirements of the Contract Documents. Final payment depends on that compliance.
  2. Make Corrections Noted: When MPO marks a submittal "MCN," the Work covered by the submittal may proceed provided it complies with notations or corrections on the submittal and requirements of the Contract Documents. Final payment depends on that compliance.
  3. Revise and Resubmit, Rejected, and Submit Specified Item: When MPO marks a submittal with these comments, do not proceed with Work covered by the submittal, including purchasing, fabrication, delivery, or other activity. Revise or prepare a new submittal according to the notations; resubmit without delay. Repeat if necessary to obtain different action mark.
    - a. Do not use, or allow others to use, submittals marked with these comments, at the Project Site or elsewhere where Work is in progress.
  4. Other Action: Where a submittal is for information or record purposes or special processing or other activity, MPO may return the submittal marked "Reviewed."
- C. Unsolicited Submittals: MPO will return unsolicited submittals to the sender without action, or marked "Not Reviewed."

**PART 2 - PRODUCTS – NOT USED**

**PART 3 - EXECUTION – NOT USED**

**END OF SECTION**

## SUBMITTAL TRANSMITTAL

**PROJECT:** \_\_\_\_\_ **SUBMITTAL NO.:** \_\_\_\_\_ - \_\_\_\_\_  
 \_\_\_\_\_ SECTION NUMBER -----| | |  
 \_\_\_\_\_ SEQUENCE NUMBER -----| | |  
**ARCH. PROJ. NO.:** \_\_\_\_\_ RE-SUBMITTAL CHARACTER -----| | |  
 SPECIFICATION TITLE: \_\_\_\_\_  
 MANUFACTURER: \_\_\_\_\_  
 DESCRIPTION OF SUBMITTED ITEM: \_\_\_\_\_

NOTE 1: Submittal transmittal to BNL or Architect indicates Contractor and Subcontractor / Vendor has reviewed for compliance with Contract Documents and has approved submittal.

NOTE 2: THIS TRANSMITTAL FORM SHALL STAY WITH SUBMITTAL THROUGHOUT ROUTING.  
COPY FOR YOUR FILE.

| ROUTING SEQUENCE                      | ACTION TAKEN BY | DATE REC'D | DATE SENT | NUMBER COPIES | ACTION TAKEN |
|---------------------------------------|-----------------|------------|-----------|---------------|--------------|
| SUBCONTRACTOR / VENDOR                |                 | N. A.      |           |               | A<br>NOTE 1  |
| CONTRACTOR                            |                 |            |           |               | A<br>NOTE 1  |
| BNL<br>Brookhaven National Laboratory |                 |            |           |               |              |
| ARCHITECT<br>HDR Architecture. Inc.   |                 |            |           |               |              |
| CONTRACTOR                            |                 |            |           |               |              |
| SUBCONTRACTOR / VENDOR                |                 |            | N.A.      |               |              |

**ACTION LEGEND:** (Indicate in ACTION TAKEN column above)

NET NO EXCEPTION TAKEN  
 MCN MAKE CORRECTIONS NOTED  
 R&R REVISE AND RESUBMIT  
 REJ REJECTED  
 SSI SUBMIT SPECIFIED ITEM  
 R REVIEWED (Record purposes only)  
 NR NOT REVIEWED (Unsolicited)

**REMARKS:**

SEE ATTACHED COMMENTS     SEE ENCLOSED SUBMITTAL FOR COMMENTS

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**END OF SUBMITTAL TRANSMITTAL**



PREVENTATIVE MAINTENANCE PROGRAM OPERATING EQUIPMENT DATA (cont'd)

17. List Shop Drawings, Equipment Cuts, Catalogs, or the other drawings that show this equipment.
18. Indicate spare parts lists, maintenance and instruction manuals, or other data furnished.
19. Indicate all services connected to this equipment - water, drain, steam, return, gas, vacuum, chilled water, electric, etc. Give sizes of connections, amount used, pressure, etc.
20. Type of refrigerant (if any)
21. Capacity of equipment
22. Electrical Characteristics:            Voltage    Amp    Phase
23. Electrical Circuit Data Panel Designation  
    Panel Location                      Circuit Number  
    Fuse Size                              Fuse Type
24. Location and data of any auxiliaries
25. Other Data

Date of Issuance: \_\_\_\_\_

Submitted By: \_\_\_\_\_

Equipment Name: \_\_\_\_\_

PMPD-2

CERTIFICATION OF SPECIFICATION COMPLIANCE

I/WE, the MANUFACTURER/SUPPLIER and INSTALLER of \_\_\_\_\_

as specified in Section Number \_\_\_\_\_ of the Contract Documents prepared by Brookhaven National Laboratory, Upton, New York 11973 for:

(Project Title) \_\_\_\_\_

(Building) \_\_\_\_\_ (J/N) \_\_\_\_\_

(Contract Number) \_\_\_\_\_

do (does) herein certify that all materials furnished for said project do fully comply with all specification requirements as stated within the Contract Documents and further certifies that installation of this work has been performed in strict accordance with recognized standards of the industry governing such work, and all applicable Codes, Regulations, and Standards.

CONTRACTOR: \_\_\_\_\_

CERTIFICATION BY: \_\_\_\_\_ TITLE: \_\_\_\_\_

ADDRESS: \_\_\_\_\_

CERTIFICATION DATED: \_\_\_\_\_

Distribution:

Original and One Copy to:

Brookhaven National Laboratory  
Jim Mills, Supervisor  
Building 134-C  
Upton, New York 11973

CSC-1

CERTIFICATION OF SPECIFICATION COMPLIANCE

CORPORATE ACKNOWLEDGEMENT

On the \_\_\_\_\_ day of \_\_\_\_\_, before me came \_\_\_\_\_  
to me known and who by me being duly sworn did depose and say that he  
resides at \_\_\_\_\_  
\_\_\_\_\_ that he is the officer of  
the said corporation executing the foregoing instrument that he knows  
the seal of said corporation, that the seal affixed to said instrument  
is such corporate seal, that it was so affixed by order of the Board of  
Directors of said corporation and that he signed his name thereto by  
like order.

\_\_\_\_\_  
Notary Public

INDIVIDUAL ACKNOWLEDGEMENT

State of \_\_\_\_\_  
County of \_\_\_\_\_

On the \_\_\_\_\_ day of \_\_\_\_\_, before me came \_\_\_\_\_  
to me known and who by me being duly sworn did depose and say that he  
resides at \_\_\_\_\_  
\_\_\_\_\_ that he is the individual who  
executed the foregoing instrument.

\_\_\_\_\_  
Notary Public

PARTNERSHIP ACKNOWLEDGEMENT

State of \_\_\_\_\_  
County of \_\_\_\_\_

On the \_\_\_\_\_ day of \_\_\_\_\_, before me came \_\_\_\_\_  
to me known and who by me being duly sworn did depose and say that he  
resides at \_\_\_\_\_  
\_\_\_\_\_  
that he is a partner in the firm of \_\_\_\_\_  
doing business under the name of \_\_\_\_\_  
and that he executed the foregoing instrument on behalf of said  
partnership.

\_\_\_\_\_  
Notary Public

CSC-2

**SECTION 01 31 00**  
**CONSTRUCTION PROGRESS DOCUMENTATION**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. Work under this section shall consist of furnishing and maintaining a Construction Schedule utilizing, network analysis system software:
1. Schedule shall be prepared in a precedence format demonstrating complete fulfillment of all work shown in the contract documents.
  2. Construction Schedule shall be based on and incorporate the Work Breakdown Structure (WBS) and the Contract Milestone and Completion Dates specified and shall show the order in which the Contractor shall perform the Work.
  3. Schedule activities shall accurately depict the entire scope of work to be performed to complete the project including, but not limited to, all activities of subcontractors, consultants, equipment vendors and suppliers. In addition, the Construction Schedule shall indicate the planned dates of start-up and testing for equipment, systems and subsystems; and all interface activities and matters involving mutual support between the Contractor, Subcontractors, Suppliers, and the Modernization Project Office.
  4. Contractor shall regularly update the schedule in accordance with the requirements of this section and utilize it in planning, coordinating and performing all of work under this contract.
- B. Contractor shall utilize Primavera P6 scheduling software and shall have the capability of furnishing data reports or sorts in the following formats:
1. Activity listing by Activity ID Number;
  2. Activity listing by early and late start dates;
  3. Activity listing by Work Breakdown Structure and early dates;
  4. Critical Path activities (defined as Longest Path);
  5. Activity listing by responsibility code or subcontractor or specification section.
  6. Activity listing by total float;
  7. Computer produced time scaled network diagram; and
  8. Computer produced bar chart.
- C. Construction Schedule shall be used as the basis for determining the schedule of values, Payment Schedule and Progress Payments. The schedule will be used to determine adequate staffing, planning and reporting during execution of work by the contractor. The construction schedule will assist in monitoring the progress of work and evaluating proposed changes to the contract:
1. BNL will be under no contractual obligation and will have no responsibility to process Contractor's application for payment until Contractor has submitted an acceptable Construction Schedule in accordance with the requirements of the Contract Documents.
  2. Once Contractor has complied with the requirements of the Contract Documents relating to submission of the Construction Schedule, BSA shall make payment to Contractor for all amounts withheld under this paragraph, in accordance with the terms and conditions of the Section for Payment Applications.

- D. Contractor agrees to adjust network logic, activity sequences or activity durations subject to BSA's review and approval, including, but not limited to, adjustments as required to maintain progress to ensure completion within the Contract Time, and to absorb within his schedule slippages, delays, changes in sequence required by project conditions, labor inefficiency and resource unavailability subject only to any time extension justified under the Contract Documents.
- E. Float or slack is defined as the amount of time between the planned early start date and the planned late start date or the planned early finish date and the planned late finish date of any of the activities in the Construction Schedule. Float is the amount of time an activity can be delayed without affecting the completion date for the project:
  - 1. Float or slack is not time for the exclusive use or benefit of either BSA or the Contractor.
  - 2. Use of float suppression techniques such as preferential sequencing or logic, special lead/lag logic restraints, and extended activity times are prohibited and use of float time disclosed or implied by use of alternative float-suppression techniques shall be shared to the benefit of BSA and Contractor.
- F. Pursuant to the float sharing requirements as set forth in the above paragraph, use of float suppression techniques such as preferential sequencing, special lead/lag logic restraints, extended activity durations, or unspecified milestones, contractor designated constrained dates shall be cause for rejection of the schedule, cause for the rejection of progress payments and any revisions or updates.
- G. Schedule shall clearly identify the activities illustrating accomplishment of the time(s) for completion of the activities leading to the Beneficial Occupancy, the Substantial Completion and Final Completion dates as set forth in the Contract Documents:
  - 1. If the schedule indicates earlier completion time(s) than that set forth in the Contract Documents, the time difference between the Contractor's planned completion date and the contract directed completion date shall be considered Project Float, jointly owned and for the mutual use of both BSA and the contractor. This float is a resource available to both BSA and Contractor and may not be used as a basis of claim by Contractor for additional compensation for actual project completion after the early completion schedule date but before the Final Completion date.
- H. Failure by the Contractor to include any element of work required for performance of the Contract or failure to properly sequence the work shall not excuse Contractor from completing all work within the Contract Time.
- I. As defined by the contract, the entire project performance period shall establish the project completion date which shall be utilized in the planning and presentation of the Contractors project schedule. Approval of the planned early completion date is solely at the discretion of BSA:
  - 1. By execution of the Contract, Contractor represents it has analyzed the work, the materials and methods involved, the systems of the building, availability of qualified labor, restrictions of the site, constraints imposed, workload and capacity to perform the work, and agrees that the specified times are reasonable considering the existing conditions prevailing in the locality of the work, including weather conditions, and other factors, with reasonable allowance for variations from average or ideal conditions.
- J. Beneficial Occupancy and Substantial Completion dates provided are considered essential to the satisfactory performance of this Contract and to the coordination of all work on the project.
- K. The Contractor shall provide the CPM schedule, graphics, cost, variance and resource reports required under this section and or requested by BSA at no additional cost to BSA throughout the contract performance period.

- L. It is understood and agreed that TIME IS OF THE ESSENCE and the Contractor agrees to diligently follow and adhere to the schedule with due diligence so as to execute the work within the Beneficial Occupancy, Substantial Completion and Final Completion dates and time frames stipulated in the Contract Documents:
1. Contractor shall take all necessary steps, including overtime, double shifts, weekends, and holiday work to complete this work and meet the Beneficial Use, Substantial Completion and Final Completion dates stipulated in the Contract Documents.

## 1.2 INTERIM SCHEDULE

- A. Within 15 calendar days after the Notice of Award, Contractor shall submit to BSA for review and approval, a preliminary schedule detailing planned work/operations/procurement activities for the first 90 days of construction with sufficient detail to support progress payments to be made while the Baseline schedule is being developed and approved:
1. All activities shown in the interim schedule shall be cost loaded. Summary level activities for the balance of the work through completion shall also be included and cost loaded. Approximate duration for the summary activities shall be shown.
  2. BSA's review of submittals shall be identified as schedule activities:
    - a. Minimum duration for these activities shall be as set forth in Section 01 30 00, SUBMITTALS PROCEDURES.
  3. If the Interim Project Overview and Preliminary Construction Schedule are not submitted in a complete and acceptable manner by the next subsequent payment application, then BSA shall be under no contractual obligation and shall have no responsibility to process Contractor's application for payment until Contractor has submitted an acceptable schedule in accordance with the requirements of the Contract Documents.
  4. These schedules are required before the start of construction activities and shall consist of 4 prints of a Network Logic Diagram, 4 sets of computer produced Schedule and Cost Reports, and 2 sets of data files on an electronic exchange media such as CD-ROM. Contractor's Submittal shall indicate which days of the week will be planned workdays and the dates of all scheduled non-work days.
  5. Project Overview Schedule shall depict major components of the Work and the sequence relations between major components and subdivisions of major components:
    - a. Schedule shall indicate the relationship and time frames in which the various facilities will be made substantially complete and placed into service as indicated in the Contract Documents.
- B. Preliminary Schedule shall include those activities that are necessary to properly indicate:
1. Approach to scheduling for the remaining-Work areas or phases of the Work:
    - a. Work for each phase or area shall be represented by at least one Summary Activity such that the activities cumulatively indicate the entire Construction Schedule.
  2. Approximate cost and duration for each Summary Activity shall be shown on the Preliminary Schedule and shall include Contractor's best estimate of the Work it represents.
  3. Procurement Activities to be accomplished during the first 180 days of the Contract Time:
    - a. 180-day procurement activities shall include preparation of Shop Drawings and sample submittals, and the fabrication and delivery of key and long-lead procurement elements, and shall also indicate intended and realistic delivery dates for fabricated items.
    - b. The Architect's review of submittals shall be identified as schedule activities:
      - 1) Minimum duration for these activities shall be as set forth in Section 01 30 00, SUBMITTAL PROCEDURES.
  4. Summary Activities shall be replaced and expanded with detailed activities when the Preliminary Schedule is incorporated into the Construction Schedule.
- C. Schedules shall be computerized and presented in the form of bar charts and shall consist of horizontal lines, or bars plotted along a daily time scale:
1. Horizontal bars shall indicate the start and finish dates for each work activity depicted.
  2. Not more than 10 sheets shall be employed to represent this overview information.
- D. Joint Review, Revisions and Acceptance:

1. BSA and Contractor shall meet within 10 days of receipt of Contractor's proposed Interim Schedules for a joint review and any correction or adjustment of the proposed Interim Schedules.
  2. Within 10 days after the joint review, Contractor shall submit:
    - a. Revised proposed Interim Schedules in accordance with agreements reached during the joint review meeting, and re-submit diagrams, printouts and diskettes.
  3. Acceptance of Contractor's Interim Schedules creates neither a warranty, expressed or implied, nor acknowledgement of admission of the reasonableness of the activities, logic, durations, manpower or cost loading in the Interim Schedule:
    - a. Such acceptance will, however, be a condition precedent to BSA's obligation to make any partial payments.
- E. Upon acceptance, Interim Schedules shall become the basis for the BSA's consideration of progress payments to the Contractor during the first 90 days of the Contract Time.
- F. Interim Schedules shall be updated on a monthly basis, while the Construction Schedule is being developed.

### **1.3 BASELINE CONSTRUCTION SCHEDULE**

- A. Within 6 weeks of the contract award, the Contractor shall submit a Construction Schedule to BSA for review by BSA:
1. If Construction Schedule is not submitted in a complete and acceptable manner by the next subsequent payment application, then BSA shall be under no contractual obligation and shall have no responsibility to process Contractor's application for payment until Contractor has submitted an acceptable schedule in accordance with the requirements of the Contract Documents.
- B. Construction Schedule shall consist of three parts: computer-drawn time-scaled network diagram; computer-generated network analysis or printout; and computer-generated off-site schedule:
1. Submission shall include 4 prints of the Network Diagram, 4 sets of computer produced Schedule and Cost Reports and 2 sets of data files on an electronic exchange media such as a CD-ROM.
  2. Construction Schedule shall cover the entire Contract Time and incorporate, in detail, the Preliminary Schedule, including all revisions thereto reviewed and accepted by BSA.
  3. Each major component and subdivision component shall be accurately plotted on time scale sheets on reproducible paper not to exceed 22 IN by 34 IN in size (D Size sheet).
- C. Initial Construction Schedule submittal shall reflect Contractor's plan for the performance of all Work as of the date of the Notice to Proceed and shall not reflect the actual progress of any of the Work:
1. Contractor's Construction Schedule shall consist of but not be limited to the following:
    - a. Procurement Activities, including the activities and information.
    - b. Construction Activities, including the activities and information.
    - c. The Construction Schedule shall indicate the sequence of the Work and the time of starting and completing each part.
- D. Activities comprising the Interim Schedules shall be included in the Construction Schedule.
- E. All constraints and contract milestones shall be clearly indicated:
1. Construction Schedule shall be used as the basis for progress reporting, schedule controlling and schedule forecasting, and shall be sufficiently detailed so as to allow BSA to evaluate Contractor's planned schedule and to monitor Contractor's progress on a day-to-day basis during performance.
- F. Construction Schedule as approved shall be the Baseline Schedule against which all progress shall be measured:
1. Construction Schedule shall be used by Contractor and BSA as the basis for evaluating changes and claims and for evaluation of Application for Payment.

2. Schedule of Values and the Payment Schedule shall be developed using the values indicated in the Construction Schedule and organized in accordance with the BSA WBS.
- G. Should BSA reject Contractor's Construction Schedule, or any subsequent update or revision, as not being in accordance with the Contract Documents, Contractor shall, within 14 calendar days of receipt of the rejection, make the changes or revisions required to conform to the Contract Documents or as directed by BSA.
- H. The following shall be depicted for each activity:
1. Activity numbers shall be unique and shall not change as revisions are made to the schedule.
  2. Activities shall have a concise description of the Work represented by the activity:
    - a. Work related to each activity shall be limited to one work trade, one construction area, and one floor.
  3. The durations of activities shall be expressed in whole working days, with a maximum duration of 21 calendar days or have a value over \$25,000 without prior acceptance by BSA. Non construction activities such as concrete curing, mobilization, submittals, fabrication of materials, and delivery of materials and equipment, may have values in excess of 21 calendar days and values over \$25,000, unless otherwise directed by the BSA.
  4. Activities shall be assigned separate activity codes to create a Work breakdown structure consistent with the BSA Work Breakdown Structure (WBS) to be provided to contractor, and, as a minimum, shall include:
    - a. Activity code, maximum 5 characters, to define specific performance responsibility by discipline or subcontractor:
      - 1) Abbreviations shall be fully described in a legend attached to the Construction Schedule.
    - b. Activity code, maximum 5 characters, to define concise Work areas, such as building, floor, site electrical, paving, etc:
      - 1) Abbreviations shall be fully described in legend attached to the Construction Schedule.
      - 2) As requested by BSA, either prior or subsequent to the acceptance of the Construction Schedule, Contractor shall provide, without additional cost to BSA, on prints of the Contract Drawings, graphic illustrations of the relationships of construction activities to intended Work areas as identified by Contractor.
    - c. Activity code, maximum 5 characters, to identify phase of each activity.
    - d. Activity code, maximum 5 characters, to identify the Specification Section for the activity.
  5. Activity durations shall be in workdays and generally shall not exceed 21 calendar days:
    - a. Work with durations greater than 21 calendar days shall generally be reduced to activities of 21 calendar days or less using logical measuring points of quantities, time or accomplishment.
    - b. The 21-calendar day limitation is not intended to impede or restrict Contractor's flexibility to properly plan and schedule the Work.
- I. Construction Schedule shall indicate that the project will begin on the date of contract award and will be completed within the number of calendar days specified in the Contract Documents.
- J. Contractor shall ensure that the schedule represents an accurate, efficient, reasonable and feasible plan and method for accomplishing the Work throughout the time of performance:
  1. While BSA will review the Construction Schedule, the schedule itself is the Contractor's, who has full responsibility for its preparation, content, revisions and updating in accordance with the requirements of the Contract Documents.
- K. It is to be expressly understood and agreed by the Contractor that BSA does not guarantee that Contractor can start work activities on the "early start" or "late start" date or complete work activities on the "early finish" or "late finish" date shown in the schedule, or as same may be updated or revised.

- L. If Contractor's schedule indicates that BSA is to perform an activity by a specific date, or within a certain duration, BSA will not be bound to said date or duration unless BSA expressly and specifically agrees in writing to same; BSA's overall review and approval or acceptance of the schedule does not constitute an agreement to specific dates or durations for activities of the BSA.
- M. The Construction schedule shall indicate the following:
1. Off-site activities.
  2. Inspections, start up, testing and balancing, mobilization, and demobilization.
  3. Interfaces with the work of outside contractor, any separate contractor.
  4. Description of activity and activity number/numbers.
  5. Planned and remaining duration time for each activity
  6. Early start date for each activity.
  7. Late start date for each activity.
  8. Early finish date for each activity.
  9. Late finish date for each activity.
  10. Float available for each path of activities containing float.
  11. Actual start date for each activity begun.
  12. Actual finish date for each activity completed.
  13. Identification of all critical path activities in the network analysis.
  14. Critical path for the project, with said path of activities being clearly and easily recognizable on the time-scaled network diagram:
    - a. Relationship between all non-critical activities and activities on the critical path shall be clearly shown on the network diagram.
  15. Planned and earned dollar value of each activity and the planned and earned dollar value each month:
    - a. Total planned value shall equal the total contract value.
    - b. Planned value each month shall equal the amounts reported in the Payment Schedule.
    - c. Activities shall have an assigned dollar value (cost loading) that shall cumulatively equal the Contract Amount.
    - d. General Conditions, General Requirements, insurance, bonds, permits, and all other overhead costs and profit shall be identified and the corresponding dollar values indicated for each.
  16. Planned and earned craft and staff manpower utilization for each activity:
    - a. Manpower-Loading for each activity of the Construction Schedule shall identify the total number of workers, not the total number of crews.
    - b. In addition, Contractor shall prepare and submit a Manpower Summary Analysis, in graphic format, depicting manpower by principal trades and in the aggregate.
    - c. Graph shall show the number of man-days of effort, by month, over the duration of the Project.
  17. The percent complete of each activity in progress or completed.
- N. Contractor shall submit with the Construction Schedule a narrative report indicating anticipated allocation of the following resources and work shifts to be utilized on the project:
1. Labor resources.
  2. Equipment resources.
  3. Whether work will be performed on a single, double or triple shift, and whether it is to be done on a 5, 6 or 7 day work week basis.
- O. Monthly anticipated adverse weather days shall be considered and included in the planning and scheduling of all weather affected Work activities in order to all Work within the Contract Time.
- P. Custom calendars should be developed by the Contractor to identify the differing holiday, weather, workweek, and other work calendars on which specific work activities will be performed:
1. Each activity should be assigned to the calendar corresponding with its work activity, weather, or season.
- Q. Joint Review, Revisions and Acceptance:

1. BSA and the Contractor shall meet, within 20 days of receipt of the Contractor's proposed Construction Schedule, to perform a joint review of, and make corrections or adjustments to, the proposed Construction Schedule:
  - a. If BSA questions the Contractor's proposed activities, logic, durations, manpower or cost loading, the Contractor shall, within 7 days of receipt of any BSA request, provide a satisfactory revision to or adequate justification for such questions, to the satisfaction of the BSA.
  - b. BSA may at any time as part of the review, acceptance and subsequent monthly updating process, request that additional details be included in the Construction Schedule.
  - c. Contractor shall provide the details requested to the satisfaction of the BSA at no additional cost.
2. In the event Contractor fails to define any element of Work, activity or logic, such omission or error, when discovered, shall be corrected by CONTRACTOR in the next monthly Construction Schedule Update, and shall not affect the Contract Time.
3. Within 14 days after the joint review between Contractor and BSA, Contractor shall revise the Construction Schedule in accordance with agreements reached or direction given during the joint review and submit diagrams, printouts and electronic copies.
4. Acceptance by BSA of Contractor's Construction Schedule does not relieve Contractor of any of its responsibility whatsoever for the accuracy or feasibility of the Construction Schedule, or of Contractor's ability to meet the Beneficial Occupancy, Substantial Completion and Final Completion requirements of the Contract, and such acceptance also creates neither a warranty, expressed or implied, nor an acknowledgment or admission of the reasonableness of the activities, logic, durations, manpower, or cost loading of Contractor's Construction Schedule.
5. Upon acceptance of the Construction Schedule by BSA, the cost-loaded values of the Construction Schedule will be used as a basis for considering subsequent Applications for Payment:
  - a. Monthly Progress payments shall be based upon information developed as a result of the monthly Construction Schedule Update meetings.
  - b. BSA will utilize the computer-produced Cost Report for verification of the Application for Payment submitted by the Contractor.

#### **1.4 NETWORK DIAGRAM REQUIREMENTS**

- A. Network Diagram shall be computer generated, in a time scaled format, on 30 x 42 IN standard size sheets.
- B. Network Diagram shall be organized by grouping activities related to specific phases, areas or floors of the Project together for ease of understanding and simplification.
- C. The following shall be depicted on the Network Diagram for each activity:
  1. Activity Number.
  2. Description of Work.
  3. Activity duration.
  4. Designation of Critical Path where applicable.

#### **1.5 COMPUTER PRODUCED SCHEDULE AND COST REPORT REQUIREMENTS**

- A. Schedule Reports shall include, for each activity depicted in the Construction Schedule, the following information:
  1. Activity Number.
  2. Description of the Work.
  3. Original Duration.
  4. Remaining Duration.
  5. Percent complete based on time.
  6. Work phase, area and floor codes, as applicable.
  7. Responsibility code.

8. Early Start and Finish dates.
  9. Actual Start and Finish dates.
  10. Total float.
- B. Contractor shall submit Cost Reports that include, for each activity depicted in the Interim and construction Schedules, and the following additional information:
1. Estimated cost value
  2. Percentage complete to date based on cost.
  3. Cost value complete to date
- C. Contractor shall submit a Schedule Calculation Summary Report that includes listings of constraints, open-ends, out-of-sequence work, and scheduling statistics:
1. Report is computer-generated when the Project Schedule is calculated upon completion of inputting all activity progress at the month end processing.
- D. Contractor shall prepare and submit cost-loading graphic charts (i.e., S-Curve and monthly histogram) that are computer generated from the Contractor's schedule data:
1. Graphic shall show forecasted monthly cash flow in a histogram format, and the forecasted cost over the planned project execution period shown on a cumulative cost curve using actual dates, early dates, and late dates.
- E. Contractor shall prepare and submit a manpower histogram depicting both the weekly forecasted manpower usage (in a histogram format) and the cumulative manpower for the planned project execution period:
1. Manpower-loading shall indicate the total number of workers, not total number of crews.
  2. Manpower charts shall be computer generated from the Contractor's schedule data.

## 1.6 UPDATES

- A. Construction Schedule, including the Project Overview Schedule, shall be updated every month to reflect the actual as-built data and the update shall be utilized as an essential part of the payment application review:
1. Three (3) copies of the preceding month's Construction Schedule computer printout shall be submitted 7 days prior to the submission of each monthly Application for Payment with proposed update and revisions marked thereon.
  2. If the Construction Schedule Updates and Revisions are not submitted in a complete and acceptable manner by the next subsequent payment application, then BSA shall be under no contractual obligation and shall have no responsibility to process Contractor's application for payment until Contractor has submitted an acceptable schedule update in accordance with the requirements of the Contract Documents.
- B. Marked up copies may be reviewed by BSA:
1. Should BSA take exception to any of the items or progress, BSA will return one (1) copy to Contractor for use in preparing the monthly update which shall be submitted with each monthly Application for Payment.
  2. Updated Construction schedule shall include the following:
    - a. Activities in progress or to be performed in the future, and the percentage complete of each activity;
    - b. Critical path for the project based upon the latest update data; and
    - c. Earned value for each activity.
    - d. Graphic Reports sorted as follows:
      - 1) Bar Chart report sorted by Area – Early Start (D size sheets).
      - 2) Six (6) week look-ahead report (11"x17").
    - e. Cost Report sorted by Responsibility (trade) code.
    - f. Summary Cost Report sorted by Area code by Early Start.
    - g. Cost loading graphic charts (i.e., S-Curve and monthly histogram).
    - h. Manpower histogram depicting both the weekly manpower usage (actual and forecasted in a histogram format).
    - i. Tabular reports sorted as follows:

- 1) By Activity ID,
  - 2) By Total Float, and
  - 3) By Early Start.
- C. Progress Reports: Contractor shall forward to BSA with each application for payment a type-written monthly summary report, in a form acceptable to BSA, of the progress of the Work, including but not limited to the following information:
1. Progress of the Contract Work, whether off-site (e.g. procurement, submittals) or in the field, stating the existing status, rate of progress, estimated time of completion and cause of delays, if any;
  2. Description of Work accomplished since submission of previous progress schedule and work planned during the next period;
  3. Comparison of the actual status of the Work with Contractor's Construction Schedule as previously updated or revised in accordance with the review of the BSA;
  4. Status of equipment and materials deliveries;
  5. Changes or additions to Contractor's supervisory personnel since the preceding progress report;
  6. Causes of any delays;
  7. Changes in logic, sequence or durations of activities and the reasons therefore;
  8. Actions proposed by Contractor to restore schedule, including what is being done or is planned to be done in problem areas;
  9. What problems or changes are anticipated or expected by Contractor and what is Contractor's plan to deal with same so as to minimize or prevent any delay to completion.
  10. Changes in the Payment Schedule.
- D. Neither the updating or revision of Contractor's Construction Schedule, nor the submission, updating, change or revision of any report or schedule submitted by Contractor under this Contract nor BSA's review or no objection of any such report or schedule shall have the effect of amending or modifying, in any way, the Contract Time, any Contract Completion Date, or Contract Milestone Dates or of modifying or limiting in any way Contractor's obligations under this Contract.

## 1.7 REVISIONS

- A. If, as a result of the monthly construction schedule Update, it is the opinion of BSA that the Construction Schedule no longer represents the actual planned prosecution and the actual progress of the Work, BSA may request that the Contractor revise the Construction Schedule to reflect its current planning:
1. Contractor shall submit in writing, a schedule analysis illustrating the influence, if any, of the proposed schedule revision on Contract Time.
  2. Each such schedule analysis shall be submitted to the satisfaction of BSA prior to the next Construction Schedule Update.
  3. Compliance with such submittal requirements shall be a condition precedent to any obligation of BSA to consider any Application for Payment.
- B. If the schedule Update indicates that any Beneficial Occupancy or Substantial Completion date will be more than 14 calendar days late, Contractor shall be required to prepare a Schedule Recovery Plan for regaining the time that the Project is behind schedule:
1. Schedule Recovery Plan shall be submitted within 5 working days and should indicate in both narrative form and in a detailed time-scaled bar chart schedule with logic for the following information:
    - a. Amount of time the activity is late.
    - b. Reason for the lateness.
    - c. Proposed method for recovering the time and achieving all required project Beneficial Occupancy or Substantial Completion deadlines, including manpower loading if applicable.

- C. Contractor may also request reasonable revisions to the Construction Schedule in the event that planning for the Work is revised:
  - 1. If Contractor desires to make changes in the Schedule to reflect revisions in its planned methods of operating and scheduling of the Work, Contractor shall notify BSA in writing, stating the reason for the proposed revisions and submit to BSA a schedule analysis illustrating the influence, if any, of the proposed schedule revision on Contract Time.
  - 2. Each such schedule analysis shall demonstrate how Contractor would propose to incorporate the proposed schedule revision into the Construction Schedule.
  - 3. Schedule analysis shall demonstrate the time impact of the proposed schedule revision as of the date upon which the revision into the Project Schedule.
  - 4. Schedule analysis shall demonstrate the time impact of the proposed schedule revision as of the date upon which the revision is proposed to be initiated, reflecting the projected status of the Work at that point in time, and provide the event time computations of all affected activities if the proposed revisions were to be accepted by BSA.
  - 5. Accepted revisions will be incorporated into the Construction Schedule at the next monthly Construction Schedule Update Meeting.
- D. If a revision to the Construction Schedule is contemplated, Contractor shall advise BSA in writing at least 7 days prior to the next Construction Schedule due date, describing the proposed revision and specifically setting forth the reason(s) for each revision.
- E. BSA initiated revisions to the Construction Schedule shall not be incorporated into the Construction Schedule without-written Notice to the Contractor, who shall respond in writing within 7 days, either agreeing with BSA's proposed revision or setting forth justification as to why it should not be made:
  - 1. If the Contractor's justification for not making the revision is accepted, such revision will not be incorporated into the Construction Schedule.
  - 2. Contractor's failure to respond in writing within 7 days will be deemed to be an acceptance of the BSA initiated revisions and such revisions will be incorporated into the construction schedule in the next schedule update.
- F. Requests for revisions of activity manpower, activity costs or the redistribution of activity costs shall be made in accordance with the requirements of this Section.
- G. Contractor shall provide any and all of the above revisions to the schedule at no additional compensation or cost to BSA.

## **1.8 CERTIFICATION**

- A. Precedent to final payment, provide three (3) copies of the Construction Schedule utilized with certification that schedule correctly represents the way the Work was performed.

## **1.9 APPLICATION FOR PAYMENT**

- A. BSA will be under no obligation to process Contractor's Application for Payment until Contractor has complied with the requirements specified herein, and BSA will have the right to withhold such payments until Contractor has complied. Monthly request for payment shall be based upon the current approved schedule update.
- B. Contractor shall furnish 5 copies of the Monthly Summary Report and the following network analysis reports with the application for payment to BSA:
  - 1. Activity listing with activity code, description, original and remaining duration, percent complete, early and late start and finish and float for each activity.
  - 2. Critical Path Report with activities listed by most critical and early finish date.
  - 3. Activity listing with planned and earned value.
  - 4. Activity listing comparing the current schedule to the Approved Baseline Schedule.
- C. Contractor shall furnish 2 sets of electronic exchange media such as a CD-ROM containing the updated construction schedule utilized to compute the total earning reported in the Pay Application to BSA.

## **1.10 REQUESTED TIME ADJUSTMENT SCHEDULE**

- A. If Contractor believes he is entitled to an extension of the Contract Time under the Contract Documents, Contractor shall submit to a Proposed Change Order, a separate schedule analysis, titled "Requested Time Adjustment Schedule", indicating suggested adjustments in the Contract Time which should, in the opinion of the Contractor, be made in accordance with the Contract Documents due to changes, delays, or conditions which are expected or contemplated by Contractor (whether such conditions are excusable under the Contract or are due to Contractor fault):
  - 1. This separate schedule shall be time-scaled utilizing a computer generated and computer-drawn network analysis schedule and shall be accompanied by a formal time extension request as required by the Contract and a detailed narrative justifying the time extension requested.
- B. Time extensions for weather delays during a given month will be allowed only for actual work days in excess of those numbers provided in the Construction Schedule, and only when those excess days of delay affect the current critical path(s) leading to the specified Substantial Completion or Contract Completion dates.
- C. Construction Schedule submitted by Contractor shall not show a required completion date (late finish) later than the Contract Time.
- D. The time adjustment request shall include schedule forecasts that predict the proposed Project Completion Date. "Requested Time Adjustment Schedule" shall clearly and accurately reflect Contractor's actual intention and proposed time adjustments as of the latest update:
  - 1. "Requested Time Adjustment Schedule" shall also reflect any adjustments made by Contractor in the logic, sequence or duration of any activities in the Construction Schedule, and any time extensions previously granted by BSA, along with actual and expected progress.
- E. BSA will not have any obligation to consider any time extension request unless the requirements of the Contract Documents, and specifically, but not limited to these requirements, are complied with; and BSA will not be responsible or liable to Contractor for any constructive acceleration due to failure of BSA to grant time extensions under the Contract Documents should Contractor fail to substantially comply with the submission requirements and the justification requirements of this Contract for time extension requests:
  - 1. Contractor's failure to perform in accordance with the Construction Schedule shall not be excused, nor be chargeable to BSA, because Contractor has submitted time extension requests.
- F. Extensions of time for performance as described in the Contract Documents will be granted only to the extent that time adjustments for the activity or activities affected exceed the total float or slack along the path of activities affected at the time of Notice to Proceed of a Change Order or the commencement of any delay or condition for which an adjustment is warranted under the Contract Documents.
- G. Change Orders: If an extension or contraction of any milestone or completion date is authorized by a change order issued by BSA, Contractor shall revise his Construction Schedule, milestone, and completion dates accordingly:
  - 1. Activities impacted by a change to the milestone or completion date shall likewise be adjusted to reflect the revised requirements.
- H. All of the Contractor's detailed calculations, documents and subcontractor data supporting or providing the basis for any schedules, reports and forecasts shall be made available within 7 days of BSA's request.

## **1.11 SCHEDULE OF OFF-SITE ACTIVITIES**

- A. Contractor shall include in his Construction Schedule all procurement related activities for long-lead items as defined below:

1. Upon written approval by BSA, these activities may be submitted as a separate Off-Site Activities Schedule, properly correlated and interrelated to the Construction Schedule showing any restraints or dependent Activities affecting the Construction Schedule.
  2. Schedule of Off-Site Activities shall include, but is not limited to, the following:
    - a. Activities for submittals, ordering, manufacturing or fabricating, and delivery of long-lead item equipment and materials:
      - 1) Long lead items are equipment or materials requiring more than one month between ordering and delivery to site.
    - b. All significant activities to be performed by the Contractor during the fabrication and erection in Contractor's plant or on another job site, including materials and equipment purchasing, and delivery; and
    - c. Contractor's drawings and submittals to be prepared and submitted to BSA for approval of long-lead items.
    - d. Required off-site inspection activities by BSA.
- B. Contractor shall be solely responsible for expediting the delivery of all material to be furnished by him so that the construction progress will be maintained according to the Construction schedule in effect.
- C. Contractor shall notify BSA in writing whenever it is anticipated that the delivery date of any material or equipment will be later than the date shown on the last submitted updated schedule.

#### **1.12 SOFTWARE**

- A. Contractor shall submit his network analysis system software and data files on an electronic exchange media such as a CD or DVD:
1. Contractor shall be responsible for having an archived copy of the analysis system software and data files on hand.
  2. Final approved version of the Construction Schedule shall be supplied on an electronic exchange media such as a CD or DVD.
  3. Software and data files shall be IBM compatible and Windows based.
  4. Software utilized shall be the current version of Primavera Project Planner (P6) scheduling program.

#### **1.13 RESPONSIBILITY FOR COMPLETION**

- A. If, in the opinion of BSA, the Contractor falls behind in meeting the schedule presented in the current monthly Construction Schedule Update, Contractor shall provide such information as may be necessary to show on a revised construction Schedule the steps that will bring it into compliance with the Construction Schedule without additional cost to BSA:
1. Such information shall be submitted to the satisfaction of BSA prior to the next Construction Schedule Update.
  2. Compliance with such submittal requirements shall be a condition precedent to any obligation of BSA to consider any Application for Payment.
- B. Failure of the Contractor to comply with the requirements of this Paragraph shall be a basis for determination that the Contractor is not prosecuting the Work with such diligence as will ensure completion within the Contract Time.

#### **1.14 PERFORMANCE MONITORING**

- A. Each Monday morning, or following day if Monday is a holiday, Contractor shall submit a status report, in a format acceptable to BSA, of all progress which has occurred in any scheduled activity during the past week:
1. Status report's actual start and finish dates and percentages of completion estimates may be used by BSA to record actual progress and evaluate the monthly Construction Schedule Update.

### **1.15 WEEKLY SCHEDULE**

- A. Contractor shall prepare and submit 3 copies to BSA, by Friday noon of each week, a "look ahead" bar chart schedule, in a format acceptable to BSA, representing the Contractor's and Subcontractors' work plans for construction activities to occur during the following 2 week period:
  - 1. The bar chart shall reference the specific activities as defined in the Construction Schedule and shall indicate locations of Work, quantities of materials to be installed and planned durations of activities.

### **PART 2 - PRODUCTS - NOT USED**

### **PART 3 - EXECUTION - NOT USED**

**END OF SECTION**



**SECTION 01 31 19**  
**PROJECT MEETINGS**

**PART 1 - GENERAL**

**1.1 PRE-CONSTRUCTION CONFERENCE**

- A. Architect schedule and hold pre-construction conference prior to construction.
- B. Attendance:
  - 1. BNL:
    - a. Project representative.
    - b. Director of Operations or Engineering.
    - c. Commissioning Agent.
    - d. Architect.
    - e. Sustainable Facilitator.
  - 2. Contractor:
    - a. Home office representative.
    - b. Field Project Manager.
    - c. Environmental Project Manager.
- C. Contractor must be prepared to discuss, as a minimum, following items:
  - 1. Contractor distribute and discuss:
    - a. List of subcontractors.
    - b. Tentative construction schedule.
      - 1) Start and completion dates.
      - 2) Critical work sequence.
  - 2. Status of Contract, bonds, and insurance.
    - a. Accepted alternates.
  - 3. Procedures.
  - 4. Designation of responsible personnel.
  - 5. Processing of field decisions and change orders.
  - 6. Submittal process.
  - 7. Procedures for maintaining record documents.
  - 8. Use of premises:
    - a. Office and storage areas.
    - b. BNL's requirements.
  - 9. Submission and processing of monthly Application for Payment and associated requirements.
  - 10. Project environmental goals and documentation procedures.
- D. Contractor to have meeting with subcontractors after preconstruction conference to discuss procedures.

**1.2 PROGRESS MEETINGS**

- A. Attend regularly scheduled meetings; time, day and place at BNL to be determined.
  - 1. Meetings to be scheduled with Architect and BNL representative to coincide with Architect's regular scheduled site visits.
- B. Contractor administer meetings and record minutes.
- C. Generally, meetings will be held weekly or as required by progress of the Work.
- D. Location of meetings: Job site or as arranged.

- E. Attendance:
  - 1. BNL:
    - a. Project representative.
    - b. Director of Operations or Engineering.
    - c. Commissioning Agent.
    - d. Architect.
    - e. LEED Project Manager
  - 2. Contractor:
    - a. Home office representative.
    - b. Field Project Manager.
    - c. Superintendent.
    - d. Environmental Project Manager.
- F. Minimum Agenda:
  - 1. Review, approve minutes of previous meeting.
  - 2. Review work progress since last meeting.
  - 3. Planned progress during next work period.
  - 4. Review construction schedule.
  - 5. Identify concerns which impede planned progress.
  - 6. Note field observations, questions, and decisions.
  - 7. Review submittal schedules.
  - 8. Review BNL/Contractor coordination items.
  - 9. Review status of changes.
  - 10. Review status of Project LEED requirements.

### **1.3 CONTRACTOR MEETINGS**

- A. It is recommended Contractor have weekly progress, coordination and scheduling meetings with subcontractors.
- B. Contractor to have pre-installation meetings with subcontractors and suppliers as needed for different segments of work.

### **END OF SECTION**

**SECTION 01 32 26**  
**PROGRESS REPORTS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. Work includes:
  - 1. Compilation and submission of progress reports.
  - 2. Taking and submission of progress photographs.

**1.2 SUBMITTALS**

- A. Project information:
  - 1. Progress report:
    - a. Submit copy with Application for Payment.
  - 2. Progress Photos:
    - a. Submit digital photographs on compact disk (CD) with progress report showing current progress of Work.
      - 1) E-Mail files are not acceptable.
  - 3. Contract Closeout:
    - a. Provide to two compact disks (CD) of all digital progress photographs, and an index.

**1.3 PROGRESS REPORTS**

- A. Each Subcontractor prepare comprehensive Daily Log and maintain it during entire project period.
- B. Each Subcontractor submit copy of Daily Log to Contractor for compilation into monthly Progress Reports.
- C. Contractor submit 6 copies plus an electronic copy of Progress Reports and photos with each Application for Payment.
- D. Progress report to include following Summary narrative for entire month.
  - 1. PROJECT DATA – Name, Budget Amount, Start Date, Contract and Actual Completion Dates, Type of Contract, etc.
  - 2. PROJECT DESCRIPTION – Brief description of project
  - 3. EXECUTIVE SUMMARY – High level review of the progress/activities and issues of the month.
  - 4. COST REPORTING – Status of cost versus approved budget; Percent work in place and anticipated cost.
  - 5. CHANGE ORDER REPORT – Identify approved, pending and anticipated change orders
  - 6. SCHEDULING/UPDATE ANALYSIS – Scheduled updated to this month; Remaining schedule contingency (float); Time extensions requested; Attached key milestone schedule planned versus actual. Attach a monthly look ahead schedule. Include a current period and cumulative variance report.
  - 7. SAFETY STATUS – Current and cumulative – Stop Work orders, Lost Time and Recordable accidents, Lost Time incident rate, OSHA Recordable index, safe work-hours and safe work-days
  - 8. QUALITY REPORT – Identify number/types of quality inspections conducted for the current and previous month. List non-conforming work identified and actions taken to correct and prevent in future.
  - 9. TRADE CONTRACTOR PAYMENTS – Are payments to subs on time; Explanation of any late payments.
  - 10. AFFIRMATIVE ACTIONS – DBE (MBE/WBE) and SBE Goals and Actual

11. RFI & SUBMITTAL REPORT – Identify number, track status and identify outstanding RFIs and submittals.
  12. MAN POWER – Provide manpower totals and labor hours by trades
  13. PHOTOS – Document progress of construction month by month.
  14. Waste Management Plan implementation.
- E. Daily logs to include following data for each day of prior month.
1. Manpower, by trade.
  2. Work performed, with location.
  3. Weather.
  4. Situations or circumstances which could delay work or give cause for claims for extension of time or added cost.
  5. List of visitors names, to include officials, BNL's representatives, and other authorities.
- F. Progress reports to include progress photographs.
1. General:
    - a. Include digital progress photographs on compact disk (CD) with progress report.
    - b. Digital camera requirement: Minimum 4 megapixels resolution.
    - c. Photograph format: JPEG format and file extension with 1600 by 1200 pixels, minimum.
    - d. Digitally date photographs.
  2. Identify photographs with project name, date, direction, and view or vantage point.
  3. Photograph/file naming: Include date (YRMODY), Building or Area, Direction photo taken (N.S.E.W.), and Description of Subject.
    - a. File name example: 070412\_Area-A1\_NE\_AHU-6.jpeg.
  4. Provide index of submitted digital photos.
  5. Minimum 12 digital photos monthly until project exterior is finished, taken from different view points of interest, related to current progress.
  6. Minimum 12 digital photos monthly until project interior is finished, taken from different view points of interest, related to current progress.
  7. Contract Closeout: Provide to two compact disks (CD) of all digital progress photographs and an index.

**END OF SECTION**

## SECTION 01 35 34

### PRODUCT OUTGASSING REQUIREMENTS FOR CLEANROOM CONSTRUCTION

#### PART 1 - GENERAL

##### 1.1 SUMMARY

- A. Process operations to be performed within the facility after construction are sensitive to outgassing (offgassing) by certain materials; e.g., system components, adhesives, finishes, lubricants, chemicals, and construction procedures. Failure to satisfy Project outgassing requirements could jeopardize the facility and possibly require demolition and/or reconstruction. Products not having prior BNL and Architect approval, or that do not knowingly meet the 'Outgassing' requirements of this Section shall be tested.
- B. The Contractor shall provide, for approval by the BNL and Architect, a list of all materials proposed for use in the clean zone. The list shall be submitted prior to the start of the formal Project Submittal process.
  - 1. The list shall identify materials or products which comply with the requirements of this Section, and materials or products which do not comply with this Section, or compliance is unknown.
  - 2. Refer to Section 01 30 00 Submittal Procedures.
- C. Contractor, subcontractors, and all vendors, suppliers, manufacturers, OEM vendors, and service agencies shall comply with the Project outgassing criteria below.

##### 1.2 QUALITY ASSURANCE

- A. Reference Standards:
  - 1. ASTM-E595; "Standard Test Method for Total Mass Loss and Collected Volatile Condensable Materials from Outgassing in a Vacuum Environment."
  - 2. IEST-RP-CC031.1; "Method for Characterizing Outgassed Organic Compounds from Cleanroom Materials and Components."
  - 3. MSFC-SPEC-1443; "Outgassing Test for Nonmetallic Materials" (National Aeronautics and Space Administration/George C. Marshall Space Flight Center).
  - 4. JSC 09604/MSFC-HDBK-527; "Materials Selection List for Space Hardware Systems" (National Aeronautics and Space Administration/George C. Marshall Space Flight Center).

##### 1.3 DEFINITIONS

- A. Total Mass Loss (TML): Total mass of material outgassed from a specimen that is maintained at a specified constant temperature and operating pressure for a specified time. TML is expressed as a percentage of the initial specimen mass.
- B. Collected Volatile Condensable Material (CVCM or VCM): The quantity of outgassed matter from a test specimen that condenses on a collector maintained at a specific constant temperature for a specified time. CVCM or VCM is expressed as a percentage of the initial specimen mass.

##### 1.4 SUBMITTALS

- A. Project Information:
  - 1. Test reports of non-metallic materials of construction proposed to be used in the construction of the clean zones and cleanrooms:
    - a. Testing materials for TML, and CVCM.
    - b. Test Reports shall be provided in formats defined by ASTM-E595 and / or MSFC-SPEC-1443.
  - 2. Test Reports shall be provided as defined in ASTM-E595 and contain the following, as a minimum level of content:
    - a. Material manufacture, technical data, Product Data Sheet.
    - b. Material Safety Data Sheet information.

- c. Manufacturer's name, address, and contact information.
- d. Maximum application and use temperatures.
- e. Thermal/vacuum stability (TVL, CVCM) data.
- f. General locations and Quantities of the material to be used.
- g. If material fails the testing, or is in non-compliance of the requirements of this Section, for any reason, the Contractor may submit a Rationale Report for the use of the material and a report of the proposed locations, quantity of weight and / or surface area proposed for use of the material.

## 1.5 PRODUCT TESTING

- A. Product samples for outgassing tests are required for those products not having prior BNL approval, that do not knowingly meet the requirements of 1.6, A, B, C, and D below and/or do not appear in JSC 09604/MSFC-HDBK-527 "National Aeronautics and Space Administration/George C. Marshall Space Flight Center Materials Selection List for Space Hardware Systems, Latest Edition."
  - 1. [www.everyspec.com](http://www.everyspec.com); search for MSFC-HDBK-527.pdf (106 MB).
- B. Test Methodology requirements shall be as defined in ASTM-E595, Sections 4 through 8.
  - 1. Test Method Summary.
  - 2. Testing Equipment.
  - 3. Sample preparation.
  - 4. Testing Procedures.
  - 5. Material samples will not be returned at completion of testing.
- C. Materials required to meet the minimum outgassing requirements for use in the construction of the clean zones (a partial list to qualify the types of materials possibly needing testing):
  - 1. Nonmetallic Materials.
  - 2. Sealants and Adhesives.
  - 3. Paints, coatings, finish materials.
  - 4. Tapes.
  - 5. Liquids.
- D. If in doubt of materials required to be in compliance with this section the Contractor shall submit questions to the BNL and Architect.

## 1.6 STANDARD OUTGASSING CRITERIA FOR CONSTRUCTION PRODUCTS

- A. Total mass loss (TML) shall not exceed 1.0 percent of initial mass, when tested in accordance with ASTM-E595 Standard Test Method for Total Mass Loss and Collected Volatile Condensable Materials from Outgassing in a Vacuum Environment. Used as minimum requirements and test procedure for project.
- B. Collected Volatile Condensable Material (CVCM or VCM) shall not exceed 0.10 percent of initial mass when tested in accordance with ASTM-E595.
- C. Additionally, products listed in "National Aeronautics and Space Administration/George C. Marshall Space Flight Center" Material Section List for Space Hardware Systems, (JSC 09604/MSFC-HDBK-527) that meet the TML, CVCM, or VCM requirements as specified herein, and also the particulate requirements for cleanliness classifications as stated in project documents will be acceptable for this project.
- D. Some products have been found acceptable for use under the outgassing requirements above. The following list is included as a partial guide in product selection and is not totally inclusive.
  - 1. Electro-galvanized Unistrut.
  - 2. Sealants:
    - a. Sika Corporation; Sikaflex – 1a; one-part polyurethane sealant / adhesive.
    - b. Dow Corning 6 - 1125; one-part RTV silicone sealant, white.
  - 3. Flanders HEPA filter medium.
  - 4. Heresite 403 and 413 baked phenolic coatings.

5. Dupont Delrin acetal resin products.
  6. EPDM (EPT, EPR).
  7. 304 or 316 Stainless Steel, Aluminum.
  8. Teflon Butyl Rubber.
  9. EPDM Gasket.
  10. Dry Powder Epoxy.
- E. Other products have been found to be unacceptable for similar applications. The following list is included as a partial guide in product selection and is not totally inclusive.
1. Acetone and acetic acid adhesives and sealants.
  2. Dioctyl Phthalate (DOP) test smoke.
  3. Fiberglass.
  4. Fluorocarbon dry lubricant.
  5. Urea-formaldehyde foam insulation.
  6. Premium grease.
  7. Gypsum board.
  8. Neoprene.
  9. Painted Unistrut.
  10. Soft plastics that contain high levels of phthalate or other plasticizers.
  11. Plywood, hardboard and pressboard; Wood Products.
  12. Two-component room temperature silicone sealants.
  13. Materials that contain flame retardants such as boron or organophosphorous (TEP).
  14. Materials that contain the following:
    - a. Amines.
    - b. Boron.
    - c. Chlorine and Fluorine.
    - d. Phosphorus and Phosphate compounds including TEP, DOP.
    - e. Sulfur.

## END OF SECTION



## **SECTION 01 35 36**

### **LEED REQUIREMENTS**

#### **PART 1 - GENERAL**

##### **1.1 SUMMARY**

- A. This is an overview of the special environmental requirements of this project. Work includes environmental, sustainable, and “green” building practice requirements related to energy conservation and efficiency, indoor air quality, and resource efficiency. It is the requirement of this project to construct a green building that meets the U.S. Green Building Council’s LEED™ Green Building Rating System standards at the Silver level. The project is tracking design under two versions as follows:
1. LEED for New Construction version 2.2
  2. LEED for New Construction version 2009 (to be tracked as indicated)
  3. Rating: Requirement: Silver
  4. Rating Goal: Gold

##### **1.2 LEED REQUIREMENTS-GENERAL**

- A. General: BNL has established with design team specific LEED requirements for design and construction of Project; Contractor, subcontractors, suppliers, and manufacturers (i.e., construction team) are encouraged to participate to realize BNL’s LEED requirements.
1. Intent is for LEED requirements to be achieved in manner that ultimately provides a safe and healthy environment for building occupants with minimal negative impact on local, regional and global environment.
  2. Contract Documents are not intended to limit alternative means of achieving LEED requirements. Suggestions from construction team during project meetings for implementing goals are encouraged.

##### **1.3 CONTRACTOR RESPONSIBILITIES**

- A. LEED Action Plan
1. The LEED Action Plan shall be submitted within [30][work] days after notice to proceed. The plan, when completed, shall provide a detailed description of all activities that relate to accomplishing project LEED requirements, including construction practices, procurement practices, and proposed submittals and documentation for each LEED credit for which the contractor is responsible. Plan shall also include the following:
    - a. Name of individual[s] responsible for ensuring those credits and/or prerequisites are earned and responsible for assembling documentation.
- B. LEED Documentation Notebook
1. The Contractor shall prepare a comprehensive notebook documenting compliance for each LEED credit for those construction credits for which they are responsible. LEED Documentation Notebook shall be formatted to match LEED numbering system for each credit and prerequisite. Both an electronic version on CD and a paper version of the notebook shall be submitted at project closeout.
  2. Notebook shall include:
    - a. LEED Credit Checklist as furnished at the end of this document (or other approved checklist)
    - b. Applicable product data for material selection
    - c. Final calculations per LEED section
    - d. Certifications for construction practices
    - e. Procurement data
    - f. Cumulative calculations

- g. Any other items as identified in the approved LEED Action Plan. Notebook must contain all required data to support full compliance with the indicated LEED construction credits.
- 3. Some LEED credits are inherent in the design provided and require no further submittal or documentation. For these credits, the Contractor shall notify the Architect in advance of selection of any specified material or use of any permissible construction methods that may result in a deviation from the LEED designer intent. Some LEED credits involve material selection and are generally identified within the technical sections with the notation "LEED," though not specifically identified in all occurrences. Some LEED credits are dependent on construction practices. In all cases where a material, product, or execution requirement is identified by "LEED" in the contract documents, additional data or certificates shall be submitted with the individual component or process validating the material or component to the respective LEED credit item.
- C. LEED Project Management and Coordination: Prior to the pre-construction meeting, Contractor shall identify and assign one person on Contractor's staff to be the LEED Project Manager who shall be responsible for environmental issues compliance and coordination.
  - 1. Experience: Similar responsibilities and successful performance for previous sustainable building construction project(s).
  - 2. Responsibilities: Carefully review Contract Documents for LEED issues, coordinate work of trades, subcontractors, and suppliers; instruct workers relating to LEED issues; and oversee Project LEED Goals.
    - a. Assemble and retain approved Environmental Submittals, tabulation charts and other records to document progress toward meeting environmental requirements.
    - b. Provide records in secure jobsite location, available for review by Architect or BNL.
    - c. Provide Action Plans, Progress Reports and final documentation according to specified requirements and schedule.
    - d. Assist Architect and/or BNL in preparing submission to the GBCI.

#### 1.4 LEED CALCULATIONS

- A. LEED credits as identified in Table 1 shall be incorporated and documented as required by the Contract documents and in full compliance with the LEED Reference Guide. LEED credits not identified elsewhere in the Contract documents and those requiring further instruction are specified below. Refer to the LEED Reference Guide (2009 edition) for further definitions and requirements.
- B. Sustainable Sites Credits:
  - 1. LEED Credit SS p, Construction Activity Pollution Prevention:
    - a. Comply with 2003 EPA Construction General Permit or local standards if more stringent.
  - 2. LEED Credit SS 7.1, Heat Island Effect – Nonroof:
    - a. Comply with requirements to achieve 50% reduction in project hardscapes and low albedo site materials. Contractor to put forth best efforts to install high albedo materials that meet the SRI requirements.
- C. Energy and Atmosphere Credits:
  - 1. LEED Credit EA p1:
    - a. Commissioning Reports as identified in LEED Reference Guide.
  - 2. LEED Credit EA 3, Enhanced Commissioning:
    - a. Commissioning Reports as identified in LEED Reference Guide.
  - 3. LEED Credit EA 5, Measurement and Verification:
    - a. Submit M&V Plan and reports as required by the IPMVP or other approved organization.
  - 4. LEED Credit EA 6, Green Power:
    - a. Submit documentation that project complies with strategies identified in the LEED Reference Guide.

- D. Material and Resources Credits:
1. LEED Credit MR 2.1 [and 2.2], Construction Waste Management:
    - a. Comply with Division 1 Section 01 74 19 - Construction Waste Management.
  2. LEED Credit MR 4.1 [and MR 4.2], Recycled Content:
    - a. Contractor shall document materials to indicate that the sum of post-consumer recycled content value plus one-half of post-industrial recycled content value constitutes at least 20 percent of the total materials cost for the project.
      - 1) Calculations
        - a) LEED Letter Template forms shall be used for tracking and documentation. Recycled content value of project materials shall be determined by the method described in the LEED Reference Guide.
      - 2) Substitutions
        - a) In the case of conflict between this requirement and individual technical section requirements, Contractor may submit for approval proposed alternative products or systems that provide equivalent performance and appearance and have greater contribution to project recycled content requirements. All such proposed substitutions shall be submitted with the LEED Implementation Plan accompanied by product data that demonstrates equivalence.
  3. LEED Credit MR 5.1 [and MR 5.2], Regional Materials:
    - a. Contractor shall document materials to indicate that a minimum of 20 percent (by dollar value) of materials and products for the project are extracted, harvested, or recovered, as well as manufactured, regionally within a 500 mile radius of the project site.]
      - 1) Calculations
        - a) LEED Letter Template forms shall be used for tracking and documentation. Amount of regional project materials shall be determined by the method described in the LEED Reference Guide.
  4. LEED Credit MR 6, Rapidly Renewable Materials:
    - a. Contractor shall document that a minimum of 2.5 percent (by dollar value) of materials and products for the project shall be rapidly renewable. Rapidly renewable materials are made from plants with a 10-year or shorter harvest cycle.
    - b. Contractor shall track cumulative calculations for this credit.
  5. LEED Credit MR 7, Certified Wood:
    - a. Contractor shall document materials to indicate a minimum of 50 percent (by dollar value) of permanently installed wood-based materials and products for the project are certified in accordance with FSC STD 01 001.
      - 1) Calculations:
        - a) LEED Letter Template shall be used for tracking and documentation. Amount of FSC-certified project materials shall be determined by the method described in the LEED Reference Guide.
- E. Indoor Environmental Quality Credits:
1. LEED Credit EQ 3.1, Construction IAQ Management Plan: During Construction:
    - a. Comply with Division 01 section 01 81 21 - Indoor Air Quality Management (IAQ) During Construction.
  2. LEED Credit EQ 3.2, Construction IAQ Management Plan – Before Occupancy:
    - a. Comply with Division 01 section 01 81 22 - Construction IAQ Management Plan – Before Occupancy.
  3. LEED Credit EQ 4.1, Low-Emitting Materials – Adhesives and Sealants:
    - a. Comply with VOC requirements for adhesives and sealants specified in Divisions 03 – 12.
    - b. Where VOC requirements are not indicated comply with South Coast Air Quality Management District Rule #1168.
  4. LEED Credit EQ 4.2, Low-Emitting Materials – Paints and Coatings:
    - a. Comply with VOC requirements for paints and coatings specified in Divisions 03 – 12.
    - b. Where VOC requirements are not indicated comply with the following standards:
      - 1) Green Seal Standard GS-11.

- 2) Green Seal Standard GS-03.
- 3) South Coast Air Quality Management District Rule #1113.
- 5. LEED Credit EQ 4.3, Low-Emitting Materials – Carpet Systems.
- 6. LEED Credit EQ 4.3, Low-Emitting Materials – Carpet Systems:
  - a. Comply VOC requirements for carpet systems as specified in Division 03 – 12.
  - b. Where VOC requirements are not indicated comply with the following standards:
    - 1) Carpet and Rug Institute Green Label Plus program.
    - 2) Carpet and Rug Institute Green Label program.
- 7. LEED Credit EQ 4.4, Low-Emitting Materials – Composite Wood and Agrifiber Products:
  - a. Comply material requirements for composite wood products as specified in Division 03 – 12.
- F. LEED 2009 Tracking Credits:
  - 1. LEED Credit EQ 4.3, Low-Emitting Materials – Flooring Systems: Manufacturer’s Product data indicating that flooring products comply with the following standards:
    - a. Manufacturers’ product data that carpet systems comply with Carpet and Rug Institute Green Label Plus Program.
    - b. Manufacturers’ product data carpet cushion complies with Carpet and Rug Institute Green Label program.
    - c. Manufacturers’ product data that all hard surface flooring comply with the Resilient Floor Covering Institute’s FloorScore program.
    - d. Manufacturers’ product data that all floor sealers and stains comply with SCAQMD Rule 1113.
    - e. Manufacturers’ product data that adhesives and grouts comply with SCAQMD Rue #1168.

## **PART 2 - PRODUCTS (NOT USED)**

## **PART 3 - EXECUTION**

### **3.1 COORDINATION MEETINGS**

- A. There will be a minimum of three onsite coordination meetings.
  - 1. The first will be a preconstruction meeting to review the LEED Implementation Plan.
  - 2. The second will be a pre-closeout meeting to review LEED Documentation Notebook for completeness and identify any outstanding issues relating to final score and documentation requirements.
  - 3. The third is a closeout meeting to review the final LEED Documentation Notebook. All meetings shall be attended by Contractor's designated individual responsible for LEED documentation, Government representative and Installation representative.
  - 4. At closeout meeting a final score for the project will be determined based on review of project performance and documentation. Contractor shall make a set of contract drawings and specifications available for review at each meeting as well as an updated LEED Documentation Notebook.

### **3.2 CHECKLISTS**

- A. LEED credits as identified in Table 1 below are contract requirements and full faith efforts shall be employed to track and document these credits in full compliance with the LEED Reference Guide such that they can be submitted to the Green Building Certification Institute for LEED certification.

## TABLE 1

### LEED for New Construction version 2.2 and version 2009 Credit Checklist

#### SUSTAINABLE SITES

|    |                 |   |
|----|-----------------|---|
| SS | Prerequisite 1: | Construction Activity Pollution Prevention Site Selection             |
| SS | Credit 2:       | Development Density and Community Connectivity                        |
| SS | Credit 3:       | Brownfield Redevelopment  |
| SS | Credit 4.1:     | Alternative Transportation - Public Transportation Access             |
| SS | Credit 4.2:     | Alternative Transportation - Bicycle Storage and Changing Rooms       |
| SS | Credit 4.3:     | Alternative Transportation - Low-Emitting and Fuel-Efficient Vehicles |
| SS | Credit 4.4:     | Alternative Transportation - Parking Capacity                         |
| SS | Credit 5.1:     | Site Development - Protect or Restore Habitat                         |
| SS | Credit 5.2:     | Site Development - Maximize Open Space                                |
| SS | Credit 6.1:     | Stormwater Design - Quantity Control                                  |
| SS | Credit 6.2:     | Stormwater Design - Quality Control                                   |
| SS | Credit 7.1:     | Heat Island Effect - Nonroof  |
| SS | Credit 7.2:     | Heat Island Effect - Roof   |
| SS | Credit 8:       | Light Pollution Reduction   |

#### WATER EFFICIENCY

|    |                 |  |
|----|-----------------|--|
| WE | Prerequisite 1: | Water Use Reduction  |
| WE | Credit 1:       | Water Efficient Landscaping<br>Reduce by 50%<br>No Potable Water Use or Irrigation |
| WE | Credit 2:       | Innovative Wastewater Technologies   |
| WE | Credit 3:       | Water Use Reduction<br>Reduce by 30%<br>Reduce by 35%<br>Reduce by 40%             |

#### ENERGY & ATMOSPHERE

|    |                 |   |
|----|-----------------|---|
| EA | Prerequisite 1: | Fundamental Commissioning of Building Energy Systems  |
| EA | Prerequisite 2: | Minimum Energy Performance  |
| EA | Prerequisite 3: | Fundamental Refrigerant Management  |
| EA | Credit 1:       | Optimize Energy Performance<br>Improve by 12% for New Buildings or 8% for Existing Building Renovations<br>Improve by 14% for New Buildings or 10% for Existing Building Renovations<br>Improve by 16% for New Buildings or 12% for Existing Building Renovations<br>Improve by 18% for New Buildings or 14% for Existing Building Renovations<br>Improve by 20% for New Buildings or 16% for Existing Building Renovations<br>Improve by 22% for New Buildings or 18% for Existing Building Renovations<br>Improve by 24% for New Buildings or 20% for Existing Building Renovations |
| EA | Credit 2:       | On-Site Renewable Energy<br>1% Renewable Energy<br>3% Renewable Energy<br>5% Renewable Energy   |
| EA | Credit 3:       | Enhanced Commissioning  |
| EA | Credit 4:       | Enhanced Refrigerant Management   |
| EA | Credit 5:       | Measurement and Verification  |

## TABLE 1

### LEED for New Construction version 2.2 and version 2009 Credit Checklist

EA Credit 6: Green Power

#### MATERIALS & RESOURCES

MR Prerequisite 1: Storage and Collection of Recyclables

MR Credit 2: Construction Waste Management  
50% Recycled or Salvaged  
75% Recycled or Salvaged

MR Credit 3: Materials Reuse  
Reuse 5%  
Reuse 10%

MR Credit 4: Recycled Content  
10% of Content  
20% of Content

MR Credit 5: Regional Materials  
10% of Materials  
20% of Materials

MR Credit 6: Rapidly Renewable Materials

MR Credit 7: Certified Wood

#### INDOOR ENVIRONMENTAL QUALITY

EQ Prerequisite 1: Minimum Indoor Air Quality Performance

EQ Prerequisite 2: Environmental Tobacco Smoke (ETS) Control

EQ Credit 1: Outdoor Air Delivery Monitoring

EQ Credit 2: Increased Ventilation

EQ Credit 3.1: Construction Indoor Air Quality Management Plan - During Construction

EQ Credit 3.2: Construction Indoor Air Quality Management Plan - Before Occupancy

EQ Credit 4.1: Low-Emitting Materials - Adhesives and Sealants

EQ Credit 4.2: Low-Emitting Materials - Paints and Coatings

EQ Credit 4.3: Low-Emitting Materials - Flooring Systems

EQ Credit 4.4: Low-Emitting Materials - Composite Wood and Agrifiber Products

EQ Credit 5: Indoor Chemical and Pollutant Source Control

EQ Credit 6.1: Controllability of Systems - Lighting

EQ Credit 6.2: Controllability of Systems - Thermal Comfort

EQ Credit 7.1: Thermal Comfort - Design

EQ Credit 7.2: Thermal Comfort - Verification

EQ Credit 8.1: Daylight and Views - Daylight

EQ Credit 8.2: Daylight and Views - Views

#### INNOVATION IN DESIGN

ID Credit 1: Innovation in Design (1-5)  
Innovation or Exemplary Performance  
Innovation or Exemplary Performance  
Innovation or Exemplary Performance  
Innovation  
Innovation

ID Credit 2: LEED Accredited Professional (1)

**TABLE 1**

LEED for New Construction version 2.2 and version 2009 Credit Checklist

**REGIONAL PRIORITY**

RP Credit 1: Regional Priority (1-4)

**END OF SECTION**



**SECTION 01 35 38**  
**SUSTAINABLE DESIGN REQUIREMENTS**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. The Project consists of construction of the Interdisciplinary Science Building:  
1. Project Location: Brookhaven National Laboratory.

**1.2 DEFINITIONS**

- A. Definitions pertaining to sustainable development: As defined in ASTM E2114 and as specified herein.
- B. Biobased Materials: As defined in the Farm Security and Rural Investment Act, for purposes of Federal procurement of biobased products, “biobased” means a “commercial or industrial product (other than food or feed) that is composed, in whole or in significant part, of biological products or renewable domestic agricultural materials (including plant, animal, and marine materials) or forestry materials.” Biobased materials also include fuels, chemicals, building materials, or electric power or heat produced from biomass as defined by The Biomass Research and Development Act of 2000:  
1. Biobased content: The amount of biobased carbon in the material or product as a percentage of weight (mass) of the total organic carbon in the material or product.
- C. Deconstruction: Disassembly of buildings for the purpose of recovering materials.
- D. DfE (Design for the Environment): A technique that includes elements of resource conservation and pollution prevention as applied in various product sectors. A technique that incorporates approaches which are part of product (or assembly) concept, need and design. Considerations involve material selection, material and energy efficiency, reuse, maintainability and design for disassembly and recyclability.
- E. Non-Renewable Resource: A resource that exists in a fixed amount that cannot be replenished on human time scale. Non-renewable resources have the potential for renewal only by geological, physical, and chemical processes taking place over of millions of years. Examples include: iron ore, coal, and oil.
- F. Perpetual Resource: A resource that is virtually inexhaustible on a human time scale. Examples include solar energy, tidal energy, and wind energy.
- G. Recycled Content Materials: Products that contain preconsumer or post-consumer materials as all or part of their feedstock. Recycled content claim shall be consistent with Federal Trade Commission (FTC) Guide for the Use of Environmental Marketing Claims.
- H. Renewable resource: a resource that is grown, naturally replenished, or cleansed, at a rate which exceeds depletion of the usable supply of that resource:  
1. Rapidly renewable material: Material made from plants that are typically harvested within a ten-year cycle.
- I. Stewardship: Responsible use and management of resources in support of sustainability.
- J. Sustainability: The maintenance of ecosystem components and functions for future generations.

**1.3 ENVIRONMENTAL GOALS**

- A. General: Support implementation of federal policy and programs for sustainable building, in accordance with EO13423 and Guiding Principles for Federal Leadership in High Performance and Sustainable Building as per the Memorandum of Understanding dated January 2006, as follows:  
1. Employing integrated design: As specified and as follows:

- a. ASTM E2348, Standard Guide for Framework for a Consensus-based Environmental Decision making Process
- b. ASTM E2432 Standard Guide for General Principles of Sustainability Relative to Buildings
- 2. Optimizing energy performance: As specified and as follows:
  - a. Energy Efficiency: EO 13423 and Energy Policy Act of 2005; 10 CFR 435 - Energy Performance Standards for New Buildings; and, FAR Part 23, 48 CFR 23 - building equipment and lighting
  - b. Energy Star
  - c. Federal Energy Management Program (FEMP)
- 3. Protecting and conserving water: As specified and as follows:
  - a. Water stewardship: FEMP Best Management Practices for Water Conservation
- 4. Enhancing indoor environmental quality: As specified and as follows:
  - a. Sheet Metal and Air Conditioning Contractor's National Association Indoor Air Quality Guidelines for Occupied Buildings under Construction
- 5. Reducing the environmental impact of materials. : As specified and as follows:
  - a. Recycled Content Products: EPA Comprehensive Procurement guidelines
  - b. Biobased Content Products: USDA Biobased (pending)
  - c. Electronics stewardship: Federal Electronics Challenge; Electronic Product Environmental Assessment Tool (EPEAT)
  - d. Environmental Management System protocols: ISO 14001 or equivalent.
- B. Independent Verification:
  - 1. ASTM E2432: Provide documentation that work is consistent with the environmental, social, and, economic principles of sustainability relative to building as identified in ASTM E2432.
  - 2. EPA Energy Performance Rating: Determine energy use target rating that meets or exceeds ENERGY STAR. Provide ENERGY STAR target using EPA Target Finder. Use Target Finder to rate estimated energy use for the completed design. If design achieves a rating of 75 or higher, provide Statement of Energy Design Intent (SEDI) generated from Target Finder to document results. Architect of Record submits the SEDI to EPA and receives the “Designed to Earn the ENERGY STAR” graphic to place on drawings to show that the energy use for the design meets EPA criteria for energy efficiency.
  - 3. EPA National Performance Track: Provide work consistent with EPA Performance Track criteria and the proposed Environmental Management System (EMS) for the project.

## **PART 2 - PRODUCTS**

### **2.1 PRODUCT REQUIREMENTS**

- A. Low-Emitting Materials:
  - 1. Meet or exceed the following requirements for low-emitting materials:
    - a. Green Seal Standard GS-1, Paints.
    - b. Green Seal Standard GC-0, Anti-corrosive paints.
    - c. South Coast Air Quality Management District Rule 1113- Architectural Coatings.
    - d. South Coast Air Quality Management District Rule 1168 – Adhesives and Sealants.
- B. Recycled Content:
  - 1. Meet or exceed EPA recycled content recommendations. The EPA recommendations for the following materials:
    - a. Building insulation
    - b. Carpet
    - c. Concrete
    - d. Paint
    - e. Floor tiles
    - f. Roofing
    - g. Restroom partitions

- C. Bio-Based Materials:
1. Meet or exceed USDA's bio-based content recommendations. The USDA has a catalog of products that have been designated for preferred procurement status under an initiative called "BioPreferred." They products are:
    - a. Acoustical Composite Panels
    - b. Interior Composite Panels
    - c. Plastic Lumber Composite Panels
    - d. Structural Interior Composite Panels
    - e. Structural Wall Composite Panels
    - f. Insulating Foam
    - g. Roof Coatings
    - h. Carpet
    - i. Fluid Filled Transformers
  2. Biobased products can be located at the USDA BioPreferred website at [www.biopreferred.gov/Catalog.aspx](http://www.biopreferred.gov/Catalog.aspx)
- D. Rapidly renewable materials:
1. Products made from agricultural waste, such as straw—the stems left after harvesting cereal grains
  2. Linoleum
  3. Form-release agents made from plant oils
  4. Natural paints
  5. Geotextile fabrics from coir and jute
  6. Cork
  7. Textiles such as organic cotton, wool, and sisal
  8. BuildingGreen.com has 184 products that they have determined meet the rapidly renewable criteria. Refer to the following website:  
<http://www.buildinggreen.com/auth/productsByLeed.cfm?LEEDCreditID=28>
- E. Certified sustainable wood:
1. The Principles for Natural Forest Management developed by [The Forest Stewardship Council](#)
  2. The [American Tree Farm System developed by the American Forest Foundation](#);
  3. Canada's [National Sustainable Forest Management Standard](#);
  4. The [Sustainable Forestry Initiative®](#) created through the American Forest & Paper Association and currently managed by the Sustainable Forestry Board (an independent entity established to manage SFI).
  5. The use of reclaimed woods.
- F. Toxic Material Source Reduction:
1. The Federal mandates require reduction of toxic materials.
  2. The Green Guide for Health Care lists the toxic materials that should be targeted for reduction or elimination:
    - a. PBT Elimination: Dioxins
    - b. PBT Elimination: Mercury
    - c. PBT Elimination: Lead and Cadmium
  3. Target elimination of the following:
    - a. Chlorinated polyethylene (CPE)
    - b. Chlorinated polyvinyl chloride (CPVC)
    - c. Chlorosulfonated polyethylene (CSPE)
    - d. Polychloroprene (CR or chloroprene rubber, also brand name Neoprene)
    - e. Polyvinyl chloride (PVC)
  4. Target elimination of materials that are not manufactured with chlorine or other halogens. Options include (but are not limited to):
    - a. TPO, EPDM, and FPO for roof membranes
    - b. Natural linoleum, rubber, or alternate polymers for flooring and surfacing;
    - c. Natural fibers, polyethylene, polyester and paint for wall covering;

- d. Polyethylene for wiring;
  - e. Wood, fiberglass, HDPE, and aluminum with thermal breaks for windows;
  - f. Copper, cast iron, steel, concrete, clay, polypropylene and HDPE for piping
- G. Reflectant Surfaces:
- 1. Ensure the spec sections for roof and outdoor materials reference being under the reflectance levels.

**PART 3 - EXECUTION (NOT USED)**

**END OF SECTION**

**SECTION 01 42 11**  
**ABBREVIATIONS - ORGANIZATIONS AND STANDARDS**

|        |   |
|--------|---|
| AABC   | Associated Air Balance Council  |
| AAMA   | American Architectural Manufacturers Association                          |
| ABMA   | American Boiler Manufacturers Association                                 |
| ACI    | American Concrete Institute   |
| ADA    | Americans with Disabilities Act   |
| ADAAG  | Americans with Disabilities Act Accessibility Guidelines                  |
| ADC    | Air Diffusion Council   |
| AGA    | American Gas Association  |
| AGC    | Associated General Contractors of America                                 |
| AIA    | American Institute of Architects  |
| AISC   | American Institute of Steel Construction                                  |
| AMCA   | Air Movement and Control Association                                      |
| ANSI   | American National Standards Institute                                     |
| APA    | APA – The Engineered Wood Association                                     |
| ARI    | Air Conditioning and Refrigeration Institute                              |
| ASA    | Acoustical Society of America   |
| ASHRAE | American Society of Heating, Refrigeration and Air Conditioning Engineers |
| ASLA   | American Society of Landscape Architects                                  |
| ASME   | American Society of Mechanical Engineers                                  |
| ASTM   | American Society for Testing and Materials                                |
| AWI    | Architectural Woodwork Institute  |
| AWPA   | American Wood Preservers Association                                      |
| AWPI   | American Wood Preservers Institute  |
| AWS    | American Welding Society  |
| AWWA   | American Water Works Association  |
|        |   |
| BAAQM  | Bay Area Air Quality Management District                                  |
| BHMA   | Builders Hardware Manufacturers Association                               |
| BIA    | Brick Industry Association  |
| BOCA   | Building Officials and Code Administration International, Inc.            |
|        |   |
| CAC    | California Administrative Code  |
| CP     | Comprehensive Procurement Guide (EPA)                                     |
| CRA    | California Redwood Association  |
| CRREL  | Cold Region Research Engineering Lab                                      |
| CRSI   | Concrete Reinforcing Steel Institute                                      |
| CS     | Commercial Standard (U.S. Department of Comm.)                            |
| CSI    | Construction Specifications Institute                                     |
| CTI    | Cooling Tower Institute   |
|        |   |
| EIA    | Electronics Institute of America  |
| EJMA   | Expansion Joint Manufacturers Association                                 |
| EIFSA  | Exterior Insulation Finish Systems Association                            |
| EP     | Environmental Protection Agency   |
| FCI    | Fluid Controls Institute, Inc.  |
| FM     | Factory Mutual  |
| FS     | Federal Specification   |
| FS     | Forest Stewardship Council  |

|       |  |
|-------|--|
| HEI   | Heat Exchanger Institute   |
| HI    | Hydraulic Institute  |
| HMI   | Hoist Manufacturers Institute  |
| HYDI  | Hydronics Institute  |
| IBI   | Intelligent Buildings Institute  |
| IBR   | Institute of Boiler and Radiator Manufacturers   |
| ICC   | International Code Council (formerly ICBO, International Conference of Building Officials)             |
| ICEA  | Insulated Cable Engineers Association  |
| IEEE  | Institute of Electrical and Electronic Engineers   |
| IESNA | Illuminating Engineering Society of North America  |
| IIA   | Incinerator Institute of America   |
| IPCEA | Insulated Power Cable Engineers Association  |
| LEE   | Leadership in Energy and Environmental Design Green Building Rating System (US Green Building Council) |
| MSS   | Manufacturers Standardization Society  |
| MCAA  | Mechanical Contractors Association of America  |
| NAAMM | National Association of Architectural Metal Manufacturers  |
| NBC   | National Building Code   |
| NBS   | National Bureau of Standards   |
| NCMA  | National Concrete Masonry Association  |
| NCRP  | National Council on Radiation Protection and Measurements  |
| NEBB  | National Environmental Balancing Bureau  |
| NEC   | National Electrical Code   |
| NECA  | National Electrical Contractors Association  |
| NECS  | National Electrical Code Standards   |
| NEMA  | National Electrical Manufacturers Association  |
| NIST  | National Institute of Standards and Technology   |
| NFoPA | National Forest Products Association   |
| NFPA  | National Fire Protection Association   |
| NOAA  | National Oceanographic and Atmospheric Administration  |
| NRCA  | National Roofing Contractors Association   |
| NSF   | National Sanitation Foundation   |
| NSPE  | National Society of Professional Engineers   |
| NTMA  | National Terrazzo and Mosaic Association   |
| OSHA  | Occupational Safety and Health Act   |
| PCA   | Portland Cement Association  |
| PCI   | Precast/Prestressed Concrete Institute   |
| PDI   | Plumbing Drainage Institute  |
| PS    | Public Standard (U.S.Dept.of Comm.)  |
| PTI   | Post Tensioning Institute  |
| SAE   | Society of Automotive Engineers  |
| SAMA  | Scientific Apparatus Markers Association   |
| SBCCI | Southern Building Code Congress International, Inc.  |
| SCAQM | South Coast Air Quality Management District  |
| SC    | Scientific Certification Systems   |
| SDI   | Steel Deck Institute / Steel Door Institute  |
| SFPA  | Southern Forest Products Association   |
| SIGMA | Sealed Insulating Glass Manufacturers Association  |

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ABBREVIATIONS - ORGANIZATIONS AND STANDARDS

|        |   |
|--------|---|
| SJI    | Steel Joist Institute   |
| SMACNA | Sheet Metal and Air Conditioning Contractors National Association, Inc. |
| SPRI   | Single Ply Roofing Institute  |
| SSPC   | Structural Steel Painting Council                                       |
| TEMA   | Tubular Exchanger Manufacturers Association                             |
| TIA    | Telecommunications Institute of America                                 |
| UBC    | Uniform Building Code   |
| UFC    | Uniform Fire Code   |
| UL     | Underwriters Laboratories, Inc.   |
| UMC    | Uniform Mechanical Code   |
| UPC    | Uniform Plumbing Code   |
| USGBC  | United States Green Building Council                                    |
| WIC    | Woodwork Institute  |
| WWPA   | Western Wood Products Association                                       |

**END OF SECTION**



## SECTION 01 42 13

### ABBREVIATIONS FOR UNITS OF MEASURE - ENGLISH SYSTEM OF UNITS (IP)

|         |   |
|---------|---|
| A (amp) | ampere(s), area   |
| ACFM    | actual CFM  |
| AIC     | amps interrupting capacity                              |
| AWG     | American Wire Gauge                                     |
| BF      | board foot (feet)                                       |
| BHP     | brake horsepower  |
| BTU     | british thermal unit                                    |
| BTUH    | british thermal units per hour                          |
| C Value | thermal conductance (BTU/(HR)(SF)(F) per inch thickness |
| CF      | cubic feet  |
| CFH     | cubic feet per hour                                     |
| CFM     | cubic feet per minute                                   |
| CM      | centimeter(s)   |
| CM/SEC  | centimeter(s) per second                                |
| CPS     | cycle(s) per second                                     |
| CU      | cubic   |
| CU FT   | cubic feet  |
| CU IN   | cubic inch(es)  |
| CY      | cubic yard(s)   |
| Db      | decibel(s)  |
| DbmV    | decibel millivolts                                      |
| DEG     | degree(s) (angular)                                     |
| degF    | degree(s) Fahrenheit                                    |
| EDR     | equivalent direct radiation                             |
| F       | fahrenheit  |
| FPM     | feet per minute   |
| FPS     | feet per second   |
| FT      | feet, foot  |
| GAL     | gallon(s)   |
| GAL/SF  | gallon(s) per square foot                               |
| GPH     | gallon(s) per hour                                      |
| GPM     | gallon(s) per minute                                    |
| GPS     | gallon(s) per second                                    |
| GHZ     | gigahertz   |
| GR      | grains  |
| GSF     | gross square feet                                       |
| HD      | head  |
| HP      | horsepower  |
| HR      | hour(s)   |
| Hz      | hertz   |

|         |  |
|---------|--|
| IN      | inch(es)                                 |
| IN Hg   | inches - mercury                         |
| IN-LB   | inch-pounds (force)                      |
| IN WG   | inches - water gage                      |
|         |  |
| K       | kip(s)                                   |
| K value | thermal conductivity (BTU/(HR)(SF)(F/IN) |
| KHz     | kilohertz                                |
| KSF     | Kips per square foot                     |
| KV      | kilovolt(s)                              |
| KVA     | kilovolt ampere(s)                       |
| KVAR    | kilovars                                 |
| KW      | kilowatt(s)                              |
| KWH     | kilowatt-hours                           |
|         |  |
| LB      | pound(s)                                 |
| LBF-IN  | pound (force) inch                       |
| LF      | linear foot, linear feet                 |
| LIN     | linear, lineal                           |
|         |  |
| mA      | milliamps                                |
| MBTU    | thousand BTU                             |
| MBH     | thousand BTU/HR                          |
| MCFH    | thousand cubic feet per hour             |
| MCM     | thousand circular mils                   |
| MFBM    | thousand feet board measure              |
| MHz     | megahertz                                |
| mHz     | millihertz                               |
| MI      | mile(s)                                  |
| MIN     | minute(s)                                |
| MO      | month(s)                                 |
| MPH     | miles per hour                           |
| MVA     | megavoltamperes                          |
|         |  |
| NSF     | net square feet                          |
|         |  |
| OZ      | ounce(s)                                 |
|         |  |
| PCE     | pyrometric cone equivalent               |
| PCF     | pound(s) per cubic foot                  |
| PCY     | pound(s) per cubic yard                  |
| PPH     | pounds per hour                          |
| PPM     | parts per million                        |
| PSF     | pound(s) per square foot                 |
| PSI     | pound(s) per square inch                 |
| PSIA    | pound(s) per square inch absolute        |
| PSIG    | pound(s) per square inch gage            |
|         |  |
| Q       | total heat transfer (BTUH)               |
| QT      | quart                                    |

|         |  |
|---------|--|
| RH      | relative humidity  |
| R value | thermal resistance (HR)(SF)(F)/BTU                                   |
| RMS     | root mean square   |
| RPM     | revolutions per minute   |
| RPS     | revolutions per second   |
| S       | second   |
| SCFM    | standard CFM   |
| SF      | square feet  |
| SQ IN   | square inch(es)  |
| SQ FT   | square foot  |
| SSU     | saybolt seconds universal  |
| T       | ton  |
| TR      | tons refrigeration   |
| U value | thermal conductance (1 divided by total R value)<br>(BTU/(HR)(SF)(F) |
| uV      | microvolts   |
| V       | volt(s), volume, velocity  |
| VAC     | volt(s), AC  |
| VAR     | volt amperes reactive  |
| VDC     | volt(s), DC  |
| W       | watt(s)  |
| YD      | yard(s)  |
| YR      | year(s)  |

**END OF SECTION**



**SECTION 01 42 19**  
**REFERENCE STANDARDS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

A. General:

1. ASTM standards are documents developed and established by American Society for Testing and Materials (ASTM) and meet approval requirements of ASTM procedures and regulations.
2. ANSI standards are documents developed and established by American National Standards Institute, Inc. (ANSI) and meet approval requirements of ANSI procedures and regulations.
3. NFPA standards (National Fire Codes) are documents developed and established by National Fire Protection Association, (NFPA) and meet approval requirements of NFPA procedures and regulations.
4. Other Reference Standards as indicated.
5. Specification sections will indicate ASTM, ANSI, NFPA and other standards by number.
  - a. Utilize the latest edition and amendments as published at the time of Contract Award.
    - 1) Exception: Where the locally adopted Codes or authorities having jurisdiction otherwise stipulate that a specific edition must be followed.
  - b. Dates and titles of referenced standards appear on appropriate web sites:
    - 1) ASTM: [www.astm.org](http://www.astm.org)
    - 2) ANSI: [www.ansi.org/catalog/search.html](http://www.ansi.org/catalog/search.html)
    - 3) NFPA: <http://www.nfpa.org/>
    - 4) Green Seal: <http://www.greenseal.org/>
    - 5) FloorScore: [http://www.rfci.com/int\\_FloorScore.htm](http://www.rfci.com/int_FloorScore.htm)
    - 6) SCAQMD: <http://www.aqmd.gov/>
    - 7) Carpet and Rug Institute: <http://www.carpet-rug.org/>
  - c. Web site indexes generally include all standards published by the subject organization; and may contain standards that are not referenced for this project.
6. Parallel metric standards apply as required, but may not be identified in specification sections.

**END OF SECTION**



**SECTION 01 43 39**  
**MOCK-UPS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. Build each of the indicated mock-ups on site for review and approval before proceeding with any construction that may be affected by the construction represented by a corresponding mock-up.

**1.2 PROCEDURE FOR MOCK-UP CONSTRUCTION:**

- A. Extent, size, form and primary components are indicated on the drawings or in the specification section pertaining to the corresponding work.
- B. Mock-up shall be located where indicated on the drawings or, if not indicated, shall be located where directed by the Architect.
- C. Mock-up shall not be provided until corresponding product data, shop drawings, samples and other preparatory submittals are approved.
- D. Mock-up shall be rebuilt as necessary until approved by Architect.
- E. After approval, mock-up shall remain and serve as the standard for judging the acceptance or rejection of the appearance characteristics and workmanship of corresponding construction.
- F. After completion and acceptance of the corresponding construction, mock-up shall be removed when directed by the Architect unless approved mock-up has been located as part of the permanent construction and has not been subsequently damaged.
- G. Surrounding and other construction affected by mock-up construction or removal shall be completed as indicated or, if construction is not indicated, the site shall be restored to the condition existing before the mock-up construction.

**PART 2 - PRODUCTS**

**2.1 MATERIALS**

- A. Materials used in the initial mock-up construction shall comply as specified in the applicable sections for the work and as approved by submittal reviews.
- B. Materials may be modified only to the extent required for mock-up approval by the Architect.
  - 1. Modified materials shall comply with the specified requirements but may differ in appearance characteristics, such as color and texture.
- C. Materials used in the construction of approved mock-up construction shall be used in the corresponding permanent construction.

**PART 3 - EXECUTION**

**3.1 CONSTRUCTION**

- A. Provide initial mock-up construction by methods proposed for the corresponding permanent construction.
  - 1. Comply with installation and application requirements for each component as specified in the section applicable for the work.

- B. Methods of construction may be modified only to the extent required for mock-up approval by the Architect.
  - 1. Modified methods of construction shall comply with the specified requirements as well as approved details of workmanship.
- C. Methods of construction used for the approved mock-up construction shall be used in the corresponding permanent construction.

**END OF SECTION**

**SECTION 01 43 43**  
**COORDINATION DRAWINGS (GC)**

**PART 1 - GENERAL**

**1.1 DESCRIPTION - INTERIOR**

- A. Coordinate construction operations included in various Sections of Specifications to assure efficient and orderly installation of all parts of Work. Coordinate construction operations included under different Sections that depend on each other for proper installation, connection, and operation.
- B. Coordination drawings: Reproducible overlay drawings showing work with horizontal and vertical dimensions to avoid interference with structural framing, ceilings, partitions, equipment, lights, mechanical, electrical, conveying systems, and other services:
  - 1. In and above ceilings.
  - 2. Within walls.
  - 3. Within chases.
  - 4. In mechanical spaces.
  - 5. In electrical spaces.
- C. Prepare coordination drawings where careful coordination is needed for installation of products and materials fabricated by separate entities.
- D. Prepare coordination drawings where limited space availability necessitates maximum utilization of space for efficient installation of different components.
- E. Coordinate installation of different components to assure maximum accessibility for required maintenance, service, and repair.
- F. Work out all “tight” conditions involving Work of various Sections in advance of installation.
- G. Sleeve, coredrill and blockout layout drawings:
  - 1. Drawings showing proposed locations and sizes of sleeves, coredrills blockouts, and embedded items in concrete walls, columns, floors and beams.
- H. Prior to start of work in any given area, each Subcontractor approve, in writing, coordination drawings affecting Subcontractor’s work in that area.
- I. Modifications required as result of failure to resolve interferences, provide correct coordination drawings, or call attention to changes required in other work as result of modifications shall be paid for by Contractor.
- J. Coordination meetings scheduled conduct by Contractor, with all affected Subcontractors.

**1.2 PRODUCTION OF COORDINATION DRAWINGS**

- A. Contractor provide minimum 1/4 IN scale plan, elevation and section drawings, showing:
  - 1. Partitions.
    - a. Fire/smoke rated barriers.
  - 2. Ceiling heights.
  - 3. Structural framing locations and elevations.
  - 4. Column lines.
  - 5. Other work.
- B. Subcontractors produce combined coordination layout drawings plan and sections of HVAC ductwork, hydronic, steam, condensate, fuel oil, fire protection piping, plumbing, special water systems, natural gas and medical gas systems, electrical cable tray, conduit, conveying systems, equipment, and other work, as applicable.

- C. Coordination Drawings shall be produced in CAD so they can be used for Shop Drawings and be updated at end of Project for Project Record Drawings.
  - 1. Architect will furnish Contractor electronic drawing files of architectural plan backgrounds on CD in AutoCAD DWG format.
    - a. CAD drawings floor plan backgrounds will indicate wall layout, column lines and room name and numbering.
    - b. Architect makes no representation as to accuracy or completeness of CAD files provided.
  - 2. Have skilled CAD technician(s) produce following plans in same CAD program and version for Coordination Drawings and Shop Drawing submittals;
    - a. Conveying systems.
    - b. HVAC ductwork system.
    - c. Piping systems.
    - d. Plumbing systems.
    - e. Fire protection system.
    - f. Fire alarm system.
    - g. Nurse call, communication and security systems.
    - h. Cable tray system.
    - i. Lightning protection system.
    - j. Building management system.
  - 3. Indicate systems on separate CAD file with layers compliant with National CAD Standard to facilitate Coordination Drawings and Project Record Documents, using the background as an XREF to the coordination file.
  - 4. Contractor may choose to create “paperspace views” and increase scale of plotted drawings to facilitate clarity of detail. Revised scale shall be indicated on plotted sheets.
  - 5. Contractor shall provide plotted transparencies of individual systems so they can be overlaid on light table to facilitate coordination with other trades.
- D. Resolve major interferences at initial coordination meeting prior to production of any drawings.
- E. Produce initial coordination drawings within 30 days after initial meeting.
- F. Contractor arrange for production of said drawings not provided by that time.
- G. Meet as required to resolve interferences and correct drawings.

### **1.3 AFTER APPROVAL**

- A. After Subcontractors’ written approval of coordination drawings, Contractor determine method used to resolve interferences not previously identified.
- B. Contractor give written approval of changes to coordination drawings prior to start of work in affected area.
- C. Maintain one copy of current approved Coordination Drawings at project site.

### **1.4 PRECEDENCE OF SERVICES FOR COORDINATION DRAWINGS**

- A. In event of conflicts involving location and layout of work; use following priority to resolve disputes:
  - 1. Structure and partitions have highest priority.
  - 2. Equipment location and access.
  - 3. Ceiling system and recessed light fixtures.
  - 4. Gravity drainage lines.
  - 5. High pressure ductwork and devices.
  - 6. Large pipe mains, valves and devices.
  - 7. Pneumatic tube and material conveying systems.
  - 8. Low pressure ductwork, diffusers, registers, grilles, HVAC equipment.
  - 9. Fire protection piping, devices and heads.
  - 10. Small piping, tubing, electrical conduit, and devices.

- a. Conduits installed in corridors shall be maintained at least 9 IN above finished ceiling. Conduits shall be grouped within a 12 IN width.
  - b. The space utilized for conduit shall be selected to allow access to all devices which normally require adjustment, repair, resetting, etc.
- 11. Sleeves through rated partitions.
  - 12. Access panels.

### **1.5 PRODUCTION OF LAYOUT DRAWINGS**

- A. Contractor provide scale plan and elevation drawings.
- B. Subcontractors indicate proposed location and size of their required sleeves, coredrills, blockouts and embedded items.
  - 1. At floor slabs and walls to be core drilled or cut, Find and mark all reinforcing in both faces located by means of x-ray, pach-ometer, or prof-ometer.
  - 2. Submit sketch showing location of rebar and proposed cores for review.

### **1.6 SUBMITTALS**

- A. Project information:
  - 1. Contractor's approved Coordination Drawings.
    - a. Letter indicating one copy of approved Coordination Drawings available at project site.
    - b. One copy of approved Coordination Drawings to Architect for information, if requested.
  - 2. Contractor's proposed sleeve, coredrill and blockout layout drawings.
    - a. One copy of drawing to Architect for information.

## **END OF SECTION**



**SECTION 01 45 23**  
**TESTS AND INSPECTIONS**

**PART 1 - GENERAL**

**1.1 QUALITY ASSURANCE**

- A. General:
1. Work shall be subject to inspection, testing and approval by testing agency, inspector and public authorities having jurisdiction.
  2. Approval as result of inspection or testing shall not be construed to be an approval of a violation of provisions of Contract Documents, or by governing codes, laws, ordinances, rules or regulations.
  3. Testing, inspections and approvals presuming to give authority to violate or cancel provisions of Contract Documents, or by governing codes, laws, ordinances, rules or regulations shall not be valid.
  4. It shall be duty of Contractor to cause Work to remain accessible and exposed for testing and inspection purposes.
  5. It shall be duty of Contractor to notify testing agency, inspector and public authorities having jurisdiction when Work is in conformance with Contract Documents and is ready for testing and inspection.
  6. It shall be duty of BNL and Contractor to provide access to, and means for testing and inspections of such Work required by Contract Documents, or by governing codes, laws, ordinances, rules or regulations.
  7. Any portion that does not comply shall be corrected and shall not be covered or concealed until authorized by testing agency, inspector and public authorities having jurisdiction.
  8. Tests, inspections and approvals of portions of Work required by Contract Documents or by codes, laws, ordinances, rules, regulations or orders of public authorities having jurisdiction shall be made at an appropriate time.
  9. Contractor shall give testing agency, inspector, public authorities having jurisdiction, and Architect, if requested, timely notice of when and where tests and inspections are to be made so that they may be present for such procedures.
  10. In event such procedures for testing, inspection and approval reveal portions of Work fail to comply with requirements established by Contract Documents, or by governing codes, laws, ordinances, rules or regulations, all costs made necessary by such failure, including those of repeated procedures and compensation for Architect's services and expenses, shall be at Contractor's expense.
  11. Required certificates of testing, inspection and approval shall, unless otherwise required by Contract Documents, be secured by Contractor and promptly delivered to Architect, inspector and public authorities having jurisdiction.
  12. If Architect, BNL, public authorities having jurisdiction, testing agency or inspector is to observe tests, inspections and approvals required by Contract Documents, or by governing codes, laws, ordinances, rules or regulations or orders of public authorities having jurisdiction, they will do so promptly, and where practicable, at normal place of testing.
- B. Test and inspection method standards: See technical sections and governing codes, laws, ordinances, rules and regulations.
- C. Qualifications of independent testing agencies:
1. Meet American Council of Independent Laboratories, "Recommended Requirements of Independent Laboratory Qualification", latest edition.
  2. Meet requirements of ASTM-E329, "Standards of Recommended Practice for Inspection and Testing Agencies for Concrete, Steel and Bituminous Materials as used in Construction", latest edition.

3. Satisfy inspection criteria of Materials Reference Laboratory of National Bureau of Standards.
  4. See technical sections for additional requirements.
- D. Testing equipment calibration: Shall be by accredited calibration agency, at maximum 12 month intervals, by devices of accuracy traceable to either:
1. National Institute of Standards and Technology.

## **1.2 DESCRIPTION**

- A. Provide for any additional inspection and testing required by public authorities having jurisdiction.
- B. Contractor shall arrange and pay for all testing and inspections specified in other sections, unless specified to be provided by BNL, and Contractor shall pay for all re-testing and re-inspections, no matter who paid for initial tests and inspections, until work conforms to requirements.
  1. Testing and inspections shall be provided by qualified independent testing agencies acceptable to the BNL.
- C. BNL will perform radiological testing and inspection of structural and pipe welds.

## **1.3 JOB CONDITIONS**

- A. Employment of independent testing agency does not relieve obligation of Contractor to comply with Contract Documents.

## **PART 2 - EXECUTION**

### **2.1 PERFORMANCE**

- A. Perform indicated inspections, sampling and testing of materials and methods of construction.
- B. Use test and inspection or sampling methods or both conforming with methods indicated.
- C. Report each test and inspection or sampling or both as indicated.
- D. Report results called for by test method, in form specified.
- E. Retest failed products and systems.

### **2.2 REPORTS**

- A. Submit reports and logs promptly to BNL, Architect, Structural Engineer (if applicable), Contractor, inspector, and public authorities having jurisdiction (if required).
- B. Include following for test or inspection reports or both:
  1. Project name and number.
  2. Project location.
  3. Product and specification section applicable.
  4. Type of test or inspection or both.
  5. Name of testing agency, if used.
  6. Name of testing or inspecting personnel, or both.
  7. Date of test or inspection or both.
  8. Record of field conditions encountered; i.e., temperature, weather.
  9. Test location.
  10. Observations regarding compliance.
  11. Test method used.
  12. Results of test.
  13. Date of report.
  14. Signature of testing or inspecting personnel or both.

- C. Maintain log of tests which have failed:
  - 1. Type of test or inspection or both.
  - 2. Date of test or inspection or both.
  - 3. Test or inspection number or both.
  - 4. Reason failed.
  - 5. Date of retest or inspection or both.
  - 6. Results of retest.
  - 7. Method of retest.

### **2.3 INDEPENDENT TESTING AGENCY DUTIES AND LIMITATIONS OF AUTHORITY**

- A. Cooperate with Architect and Contractor.
- B. Provide qualified personnel promptly on notice.
- C. Promptly notify Architect and Contractor of irregularities, or deficiencies of work which are observed during performance of services.
- D. Testing agency is not authorized to:
  - 1. Release, revoke, alter, or enlarge on requirements of Contract Documents.
  - 2. Approve or accept any portion of Work.
  - 3. Perform any duties of Contractor.

### **2.4 CONTRACTOR'S DUTIES**

- A. Cooperate with testing agency personnel, inspector and public authorities having jurisdiction and provide access to work.
- B. Provide preliminary representative samples of materials to be tested, in required quantities.
- C. Furnish copies of mill test reports.
- D. Furnish labor and facilities:
  - 1. To provide access to work to be tested.
  - 2. To obtain and handle samples at site.
  - 3. To facilitate inspections and tests.
  - 4. Storage and curing facilities for testing agency's exclusive use.
- E. Notify appropriate testing agency, inspector or public authorities having jurisdiction sufficiently in advance of operations.

**END OF SECTION**



**SECTION 01 50 00**  
**TEMPORARY FACILITIES**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. This section specifies temporary services and facilities, including utilities, construction and support facilities, security and protection. Provide facilities ready for use. Maintain, expand and modify as needed. Remove when no longer needed, or replaced by permanent facilities.

**1.2 USE CHARGES**

- A. BNL will not impose on the Contractor, except for telephone charges, the cost or use charges for temporary utilities, providing the Contractor does not abuse the use of these utilities.

**1.3 REGULATIONS**

- A. Comply with applicable laws and regulations.

**1.4 STANDARDS**

- A. Comply with NFPA Code 241, "Building Construction and Demolition Operations", ANSI-A10 Series standards for "Safety Requirements for Construction and Demolition", and NECA Electrical Design Library "Temporary Electrical Facilities."
  - 1. Electrical Service: Comply with NEMA, NECA and UL standards and regulations for temporary electric service. Install service in compliance with National Electric Code (NFPA 70).
  - 2. GFIs: Ground fault circuit interrupters are required for all electric services to construction sites from other than permanent wiring of building or structure.

**1.5 INSPECTIONS**

- A. Arrange for BNL personnel to inspect and test each temporary utility, as required, before use.

**1.6 CONDITIONS OF USE**

- A. Keep facilities clean and neat. Operate in a safe and efficient manner. Take necessary fire prevention measures. Do not overload, or permit facilities to interfere with progress. Do not allow hazardous, dangerous or unsanitary conditions, or public nuisances to develop or persist on the site.

**1.7 MATERIALS AND EQUIPMENT**

- A. Provide new materials and equipment. When acceptable to BNL, undamaged previously used materials and equipment in serviceable condition may be used. Provide materials and equipment suitable for the use intended.
- B. Lumber and Plywood:
  - 1. Provide fire treated lumber and plywood for sheds and offices. Provide minimum 5/8" thick exterior plywood for other uses. Comply with requirements in Section 06 10 53, "Carpentry".
- C. Roofing Materials:
  - 1. Provide Class "A" standard weight asphalt shingles complying with ASTM D 3018, or Class "C" mineral surfaced roll roofing complying with ASTM D 249, where temporary roofing is required.

- D. Paint:
  1. Prepare and paint new surfaces with one (1) prime coat and two (2) finish coats matching surrounding areas. Comply with OSHA 29 CFR 1926, BNL Standards-Based Management System; ES&H Standards, 6NYCRR Parts 205 & 228, UL standards and regulations.
- E. Tarpaulins:
  1. Waterproof, fire-resistant, UL labeled tarpaulins with flame-spread rating of 15 or less. For temporary enclosures provide translucent nylon reinforced laminated polyethylene or polyvinyl chloride fire retardant tarpaulins.
- F. Temporary Fencing:
  1. Wood slat and wire roll-out-type snow fencing, securely fastened to vertical galvanized or painted steel fence supports.
  2. Open-mesh expanded plastic sheet fencing is an acceptable substitute if properly installed and maintained.
  3. If temporary fencing is not maintained properly, BNL will secure the fencing and back charge the Contractor.

## **1.8 TEMPORARY UTILITY INSTALLATION**

- A. All requests by the Contractor for temporary services, i.e. electric power, for their own use or for use by any subcontractor, shall be made only through BNL's designated MPO. All methods, materials, and scheduling of temporary services shall be as directed and approved by BNL.
  1. BNL will furnish, without charge, sources of water and electric power, and will indicate locations.
  2. Contractor shall supply, install, maintain, and remove all equipment and required devices for temporary water, power, and lighting systems from point of initial tie-in as necessary to perform the work.
  3. Water Service: Install water service and distribution piping of sizes and pressures adequate for construction. Sterilize water piping prior to use. Provide 3/4" heavy-duty, rubber hoses 100 ft. long with shut-off nozzle at each outlet. Provide a proper back-flow preventer as required by MPO.
  4. Electric Power Service:
    - a. Power available at the Site will be from the secondary of a 75 KVA transformer at 208Y/120 volt, 3 phase, 4 wire. Contractor shall provide connection to transformer, overcurrent protection, distribution equipment, transformers where required, GFI outlets, extension cords and accessories for a complete power distribution system.
    - b. Power Distribution System: Install wiring overhead, and rise vertically where least exposed to damage.
    - c. Electrical Outlets: Provide properly configured NEMA polarized outlets. Provide outlets equipped with ground-fault circuit interrupters, reset button and pilot light, for connection of power tools and equipment.
    - d. Electrical Power Cords: Provide grounded "hard-service" extension cords.
  5. Lighting: Provide temporary lighting with local switching to fulfill security requirements and provide illumination for construction operations and traffic conditions.
    - a. Lamps and Light Fixtures: Provide general service incandescent lamps. Provide guard cages or tempered glass enclosures, where exposed to breakage. Provide exterior fixtures where exposed to moisture.
  6. Telephones: BNL will not provide telephones. Provide temporary telephone service for personnel engaged in construction. At each telephone, post a list of important telephone numbers.
    - a. Contact MPO Administration Office within five (5) working days of Notice to Proceed, and arrange for temporary telephone to be installed. Contractor will be billed for telephone service.
  7. Sewers and Drainage: If storm sewers are available at the Site, the Contractor may provide temporary connections to remove storm water. If sewers are not available or cannot be used, provide drainage ditches, dry wells, stabilization ponds or similar facilities.

- a. Filter out construction debris and other contaminants that might clog sewers or pollute waterways before discharge.
- b. Connect temporary sewers to the BNL storm system as directed by MPO. Maintain sewers and drainage facilities in a sanitary condition. Following heavy use, restore normal conditions promptly.
- c. Provide earthen embankments, hay bales and polyethylene sheeting, and similar barriers in and around excavations and subgrade construction to prevent flooding by runoff of storm water from heavy rains.

## **1.9 TEMPORARY CONSTRUCTION AND SUPPORT FACILITIES INSTALLATION**

- A. Locate for easy access. Maintain facilities until removal prior to Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to BNL.
- B. Provide incombustible construction for offices and sheds located within the construction area, or within 30 feet of building lines. Comply with requirements of NFPA 241.
- C. Temporary Heat:
  - 1. Provide temporary heat for curing or drying of completed installations or protection of installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations; heating units shall have been tested and labeled by UL, FM or another recognized trade association related to the type of fuel used. Coordinate ventilation requirements to produce the ambient condition required.
    - a. Heating Facilities: Provide vented self-contained LP gas heaters with individual space thermostatic control. Use of gasoline- and kerosene-burning space heaters, or electric resistance heating units is prohibited.
    - b. Conform to requirements of NFPA 31, 54, 89M, 211, and OSHA Part 1926.154.
- D. Ventilation During Construction:
  - 1. Provide ventilation of enclosed areas during construction as may be required to permit proper curing and drying out, and to prevent excessive humidity, moisture and condensation.
  - 2. Ventilation shall be by natural or artificial means as required by conditions involved.
  - 3. Maintain proper ventilation for health and safety of personnel, conforming to standards of the American Conference of Governmental Industrial Hygienists Threshold Limit Values and Occupational Safety and Health Administration Standards for permissible exposure limits.
- E. Field Offices:
  - 1. Provide insulated, weathertight offices of size to accommodate Contractor's field personnel.
  - 2. Provide heated and air-conditioned, prefabricated units or similar construction, on adequate foundations, with lockable entrances, operable windows and serviceable finishes.
  - 3. Keep clean and orderly for use for small progress meetings.
    - a. Furnish with a minimum of a desk and chairs, and a plan table. Provide additional furniture and furnishings as required by the Contractor, and bulletin boards for posting required documents.
- F. Storage and Fabrication Shed:
  - 1. Install sheds, equipped to accommodate materials and equipment involved. Sheds may be open shelters, enclosed spaces within the building, separate trailers, or combined with the field office.
- G. Paving:
  - 1. Construct temporary paving for roads, storage areas and parking where permanent paved areas will be located. Comply with Section 32 12 16, "Asphaltic Concrete Paving." Coordinate with subgrade grading, compaction, installation and stabilization of subbase, and installation of base and finish courses of permanent paving.

- a. Delay installation of the final course of paving until Substantial Completion. Coordinate with weather conditions to avoid unsatisfactory results.
  - b. Extend temporary asphalt paving or crushed stone overlay in and around the construction area to accommodate delivery and storage of materials, equipment usage, administration and supervision as and where directed by MPO.
- H. Sanitary Facilities include temporary toilets, wash and shower facilities and drinking water fixtures. Comply with regulations and local health codes. Install where facilities, as approved by MPO, will best serve the Project. Provide paper goods and similar disposable materials for each facility. Provide covered waste containers for used material.
  - 1. Toilets:
    - a. Install self-contained single-occupant toilet units of the chemical type, properly vented and fully enclosed with a glass fiber reinforced polyester shell or similar nonabsorbent material. Toilets must be serviced at least weekly, and more often if needed, as determined by MPO.
  - 2. Wash and Shower Facilities:
    - a. Install wash and/or shower facilities supplied with potable water at convenient locations for personnel involved in handling materials that require wash-up. Dispose of drainage properly. Supply cleaning compounds.
  - 3. Drinking Water Facilities:
    - a. Provide containerized tap-dispenser bottled-water type drinking water units.
  - 4. Dewatering Facilities and Drains:
    - a. For temporary drainage and dewatering operations not associated with construction, comply with requirements of applicable Division 2 sections. Where feasible, utilize the same facilities. Maintain excavations and construction free of water.
- I. First Aid Kit:
  - 1. One (1) industrial first aid kit as manufactured by Acme Products, Kit Number 25, or equal, located where directed by MPO.
- J. Temporary Enclosures, Interior:
  - 1. Provide temporary enclosure for protection of construction from exposure, foul weather, other construction operations and similar activities. Where heat is needed and the building enclosure is incomplete, provide enclosures where there is no other provision for containment of heat. Install tarpaulins securely, with incombustible framing.
  - 2. Coordinate enclosure with ventilating and material drying or curing requirements to avoid dangerous conditions.
  - 3. Close all openings through floor or roof decks and horizontal surfaces with load-bearing construction.
- K. Temporary Partitions, Interior:
  - 1. Provide, where indicated on Drawings, temporary, dust-tight partitions, complete with all doors, constructed of noncombustible materials with all joints and edges taped.
- L. Temporary Lifts and Hoists:
  - 1. Provide facilities for hoisting materials.
  - 2. Contractor shall notify MPO 48 hours prior to any earthwork and/or rigging operations. All cranes, boom trucks, and lifting equipment must be approved by MPO prior to use. No equipment operations will be allowed until approval of equipment has been granted. Contact the MPO Hoist and Rigging Inspector, J. Hynan (631) 344-5456, for equipment inspections.
  - 3. All heavy equipment, including cranes and earth-working equipment, must be in compliance with OSHA and DOT requirements, must be in good repair, and is subject to inspection by BNL. Equipment found to be leaking oil or other fluids shall not be permitted to operate at BNL.
- M. Project Identification and Temporary Signs:
  - 1. Install project identification signs where indicated, or as directed. Support on framing of preservative treated wood or steel.

2. BNL will prepare signs at BNL for pickup and installation by Contractor.

#### **1.10 COLLECTION AND DISPOSAL OF WASTE**

- A. Collect waste and dispose into the dumpster daily. Comply with NFPA 241 for removal of combustible waste. Enforce requirements strictly. Provide a dumpster of sufficient size for the waste to be generated. Do not overfill. Remove and replace on a timely basis.
- B. Handle hazardous, dangerous, or unsanitary waste materials separately from other waste by containerizing properly. Dispose in a lawful manner.
- C. Coordinate with Supplementary Conditions, Section 01 74 19, "Construction Waste Management" and Section 01 74 23, "Cleaning".

#### **1.11 RODENT AND PEST CONTROL**

- A. BNL will provide, if required, an exterminator to perform extermination and control procedures so the project will be free of pests at Substantial Completion.
- B. Notify BNL if pests or rodents are observed at the Site.

#### **1.12 STAIRS**

- A. Provide temporary stairs where ladders are not adequate. Cover finished permanent stairs with a protective covering so finishes will be undamaged at the time of acceptance.

#### **1.13 SECURITY AND PROTECTION FACILITIES INSTALLATION**

- A. Do not change from use of temporary security and protection facilities to permanent facilities until Substantial Completion.
  1. Fire Protection:
    - a. Until fire protection is supplied by permanent facilities, install and maintain temporary fire protection of types needed to protect against predictable and controllable fire losses. Comply with NFPA 10 "Standard for Portable Fire Extinguishers" and NFPA 241 "Standard for Safeguarding Construction, Alterations and Demolition Operations."
  2. Fire Extinguishers:
    - a. Provide, in accordance with OSHA requirements, hand-carried, portable UL-rated Class "A" fire extinguishers for temporary offices and similar spaces. In other locations provide hand-carried, portable, UL-rated, Class "ABC" dry chemical extinguishers. Locate fire extinguishers where effective for the intended purpose, but not less than one on each floor near each usable stairwell.
      - 1) Maintain unobstructed access to fire extinguishers, fire hydrants, temporary fire protection facilities, stairways and other access routes for fighting fires. Prohibit smoking in hazardous fire exposure areas.
      - 2) Store combustible materials in containers in fire-safe locations.
      - 3) Provide continuous supervision of welding operations, combustion type temporary heating units whenever operating, and other sources of fire ignition.
  3. Barricades, Warning Signs and Lights:
    - a. Comply with standards and code requirements for erection of barricades. Paint appropriate warning signs to inform personnel and the public of the hazard being protected against. Where needed, provide lighting, including flashing lights.
    - b. Enclosure Fence: When excavation begins, install an enclosure fence with lockable entrance gates where indicated, or enclose the entire site or the portion sufficient to accommodate operations. Provide chain-link or expanded plastic fencing securely fastened and properly maintained.
    - c. Security Enclosure and Lockup: Install temporary enclosure of partially completed areas of construction. Provide locking entrances to prevent unauthorized entrance, vandalism and theft. Where materials and equipment must be stored, provide a secure lockup.

#### **1.14 ENVIRONMENTAL PROTECTION**

- A. Operate temporary facilities and equipment and conduct construction by methods that comply with environmental regulations, and minimize the possibility that air, waterways and subsoil might be contaminated or polluted.
- B. When the work requires the Contractor to bring temporary fuel storage facilities on to the BNL Site, the Contractor shall be responsible for providing a temporary impermeable containment area for all fuel transfer operations in accordance with Suffolk County Department of Health Services, Article 12.
- C. If, during construction activities, a release, discharge, or spill of petroleum products or chemicals occurs, the Contractor shall:
  - 1. Immediately notify Safeguards and Security at Ext. 2222 (or 911) from Site telephones or 631-344-2222 from cell phones, and MPO, of the release, discharge, or spill.
  - 2. Immediately, per SBMS, initiate cleanup and disposal operations by a BNL approved hazardous waste management contractor, complete the operations, and be responsible for monitoring and/or sampling in the event of a spill, to the satisfaction of BNL.
- D. The disposal of contaminated material will be coordinated by MPO through the Waste Management Division of the Environmental Management Division, with appropriate documentation and disposition forms.
- E. Avoid use of tools and equipment that produce harmful noise. Restrict use of noise making tools and equipment to hours that will minimize complaints.

#### **1.15 OPERATION**

- A. Enforce strict discipline in use of temporary facilities. Limit availability to intended use to minimize abuse. Maintain facilities in good operating condition until removal.
- B. Protect from damage by freezing temperatures and the elements.
  - 1. Maintain operation of enclosures, heating, cooling, humidity control, ventilation and similar facilities on a 24-hour day basis to achieve indicated results and to avoid damage.
  - 2. Prevent piping from freezing. Maintain markers for underground lines. Protect from damage during excavation operations.

#### **1.16 TERMINATION AND REMOVAL**

- A. Remove each facility when the need has ended, or replaced by a permanent facility, or no later than Substantial Completion.
- B. Complete or restore construction delayed because of interference with the facility. Repair damaged Work, clean exposed surfaces and replace construction that cannot be satisfactorily repaired.
  - 1. Temporary facilities are property of the Contractor.
  - 2. Remove paving that is not acceptable for integration into permanent paving. Where the area is intended for landscape development, remove soil and fill that does not comply with requirements. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials. Repair or replace street paving, curbs and sidewalks at the temporary entrances. Remove temporary asphalt paving and/or crushed stone that was placed only for temporary use and regrade to final contours.
  - 3. At Substantial Completion, renovate permanent facilities used during the construction period, including but not limited to:
    - a. Replace air filters and clean inside of ductwork and housings.
    - b. Replace worn parts and parts subject to unusual operating conditions.
    - c. Replace burned out lamps.

**PART 2 - PRODUCTS – NOT USED**

**PART 3 - EXECUTION – NOT USED**

**END OF SECTION**



**SECTION 01 50 13**  
**GENERAL CLEAN ZONE CONSTRUCTION PROCEDURES**

**PART 1 - GENERAL**

**1.1 WORK INCLUDED**

- A. This section covers the general requirements for construction in the cleanroom.
- B. Related work: This section shall be used in conjunction with the following for managing construction activities within the Clean Zone:
  - 1. Special Clean Zone Requirements. Section 13 60 13.
  - 2. Cleanroom Protocol. Section 13 60 16.
  - 3. Cleanroom Certification. Section 13 60 19.

**1.2 GENERAL**

- A. The following personal work habits shall not be allowed anywhere inside the building. Violators shall be reported to their supervisors and BNL by Contractor. Subsequent violations shall be grounds for permanent removal (of violator) from the Project:
  - 1. Smoking of cigarettes, cigars, and pipes and the use of any nicotine products (including chewables).
  - 2. Spitting.
  - 3. Standing on electrical conduits and bus duct, HVAC ductwork, fire sprinkler piping, or other building utility piping.
  - 4. Breaking open any clean products specially sealed and wrapped for protection until product is ready to be installed in the cleanroom.
- B. The following work activities shall not be tolerated anywhere inside any Clean Zone. Violators shall be automatically removed from the Project by the Contractor:
  - 1. Eating or drinking foodstuffs.
  - 2. Standing or sitting on process high-purity or double-contained specialty gas piping.
  - 3. Standing or sitting on cleanroom ceiling system components including ceiling filter modules.
  - 4. Cutting or threading pipe or fittings.
  - 5. Operating any propane, diesel, gas, or oil-fueled tool, high-lift, or other piece of construction equipment.
  - 6. Applying oil, stain, paint, sealant, caulking or other diffusing (contaminating) product on the structural floor before application of specified sealers and paints.
  - 7. Entering clean zone in garments and footwear that are not in compliance with posted clean zone cleanliness stage protocol.
  - 8. Standing, sitting or placing tools on cleanroom wall system components including panels and supports.
- C. The following procedures will be mandatory for all workers entering and working in the clean zone:
  - 1. Clean all footwear with electric foot scrubber (supplied by Contractor) at entry to gowning area.
  - 2. Walk on all sections of tacky mat (provided by Contractor) at entry to clean zone.
  - 3. Wipe down and HEPA vacuum all construction materials, tools and accessories (as specified).
  - 4. Wipe all spills of caulking, sealant, paint and similar materials immediately and dispose of same in designated trash receptacles.
  - 5. Dispose of tie-straps, plastic seal wraps, and other product/system component protecting devices in designated trash receptacles.

6. Enclose and contain bits of construction debris such as nuts, washers, wire cut-ends, insulation scraps, and metal trimmings, from falling beyond the work zone into interstitial or underfloor cavities.
  7. Attend cleanroom protocol training session as conducted by the Contractor or Cleanroom Sub-Contractor.
- D. Safety:
1. Vacuum cleaners or other electrical cleaning equipment shall be plugged into the building wall receptacles only (or Contractor provided "temporary" power distribution centers).
  2. Do not mop or clean with liquids when high voltage tests are being conducted.
  3. Report all piping leaks to BNL and Contractor immediately.
  4. Do not stand, sit, lean, rest or place tools or equipment on any portion of the cleanroom systems/components or equipment installed.
  5. Hard hats, safety glasses, booties or cleanroom boots, and clean body garments shall be worn at all times when working in the clean zone.
  6. Construction Safety Training:
    - a. Job Site safety training shall be administered by the Contractor.
    - b. Normal safety training shall be performed by each contractor/subcontractor as standard procedure for the trade, employee experience, and type of work required including avoidance of prolonged breathing of all solvents and cleaning solutions.
- E. Security:
1. All workers shall be required to wear security badges and display company identification at all times inside the Site perimeter boundary in accordance with BNL procedures.
  2. Security badges will be color coded to permit entry into posted controlled security/clean areas or construction zones. No entry shall be permitted without proper badge clearances. Badges shall be used to control workers by level of clean construction protocol and safety training.
  3. Workers found inside a posted controlled security/clean area without proper badge clearance shall be removed immediately from the Job Site by Contractor. Repeat violators shall be permanently prohibited from entering the Job Site.
  4. Entrance to the clean zones shall be limited to construction employees and BNL-approved staff with "clean zone" badges. All other visitors or guests must be accompanied by BNL or the Architect and must check in with Contractor's Clean Zone Director prior to entry into the clean zone. Gowns shall be worn by all personnel within the clean zone in keeping with the posted cleanliness stage.
  5. Temporary locks shall be installed (by Contractor) at each exit point to restrict entry but permit safe exit.

### **1.3 DELIVERY, STORAGE, AND HANDLING**

- A. All cleanroom systems components shall be delivered with the manufacturer's approved protective covering and packaged to prevent transit and construction dust from contaminating surfaces. Return all material or equipment to the original manufacturer for recleaning and repackaging if the original shipping protective wrap is torn or defective and on-site clean-up cannot be accomplished. Stripping of packaging shall be done outside the cleanroom area.
- B. Materials shall be sealed and delivered by the O.E.M. in their original unopened packages.
- C. Extreme care shall be used in handling systems components to prevent damage.
- D. Products shall be stored within the "building" in space designated by the Contractor, and as approved by BNL.
- E. Products and components shall be stored in such manner as to prevent damage or intrusion of foreign matter. Conspicuously mark "Rejected" on materials which have been damaged (and/or rejected) and remove from the Job Site immediately.

- F. Products shall not be stored in the “clean staging area” in excess of that used in 1 (one) day’s work.
- G. Contaminated materials shall not be stored in the clean staging areas or clean zones. Remove same from Job Site immediately.
- H. Absolutely no wood/cardboard/paper products shall be allowed in the staging/perimeter or clean zone spaces.

**END OF SECTION**



**SECTION 01 61 00**  
**ACCEPTABLE MANUFACTURERS AND PRODUCTS**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. The performance of product, material, or system is result of manufacturing, fabrication, installation procedures, use, and maintenance:
  - 1. Therefore, Architect endeavors to specify quality levels for products, materials, or systems that are advertised to conceptually meet performance goals and desired attributes for the project.
    - a. For most conceptually equal systems and materials, Architect may specify multiple manufactures.
    - b. In some cases, based on quality and attribute goals for project, the number of manufacturers may be limited.
- B. Product, material, or system substitutions:
  - 1. Prior to bid: See Section 01 25 13.
  - 2. After execution of the contract: See Section 01 25 13.

**1.2 DEFINITIONS**

- A. Following definitions are applicable to acceptable manufacturers and products listed in technical specification sections:
  - 1. "Base" manufacturer:
    - a. Manufacturer listed as "Base" in Part 2 of specification section.
    - b. Manufacturer listed as "Base" is particular manufacturer of a specific product used as basis of design.
  - 2. "Optional" manufacturer:
    - a. Manufacturer listed as "Optional" in Part 2 of specification section.
    - b. More than one manufacturer may be listed as "Optional."
    - c. Manufacturers listed as "Optional" are particular manufacturers of products similar to specific product used as basis of design.
    - d. Listing manufacturer as "Optional" indicates acceptance of that manufacturer as supplier of a product, but only to the extent product complies with specified requirements, including salient qualities provided by "Base" manufacturer's product.
      - 1) Salient qualities include, but are not necessarily limited to following:
        - a) Purpose and function.
        - b) Material and finish.
        - c) Strength, durability and other applicable physical properties.
        - d) Compatibility and performance attributes for indicated application.
        - e) Capacity and operating characteristics, where applicable.
        - f) Size and configuration to extent required for fit with adjoining and adjacent conditions and within spatial limitations.
        - g) Appearance, including exposed dimensions, profile, texture, pattern and color, where visible to personnel in finished space, or from exterior.
        - h) NRTL listing, where applicable.
    - e. Contractor is responsible for costs to provide dimensional, operational, structural, utility or any other related adjustments to fit an "Optional" manufacturer's product into the Work.
  - 3. "Base Product:"
    - a. Declares the specific product or system that has been used as basis for design.

4. Manufactures listed as "Optional Manufactures" may submit their equivalent products, but only if product complies with specified requirements, including salient qualities of "Base Product."
  - a. Products proposed by "Optional" manufactures must also comply with descriptive requirements listed in technical specification.
  - b. Optional Products that obviously differ in appearance and quality of "Base Product" will be rejected.
  - c. Refer to preceding paragraph for additional requirements.

**END OF SECTION**

## **SECTION 01 65 00**

### **DELIVERY, HANDLING AND STORAGE: MATERIALS AND EQUIPMENT**

#### **PART 1 - GENERAL**

##### **1.1 JOB CONDITIONS**

- A. Comply with applicable codes.
- B. Accomplish work to avoid damage to property.
- C. Provide fire protection.

#### **PART 2 - EXECUTION**

##### **2.1 PRODUCT DELIVERY**

- A. By manufacturer's normal means.
- B. In original labeled containers.
- C. Where applicable, with UL labeling on packages.
- D. Contractor responsible for acceptance at site.
- E. Schedule deliveries to avoid delaying Work, and to minimize space and duration of storage on site.
  - 1. Sequence deliveries to avoid unnecessary additional construction of temporary protection.
- F. Schedule and coordinate deliveries to avoid interference with BNL's operation.
- G. Inspect items for damage upon delivery, reorder as required to avoid delays.
- H. Comply with environmental packaging requirements specified in Division 01, Section 01 35 36 Environmental Requirements.

##### **2.2 PRODUCT HANDLING AND STORAGE**

- A. Use methods to avoid damage to item or structure.
- B. Protect weather fragile items from weather damage.
- C. Handle and store bulk aggregates to avoid contamination.
- D. Store to allow air circulation.
- E. Store only in authorized areas.
  - 1. Coordinate on site storage with BNL and other contractors working on site.
- F. Replace or repair damaged items.
- G. Uncrate, assemble, if required, and remove debris.
- H. When off-site storage is utilized, perform rehandling to move items to site at no added cost.

##### **2.3 CLEANUP**

- A. Remove excess materials from site.
- B. Turn over to BNL, excess materials scheduled to remain.

- C. Clean debris from site and storage area.
  - 1. Comply with construction waste recycling requirements specified in Division 01, Section 01 74 19, Construction Waste Management.
  - 2. Comply with environmental cleaning product requirements specified in Division 01, Section 01 74 23, Cleaning.

**END OF SECTION**

**SECTION 01 73 29**  
**CUTTING AND PATCHING**

**PART 1 - GENERAL**

**1.1 QUALITY ASSURANCE**

- A. General: Employ skilled workmen to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time and complete without delay.
- B. Requirements for Structural Work: Do not cut and patch structural elements in a manner that would change their load-carrying capacity or load-deflection ratio.
- C. Operational Limitations: do not cut and patch operating elements or related components in a manner that would result in reducing their capacity to perform as intended. Do not cut and patch operating elements or related components in a manner that would result in increased maintenance or decreased operational life or safety.
- D. Visual Requirements: Do not cut and patch construction exposed on exterior or in occupied spaces in a manner that would, in Architect's opinion, reduce the building's aesthetic or visual qualities. Do not cut and patch construction in a manner that would result in visual evidence of cutting and patching. Remove and replace construction which was cut and patched in a visually unsatisfactory manner.
- E. Warranty or existing warranties: Replace, patch, and repair material and surfaces cut or damaged by methods and with materials in such a manner as not to void any warranties required or existing.

**1.2 DESCRIPTION**

- A. Install Work in such a manner and sequence as to preclude or minimize cutting and patching of new Work.
- B. Execute cutting (including excavation), fitting or patching of Work, required to:
  - 1. Make several parts fit properly.
  - 2. Uncover Work to provide for installation of ill timed Work.
  - 3. Remove and replace defective Work.
  - 4. Remove and replace non-conforming Work.
  - 5. Remove samples of installed Work for testing.
  - 6. Install specified Work in existing construction.
  - 7. Provide rerouting penetrations of non-structural surfaces for installation of piping and electrical conduit.
  - 8. Patch and repair fireproofing damaged after installation of other Work or demolition activities.
  - 9. Remove and finish construction at connections to other structures.
- C. Do not endanger any Work or any Work of other Contractors, by cutting, excavating, or otherwise altering any Work except with written consent of Contractor subject to review by Architect.
- D. Do not cut into or cut away any structural concrete or other structural members, any other concrete nor dig under any foundations or into structural walls or other parts, or in any case allow same to be done without full knowledge and written consent of Architect.
- E. Be responsible for damage resulting from violation of these provisions.
- F. Use only firms or individual trades qualified to perform Work required under this Section.

### **1.3 JOB CONDITIONS**

- A. Before start of Work, obtain and pay for all permits required by all authorities having jurisdiction and notify all interested utilities companies.
- B. Obtain approval of BNL and authorities having jurisdiction for Work which affects existing exitways, exit stairs, means of egress, or access to, or exit from, areas.
  - 1. Review with and obtain approval of authorities for any temporary construction which affects such areas.
- C. Protect existing construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.
- D. Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.
- E. Avoid cutting existing utilities, pipe, conduit, or ductwork serving the building but scheduled to be removed or relocated until alternate provisions have been provided.
- F. Items to be salvaged and delivered to BNL shall be carefully removed and properly stored in an area easily accessible for removal by BNL.

### **1.4 PAYMENT FOR COSTS**

- A. Costs caused by non-coordinated or defective Work, or Work not conforming to Contract Documents, paid by Contractor responsible for non-coordinated, rejected, or non-conforming Work.

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS - GENERAL**

- A. Use materials identical to existing materials.
- B. For exposed surfaces, use materials that visually match existing adjacent surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible if identical materials are unavailable or cannot be used.
- C. Use materials whose installed performance will equal or surpass that of existing materials.
- D. Where applicable, comply with specifications for type of Work to be performed.

## **PART 3 - EXECUTION**

### **3.1 INSPECTION**

- A. Perform preliminary investigations as required to ascertain extent of Work.
  - 1. Conditions which would be apparent by such investigation will not be allowed as cause for claims for extra costs.
- B. Inspect existing conditions for work, including elements subject to movement or damage during:
  - 1. Cutting and patching.
  - 2. Excavating and backfilling.
- C. If unsafe or unsatisfactory conditions are encountered, take corrective action before proceeding.
- D. Before proceeding, meet at Project Site with parties involved in cutting and patching, including mechanical and electrical trades.
  - 1. Review areas of potential interference and conflict.
  - 2. Coordinate procedures and resolve potential conflicts before proceeding.

- E. After uncovering existing conditions for Work, inspect conditions affecting installation of new products or Work.

### **3.2 PREPARATION PRIOR TO CUTTING**

- A. Provide adequate shoring, bracing and support as required to maintain structural integrity of Project.
- B. Provide protection for other portions of Project which may be affected.
- C. Provide protection from elements when required.

### **3.3 CUTTING AND REMOVAL - GENERAL**

- A. Execute fitting and adjustment to provide finished installation to comply with specified tolerances and finishes.
- B. Execute cutting by methods which will prevent damage to existing or other Work and will provide proper surfaces to receive installation of new Work.
- C. Perform backfilling as specified in applicable sections.
- D. Neatly cut and remove materials, and prepare all openings to receive new work.
- E. Remove masonry or concrete in small sections.
- F. Provide shoring, bracing, and other supports to prevent movement, settlement, or collapse of remaining or adjacent wall areas, structure, or facilities.
- G. Arrange shoring, bracing, and supports to prevent overloading of structure.
- H. Take all precautions necessary to prevent damage to existing remaining work or to adjacent facilities.
- I. Execute Work using methods which will prevent interference with use of remaining and adjacent facilities by BNL.
- J. Remove existing work indicated to be removed, or as necessary for installation of new Work.
- K. Provide for cutting, fitting, repairing, patching and finishing of Work disturbed by installation of new Work.
- L. Do not remove or damage fireproofing materials.
  - 1. Install hangers, inserts, supports, and anchors prior to installation of fireproofing.
  - 2. Repair or replace fireproofing damaged.

### **3.4 CUTTING IN CONCRETE CONSTRUCTION**

- A. Do not cut into nor core drill openings or holes in beams, joists, and columns without prior written approval of Architect.
  - 1. When written approval is obtained, comply with additional requirements and instructions of Architect.
- B. In members other than beams, joists, and columns; where an opening larger than 10 IN in any dimension is required, or where dimension between 2 openings is less than 2 times maximum dimension of largest opening, and condition is not shown on architectural or structural drawings, obtain prior written approval of Architect.
  - 1. At floor slabs and walls to be core drilled or cut, find and mark all reinforcing in both faces located by means of x-ray, pach-ometer, or prof-ometer. Submit sketch showing location of rebar and proposed cuts or cores for review.
  - 2. When written approval is obtained, comply with additional requirements and instructions of Architect.

### **3.5 CUTTING IN STEEL FRAME AND METAL DECK CONSTRUCTION**

- A. Do not cut nor drill holes in webs and flanges of columns, beams, purlins, and joists without prior written approval of Architect.
  - 1. When approval is obtained, comply with requirements and instructions of Architect and provide reinforcing at such locations when required.
- B. When openings are cut into metal decks having cast-in-place concrete slab over metal deck:
  - 1. No reinforcing of holes is required for circular openings or sleeves up to 6 IN diameter and for rectangular openings having no side dimension greater than 6 IN.
  - 2. Reinforce openings greater than 6 IN.
  - 3. Obtain prior written approval of Architect for openings not shown on architectural or structural drawings.
    - a. Comply with additional requirements and instructions of Architect.
- C. When openings are cut into metal roof decks that have no concrete cast-in-place (except lightweight insulating cementitious roof fill) over deck:
  - 1. No reinforcing of holes is required for circular openings less than 6 IN diameter and for rectangular openings having no side dimension greater than 6 IN.
  - 2. Reinforce openings between 6 IN and 12 IN, with 20 GA flat steel sheet 12 IN greater in dimension than opening; fusion weld to top surface of deck at each corner and on each side midway between corners.
  - 3. Do not cut openings greater than 12 IN without prior written approval of Architect.
    - a. Comply with requirements and instruction of Architect.

### **3.6 MATCHING AND PATCHING**

- A. Where items are removed from existing walls, ceilings, floors or partitions to remain, repair wall, ceiling, floor or partition disturbed by removal.
- B. Where walls, ceilings, floors or partitions are removed, repair abutting walls, ceilings or floors disturbed by removal.
- C. Where existing construction is cut, removed or otherwise disturbed to permit installation of new Work, match and patch existing disturbed construction.
- D. Use methods and materials similar in appearance, and equal in quality to areas or surfaces being repaired.
- E. Restore Work which has been cut or removed; install new products to provide completed Work in accord with requirements of Contract Documents.
- F. Patch Work must in every way possible match existing work and adjacent surfaces.
- G. Re-finish entire surfaces as necessary to provide an even finish to match adjacent finishes.
  - 1. Continuous surfaces; to nearest intersections.
  - 2. Assembly - entire refinishing.
- H. In existing areas remove and replace existing ceilings and finishes for installation of Work, if not shown to be removed on Architectural Drawings and Schedules.
  - 1. If existing ceiling can not be satisfactorily reinstalled, replace with like materials and construction.
  - 2. Replace damaged construction with like materials.

**END OF SECTION**

**SECTION 01 74 19**  
**CONSTRUCTION WASTE MANAGEMENT**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. BNL has established that this Project shall include proactive measures for waste management participation by all parties to the contract.
1. The purpose of this program is to ensure that during the course of the Project all diligent means are employed to pursue practical and economically feasible waste management and recycling options.
  2. Upon award, each subcontractor shall be required to furnish documentation from suppliers or manufacturers regarding waste management and recycling options for those products and procedures furnished.
  3. Waste disposal to landfills shall be minimized.
- B. Definitions:
1. Waste: Any material that has reached the end of its intended use. Waste includes salvageable, returnable, recyclable and reusable construction materials that would otherwise be discarded or destroyed.
  2. Construction waste: Solid wastes including, but not limited to, building materials, packaging materials, debris and trash resulting from construction operations.
  3. Disposal: Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.
  4. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.
  5. Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorporation into the work.
  6. Hazardous waste: Any material or byproduct of construction that is regulated by the Environmental Protection Agency and that may not be disposed in any landfill or other waste end-source without adherence to applicable laws.
  7. Trash: Any product or material unable to be returned, reused, recycled or salvaged.
  8. Landfill: Any public or private business involved in the practice of trash disposal.
  9. Waste Management Plan: A Project-related plan for the collection, transportation, and disposal of the waste generated at the construction site.

**1.2 PERFORMANCE GOALS AND REQUIREMENTS**

- A. General: Develop waste management plan that results in end-of-Project rates for salvage/recycling of a minimum of 75 percent by weight of total waste generated by the Work.

**1.3 SUBMITTALS**

- A. Project Information:
1. Construction Waste Management Plan.
- B. Waste Reduction Progress Reports: Concurrent with each Application for Payment, submit copies of report. Include separate report for demolition and construction waste. Include the following information:
1. Material category.
  2. Total quantity of waste in tons.
  3. Quantity of waste recycled, both estimated and actual in tons.

- C. Waste Reduction Calculations: Before request for Substantial Completion, submit copies of calculated end of Project rates for salvage, recycling, and disposal as a percentage of total waste generated by the Work.
- D. Records of Sales: Indicate receipt and acceptance of salvageable waste sold to individuals and organizations. Indicate whether organization is tax exempt.
- E. Recycling and Processing Facility Records: Indicate receipt and acceptance of waste by landfills and incinerator facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.
- F. Landfill and Incinerator Disposal Records: Indicate receipt and acceptance of waste by landfills and incinerator facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.
- G. LEED Submittal: LEED letter template for Credit MR 2.2, signed by Contractor, tabulating total waste material, quantities diverted and means by which it is diverted, and statement that requirements for the credit have been met.
- H. Qualification Data: For refrigerant recovery technician.
- I. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.

#### **1.4 QUALITY ASSURANCE**

- A. Refrigerant Recovery Technician Qualifications: Certified by EPA-approved certification program.
- B. Regulatory Requirements: Comply with hauling and disposal regulations of authorities having jurisdiction.
- C. Waste Management Conference: Environmental Project Manager shall conduct conference at Project site to review methods and procedures related to waste management including but not limited to, the following:
  1. Review and discuss Waste Management Plan.
  2. Review requirements for documenting quantities of each type of waste and its disposition.
  3. Review and finalize procedures for materials separation and verify availability of containers and bins needed to avoid delays.
  4. Review procedures for periodic waste collection and transportation to recycling and disposal facilities.
  5. Review waste management requirements for each trade.

#### **1.5 CONSTRUCTION WASTE MANAGEMENT PLAN**

- A. General: Develop plan consisting of waste identification, waste reduction work plan.
- B. Waste Identification: Indicate anticipated types and quantities of construction waste generated by the Work.
- C. Waste Reduction Work Plan: List each type of waste and whether it will be salvaged, recycled, or disposed in landfill or incinerator. Include points of waste generation, total quantity of each type of waste, quantity for each means of recovery, and handling and transportation procedures.
  1. Recycled Materials: Assign recycling to recycling subcontractor, or list local receivers and processors, and type of recycled materials each will accept. Include names, addresses, and telephone numbers.
  2. Disposed Materials: Indicate how and where materials will be disposed of. Include name, address, and telephone number of each landfill and incinerator facility. List hazardous material waste and disposal separately.

3. Handling and Transportation Procedures: Include method that will be used for separating recyclable waste including sizes of containers, container labeling, and designated location on Project site where materials separation will be located.
- D. Waste Management Plan shall include locations of sorting and waste storage facilities on Site Plan of project.

## **PART 2 - PRODUCTS – NOT USED**

## **PART 3 - EXECUTION**

### **3.1 CONSTRUCTION WASTE MANAGEMENT PLAN IMPLEMENTATION**

- A. Implement waste management plan as approved by Architect. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract. Comply with the following procedures:
1. Define specific areas to facilitate separation of materials for recycling, salvage, reuse or return.
  2. Separate construction waste by type at Project site to the maximum extent practical.
  3. Recycle and waste bin areas are to be maintained in an orderly manner and clearly marked to avoid contamination of materials. Inspect containers and bins weekly for contamination and remove contaminated materials if found.
  4. Do not mix recyclable materials.
  5. Stockpile processed materials on site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
  6. Store materials away from construction area. Do not store within drip line of remaining trees.
  7. Store components off the ground and protect from weather.
  8. Remove construction waste off BNL's property and transport to appropriate receiver or processor.
- B. Hazardous Wastes: Store in secure areas and comply with the following:
1. Hazardous wastes shall be separated, stored and disposed of in accordance with local and EPA regulations and additional criteria listed below:
    - a. Building products manufactured with PVC or containing chlorinated compounds shall not be incinerated.
    - b. Disposal of fluorescent tubes to open containers is not permitted.
- C. Unused fertilizers shall not be co-mingled with construction waste.
- D. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work occurring at Project site.
1. Distribute waste management plan to everyone concerned within seven days of submittal return.
  2. Distribute waste management plan to entities when they first begin work on site. Review plan procedures and locations established for salvage, recycling, and disposal.
- E. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
1. Designate and label specific areas on Project site necessary for separating materials that are to be recycled.
  2. Comply with environmental controls specified in Division 01 Section 01 50 00 Temporary Facilities, Construction Controls and Facilities.
- F. Submit "Waste Reduction Progress Reports" each month as part of Application For Payment.
- a. Materials identified in the Report shall be reported by weight.

- b. Where weight is not applicable, Contractor shall report materials by units applicable to material recipient.
- c. Procure receipts or other validation of waste management procedures and include them as part of the submittal.

### **3.2 RECYCLING CONSTRUCTION WASTE, GENERAL**

- A. General: Recycle paper and beverage containers used by on-site workers.

### **3.3 DISPOSAL OF WASTE**

- A. General: Except for items or materials to be salvaged, recycled, or otherwise reused, remove waste materials from Project site and legally dispose of them in a landfill for incinerator acceptable to authorities having jurisdiction.
  - 1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.
  - 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
- B. Burning: Do not burn waste materials on site.
- C. Disposal: Transport waste materials off BNL's property and legally dispose of them.

**END OF SECTION**

**SECTION 01 74 23**  
**CLEANING**

**PART 1 - GENERAL**

**1.1 FIRE PROTECTION**

- A. Store volatile waste in covered metal containers.
- B. Remove from premises daily.

**1.2 POLLUTION CONTROL**

- A. Conduct cleanup and disposal operations to comply with codes, rules, regulations, ordinances, and anti-pollution laws.
- B. Do not burn or bury rubbish and waste on site.
- C. Do not discharge volatile, harmful, or dangerous materials into drainage systems.
- D. General: Comply with pollution control requirements specified in Division 01 Section 01 35 36 LEED Requirements.

**PART 2 - PRODUCTS**

**2.1 CLEANING MATERIALS**

- A. Use materials recommended by manufacturers of surfaces to be cleaned.
- B. Use cleaning materials only on surfaces recommended by cleaning material manufacturer.
- C. Use only those cleaning materials which will not create hazards to health or property and will not damage surfaces.
- D. Use only those cleaning materials which will not create hazards to health or property, are non-toxic to both humans and aquatic life, and will not damage surfaces, and comply with the following:
  - 1. Use cleaners that comply with criterion specified in Green Seal Standard GS-37 – Industrial and Institutional Cleaners.
  - 2. Where chemical products are recommended for cleaning procedures, provide documentation to indicate that no component present in the cleaning product at more than 1% of the total mass of the cleaning product is a carcinogen or reproductive toxicant.
  - 3. For purposes of reporting, identification of product VOC contents shall not be limited to those regulated under Clean Air Act (CAA) but shall also include compounds exempted from the CAA definition and list of VOCs.
  - 4. Avoid cleaning products containing alpha-pinene, d-limonene or other unsaturated carbon double bond alkenes due to chemical reactions with ozone to form aldehydes, acidic aerosols, and ultra fine particulate matter in indoor air.
  - 5. If State and local standards for these products are not required, acceptable products can be found in Green Seal's Choose Green Reports "General Purpose Cleaners" and "Industrial and Institutional Cleaners."

## **PART 3 - EXECUTION**

### **3.1 GENERAL**

- A. Clean all items installed under this Contract:
  - 1. Leave free of stains, dirt, dust, damage, or defects.
  - 2. Include washing, sweeping, polishing of wall surfaces, floors, windows, hardware, mirrors, lighting fixtures, equipment, etc.

### **3.2 DURING CONSTRUCTION**

- A. Provide on-site containers for the collection of waste materials, debris, and rubbish.
- B. Clean up all waste materials, rubbish, and debris from site and access daily:
  - 1. Dispose of off site once a week or as required by BNL.
  - 2. Dispose/recycle construction waste off site according to approved construction waste management plan.
- C. Wet down dusty materials and rubbish to prevent blowing dust during entire construction period:
  - 1. If use of water is prohibited by law, seek an alternate method to prevent blowing dust.
  - 2. Comply with exterior environmental controls as specified in Division 01 Section 01 50 00 Construction Facilities, Temporary Controls and Utilities.
- D. Perform cleaning operations as required during construction to prevent accumulations of dust, soil, and debris.
- E. Clean and protect Work in progress and adjoining materials in place, during handling and installation.
- F. Clean and vacuum interior space prior to start of painting, and continue cleaning on an as-needed basis until painting is completed.
- G. Schedule cleaning operations so that contaminants resulting from cleaning do not fall on wet painted surfaces.
- H. Clean and provide maintenance on completed Work as frequently as necessary through out construction period.
- I. Clean lunch/break area after each use.
- J. Maintain site and building so no condition provides a fire hazard.
- K. Remove snow and ice from accesses to buildings.
- L. Remove dirt and mud from vehicles prior to their use on public roads, on site roads, and drives.

### **3.3 FINAL CLEANING**

- A. At Substantial Completion, perform final cleaning of Work and existing areas wherever any area are left less than clean by construction operations:
  - 1. Complete cleaning operations before requesting review for Substantial Completion.
- B. Use experienced workmen or professional cleaners for final cleaning.
- C. Repair and touch-up marred areas.
- D. Broom clean and remove stains from paved surfaces; rake clean other surfaces of grounds.
- E. Replace air conditioning filters if units were operated during construction.
- F. Clean ducts, blowers, and coils if air conditioning units were operated during construction.
- G. Remove grease, dust, dirt, stains, labels, fingerprints, mastic, adhesive, and other foreign materials from interior and exterior surfaces, and fixtures, hardware, and equipment.

- H. Remove temporary protection and facilities installed for protection of the Work during construction.
- I. Wash and shine glazing, mirrors, stainless steel, etc., including existing windows in area of construction.
- J. Prior to BNL occupancy, Contractor and BNL shall conduct an inspection of interior and exterior surfaces and all Work areas to verify that the Project is clean to BNL's satisfaction.

**END OF SECTION**



**SECTION 01 77 00**  
**CONTRACT CLOSEOUT (GC)**

**PART 1 - GENERAL**

**1.1 SUBMITTALS**

- A. Contract closeout information:
  - 1. For substantial completion:
    - a. Comprehensive list of all items to be completed or corrected.
    - b. Contractor's Notice of Substantial Completion.
    - c. Certificates of governing authorities.
    - d. Submittals required by other Sections.
  - 2. For final completion:
    - a. Contractor's Certificate of Completion.
    - b. Evidence of payments and release or waiver of liens in triplicate.
      - 1) Contractor's Affidavit of Payments of Debts and Claims: AIA Document G706.
      - 2) Contractor's Affidavit of Release of Liens: AIA Document G706A.
      - 3) Contractor's release or waiver of liens.
      - 4) Separate releases or waivers of liens for subcontractors, suppliers, and others with lien rights against BNL, together with list of all such parties.
      - 5) If required by BNL, other data establishing payment or satisfaction of obligations arising out of Contract.
    - c. Consent of Surety (if any) to Final Payment: AIA Document G707.
    - d. Certificates evidencing that insurance to remain enforce.
    - e. Final application for payment.
    - f. Initialed list(s) of items to be completed or corrected verifying completion of each items.
    - g. List of Subcontractors and equipment suppliers. Include:
      - 1) Name.
      - 2) Address.
      - 3) Telephone number.
      - 4) Representative.
    - h. Letter of site conformance.
    - i. Closeout submittals required by other Sections.

**1.2 SUBSTANTIAL COMPLETION**

- A. Substantial Completion is the stage in the progress of Work when the Work or designated portion thereof is sufficiently complete in general accordance with Contract Documents so BNL can occupy or utilize Work for its intended use.
  - 1. Work will not be considered for Substantial Completion until all systems and equipment are operational; all designated or required governing agency inspections and certifications have been made and posted, instruction of designated BNL's personnel in operation of systems and equipment has been completed, operation and maintenance data has been satisfactorily turned over to BNL, and finishes are in place. In general, the only remaining Work shall be minor in nature, such that BNL may occupy or utilize Work or designated portion thereof, and completion or correction of Work by Contractor would not materially interfere or hamper BNL's intended business use or operation.
  - 2. Contractor shall certify that all remaining Work will be completed within 30 consecutive calendar days following date of Substantial Completion, or as agreed to in writing, and failure to do so shall automatically reinstate provisions for damages due BNL as contained elsewhere in Contract Document or as provided by law for such period of time as may be required by Contractor to fully complete Work whether BNL has occupied Work or not.

- B. Obtain evidence of compliance with requirements of governing authorities:
  - 1. Certificates of inspection of:
    - a. Mechanical.
    - b. Electrical.
    - c. Plumbing.
    - d. Fire protection and life safety systems.
    - e. Elevators.
    - f. Etc.
  - 2. Health Department and other governing authorities as required.
  - 3. Certificate of Occupancy.
- C. When Contractor considers that Work, or a portion thereof which BNL agrees to accept separately, is substantially complete, Contractor shall thoroughly inspect Work, and prepare and submit to Architect a comprehensive list of items to be corrected or completed, and Contractor's Notice of Substantial Completion (utilize form at end of this Section).
- D. Contractor certify that:
  - 1. Work performed under this Contract has been thoroughly inspected and considered to be sufficiently complete, in accordance with Contract Documents, so BNL can occupy or utilize Work for its intended use.
- E. Failure of Contractor to include an item on such list(s) does not alter responsibility of Contractor to complete all Work in accordance with Contract Documents.
- F. Contractor shall proceed promptly to complete and correct the items on list.
- G. After receipt of Contractor's comprehensive list of items to be corrected or completed, and Contractor's Notice of Substantial Completion, Architect and BNL will, within reasonable period after notification, review list of items to be completed or corrected, or inspect Work, or designated portion thereof, to determine whether Work is Substantially Complete.
- H. If Architect's or BNL's review or inspection discloses any item, whether or not included on Contractor's list, which is not sufficiently complete in general accordance with Contract Documents so BNL can occupy or utilize Work or designated portion thereof for its intended use:
  - 1. Contractor will be notified stating reasons.
  - 2. Contractor shall substantially complete or correct Work.
  - 3. Contractor shall thoroughly reinspect Work.
  - 4. Contractor shall submit another Contractor's Notice of Substantial Completion, a revised list of items to be completed or corrected, and a request for another review and inspection.
  - 5. Architect and BNL will again review list of items to be completed or corrected and Work.
- I. If Contractor prematurely submits a Contractor's Notice of Substantial Completion or requests Architect's review of the Work, and Architect determines that Project or designated portion thereof is not Substantially Complete, Architect may invoice BNL as a change in services for such cost involved in evaluating and reviewing Work, and associated travel costs. Contractor shall reimburse BNL for such costs.
- J. Architect will not perform more reviews of sub-projects or phases than number indicated in Contract Documents or BNL – Architect Agreement, unless otherwise mutually agreed to by Architect and BNL.
- K. When Work or designated portion thereof is considered Substantially Complete, Architect will prepare a Certificate of Substantial Completion.
  - 1. The Certificate of Substantial Completion shall establish date of Substantial Completion, shall establish responsibilities of BNL and Contractor for security, maintenance, heat, utilities, damage to Work and insurance, and shall fix time within which Contractor shall complete and correct Work.

2. Warranties required by Contract Documents shall commence on date of Substantial Completion of Work or designated portion thereof unless otherwise provided in Certificate of Substantial Completion.
  3. The Certificate of Substantial Completion shall be submitted to BNL and Contractor for their written acceptance of responsibilities assigned to them in such Certificate.
- L. BNL may occupy Project, or designated portion thereof, under provisions agreed to in Certificate of Substantial Completion, and if required, a certificate of occupancy has been issued by governing authorities.
1. If BNL is going to occupy Project, or designated portion thereof, Contractor shall perform final cleaning immediately.
  2. If BNL or architect discovers any Work which is not complete and/or is not in conformance with Contract Documents, during or after occupying or utilizes Work, whether included on a list or not, BNL shall notify Contractor to complete or correct item(s) identified.
- M. Contractor shall proceed expeditiously with adequate forces to complete or correct Work, and to complete all Project closeout requirements within designated time.
- N. Upon completion of Work, employ Licensed Surveyor to make survey of site to assure conformance of elevations, grade and site work to contours shown. Provide letter of site conformance.

### 1.3 FINAL COMPLETION

- A. After Contractor has completed all Work, and has thoroughly inspected Work to determine that it is complete, is in accordance with Contract Documents and Contract is fully performed, Contractor shall submit Contractor's Certificate of Completion to Architect, and the list(s) of items to be completed or corrected initialed to indicate Contractor has verified completion of each item. Utilize form at end of this section. Certify that:
1. Work has been thoroughly inspected by Contractor for compliance with Contract Documents.
  2. Work has been completed in accordance with Contract Documents.
  3. Equipment and systems have been tested and are operating satisfactorily.
  4. Contract closeout requirements have been completed satisfactorily and submitted.
  5. Contractor knows of no reason that insurance will not be renewable to cover period required by Contract Documents.
  6. Work is ready for final inspection and acceptance.
- B. Submit final closeout submittals required by this and other Sections.
- C. BNL and Architect will make final walk through within a reasonable time after receipt of Contractor's Certificate of Completion and final Application for Payment.
1. If Contractor prematurely submits a Contractor's Notice of Final Completion or requests Architect's final review of Project, and Architect determines that Project is not satisfactorily complete, Architect may invoice BNL as a change in services for such cost involved in evaluating and reviewing Work, and associated travel costs. Contractor shall reimburse BNL for such costs..
- D. Contractor shall remedy any remaining deficiencies or incomplete Work, at Contractor's expense.
- E. When BNL and Architect finds Work acceptable under Contract Documents and Contract satisfactorily performed, Architect will promptly issue a final Certificate for Payment.
- F. Neither final payment nor any remaining retained percentage shall become due until Contractor submits to Architect;
1. an affidavit that payrolls, bills for materials and equipment, and other indebtedness connected with Work for which BNL or BNL's property might be responsible or encumbered (less amounts withheld by BNL) have been paid or otherwise satisfied (AIA Documents G706 and G706A),

2. a certificate evidencing that insurance required by Contract Documents to remain in force after final payment is currently in effect and will not be canceled or allowed to expire until at least 30 days' prior written notice has been given to BNL,
  3. a written statement that Contractor knows of no substantial reason that insurance will not be renewable to cover period required by Contract Documents,
  4. consent of surety, if any, to final payment (AIA Document G707),
  5. Contractor's release or waiver of liens,
  6. if required by BNL, other data establishing payment or satisfaction of obligations, such as receipts, releases and waivers of liens, claims, security interests or encumbrances arising out of Contract, to extent and in such form as may be designated by BNL, for BNL's review, and
  7. if a Subcontractor refuses to furnish a release or waiver required by BNL, Contractor may furnish a bond satisfactory to BNL to indemnify BNL against such lien. If such lien remains unsatisfied after payments are made, the Contractor shall refund to BNL all money that BNL may be compelled to pay in discharging such lien, including all costs and reasonable attorneys' fees.
- G. If Substantial Completion or Final Completion is delayed through no fault of BNL or Architect, Architect may invoice BNL as a change in services for such costs, and associated travel costs. Contractor shall reimburse BNL for such costs.

**END OF SECTION**

**CONTRACTOR'S NOTICE OF SUBSTANTIAL COMPLETION**

PROJECT: \_\_\_\_\_

ARCH PROJ. NO.: \_\_\_\_\_ CONTRACT DATE: \_\_\_\_\_

CONTRACT FOR: \_\_\_\_\_

WORK OR DESIGNATED PORTION SHALL INCLUDE: \_\_\_\_\_

Work performed under this Contract has been thoroughly inspected and is considered to be sufficiently complete, in accordance with Contract Documents, so BNL can occupy or utilize Work or designated portion thereof for its intended use.

- Certificates of inspections indicating compliance with requirements of governing authorities, are attached hereto.
- Certificate of Occupancy have been obtained from governing authorities, are attached hereto.
- A comprehensive list of items to be completed or corrected, prepared by Contractor is attached, hereto. Failure to include any items on such list does not alter responsibility of Contractor to complete all Work in accordance with Contract Documents.

Contractor will complete or correct Work by: \_\_\_\_\_

CONTRACTOR: \_\_\_\_\_

BY: \_\_\_\_\_ DATE: \_\_\_\_\_

BNL (agrees) (does not agree) to accept portion designated above separately from rest of Project.

BNL intends to utilize, occupy or take use on: \_\_\_\_\_

BNL: \_\_\_\_\_

BY: \_\_\_\_\_ DATE: \_\_\_\_\_

The Work designated above, has been determined to be:

- Substantially Complete and a Certificate of Substantial Completion will be issued.
- Not substantially complete for following reasons: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

ARCHITECT: HDR Architecture, Inc.

BY: \_\_\_\_\_ DATE: \_\_\_\_\_

DISTRIBUTION:  BNL  ARCHITECT  CONTRACTOR

**END OF CONTRACTOR'S NOTICE OF SUBSTANTIAL COMPLETION**

## CONTRACTOR'S CERTIFICATE OF COMPLETION

---

PROJECT: \_\_\_\_\_  
ARCH. PROJECT NUMBER: \_\_\_\_\_  
CONTRACT FOR: \_\_\_\_\_  
CONTRACT DATE: \_\_\_\_\_

This is to certify that I am an authorized official of, and have been properly authorized by said firm or corporation to certify following:

I know of my own personal knowledge, and do hereby certify on behalf of Contractor, that Work has been reviewed and thoroughly inspected for compliance with Contract Documents, that Work has been completed, in accordance with Contract Documents and Contract is fully performed, that all equipment and systems have been tested and are operating satisfactorily, that all Contract closeout requirements have been completed satisfactorily and submitted, know of no substantial reason that insurance will not be renewable to cover period required by Contract Documents, and Work is ready for final inspection and acceptance.

Attached are three (3) copies of following documents, which are required prior to final payment:

- Final Application for Payment.
- Contractor's Affidavit of Payments of Debts and Claims: AIA Document G706.
- Contractor's Affidavit of Release of Liens: AIA Document G706A.
- Consent of Surety (if any) to Final Payment: AIA Document G707.
- Certificate evidencing that insurance required by the Contract Documents to remain in force after final payment is currently in effect and will not be canceled or allowed to expire until at least thirty (30) days' prior written notice has been given to BNL.
- The list(s) of if items which were to be completed and corrected, with each item initialed to indicate Contractor has verified completion or correction of each.
- List of subcontractors and equipment suppliers.
- Certified list of all sales and service taxes paid.
- Letter of site conformance by licensed surveyor.
- If required by BNL, other data establishing payment or satisfaction of obligations arising out of Contract.
- Bond satisfactory to BNL to indemnify BNL against liens from Subcontractors.
- Transmittal indicating BNL has received Project Record Documents.

I understand that acceptance of final payment by Contractor, a Subcontractor or material supplier shall constitute a waiver of claims by that payee except those previously made in writing and identified by that payee as unsettled at time of final Application for Payment.

CONTRACTOR: \_\_\_\_\_ BY: \_\_\_\_\_  
TITLE: \_\_\_\_\_ DATE: \_\_\_\_\_

Subscribed and sworn to me this \_\_\_\_\_ day of \_\_\_\_\_

NOTARY PUBLIC: \_\_\_\_\_

My commission expires: \_\_\_\_\_

DISTRIBUTION:    BNL                    ARCHITECT

## END OF CONTRACTOR'S CERTIFICATE OF COMPLETION

**SECTION 01 78 23**  
**OPERATION AND MAINTENANCE DATA**

**PART 1 - GENERAL**

**1.1 SUBMITTALS**

- A. Contract closeout information:
  - 1. Copy of transmittal letter indicating BNL's acceptance to Architect.

**PART 2 - PRODUCTS**

**2.1 OPERATION AND MAINTENANCE MANUALS**

- A. Assemble data indicated and other data required to completely describe operation and maintenance procedures.
- B. Assemble in 3-ring binders, completely indexed by specification section, with each item clearly labeled. Identify each volume with Project name and contents.
- C. Identify each item in manner consistent with names and identification numbers used in Contract Documents, not with manufacturer's catalog numbers.
- D. Neatly type data not furnished in printed form.
- E. Organize data for ease of reference with indexed tabs.
- F. Included each item on table of contents.

**2.2 DATA REQUIRED FOR EACH COMPONENT AND SYSTEM**

- A. Sequence of operation:
  - 1. List valves, switches, etc., used to start, stop and adjust systems.
  - 2. Provide flow diagrams, control sequences and valve directory.
  - 3. Submit valve directory for review prior to inclusion in manual:
    - a. Show valve number, location.
    - b. List equipment controlled.
- B. Lubrication instructions:
  - 1. Frequency of inspection and lubrication recommended.
  - 2. Type of grease.
  - 3. Amount of lubrication recommended.
- C. Maintenance and trouble shooting data:
  - 1. All manufacturer furnished data.
  - 2. Project record wiring diagrams.
  - 3. Name and address of manufacturer.
  - 4. Name and address of local representatives who stock or distribute repair parts.

**2.3 DATA REQUIRED FOR FINISH MATERIALS**

- A. Maintenance data:
  - 1. Precautions necessary.
  - 2. Manufacturer's instructions and recommendations.
  - 3. Maintenance materials and tools required.
  - 4. Repair and/or replacement instructions.
  - 5. Name and address of manufacturer.
  - 6. Name and address of local supplier of materials.

## **PART 3 - EXECUTION**

### **3.1 DELIVERY**

- A. Deliver two copies to BNL 60 days prior to BNL instruction of systems and equipment, and substantial completion.
- B. Use Operation and Maintenance Data Transmittal form at end of this Section.
- C. Acquire BNL's acceptance of items listed on transmittal form.
- D. Forward copy of transmittal form with BNL's acceptance to Architect.

**END OF SECTION**

**OPERATION AND MAINTENANCE DATA TRANSMITTAL**

---

Project:

To BNL:

Date:

From C.M./Contractor:

---

Contractor to assemble data required to completely describe operation and maintenance procedures. Index and bind in 3-ring binders. Include name, address, and phone number of closest supplier for each item.

**DATA TURNED OVER TO BNL**

| SECTION | DESCRIPTION | BINDER |
|---------|-------------|--------|
|         |             |        |

**BNL'S VERIFICATION & ACCEPTANCE**

Accepted by: \_\_\_\_\_

Date: \_\_\_\_\_

Forward copy of this transmittal to the Architect.

---

DISTRIBUTION:     BNL     CONTRACTOR     C. M.     ARCHITECT

**END OF TRANSMITTAL**



**SECTION 01 78 36**  
**WARRANTIES AND GUARANTEES**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. Execute and provide notarized Project Warranty on form furnished at end of section.
- B. Provide special written warranties/guarantees for products, equipment, systems and installations indicated by other sections.
- C. Provide special warranties/guarantees for period(s) indicated in other sections.
- D. Provide manufacturer's warranties/guarantees indicated in other sections for products, equipment and systems for duration indicated:
  - 1. Where manufacturer's standard warranties/guarantees expire before duration required by Contract Documents, obtain and pay for extensions as part of Contract Price.
- E. Provide all warranties/guarantees prior to final payment.
- F. Warranties/guarantees required by Contract Documents shall commence on date of Substantial Completion of Work, or designated portion thereof, unless otherwise indicated in Certificate of Substantial Completion.

**1.2 SUBMITTALS**

- A. Contract Closeout Information:
  - 1. Full executed and notarized Project Warranty on included form.
  - 2. Transmittal letter indicating BNL's receipt of 3-ring binder containing all product equipment and system warranties/guarantees indicated in other sections of Contract Documents.

**1.3 JOB CONDITIONS**

- A. If for any reason, Contractor cannot warrant or guarantee or both any portion of Work using products or construction methods indicated or required by other sections of Contract Documents, notify Architect in writing during bid period, and before contracts are awarded, indicating reasons and names of products and data on substitutions that can be warranted or guaranteed or both:
  - 1. Should Contractor fail to notify Architect, Contractor will be held to having agreed to warrant or guarantee or both Work indicated.

**PART 2 - PRODUCTS (NOT USED)**

**PART 3 - EXECUTION**

**3.1 PROJECT WARRANTY**

- A. Execute and provide notarized Project Warranty on form furnished at end of section:
  - 1. Provide Contractor's name, address, signature and date.
  - 2. Notarial Act and notarization: Warranty document is required to be signed, dated, and sealed with Notary Public seal or stamp in accordance with state and territorial notary laws.

### **3.2 PRODUCT, EQUIPMENT & SYSTEM WARRANTIES AND GUARANTEES**

- A. Compile approved warranties and guarantees or both required by other sections of Contract Documents.
- B. Bind or assemble in 3-ring binders, completely indexed by specification section, with each warranty or guarantee or both clearly labeled.
- C. Identify each warranty or guarantee or both in manner consistent with names and identification numbers used in Contract Documents.
- D. Neatly type or draft all warranties or guarantees or both not furnished in printed form.
- E. Organize warranties or guarantees or both for ease of reference.
- F. Provide transmittal letter containing:
  - 1. Date.
  - 2. Project title.
  - 3. Contractor's name and address.
  - 4. Title and number of warranties or guarantees or both.
  - 5. Indicating BNL's receipt.
- G. Deliver to BNL prior to final payment with copy of transmittal letter indicating BNL's receipt.

**END OF SECTION**

**PROJECT WARRANTY**

---

PROJECT:

PROJECT NO.:

BNL:

DATE OF SUBSTANTIAL COMPLETION:

As indicated on Certificate of Substantial Completion

Contractor, warrants to BNL that Work is free from defects not inherent in the quality required or permitted, and that Work conforms with requirements of Contract Documents. Work not conforming to these requirements, including substitutions not properly approved and authorized, may be considered defective. Contractor's warranty excludes remedy for damage or defect caused by abuse, modifications not executed by Contractor, improper or insufficient maintenance, improper operation, or normal wear and tear under normal usage.

If, within one-year after the date of Substantial Completion of Work or designated portion thereof, or by terms of an applicable special warranty required by Contract Documents, any of the Work is found to be not in accordance with requirements of Contract Documents, the Contractor shall correct it promptly after receipt of written notice from BNL to do so unless BNL has previously given Contractor a written acceptance of such condition. BNL shall give such notice promptly after discovery of the condition.

The above shall not be construed to establish a period of limitation with respect to other obligations which Contractor might have under Contract Documents. Establishment of one-year period for correction of Work relates only to specific obligation of Contractor to correct Work, and has no relationship to time within which obligation to comply with Contract Documents may be sought to be enforced, nor to time within which proceedings may be commenced to establish Contractor's liability with respect to Contractor's obligations other than specifically to correct Work.

CONTRACTOR:  
ADDRESS:

BY:  
TITLE:

SIGNATURE: \_\_\_\_\_  
DATE:

Subscribed and sworn to me this \_\_\_\_ day of \_\_\_\_\_ in the year of \_\_\_\_\_

NOTARY PUBLIC:  
LOCATION:

SIGNATURE: \_\_\_\_\_

My Commission Expires:

**END OF DOCUMENT**



**SECTION 01 78 39**  
**PROJECT RECORD DOCUMENTS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. Definitions:
1. Documents required for construction: Complete set of all documents required by Contract Documents, including but not limited to:
    - a. Contract Drawings.
    - b. Project Manual and Specifications.
    - c. Addenda.
    - d. Shop Drawings.
    - e. Product Data.
    - f. Samples and Mock-ups.
    - g. Project Information.
    - h. Change Orders.
    - i. Directives, Clarifications, Interpretations, etc.
    - j. Field test records.
    - k. Warranties.
  2. Field documents: Complete set of all documents required for construction.
    - a. Used for construction of project.
    - b. Contract drawings in form of prints.
  3. Periodic Update Documents: Complete separate set of all documents required for construction with exception of samples and mock-ups.
    - a. Do not use for construction of project.
  4. Project Record Documents: Complete set of all documents required for construction with exception of samples and mock-ups.
  5. Environmental Submittals: Complete set of all environmental submittals required.

**1.2 SUBMITTALS**

- A. Contract closeout information:
1. Copy of transmittal letter to BNL.
    - a. At completion of project, turn over Project Record Documents to BNL with letter of transmittal.
    - b. Submit Record Documents in containers used for Periodic Update Documents.
    - c. Provide Transmittal Letter containing:
      - 1) Date.
      - 2) Project title.
      - 3) Contractor's name and address.
      - 4) Title and number of each Project Record Document.
      - 5) Certification that Project Record Documents submitted are complete, accurate and reflect actual construction of project.
      - 6) BNL's signature indicating receipt and acceptance of Project Record Documents.
  2. Copy of Record Drawing files on compact disk to Architect.

## **PART 2 - PRODUCTS - NOT USED**

## **PART 3 - EXECUTION**

### **3.1 POSTING PRIOR TO CONSTRUCTION**

- A. After Contract is executed, but prior to start of construction, obtain Contract Drawings and Project Manual/Specifications that will be used for Field Documents and Periodic Update Documents.
- B. Obtain copies of all addenda and post all above documents.

### **3.2 FIELD DOCUMENTS**

- A. Maintain minimum of one copy at project site.
- B. Label each document "FIELD."
- C. These documents will be used for construction of project.
- D. Make documents available at all times for review by Architect, BNL and authorities having jurisdiction.

### **3.3 PERIODIC UPDATE DOCUMENTS**

- A. Maintain one copy at project site.
- B. Label each document "PERIODIC UPDATE."
- C. Do not use these documents for construction purposes.
- D. Make documents available at all times for review by Architect, BNL and authorities having jurisdiction.
- E. Maintain in clean, dry, legible condition.
- F. Maintain Contract Drawings in stackable, enclosed cardboard file drawers designed to hold drawings horizontally.
  - 1. Provide index of contents of each file drawer on outside of drawer.
- G. Maintain all other Periodic Update Documents in stackable, enclosed file boxes designed to hold specific type of document.
  - 1. Provide index of contents of each box on outside of box.

### **3.4 POSTING AND UPDATING OF PERIODIC UPDATE DOCUMENTS**

- A. Post and update on weekly basis.
- B. Contract drawings: Mark legibly to record actual construction including but not limited to:
  - 1. Depths of various elements of foundations in relation to first floor level.
  - 2. Horizontal and vertical location of underground utilities and appurtenances referenced to permanent surface improvements.
  - 3. Location of internal utilities and appurtenances concealed in construction referenced to visible and accessible features of structure.
  - 4. Field changes of dimension and detail.
  - 5. Changes made by change order, field order, clarifications, interpretations, directives, etc.
  - 6. Addenda.
- C. Project Manual/Specifications: Type on each section to record all changes including but not limited to:
  - 1. Addenda.
  - 2. Change order or field order.

3. Clarifications, interpretations, directives, etc.
  4. Bind added sections into Project Manual/Specifications.
  5. Indicate manufacturer, makes, and models used for actual construction of project.
- D. Do not conceal work for which information must be recorded until all required information is recorded on Periodic Update Documents.
- E. Any work concealed prior to recording of required information must be uncovered.
- F. Once all required information is recorded on Periodic Update Documents, restore work at Contractor's expense.

### **3.5 PRODUCTION OF PROJECT RECORD DOCUMENTS**

- A. Utilize set of Contract Drawings.
- B. Record Drawings:
1. Clean set of Contract Drawings with Architect's seals and signatures removed shall be used for Record Drawings.
  2. Skilled draftsman shall transfer all changes, corrections, entries, and other items from Periodic Update Documents to prints utilizing red pen.
  3. Label each document "PROJECT RECORD PRODUCED BY CONTRACTOR" and date in prominent place.
  4. Scan Record Drawings into electronic Adobe PDF file format.
    - a. 300 dpi resolution.
    - b. Name each PDF file to match Contract Drawing identification (i.e. "A-103G.pdf").
  5. Provide BNL original Record Drawings, and CD-R of scanned drawings in PDF file format.
  6. Provide Architect CD-R of scanned drawings in PDF file format.

### **3.6 ENVIRONMENTAL RECORD DOCUMENTS**

- A. Comply with "Environmental Closeout Submittals" paragraph in Division 01 Section 01 30 00 "Submittal Procedures".
- B. Provide environmental submittals as specified, including USGBC LEED Green Building Rating System documentation documents.
- C. Label each document "ENVIRONMENTAL"
- D. These documents will be used for documentation of specified sustainable construction practices.
- E. In addition to specified environmental submittals, provide US Green Building Council LEED documentation according to specifications and requirements of LEED version used for the Project.

**END OF SECTION**



**SECTION 01 78 43**  
**SPARE PARTS AND MAINTENANCE MATERIALS**

**PART 1 - GENERAL**

**1.1 SPARE PARTS AND TOOLS**

- A. Package in clearly identified boxes.
  - 1. Indicate manufacturer's name, part name and stock number.
  - 2. Indicate piece of equipment part or tool is for.
  - 3. Indicate name, address and phone number of closest supplier.

**1.2 MAINTENANCE MATERIALS**

- A. Package in clearly identified boxes.
  - 1. Indicate trade name and stock number.
  - 2. Indicate which item material is to be used with.
  - 3. Indicate name, address and phone number of closest supplier.

**1.3 EXTRA MATERIALS**

- A. Package in clearly identified containers, or install where indicated.
  - 1. Indicate trade name, stock number, size, color, etc.
  - 2. Indicate where product is to be used.
  - 3. Indicate name, address and phone number of closest supplier.

**PART 2 - EXECUTION**

**2.1 DELIVERY**

- A. Deliver to BNL prior to substantial completion unless BNL requests earlier delivery.
- B. Delivery to location directed by BNL.
- C. Use Spare Parts and Maintenance Material Transmittal form at end of this Section.
  - 1. Acquire BNL's acceptance of items listed on transmittal.
  - 2. Transmittal to indicate BNL's acceptance.
  - 3. Forward copy of transmittal forms with BNL's acceptance to architect.

**END OF SECTION**



**SECTION 01 79 00**  
**SYSTEM DEMONSTRATIONS**

**1.1 DESCRIPTION**

- A. Provide instruction for all equipment and systems for which operating and maintenance data is required.

**1.2 QUALITY ASSURANCE**

- A. Instructors:
  - 1. Member of installer's staff and authorized representative of component, assembly, or system manufacturer.
  - 2. See specification technical sections for additional requirements.

**1.3 JOB CONDITIONS**

- A. Complete all instruction prior to Substantial Completion.
  - 1. Submit separate report for each system or type of equipment, subject to BNL's approval.
    - a. Submit report (form attached), with preliminary information indicated, to BNL at least 2 weeks prior to first instruction period.
    - b. Submit completed report to BNL and Architect.

**PART 2 - EXECUTION**

**2.1 PREPARATION**

- A. Do not begin instruction until component, assembly, or system has been tested as specified and is in correct operating condition.
- B. Assemble instructional aids.
- C. Have operating and maintenance data available for use during instruction.
- D. Schedule all instruction with BNL.

**2.2 INSTRUCTION**

- A. Instruct BNL's personnel in operation and maintenance of equipment and systems.
- B. Provide all necessary instruction to satisfaction of BNL.
- C. Explain use of operating and maintenance manuals.
- D. Tour building areas involved and identify:
  - 1. Maintenance points and access.
  - 2. Control locations and equipment.
- E. Explain operating sequences.
  - 1. Identify location and show operation of switches, valves, etc., used to start, stop and adjust systems.
  - 2. Explain use of flow diagrams, operating sequence diagrams, etc.
  - 3. Demonstrate operation through complete cycle or cycles and full range of operation in all modes, including testing and adjusting relevant to operation.
- F. Explain use of control equipment, including temperature settings, switch modes, available adjustments, reading of gauges, and functions that must be serviced only by authorized factory representatives.

- G. Explain trouble shooting procedures.
  - 1. Demonstrate common occurring problems.
  - 2. Note procedures which must be performed by factory personnel.
- H. Explain maintenance procedures and requirements.
  - 1. Point out items requiring periodic maintenance.
  - 2. Demonstrate typical preventive maintenance procedures and recommended typical maintenance intervals.
  - 3. Demonstrate other commonly occurring maintenance procedures not part of preventive maintenance program.
  - 4. Identify maintenance materials to be used.
- I. Furnish all tools required.

**END OF SECTION**

## EQUIPMENT AND SYSTEMS BNL INSTRUCTION REPORT

Project: \_\_\_\_\_  
 Project No.: \_\_\_\_\_  
 Contractor: \_\_\_\_\_  
 System or equipment: \_\_\_\_\_  
 Specification Section: \_\_\_\_\_

NOTE: Contractor's Representative/Construction Managers Representative maintain and complete this report during course of instruction.

### PRELIMINARY INFORMATION

To be completed by Contractor/Construction Manager:

Proposed dates for instruction period: \_\_\_\_\_ to \_\_\_\_\_.  
 Contractor Representative conducting instruction: \_\_\_\_\_.  
 Number of hours of instruction required by Contract Documents: \_\_\_\_\_.

To be completed by BNL:

BNL's personnel to be instructed (designate supervisor if required).

\_\_\_\_\_  
 \_\_\_\_\_

| INSTRUCTION LOG |           |                  |              |                                       |       |          |
|-----------------|-----------|------------------|--------------|---------------------------------------|-------|----------|
| Date            | No. Hours | Material Covered | Instr. Init. | BNL's Personnel Receiving Instruction | Init. | Comments |
|                 |           |                  |              |                                       |       |          |
|                 |           |                  |              |                                       |       |          |
|                 |           |                  |              |                                       |       |          |
|                 |           |                  |              |                                       |       |          |
|                 |           |                  |              |                                       |       |          |
|                 |           |                  |              |                                       |       |          |

Total Hours Completed: \_\_\_\_\_ Instructor's Signature: \_\_\_\_\_

Date Instruction Completed: \_\_\_\_\_ BNL's Signature: \_\_\_\_\_

Distribution:     BNL     Architect     Construction Manager     Contractor

## END INSTRUCTION REPORT



## **SECTION 01 81 21**

### **INDOOR AIR QUALITY MANAGEMENT (IAQ) DURING CONSTRUCTION**

#### **PART 1 - GENERAL**

##### **1.1 SUMMARY**

- A. Section includes administrative and procedural requirements governing protection of indoor air quality (IAQ), absorbent materials, and mechanical system from contamination during construction and building flush out.

##### **1.2 DESCRIPTION, GENERAL**

- A. IAQ Management During Construction: Minimize contaminants generated during construction. Methods to include, but not limited to:
  1. Practices which minimize the amount of dust generated.
  2. Reduction of solvent fumes and volatile organic compound (VOC) emissions.
  3. Maintaining good housekeeping practices including sweeping and periodic dust and debris removal.
  4. No visible haze in the air.

##### **1.3 SUBMITTALS**

- A. Project Information:
  1. Construction IAQ Management Plan.

#### **PART 2 - PRODUCTS (NOT USED)**

#### **PART 3 - EXECUTION**

##### **3.1 CONSTRUCTION IAQ MANAGEMENT**

- A. Construction IAQ Management Plan. General IAQ Plan requirements during construction shall include:
  1. Compliance with "SMACNA Guidelines for Occupied Buildings Under Construction."
  2. Provide solid physical barriers to isolate areas of construction. Securely attach and seal at floor and structure above.
  3. Schedule adequate time for product installation.
  4. Maintain negative pressure in construction area.
  5. Do not recirculate air prior to occupancy.
  6. Seal return air ducts and use direct exhaust to outside.
  7. Factory age sheet goods.
  8. Comply with manufacturer's instructions for appropriate drying times.
  9. Protect installed absorbent materials with recycled or recyclable materials.
- B. The IAQ Plan shall meet or exceed the five SMACNA requirements and shall include the following measures:
  1. HVAC Protection.
  2. Source Control.
  3. Pathway Interruption.
  4. Housekeeping.
  5. Scheduling.

- C. HVAC Protection:
1. Protect air handling and distribution equipment, and air supply and return ducting during construction.
  2. Adequately cover and protect exposed air inlets and outlets, openings, grilles, ducts, plenums, as required to prevent water, moisture, and other contaminant intrusion.
  3. Apply protection immediately after installation of equipment and ducting.
  4. Ducting runs that require more than a single day to install shall be protected at the end of each day's Work.
  5. During dust producing activities, (e.g., drywall installation and finishing), turn the ventilation system off, and protect HVAC supply and return openings from dust infiltration. Provide temporary ventilation as required.
- D. Source Control:
1. Protect stored on-site or installed absorptive or porous materials such as batt insulation and drywall from exposure to moisture.
  2. Do not use wet, damaged porous materials in the building. Materials with evidence of moisture damage, including stains, are not acceptable, including both stored and installed materials. Immediately remove them from the site and properly dispose.
  3. Preconditioning:
    - a. Prior to delivery to the construction site allow products that have odors and significant volatile organic compound (VOC) emissions to off-gas in dry, well ventilated space for 14 calendar days to allow for reasonable dissipation of odors and emissions.
    - b. Condition products, without containers and packaging, to maximize off-gassing of VOCs.
    - c. Condition products in a ventilated warehouse or other building. Provide a temperature range of 60 degrees F minimum to 90 degrees F maximum continuously during the ventilation period.
    - d. Do not ventilate within limits of Work unless otherwise accepted by Architect.
    - e. Comply with substitution requirements for consideration of other locations.
  4. Take special care to prevent accumulation of moisture on installed materials and within packaging during delivery, storage, and handling to prevent development of molds and mildew, including materials with moisture stains.
  5. Replace moldy materials with new, undamaged materials.
  6. Provide sufficient ventilation, air circulation and air changes to dissipate excess humidity when present.
- E. Pathway Interruption:
1. All openings within the designated work area shall be sealed.
  2. Adequate exhaust ventilation equipment shall be installed to maintain a negative pressure differential between the work area and adjacent areas of the building.
  3. Ventilation units shall be exhausted to the outside of the building.
- F. Housekeeping:
1. Provide temporary ventilation during construction to minimize accumulation of dust fumes, vapors, or gases in the building.
  2. Continuously ventilate during and after installation of materials that emit VOCs until emissions dissipate:
    - a. Period after installation shall be sufficient to dissipate odors and elevated levels of VOCs. Where no specific period is stated in these Specifications, a period of 72 hours shall be used.
    - b. Ventilate areas directly to outside, do not ventilate to other enclosed spaces.
    - c. If continuous ventilation is not possible via the building's HVAC system(s), then ventilate via open windows and temporary fans that sufficiently provide no less than three air changes per hour.
  3. Suppress dust with wetting agents or sweeping compounds.
  4. Clean-up dust using a wet rag or damp mop.
  5. Increase the cleaning frequency when dust build-up is noted.

6. Remove spills or excess applications of solvent-containing products as soon as possible.
  7. Remove accumulated water and keep work areas as dry as possible.
  8. Store volatile liquid containers closed when the container is inside of the building and not in use.
  9. Keep volatile liquid containers closed when the container is inside of the building and not in use.
- G. Scheduling:
1. Where odorous and/or high VOC-emitting products are applied on site, apply them before installation of porous and fibrous materials. Where this is not possible, protect porous materials with polyethylene vapor retarders.
  2. Insure that wet applied interior finish materials, such as paints, adhesives, sealants, coatings, finishes, and spray-applied materials, such as structural fireproofing, are properly and fully cured before installing other finish materials over them.
  3. Install carpets and furnishings after all other interior finish materials have been applied and fully cured.
  4. Provide adequate ventilation of packaged dry products prior to installation. Remove from packaging and ventilate in a secure, dry, well-ventilated space free from strong contaminant sources and residues.
  5. Complete interior finish material installation no less than 14 days prior to Substantial Completion to allow for building flush-out and testing prior to occupancy.

## **END OF SECTION**



**SECTION 01 81 22**  
**INDOOR AIR QUALITY PROTECTION BEFORE OCCUPANCY**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section includes administrative and procedural requirements governing protection of indoor air quality (IAQ), absorbent materials, and mechanical system from contamination during construction and building flush out and baseline indoor air quality testing prior to occupancy.

**1.2 DESCRIPTION, GENERAL**

- A. Minimize indoor pollutant concentrations to required levels prior to occupancy by building flush out and/or baseline testing of targeted pollutants.
- B. Contractor may elect to pursue any one of the three identified options to complete the Work under this Section.

**1.3 SUBMITTALS**

- A. LEED Information:
  - 1. Submit narrative from responsible parties indicating that building flush out procedures were satisfactorily executed.
  - 2. Submit testing laboratories report indicating that Baseline Indoor Air Testing has been satisfactorily completed.

**PART 2 - PRODUCTS (NOT USED)**

**PART 3 - EXECUTION**

**3.1 BUILDING FLUSHOUT – (OPTIONS 1 AND 2)**

- A. LEED Credit EQ 3.2, Construction IAQ Management Plan, Before Occupancy - Flushout:
  - 1. Option 1:
    - a. After construction ends, prior to occupancy and with all interior finishes installed, perform a building flush-out by supplying a total volume of 14000 cu. ft. of outdoor air per sq. ft. of floor area while maintaining an internal temperature of at least 60 deg F and a relative humidity of no higher than 60 percent.
  - 2. Option 2:
    - a. If occupancy is desired prior to flush-out completion, the space may be occupied following delivery of a minimum of 3500 cu. Ft. of outdoor air per sq. ft. of floor area to the space. Once a space is occupied, it shall be ventilated at a minimum rate of 0.30 cfm per sq. ft. of outside air or the design minimum outside air rate determined in EQ Prerequisite 1, whichever is greater. During each day of the flush-out period, ventilation shall begin a minimum of three hours prior to occupancy and continue during occupancy. These conditions shall be maintained until a total of 14000 cu. ft./sq. ft. of outside air has been delivered to the space.

**3.2 BASELINE IAQ TESTING – (OPTION 3)**

- A. LEED Credit EQ 3.2, Construction IAQ Management Plan, Before Occupancy - Baseline IAQ Testing:
  - 1. Air Quality Testing:

- a. Conduct baseline indoor air quality testing, after construction ends and prior to occupancy, using testing protocols consistent with the EPA's "Compendium of Methods for the Determination of Air Pollutants in Indoor Air," and as additionally detailed in the USGBC's "LEED Reference Guide."
- b. Demonstrate that the contaminant maximum concentrations listed below are not exceeded:
  - 1) Formaldehyde: 50 ppb.
  - 2) Particulates (PM10): 50 micrograms/cu. m.
  - 3) Total Volatile Organic Compounds (TVOC): 500 micrograms/cu. m.
  - 4) 4-Phenylcyclohexene (4-PH): 6.5 micrograms/cu. m.
  - 5) Carbon Monoxide: 9 ppm and no greater than 2 ppm above outdoor levels.
- c. For each sampling point where the maximum concentration limits are exceeded, conduct additional flush out with outside air and retest the specific parameter(s) exceeded to indicate the requirements are achieved. Repeat procedure until all requirements have been met. When retesting noncomplying building areas, take samples from same locations as in the first test.
- d. Air sample testing shall be conducted as follows:
  - 1) All measurements shall be conducted prior to occupancy but during normal occupied hours and with building ventilation system starting at the normal daily start time and operated at the minimum outside air flow rate for the occupied mode throughout the duration of the air testing.
  - 2) Building shall have all interior finishes installed including, but not limited to, millwork, doors, paint, carpet, and acoustic tiles. Nonfixed furnishings such as workstations and partitions are encouraged, but not required, to be in place for the testing.
  - 3) Number of sampling locations will vary depending on the size of building and number of ventilation systems. For each portion of building served by a separate ventilation system, the number of sampling points shall not be less than one per 25,000 sq. ft. or for each contiguous floor area, whichever is larger, and shall include areas with the least ventilation and greatest presumed source strength.
  - 4) Air samples shall be collected between 3 and 6 feet from the floor to represent the breathing zone of occupants, and over a minimum four hour period.

## **END OF SECTION**

**SECTION 01 91 13**  
**GENERAL BUILDING SYSTEMS COMMISSIONING REQUIREMENTS**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section. Refer to the following sections for related work:
  - 1. Section 20 05 00 – General Mechanical Requirements
  - 2. Section 20 08 00 – Testing and Balancing
  - 3. Section 23 90 00 – Mechanical Systems Commissioning
  - 4. Section 25 50 00 – Building Management and Control System
  - 5. Section 26 00 10 – Electrical General Requirements
  - 6. Section 26 80 00 – Electrical Systems Commissioning
- B. OPR and BoD documentation prepared by BNL and Architect / Engineer contain requirements that apply to this section.

**1.2 SUMMARY**

- A. This section includes requirements for commissioning during the construction phase, functional testing phase and the building turnover phase. Includes requirements for all specified and associated systems, subsystems and equipment. The intent of this section is to specify the commissioning responsibilities of the Contractor, HVAC Subcontractor, TAB Subcontractor, Automated Temperature Controls Subcontractor, Plumbing Subcontractor, and the Fire Protection Subcontractor. The Contractor will assure participation and cooperation of his subcontractors as required for the commissioning process.
- B. This project has been designed and built to meet the requirements of the US Green Building Council's Leadership in Energy and Environmental Design New Construction (LEED-NC) guidelines. This commissioning section includes all requirements of the LEED program for EA Prerequisite 1, Fundamental Commissioning of the Building Energy Systems and EA Credit 3, Enhanced Commissioning as described in the Energy and Atmosphere section.
- C. The CxA is not responsible for construction means, methods, job safety or any management function on the job site.

**1.3 DEFINITIONS**

- A. Architect: Includes Architect identified in the Contract for Construction between BNL and Contractor.
- B. Basis of Design (BoD): A document that records concepts, calculations, decisions, and product selections used to meet the OPR and to satisfy applicable regulatory requirements, standards, and guidelines. The document includes both narrative descriptions and lists of individual items that support the design process.
- C. Commissioning Plan: A document that outlines the organization, schedule, allocation of resources, and documentation requirements of the commissioning process.
- D. Contractor: The prime Contractor identified in the Contract for Construction between BNL and Contractor.

- E. Construction Checkout Documents / Pre-Functional Checklists: The CxA will produce pre-functional checklists that can be used by the Contractor / Subcontractors prior to the start of functional testing. These checklists are tools to help the Contractor and Subcontractors verify that the installation complies with the Contract Documents. Any deficiencies that are found can then be corrected early in the process when the Contractors are fully mobilized on the site. The pre-functional checklists will be created for all equipment included in the scope of the commissioning process.
- F. Commissioning Authority (CxA): The individual or group responsible for executing the commissioning process.
- G. Engineering Professionals: Includes the Engineers identified in the Contract for Construction between BNL and Contractor, responsible for design of HVAC, plumbing, fire protection, electrical, communications, controls for HVAC systems and other related systems.
- H. Leadership in Energy and Environmental Design New Construction (LEED-NC): A rating system provided by the U.S. Green Building Council that rates the environmentally friendly and energy efficient performance of a newly constructed building based on established guidelines.
- I. BNL's Project Requirements (OPR): A document that details the functional requirements of a project and the expectations of how it will be used and operated. These include Project goals, measurable performance criteria, cost considerations, benchmarks, success criteria, and supporting information.
- J. Subcontractor: Individual contractors responsible to the Contractor for installation of specific systems to be commissioned.
- K. Systems, Subsystems, Equipment, and Components: Where these terms are used together or separately, they shall mean "as-built" systems, subsystems, equipment, and components.
- L. Testing, Adjusting, and Balancing (TAB): Testing, adjusting and balancing of air and water systems, subsystems, equipment and components as required per Division 1 sections.

#### **1.4 COMMISSIONING TEAM**

- A. Members Appointed by Contractor(s): Individuals, each having the authority to act on behalf of the entity he or she represents, explicitly organized to implement the commissioning process through coordinated actions. The commissioning team shall consist of, but not be limited to, representatives of each Contractor, including Project superintendent and subcontractors, installers, suppliers, and specialists deemed appropriate by the CxA.
- B. Members Appointed by BNL:
  - 1. The CxA: BNL has engaged the CxA under a separate contract.
  - 2. Representatives of BNL including facility users and operation and maintenance personnel.
  - 3. Architect and engineering design professionals.

#### **1.5 BNL'S RESPONSIBILITIES**

- A. Provide the OPR and BoD documentation for use in developing the commissioning plan, checklists and testing plans, operation and maintenance training plan, and a systems manual.
- B. Assign operation and maintenance personnel and schedule them to participate in commissioning team activities, including but not limited to, the following:
  - 1. Coordination and testing meetings.
  - 2. Training in operation and maintenance of systems, subsystems, and equipment.
  - 3. Demonstration of operation of systems, subsystems and equipment.

#### **1.6 CONTRACTOR'S RESPONSIBILITIES**

- A. Contractor shall assign representatives with expertise and authority to act on its behalf and shall schedule them to participate in and perform commissioning process activities including, but not limited to, the following:

1. Evaluate performance deficiencies identified in test reports and, in collaboration with entity responsible for system and equipment installation, recommend corrective action.
  2. Provide the CxA with a detailed and accurate construction schedule updated on a monthly basis. Coordinate scheduling of commissioning activities with the CxA and include them in the construction schedule.
  3. Provide a schedule for equipment submittals, installation manual submittals, operation and maintenance data submittals, equipment start-up, and testing to CxA for incorporation into the commissioning plan. Update schedule on a monthly basis throughout the construction period.
  4. Provide CxA with copies of all approved change orders or other modifications impacting construction when approved.
  5. Participate in construction phase coordination meetings.
  6. Participate in commissioning inspections.
  7. Ensure accurate completion of construction checkout documents for all systems to be commissioned prior to verification site visits by the CxA.
  8. Certify readiness of systems to be commissioned prior to functional performance testing.
  9. Participate in functional performance testing of systems to be commissioned.
  10. Resolving issues identified during commissioning and coordinating correction of deficiencies. Ensure responses to open issues within two weeks of being posted via online tracking database.
  11. Participate in operation and maintenance planning and verification.
  12. Participate in operation and maintenance training sessions.
  13. Participate in final review at acceptance meeting.
  14. Certify the work is complete and systems are operational according to the contract documents, including calibration of controls and any instrumentation.
  15. Coordinate subcontractor commissioning activities.
  16. Review and approve final commissioning documentation.
  17. Assist in coordinating the Subcontractors, as needed, to perform testing of systems and equipment as it relates to project phasing.
  18. Assist in coordinating the Subcontractors, as needed, to perform deferred or opposite seasonal testing of systems and equipment.
  19. Assist in coordinating the Subcontractors to resolve issues discovered during the system performance review 10 months into the 12 month warranty period.
  20. Assist in coordinating personnel and providing documentation, as needed, to meet the LEED-NC requirements.
- B. Subcontractors shall assign representatives with the expertise and the authority to act on behalf of the entity responsible for installation of systems to be commissioned who shall participate in and perform commissioning team activities including, but not limited to, the following:
1. Provide a schedule for equipment submittals, installation manual submittals, operation and maintenance data submittals, equipment start-up, and testing to CxA for incorporation into the commissioning plan. Update schedule on a monthly basis throughout the construction period.
    - a. Participate in construction phase coordination meetings.
    - b. Provide information to the CxA for developing construction phase commissioning plan including, but not limited to:
      - 1) Schedule as mentioned above.
      - 2) Equipment submittals.
      - 3) Installation manual submittals.
      - 4) Operation and maintenance information submittals.
    - c. Complete construction checkout documents for all systems to be commissioned.
    - d. Maintain updated Project Record Documents for periodic review by the CxA and submit final record documents at project completion.
    - e. Certify readiness of systems to be commissioned prior to functional performance testing.
    - f. Participate in functional performance testing of systems to be commissioned.

- g. Participate in test procedures meeting.
- h. Provide technicians who are familiar with the construction and operation of the installed systems, are trained in the use of required testing instruments and procedures to participate in testing of installed systems, subsystems and equipment.
- i. Participate in operation and maintenance planning, documentation and verification.
- j. Resolving issues identified during commissioning and coordinating correction of deficiencies. Ensure responses to open issues within two weeks of being posted via online tracking database.
- k. Participate in training sessions for BNL's operation and maintenance personnel.
- l. Participate in final review at acceptance meeting.
- m. Participate, as needed, in performing deferred or opposite seasonal testing of systems and equipment.
- n. Assist in coordinating personnel and providing documentation, as needed, to meet the LEED-NC requirements.

## 1.7 COMMISSIONING DOCUMENTATION

- A. Commissioning Plan: A document, prepared by the CxA, that outlines the schedule, allocation of resources and documentation requirements of the commissioning process, including:
  - 1. Plan for delivery and review of submittals, systems manuals and other documents and reports. Identification of the relationship of these documents to other functions and a description of submittals that are required to support the commissioning processes. Submittal dates include the latest date approved submittals must be received without adversely affecting commissioning.
    - a. Overview of the organization, layout and content of commissioning documentation and a description of documents to be provided along with identification of responsible parties.
    - b. Identification of systems and equipment to be commissioned.
    - c. Description of schedules for testing procedures along with identification of parties involved in performing and verifying tests.
    - d. Identification of items that must be completed before the next operation can proceed.
    - e. Description of responsibilities of commissioning team members.
    - f. Description of observations to be made.
    - g. Description of requirements for operation and maintenance training, including required training materials.
    - h. Description of expected performance for systems, subsystems, equipment and controls.
    - i. Requirements for documenting changes on a continuous basis to appear in the project record documents.
    - j. Process and schedule for completing construction checklists for systems to be commissioned,
    - k. Step by step procedures for testing systems, subsystems and equipment with descriptions for methods of verifying relevant data, recording the results obtained and listing parties involved in performing and verifying tests.
- B. Pre-functional Checklists: CxA shall develop construction checklists for each system to be commissioned including interfaces and interlocks. Separate entries will be provided for each item to be checked. Construction checklists will be completed by the installing Subcontractor and verified by the Contractor and CxA. Space will be provided for sign off of installing Subcontractor, Contractor and CxA. Each checklist will include, but not limited to, the following:
  - 1. Name and identification code of each item being checked.
    - a. Verification of each item including verification of all required data and construction practices listed in the construction checklists. This list outlines all work necessary to be completed prior to the start of functional testing for the particular system, subsystem and equipment.
    - b. Notation of any equipment or installation that deviates from approved submittals or the construction documents.

- c. Name(s) of personnel involved with verification and dates on which verification activities and construction checklists were completed.
- C. Witness systems, assemblies, equipment, and component startup.
- D. Certificate of Readiness: Certificate of Readiness shall be signed by the Contractor, Subcontractor(s), Installer(s) and CxA certifying that systems, subsystems, equipment, and associated controls are ready for testing and that all relevant information including submittals, installation data and operation and maintenance documentation has been submitted. Completed construction checklists signed by the responsible parties shall accompany this certificate.
- E. Functional Performance Testing: CxA shall develop functional performance test documents for each system to be commissioned including interfaces and interlocks. Separate entries will be provided for each item to be tested. CxA shall prepare separate tests for each mode of operation and provide space to indicate whether the mode under test responded as required. All information gathered will be documented by the CxA. Each test will include, but not limited to, the following:
  - 1. Name and identification of each item being checked.
    - a. Date of test.
    - b. Indication of whether the record is for a first test or retest following correction of a problem or issue.
    - c. List of deficiencies.
    - d. Calibration of sensors and sensor function.
    - e. Testing conditions under which test was conducted, including (where applicable) ambient conditions, setpoints, override conditions, and status and operating conditions that impact the results of the test.
    - f. Control sequences for mechanical and electrical systems.
    - g. Verification of control signals for each setpoint at specified conditions.
    - h. Responses to control signal at specified conditions.
    - i. Sequence of responses to control signals at specified conditions.
    - j. Electrical demand or power input at specified conditions.
    - k. Expected performance of systems, subsystems and equipment at each step of the tests. Narrative description of observed performance of systems, subsystems and equipment. Notation to indicate whether the observed performance at each step meets the expected results.
    - l. Interaction of auxiliary equipment.
- F. Test and Verification Reports: CxA will create test scenarios, record test data, observations, and measurements on test documents. Photographs, forms and other means appropriate for the application shall be included with test documentation. CxA will compile test and verification reports and verification certificates and include them in the commissioning report.
- G. Training Plans: To be prepared by the contractor and submitted to the CxA and BNL for review and comment prior to finalizing training plans.
- H. Corrective Action Documents: CxA will document corrective action taken for systems and equipment that fail tests including required modifications to systems and equipment and revisions to test procedures. Retest and final results will also be documented.
  - 1. Issues Log or Commissioning Notice: CxA prepares and maintains an issues log that describes design, installation and performance issues that are at variance with the OPR, BoD and contract documents. Identification and tracking of issues as they are encountered, documenting the status of unresolved and resolved issues. Issues log is shared with members of the Design/Construction/Commissioning team via an internet portal which is maintained by the CxA.

- a. BVH Commissioning Portal: The CxA Commissioning Portal is an on-line issue tracking database developed by BVH Integrated Services, Inc. The Portal is used by the CxA to track issues and assign responsibility for corrective action. All members of the Commissioning Team will be given access to the Portal to respond to issues and / or deficiencies. Open issues will be sorted by the individual trades. Once the Contractor / Subcontractor(s) have made any necessary corrections they will update their specific issues on line for re-verification by the commissioning provider.

## **1.8 SUBMITTALS BY CONTRACTOR**

- A. Information listed below shall be submitted with the product and system product literature and shop drawing submittals for review and approval by the BNL, Architect, Engineering Professionals and the CxA. This information will be used to confirm the product compliance with the Contract Documents and to establish detailed commissioning requirements and procedures. The information shall be specific to each system to be commissioned and shall be inclusive of all related systems, equipment and components.
  1. Manufacturer cut sheets and product literature and shop drawings in accordance with the requirements of other divisions.
    - a. Manufacturer's detailed installation and start-up requirements including equipment checklists for each piece of equipment.
    - b. Operation instructions.
    - c. Manufacturer's recommended maintenance and troubleshooting procedures.
    - d. Warranty and BNLs obligations to maintain warranty.
    - e. Detailed product data for each piece of equipment including part load capacities, electrical components and requirements, etc. (As appropriate)
    - f. Manufacture's certified test reports on each piece of equipment.
    - g. Performance curves for each piece of equipment being submitted. (As appropriate)
    - h. Coordination and Record Drawings.
    - i. Logic flow diagrams for control systems sequences of operation. Include detailed sections of the Sequence of Operations for related function groups.
    - j. Interpret function groups for clarity.
    - k. Indicate initial setpoints, reset schedules, sensor locations, etc.
- B. Operation and Maintenance Manuals:
  1. The Contractor shall develop the Operation and Maintenance manuals in accordance with the requirements indicated in Divisions 1, 13, 15 and 16.
    - a. All submittal information indicated in item 1.8A above shall be included in the operations and maintenance manual in addition to the information required below.
    - b. Manufacturer's break-in instructions.
    - c. Manufacturer suggested service requirements.
    - d. Spare parts list edited for specific equipment used on the project. Provide names/numbers of local distributors for spare parts.
    - e. Copy of all equipment specifications.
    - f. Preventative maintenance instructions.
    - g. Troubleshooting guide.
    - h. Plumbing and HVAC piping sanitation certificates.
    - i. Air and Water Balancing Reports.
    - j. Warranties and Warranty start dates.
    - k. Equipment Start-up Reports

## **1.9 QUALITY ASSURANCE**

- A. Operations and Maintenance Training Instructor Qualifications: Equipment training shall be provided by a factory authorized technical representatives, experienced in training, operation and maintenance procedures for installed systems, subsystems and equipment.

## 1.10 COORDINATION

- A. Coordination Meetings: CxA shall conduct periodic coordination meetings of the commissioning team to review progress on the commissioning plan, to discuss scheduling conflicts and to discuss upcoming commissioning process activities.
- B. Pretesting Meetings: CxA shall conduct pretest meetings of the commissioning team to review start-up reports, pretest verification results, testing procedures, testing personnel and instrumentation requirements and manufacturer's authorized service representative services for each system, subsystem, equipment and component to be tested.
- C. Testing Coordination: CxA shall coordinate sequence of testing activities to accommodate required quality assurance and control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and verification.
- D. Manufacturer's Field Services: CxA shall coordinate services with the help of the Contractor/Subcontractor of manufacturer's field services.

## 1.11 SYSTEMS TO BE COMMISSIONED

- A. The following systems will be commissioned in this project:
  - 1. Hot Water Heating System: Includes any and all of the following equipment: primary & secondary heating pumps, heating coils, heat exchangers, hydronic balancing, variable frequency drives, controls, valves, unit heaters, cabinet unit heaters, electric duct heating coils, steam pressure reducing stations and condensate pumps.
  - 2. Cooling System: Includes any and all of the following equipment: chilled water pumps, cooling towers, condenser water pumps, heat exchangers, hydronic balancing, variable frequency drives, valves and controls associated with the central cooling system.
  - 3. Air Handling Systems: Includes any and all of the following equipment: As a minimum, all of the air-handling units and make up air units will be thoroughly checked for proper operation and control. The units will be verified for their operation as heating, cooling, and ventilation systems, including outdoor air economizer. Unit shut down and start-up under normal and emergency power will be verified. All refrigeration (DX systems) will be verified for proper operation.
  - 4. Supply Air Distribution Systems: all of the installed terminal variable air volume boxes and exhaust air boxes will be tested to provide a thorough evaluation of their operation.
  - 5. Exhaust Fans: all of the general exhaust fans will be verified for proper operation and their interaction with total building air balance.
  - 6. All of the smoke exhaust operations will be verified under normal and smoke conditions.
  - 7. All Direct Digital Controls (DDC) shall be verified for proper operation as they relate to the above equipment including interfaces for remote monitoring.
  - 8. All security and system interlocks associated with the control system shall be commissioned.
  - 9. Spot checking of air and water balancing readings including space pressurization.
  - 10. All of the emergency lighting and emergency power transfer switches shall be verified for proper operation and control. Lighting levels shall be recorded and any deficiencies reported.
  - 11. Building domestic hot water heating systems
  - 12. Building elevators
  - 13. Fire protection system
  - 14. Day lighting controls
  - 15. Scheduled or occupancy sensor lighting controls
  - 16. Fire alarm system
  - 17. Site lighting and controls
  - 18. Process water pumping and mixing systems
  - 19. Storm water system
  - 20. Compressed air systems
  - 21. Gaseous nitrogen system

22. Electrical power system
23. Data & Communication

## **PART 2 - PRODUCTS**

### **2.1 TEST EQUIPMENT**

- A. All standard testing equipment required to perform start-up and initial checkout and required functional performance testing shall be provided by the Division contractor for the equipment being tested.
- B. All testing equipment shall be of sufficient quality and accuracy to test and/or measure system performance with the tolerance specified in this Section. The Contractor(s) instrumentation shall meet the following standards:
  1. Be of sufficient quality and accuracy to test and/or measure system performance within the tolerances required to determine adequate performance.
  2. Be calibrated on the manufacturer's recommended intervals with calibration tags permanently affixed to the instrument being used.
  3. Be maintained in good repair and operating condition throughout the duration of use on this project.
  4. Be recalibrated / repaired if dropped and/or damaged in any way since last calibrated.

## **PART 3 - EXECUTION**

### **3.1 TESTING PREPARATION**

- A. Prerequisites for Testing:
  1. Certify that systems to be commissioned have been completed, calibrated and manufacturer start-ups (where required) are complete. Verify systems to be commissioned are operating according to the OPR, BoD, and the contract documents and the Certificates of Readiness are signed and submitted.
  2. Certify that instrumentation and controls associated with the systems to be commissioned have been completed and calibrated and are operating according to the OPR, BoD, and the contract documents and that preset set points have been recorded.
  3. Certify that TAB procedures have been completed and that TAB reports have been submitted, discrepancies corrected and corrective work approved.
  4. Test systems and intersystem performance after approval of construction checklists for systems, subsystems, and equipment.
  5. Set systems, subsystems, and equipment into operating mode to be tested (i.e. normal shut down, normal auto position, normal manual position, unoccupied cycle, emergency power and alarm conditions.)
  6. Verify each operating cycle after it has been running for a specified period and is operating in a steady state condition.
  7. Inspect and verify the position of each device and interlock identified on checklists. Sign off each item as acceptable or failed. Repeat this test for each operating cycle that applies to system being tested.
  8. Check safety cutouts, alarms and interlocks with smoke control and life safety systems during each mode of operation.
  9. Update checklists or data sheet after a deficiency is observed and corrected.
  10. Verify equipment interface with monitoring and control system and TAB criteria including the following:
    - a. Supply and return flow rated for variable flow and constant volume systems in each operational mode, including maximum and minimum flow capacity.
    - b. Operation of terminal units in both heating and cooling cycles.

- c. Minimum outdoor air intake in each operational mode and at minimum and maximum airflows.
  - d. Building pressurization.
  - e. Total exhaust airflows and total outdoor air intake.
  - f. Operation of indoor air quality monitoring systems.
11. Verify proper responses of monitoring and control systems controllers and sensors to include the following:
- a. For each controller or sensor, record the indicated monitoring and control system reading and the test instrument reading. If the initial test indicates that the test reading is outside of the control range of the installed device, check calibration of the installed device and adjust as required. Retest malfunctioning devices and record results on checklist or data sheet.
  - b. Report deficiencies and prepare an issues log entry.
12. Verify that construction checkout of systems to be commissioned has been completed and approved. CxA shall verify construction checkout and start-up including requirements specified in individual Division Sections and equipment manufacturer's recommendations.
- B. Testing Instrumentation: Install measuring instruments and logging devices to record test data for the required test period. Instrumentation shall monitor and record full range of operating conditions and shall allow for calculation of total capacity of system for each mode of operation. Operational modes may include the following:
- 1. Occupied and unoccupied
  - 2. Full load and minimum flow
  - 3. Maximum flow and minimum flow
  - 4. Warm up and cool down
  - 5. Economizer cycle
  - 6. Emergency power supply
  - 7. Life safety alarm modes
  - 8. Temporary upset of system operation
  - 9. Partial occupancy conditions
  - 10. Special cycles

### **3.2 START-UP, CONSTRUCTION CHECKLISTS AND INITIAL CHECKOUT**

- A. The following procedures apply to all equipment to be commissioned.
- B. General: Each piece of equipment receives full construction checkout. No sampling strategies are used. The construction checkout protocol for a given system must be successfully completed prior to formal functional performance testing of equipment or subsystems of the given system. Before any system start-ups begin, the Contractor(s) shall conduct a final installation verification audit for their work. The Contractor shall be responsible for completion of all work including change orders and punch list items to BNL's / CxA satisfaction. This visual check of the various systems to be commissioned shall verify that all components are properly installed. The following items as a minimum shall be observed, but not be limited to, check of:
- 1. Air Distribution Systems:
    - a. Mounting and support of equipment.
    - b. Noise, vibration, air and water leaks.
    - c. Air filtration, presence and operation of dampers, diffusers, grilles, fire dampers and access doors.
    - d. Presence of thermostats and other adjustable temperature control devices.
    - e. Presence of smoke sensors and other safety devices.
    - f. Instrumentation, gauges, thermometers and flow measuring devices.
    - g. Access to equipment and filters.
    - h. Insulation of ductwork is complete.
    - i. Ductwork is sealed.
    - j. Power available to equipment.
    - k. Temperature controls are complete.

1. Air and water balancing is complete and a hand written report available.
2. Heating and Cooling Systems Equipment and Piping:
  - a. Service access is acceptable.
  - b. Proper cycling.
  - c. Excessive noise, vibration or leaks.
  - d. Presence of safety devices and controls.
  - e. Proper identification of all piping, valves, starters and equipment.
  - f. Pressure testing and flushing of systems.
  - g. Power available to equipment.
  - h. Temperature controls are complete.
  - i. Equipment start-up and checkout by the manufacturer's representatives are complete.
  - j. Air and water balancing is complete and a hand written report available.
3. Plumbing Systems and Equipment:
  - a. Service access is acceptable.
  - b. Proper cycling.
  - c. Excessive noise, vibration or leaks.
  - d. Presence of safety devices and controls.
  - e. Proper identification of all piping, valves, starters and equipment.
  - f. Pressure testing and flushing of systems.
  - g. Power available to equipment.
  - h. Equipment start-up and checkout by the manufacturer's representatives are complete.
4. Building Electrical System and Equipment:
  - a. Service access is acceptable to generator and transfer switches.
  - b. Proper cycling.
  - c. Excessive noise, vibration or leaks.
  - d. Presence of safety devices and controls.
  - e. Proper identification of all starters, switches and equipment.
  - f. Power available to equipment.
  - g. Equipment start-up and checkout by the manufacturer's representatives are complete.
  - h. Fire alarm system is complete and all devices are communicating with the fire alarm master panel.
  - i. All emergency lighting is in place and power is complete.
- C. If any work is found incomplete, incorrect, or non-functional, the Contractor shall correct the deficiency before system start-up work proceeds.
- D. Contractor shall provide a full start-up plan for each system to be commissioned including all subsystems, equipment and components which shall at a minimum include the following documentation:
  1. Construction Check-out Documents
  2. Manufacturer's standard written start-up procedures copied from the installation manuals with check boxes by each procedure and a signature block added by hand at the end.
  3. Manufacturer's normally used field checkout sheets.
- E. Sensor Calibration:
  1. Calibration of all sensors shall be included as part of the construction checklists performed by the Contractors.

### **3.3 FUNCTIONAL PERFORMANCE TESTING**

- A. This sub section applies to commissioning functional performance testing for all Divisions.
- B. Objectives and Scope:
  1. The objective of functional performance testing is to demonstrate that each system is operating according to the documented design intent and Contract Documents. Functional testing facilitates bringing the systems from a state of substantial completion to full dynamic operation. Additionally, during the testing process, areas of deficient performance are identified and corrected, improving the operation and function of the systems.

2. In general, each system to be commissioned should be operated through all modes of operation where there is a specified system response. Verifying each sequence in the sequences of operation is required. Proper responses to such modes and conditions as power failure, freeze condition, low oil pressure, no flow, equipment failure, etc. shall be tested.
- C. The responsible subcontractor or his/her designee executes the performance of the construction checkout, start-up, and checkout. When checking off construction checklists, signatures may be required of other subcontractors for verification of completion of their work.
  - D. The CxA shall observe, at minimum, the procedures for each piece of primary equipment.
  - E. For lower level components of equipment, (i.e. VAV boxes, sensors, controllers), the CxA shall observe 10% of the construction checkout and start-up procedures.
  - F. The subcontractors shall execute start-up and provide the CxA with a signed and dated copy of the completed start-up and construction checklists.
  - G. Only individuals that have a direct knowledge and witness that a line item task on the construction checklist was actually performed shall initial or check that item off.
  - H. Test Methods:
    1. Functional performance testing and verification may be achieved by manual testing (persons manipulate the equipment and observe performance) or by monitoring the performance and analyzing the results using the control system's graphic trend log capabilities.
    2. Tests shall be performed using design conditions whenever possible and where required.
    3. Set-up:
      - a. Each function and test shall be performed under conditions that simulate actual conditions to the closest practical approximation.
      - b. The Contractor executing the test shall provide all necessary materials, system modifications, etc. to produce the flows, pressures, temperatures, etc. necessary to execute the test under specified conditions.
      - c. At completion of the test, the Contractor shall return all affected building equipment and systems to their pre-test condition.
      - d. Functional performance testing will commence as systems are brought to substantial completion and will be done on a system by system basis. The results of these tests will be documented and submitted to BNL for final system acceptance. The Commissioning Agent shall attain this objective by developing individual systems testing protocols which, when implemented by the trade Contractor, will allow the Commissioning Agent to observe, evaluate, identify deficiencies, recommend modifications, adjust, and document the systems and systems equipment performance over a range of load and functional levels. Functional performance testing as a minimum will be performed on the following systems:
    4. Air Distribution Systems:
      - a. The Testing and Balancing Contractor (TAB) shall demonstrate total airflow at each piece of air handling equipment at simulated full cooling, heating and/or max/min or fresh (outside) air.
      - b. Spot checks of approximately 50% of air outlets shall be made. The Commissioning Agent shall select outlets and the air balancer shall demonstrate a reading of that outlet. Where appropriate, the thermostat shall be adjusted to simulate full cooling, full heating, etc.
      - c. The Testing and Balancing Contractor (TAB) shall demonstrate proper room static pressure with respect to the adjacent space(s).
      - d. Observe motor HP draw at selected fan motors.
      - e. Discrepancies between the balancing report and spot check results shall be dealt with to correct all deficiencies. In the event that significant deficiencies are detected, the entire balancing procedure shall be repeated.
        - 1) Any noted drafts or noisy air distribution devices shall be evaluated and corrective action taken.

- 2) The Testing and Balancing Contractor (TAB) shall verify the proper calibration of temperature, pressure and safety devices as installed on the various pieces of mechanical equipment. The Testing and Balancing Contractor (TAB) shall assist the Commissioning Agent in the proper setting of all temperature, pressure and safety devices.
  - 3) Any balancing related problems identified during the functional testing procedures shall be addressed and corrected.
  - 4) (TAB) shall demonstrate laboratory airflows at each lab at a simulated full cooling with fume hoods closed, full cooling with fume hoods open, heating mode with fume hoods closed, heating mode with fume hoods open, and fume hoods fully closed with thermostat satisfied.
5. Hydronic Systems:
- a. The Testing and Balancing Contractor shall demonstrate total water flows at each pump, air handler, heat exchanger and terminal heating equipment.
  - b. Discrepancies between the balancing report and actual testing results shall be dealt with to correct all deficiencies. In the event that significant deficiencies are detected, the entire balancing procedure shall be repeated.
  - c. Assist in verifying the calibration and operation of any flow meters and differential pressure sensors.
  - d. Assist in verifying the calibration and operation of any temperature sensors.
6. Any balancing related problems identified during the functional testing procedures shall be addressed and corrected.
- a. Exhaust Systems:
    - 1) The Testing and Balancing Contractor (TAB) shall demonstrate total airflow at each exhaust fan system.
    - 2) Spot checks of approximately 50% of air outlets shall be made. The Commissioning Agent shall select outlets and the air balancer shall demonstrate a reading of that outlet.
    - 3) The Testing and Balancing Contractor (TAB) shall demonstrate proper room static pressure with respect to the adjacent space(s).
  - b. (TAB) shall demonstrate proper face velocities at fume-hoods with various fume hood sash positions.
  - c. Observe motor HP draw at selected fan motors.
  - d. Discrepancies between the balancing report and spot check results shall be dealt with to correct all deficiencies. In the event that significant deficiencies are detected, the entire balancing procedure shall be repeated.
  - e. Any noted drafts or noisy air distribution devices shall be evaluated and corrective action taken.
  - f. Any balancing related problems identified during the functional testing procedures shall be addressed and corrected.
7. Automatic Temperature Controls (ATC):
- a. ATC Contractor shall demonstrate the proper operation of the temperature control sequences for each air handling systems, variable air volume boxes, boilers, chillers, pumps, exhaust and terminal heating/cooling equipment as listed in 1.11 of this Section.
  - b. ATC Contractor shall demonstrate the proper sequences as they apply to the equipment listed in 1.11 of this Section: This includes but not limited to the following:
    - 1) Occupied/unoccupied time sequences.
    - 2) Night setback/night set-up features.
    - 3) Morning warm-up sequences.
    - 4) Air-side economizers.
    - 5) Proper control of discharge air temperature from air handling equipment including reset temperature sequences.
    - 6) Heating hot water discharge temperature control to the building systems including hot water reset.
    - 7) Proper staging and control of the heat exchangers.
    - 8) Lead/lag operation of the various pumps.

- 9) Control of hot water freeze pumps.
  - 10) Proper control and discharge temperatures from the reheat coils.
  - 11) Operation and control of the fan coils and unit heaters.
  - 12) Proper operation and control of the air-cooled chillers and condensers.
  - 13) Run standby operation of pumps.
  - 14) Proper operation and control of any energy recovery systems.
  - 15) Proper control of the refrigerant alarm exhaust fans
  - 16) Proper annunciation of building alarms including fail safe controls and proper shut down of equipment.
  - 17) Proper control of all air handling equipment with respect to air volume.
  - 18) Demonstrate any terminal box operation for 30 consecutive days (24 / 7) without a system problem. Shall include temperature and humidity (where applicable) and recording of same.
  - 19) Calibration of all temperature pressure and safety devices.
  - 20) Proper display of all ATC graphics.
  - 21) Control of all automatic control valves and dampers.
  - 22) Assist in calibration of all airflow stations.
  - 23) Demonstrate proper operation of any smoke control management systems.
  - 24) Demonstrate proper system operation when operating on emergency power.
  - 25) Demonstrate proper operation when electrical systems return back to "Normal" power.
8. Plumbing Systems:
- a. Verify proper operation and control of the domestic water heating system.
  - b. Proper operation and calibration of the thermostatic mixing valves.
  - c. Verify proper operation of the re-circulating pump.
  - d. Verify proper operation of the sump pumps including alarms and float adjustments.
  - e. Demonstrate proper operation and control of the emergency power shut-off gas valves.
  - f. Demonstrate proper operation and control of the various pumping systems – (i.e. domestic water booster, sewage ejector, re-circulation pumps)
  - g. Sump Pumps – Demonstrate sump pump capacity. Contractor will fill sump pit / tank with a constant flow at the rate listed for a period of one hour. Contractor will take amperage and voltage readings throughout the test and record. All alarms will be demonstrated.
  - h. Demonstrate proper operation and control of the water recovery, storage and pumping systems.
  - i. Verify proper start-up and alarm features for the RO/DI water systems
  - j. Verify proper operation and control of the lab gas – compressed air, gas and vacuum systems.
  - k. Demonstrate proper operation and control of the eye wash stations and tepid water systems.
  - l. Demonstrate the ability of the domestic hot water system to maintain a minimum of 120 degrees at all the faucets serviced by the system for 5 minutes while all faucets are active.
  - m. Demonstrate domestic hot water at the faucet within 15 seconds of faucet opening.
  - n. Demonstrate proper operation and control of the acid neutralization tank.
9. Fire Protection Systems:
- a. Demonstrate proper operation of floor zone control valves. Verify system can be reset.
  - b. Demonstrate proper operation of alarm check valves. Verify valves can be reset.
  - c. Verify proper operation of dry type alarm valves. Verify valves can be reset.
  - d. Verify proper operation of the all water flow switches. Verify alarm can be generated when the flow switch is activated.
  - e. Verify proper operation of the all tamper switches. Verify alarm can be generated when the switch is activated.
  - f. Demonstrate proper operation, proper flow and control of the fire pump under both Normal and Emergency power modes of operation.
10. Electrical Systems:

- a. Electrical Contractor shall demonstrate the proper operation of the Emergency Power Systems including transfer of power from “Normal” to “Emergency” and back to “Normal” power.
  - b. Demonstrate proper operation of emergency lighting during an emergency power scenario.
  - c. Demonstrate proper operation of building and site lighting controls.
  - d. Demonstrate site lighting time-clock operations.
  - e. Assist in the verification all fire alarm points including smoke detectors, pull stations, water flow switches, tamper switches, and any smoke damper control. Verify all addresses are complete and accurate.
11. Coordination and Scheduling:
- a. Scheduling is the responsibility of the Contractor. Commissioning activities shall be scheduled through the Contractor. The Contractor shall be responsible for integrating functional performance testing and commissioning requirements into the master activity schedule.
  - b. The subcontractors shall provide sufficient notice to the CxA regarding their completion schedule for the construction checklists and start-up of all equipment and systems. The CxA shall direct, witness and document the functional testing of all equipment and systems.
  - c. Subcontractors are responsible for execution of all tests.
  - d. Functional testing is conducted after construction checklists and start-up has been satisfactorily completed. The control system is sufficiently tested and approved by the CxA before it is used for TAB or to verify performance of other components or systems.
  - e. The Contractor shall verify completeness of the building envelope, perimeter and interior items which affect proper operation and control of HVAC, Plumbing, Fire Protection and electrical equipment and systems.
  - f. The air and water balancing is completed and debugged before functional testing of air and water related equipment or systems.
  - g. Testing proceeds from components to subsystems to systems.
  - h. When the proper performance of all interacting individual systems has been achieved, the interface or coordinated responses between systems is checked.
12. Problem Solving:
- a. The CxA will recommend solutions to problems found, however the burden of responsibilities to solve, correct and retest problems rests with the Contractor, Subcontractor, Architect and Engineering Professionals.
13. Trend Logs:
- a. Upon completion of successful functional performance testing, contractor shall submit graphic trend logs to CxA.
  - b. Submit graphic trend log for each piece of controlled equipment for each controlled parameter.
  - c. Trend logs shall demonstrate successful performance for a seven day period unless the controlled process requires a longer timeline.
  - d. Trend log color printouts shall be submitted demonstrating successful seasonal performance.
  - e. Trend logs shall be color graphic with legend submitted to the CxA in printout.

### **3.4 SEASONAL/DEFERRED TESTING**

- A. The purpose of (opposite) seasonal functional testing is to evaluate the performance of selected equipment during design weather conditions that may not have been available during the initial functional testing. Ideally cooling equipment needs to be functionally tested under hot, humid summer conditions to ensure proper operation in accordance with design specifications. The same is true for heating hot water and steam systems which require colder, winter climates.
- B. The functional testing performed during seasonal testing will adhere to the guidelines listed above in item 3.03 in this section.

- C. Any deficiencies will be documented and submitted to the Contractor.

### **3.5 POST OCCUPANCY/WARRANTY REVIEW**

- A. The purpose of a post occupancy/warranty review is to review the building systems and equipment prior to warranty expiration. The post occupancy/warranty review will take place approximately 10 months into the 12 month warranty period. The facilities operating staff will be interviewed to discuss any issues discovered during the previous month's operation of the facility (concerning previously commissioned equipment). The building control system and equipment will be inspected to identify any deficiencies.
- B. Any warranty related deficiencies will be documented and submitted to the Contractor and correction of these items will be the responsibility of the respective Subcontractors.

### **3.6 DOCUMENTATION, NON-COMFORMANCE AND APPROVAL OF TESTS**

- A. Documentation:
  - 1. The CxA will witness and document the results of functional performance tests using the specific procedural forms developed for that purpose.
  - 2. Reports will include measured data, data sheets and a comprehensive summary describing the operation of systems at the time of testing.
  - 3. Data sheets for each controller verifying proper operation of the control system, the system it serves, the service it provides and its location will be provided.
- B. Non- Conformance:
  - 1. The CxA will record the results of the functional testing on the procedure or test form.
  - 2. Corrections of minor deficiencies identified may be made during the tests at the discretion of the CxA. In such cases the deficiency and resolution will be documented on the procedure form.
  - 3. Every effort will be made to expedite the testing process and minimize unnecessary delays, while not compromising the integrity of the procedures. However, the CxA will not be pressured into overlooking deficient work or loosening acceptance criteria to satisfy scheduling or cost issues, unless there is an overriding reason to do so at the request of BNL.
  - 4. Should a deficiency be identified during checkout, start-up or testing, the CxA will discuss the issue with the responsible subcontractor. When there is no dispute on the deficiency and the subcontractor accepts responsibility to correct it.
    - a. The CxA documents the deficiency and the subcontractor's response and intentions and they go on to another test or sequence.
    - b. After a system performance testing is complete, the CxA submits the noncompliance issues on the internet portal.
  - 5. If there is a dispute about a deficiency, regarding whether it is a deficiency or who is responsible:
    - a. The deficiency shall be documented on the non-compliance form with the subcontractor's response and a copy given to the Contractor.
  - 6. Resolutions are made at the lowest management level possible. Other parties are brought into the discussions as needed. Final interpretive authority is with BNL.
  - 7. The CxA documents the resolution process.
  - 8. Once the interpretation and resolution have been decided, the appropriate party corrects the deficiency, signs the statement of correction on the non-compliance form and provides it to the CxA. The CxA reschedules the test and the test is repeated until satisfactory performance is achieved.
  - 9. If it is determined that the system is constructed according to the Contract Documents, BNL will decide whether modifications required to bring the performance of the system to the OPR and BoD documents shall be implemented or if tests will be accepted as submitted. If corrective Work is performed, BNL will decide if tests shall be repeated and a revised report submitted.
  - 10. Cost of Retesting.

- a. The cost for the subcontractor to re-perform a construction check-out or functional test, if they are responsible for the deficiency, shall be theirs. If they are not responsible, any cost recovery for retesting costs shall be negotiated with BNL.
- b. The time for the CxA to direct any retesting required because a specific construction checklist or start-up test item, reported to have been successfully completed, but determined during functional testing to be fault, will be back charged to the Contractor, who may choose to recover costs from the party responsible for executing the faulty test.
- c. The CxA retains the original non-conformance forms until the end of the project.
- d. Failure Due to Manufacturer Defect:
  - 1) If 10% or three, whichever is greater, of identical pieces (size alone does not constitute a difference) of equipment fail to perform to the Contract Documents (mechanically or substantively) due to manufacturing defect, not allowing it to meet its submitted performance spec, all identical units may be considered unacceptable by the CxA. In such case, the subcontractor shall provide BNL with the following:
    - a) Within one week of notification from the Contractor, the subcontractor or manufacturer's representative shall examine all other identical units making a record of the findings.
    - b) The findings shall be provided by the CxA within two weeks of the original notice.
    - c) Within two weeks of the original notification, the Contractor, subcontractor or manufacturer shall provide a signed and dated, written explanation of the problem, cause of failures, etc. and all proposed solutions which shall include full equipment submittals.
  - 2) The proposed solutions shall significantly exceed the specification requirements of the original installation.
  - 3) BNL will determine whether a replacement of all identical units or a repair is acceptable.
  - 4) Two examples of the proposed solution will be installed by the subcontractor and the subcontractor will be allowed to test the installations for up to one week, upon which BNL will decide whether to accept the solution.
  - 5) Upon Acceptance, the Contractor and/or manufacturer shall replace or repair all identical items, at their expense and extend the warranty accordingly, if the original equipment warranty had begun. The replacement/repair work shall proceed with reasonable speed beginning within one week from when parts can be obtained.
    - a) Approval: The CxA notes each satisfactorily demonstrated function on the test form. The CxA recommends acceptance of each test to BNL using a standard form.
    - b) Deferred Testing:
      - (1) If tests cannot be completed because of a deficiency outside the scope of the subcontractor responsible for installation of the System to be commissioned, the deficiency shall be documented and reported to BNL. Deficiencies shall be resolved and corrected by appropriate parties and test rescheduled.
      - (2) If the testing plan indicates specific seasonal testing, appropriate initial performance tests shall be completed, documented, and additional tests scheduled.

### **3.7 OPERATION AND MAINTENANCE TRAINING REQUIREMENTS**

- A. The Contractor shall be responsible for coordination, scheduling and completing operations and maintenance training for BNLS designated personnel on all Systems to be commissioned.
  1. Training materials shall be submitted for review and approval of the CxA well in advance of training.

2. Trainer qualifications and certifications shall be submitted for review and approval of the CxA well in advance of training.
  3. Each subcontractor responsible for training will submit a written training plan to the CxA for review and approval prior to training. The plan will include field orientation during installation, classroom instruction and field training after the completion of installation and cover the following elements:
    - a. Equipment (included in training)
    - b. Intended audience
    - c. Location of training
    - d. Objectives
    - e. Subjects covered (description, duration of discussion, special methods, etc.)
    - f. Duration of training on each subject.
    - g. Instructor for each subject
    - h. Methods (classroom lecture, video, site walk-through, actual operational demonstrations, written handouts, etc.)
    - i. Instructor and qualifications
  4. For the primary equipment, the Controls subcontractor shall provide a short discussion of the control of the equipment during the mechanical or electrical training conducted by others.
  5. Subcontractors shall provide all qualified personnel, including manufacturer representatives, for equipment and system training. Classroom/system training sessions shall be videotaped by the CxA.
- B. The CxA will verify and approve the content and adequacy of the training of BNL personnel for systems to be commissioned.
1. Training rigor: to be established by BNL & CxA
  2. In addition to these general requirements, the specific training requirements for BNL personnel are specified in Division 15 and 16.
- C. Training Planning Meeting: Before operation and maintenance training, CxA shall convene a training planning meeting to include BNL's operation and maintenance personnel, each Contractor, and subcontractors. In addition to requirements specified in other Divisions, perform the following:
1. Review the OPR and BoD.
    - a. Review installed systems, subsystems, and equipment.
    - b. Review instructor qualifications
    - c. Review instructional methods and procedures.
    - d. Review training module outlines and contents.
    - e. Review course materials (including operation and maintenance manuals.
    - f. Verify and discuss locations and other facilities required for instruction.
    - g. Review and finalize training schedule and verify availability of educational materials, instructors, audiovisual equipment, and facilities needed to avoid delays.
    - h. For instruction that must occur outside, review weather and forecasted weather conditions and procedures to follow if conditions are unfavorable.

### **3.8 EXCLUSIONS**

- A. The CxA is not responsible for construction means, construction methods, facilitating job safety or any other unrelated management function on the job site.
- B. The Contractor and Subcontractors will provide all technician services requiring tools or the use of tools to functionally test, adjust or otherwise bring equipment into a fully operational state. The CxA shall observe technicians as they complete testing, and may make minor adjustments, but shall not perform construction or technician services.

### **END OF SECTION**



**HDR**

**D I V I S I O N    0 2**  

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**EXISTING CONDITIONS**

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**SECTION 02 41 00**  
**DEMOLITION**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. Work includes:
  - 1. Demolition of portions of pavement and site features indicated.
  - 2. Removal of demolition debris.
  - 3. Protection of construction to remain, including:
    - a. Utilities to remain.
    - b. Other items indicated.
- B. Condition of existing structures to be demolished:
  - 1. BNL assumes no responsibility for actual condition of items to be demolished.
  - 2. Conditions existing at time of inspection for bidding purposes will be maintained by BNL insofar as practicable.

**1.2 QUALITY ASSURANCE**

- A. Conduct work in accordance with OSHA and EPA requirements.
- B. Use only firms or individual trades qualified to perform work required under this section.

**1.3 JOB CONDITIONS**

- A. Perform preliminary investigations as required to ascertain extent of work:
  - 1. Conditions which would be apparent by such investigation will not be allowed as cause for claims for extra costs.
- B. Before start of work, obtain and pay for permits required by authorities having jurisdiction. Notify BNL before demolishing or abandoning any utility.

**PART 2 - PRODUCTS - NOT USED**

**PART 3 - EXECUTION**

**3.1 POLLUTION CONTROLS**

- A. Clean adjacent structures and improvements of dust, dirt, and debris caused by demolition operations.
- B. Return adjacent areas to condition existing prior to start of work.

**3.2 ITEMS TO BE SALVAGED FOR BNL**

- A. Remove salvage items at appropriate stage of demolition, but early enough to prevent damage to them by demolition operations. Deliver salvaged items to BNL.

**3.3 ITEMS SALVAGED FOR CONTRACTOR'S USE**

- A. Items of salvage value to Contractor may be removed from site as work progresses.
- B. Transport salvaged items from site as they are removed.
- C. Storage or sale of removed items not permitted on site.

### **3.4 GENERAL DEMOLITION PROCEDURES**

- A. Install temporary construction fence.
- B. Removal of existing improvements:
  - 1. Remove surfacing and pavements, including, concrete slabs, manhole frames and covers, and other items indicated.
- C. Start and complete work as established by approved schedule; operational procedures and sequence of work are optional provided schedule is maintained.
- D. Protect property to remain:
  - 1. Promptly repair damage caused by demolition, as directed by BNL, at no cost to BNL.
- E. Conduct operations to insure minimum interference with roads, walks, entrances, exits, and other adjacent occupied facilities:
  - 1. Do not close or obstruct drives, walks or other occupied or used facilities unless approved in writing.
  - 2. Do not close or obstruct roadways or walks unless approved by BNL.
  - 3. Do not obstruct exits from existing facilities without approval of BNL.
  - 4. Provide alternate routes around closed or obstructed traffic ways.
- F. Provide barricades and safety lights as required.
- G. Maintain existing utilities that are indicated to remain:
  - 1. Keep in service, and protect against damage during demolition.
  - 2. Do not interrupt existing utilities serving occupied or used facilities, except when authorized by BNL.
  - 3. Provide temporary services during interruptions to existing utilities, as acceptable to BNL.

### **3.5 PROTECTION OF OCCUPIED FACILITIES TO REMAIN**

- A. Protect occupants from injury and discomfort.

### **3.6 CLEAN-UP AND DISPOSAL OF DEMOLITION MATERIALS**

- A. Remove debris, rubbish, and materials resulting from demolition operations:
  - 1. Remove from site; legally dispose of off site.
- B. Dispose of items and materials not designated by BNL or these documents for BNL's salvage or reuse:
  - 1. Promptly remove from site.
  - 2. Do not store or sell Contractor salvaged items or materials on site.
- C. Clean up other debris resulting from this work.
- D. All materials being removed from the site must pass through the radiation vehicle monitor located on East Princeton Road.

**END OF SECTION**

**SECTION 02 42 00**  
**ASBESTOS CEMENT (TRANSITE) PIPE REMOVAL**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Furnish all labor, materials, and equipment necessary to provide abatement of Asbestos Containing Materials (ACM), including but not limited to, certified personnel, permits, protective equipment, barriers and barricades, decontamination, training, disposals, clean-up, removals and certifications.
- B. Items of ACM to be removed are as follows, as shown and/or noted on the drawings.
  - 1. Asbestos-Cement (Transite) Pipe (ACP) located in an outdoor environment.

**1.2 GENERAL REMOVAL**

- A. BNL will notify EPA as outlined in EPA Regulation 40 CFR 61 prior to asbestos removal. No work shall commence until given "go-ahead" by BNL.
- B. BNL will notify Safeguards and Security Division if work is to be accomplished during hours other than those considered normal working hours.
- C. BNL will notify Fire/Rescue Group of Project.
- D. Fire extinguishers, used in the containment area, and those for training workers in the use of firefighting equipment, shall be provided as per 29 CFR 1926.150.
- E. Contractor shall designate a competent person to supervise and be present during all asbestos abatement activities. Construction Supervisor shall have received comprehensive training by an EPA asbestos training center or equivalent and hold a valid New York State Department of Labor Division of Safety and Health Asbestos Supervisors Certificate. Construction supervisor shall be responsible for maintaining entry/exit log and construction log which shall be turned over to BNL at completion of project or as requested.
- F. Before work is started, Construction Supervisor shall familiarize asbestos removal crew in proper use of equipment, and safety precautions and procedures for controlling asbestos hazards. Workers shall be able to comprehend work and safety instructions in English or a supervisor who can translate shall be provided and be present at all times. All workers shall be required to attend Contractor/Vendor Orientation Training (2 hours) and General Employees Radiological Training (GERT) (1 hour).
- G. Asbestos crew shall be thoroughly trained before work is started in the proper use of equipment and of safety precautions and procedures for controlling hazards associated with asbestos. All crew members shall have on their possession at all times a valid New York State Department of Labor Division of safety and Health Asbestos Handlers Certificate.
- H. Contractor shall be responsible for personnel exposure monitoring unless BNL performs the monitoring. Monitoring shall comply with 29 CFR 1926.1101 (f) and monitors shall be NYS DOL Industrial Code Rule 56 and USEPA trained and certified. Submit results to BNL at project completion. As work proceeds PE may take air samples of contractor personnel and work area. If samples indicate airborne fibers are above acceptable limits, established by EPA and OSHA, work shall be stopped and personnel will be required to leave work area.
- I. All personnel required to wear respirators shall have been fit tested and be clean shaven. Contractor shall have a respirator program in compliance with 29 CFR 1910.134 and 1926.1101 including physicals and training.
- J. Provide MSDS for all abatement materials to be used to BNL for approval.

- K. Designate work area by posting approved asbestos warning signs and installing isolation barriers, if required. Access shall be limited to personnel having NYS certification and approval of BNL.

### **1.3 DEFINITIONS**

- A. ES&H - BNL Environment, Safety & Health Services Division.
- B. Responsible Authority - Plant Engineering Safety Coordinator, ES&H Industrial Hygienist, Plant Engineering Asbestos Abatement Engineer, or authorized representative.
- C. HEPA - High efficiency particulate air.
- D. PE - Plant Engineering.
- E. ACM - Asbestos containing material.
- F. WH - New York State certified Worker/Handler.
- G. MSDS - Material Safety Data Sheet.

### **1.4 CODES AND REGULATIONS**

- A. OSHA Construction Standard 29 CFR 1926.1101 - Asbestos, tremolite, anthophyllite, and actinolite.
- B. BNL ES&H Policies & Procedures.

## **PART 2 - PRODUCTS**

### **2.1 REMOVAL EQUIPMENT**

- A. HEPA Vacuum Cleaner: Nilfisk GS83, 110 volt, with overhead, machinery, and floor cleaning accessories, main filter manometer, grounded motors, 6 mil plastic liner, micro filters, and HEPA exhaust filters rated at 99.97% efficiency DOP Test Method on 0.3 micron particles in accordance with MIL-STD 282.
- B. Wetting Agent: U.S. Coatings Collaborative, Inc., Penefact. See manufacturer's warnings.
- C. Wetting Agent Applicator: Airless Sprayer.
- D. Plastic Sheets: Six (6) mil fire retardant polyethylene minimum.
- E. Tape: Nashua FR-357 Flamex grey duct tape or 3M Company Duct Sealer 800.
- F. Plastic Bags: Double 6 mil, OSHA and DOT labeled. Labeling to include "DANGER, CONTAINS ASBESTOS FIBERS, AVOID CREATING DUST, CANCER AND LUNG DISEASE HAZARD".
- G. Protective Clothing and Equipment: Provide as a minimum, each worker entering the work area with the following, in good, clean condition at the start of each work shift:
  - 1. Disposable full-body covers including head cover, gloves and shoe covers.
  - 2. Respirators as per 29 CFR 1926.1101 (h) with filters for operation with designation label affixed to them. Do not remove or damage label. Wear ANSI - Z87.1, tested safety goggles with half mask respirators.
- H. Glove Bags: Asbestos Control Technology, Profo-bag, Minimum 6 mil thick transparent polyethylene plastic with tyvek arms and pre-labeled OSHA asbestos warnings.
- I. Tools normally used for removing asbestos, such as razors, knives, wire brushes and nips.
- J. Caution Signs: Floor stands and wall mounted, OSHA labeled, "DANGER, ASBESTOS, CANCER AND LUNG DISEASE HAZARD, AUTHORIZED PERSONNEL ONLY, RESPIRATORS AND PROTECTIVE CLOTHING ARE REQUIRED IN THIS AREA".

- K. Electrical Equipment: All equipment shall conform to OSHA and NEC standards including grounding protection and GFCI protection.

## **PART 3 - EXECUTION**

### **3.1 PREPARATION**

- A. Establish a regulated work area (RWA) using orange mesh safety fence.
- B. Provide a hand/face wash station at the entry point to the RWA.
- C. Post asbestos-warning signs at the RWA entry point.
- D. Establish a waste load-out area attached to the RWA.
- E. Once RWA is established and work begins, no access should be permitted without the required personal protection equipment.

### **3.2 AIR MONITORING AND SAMPLING OF EXPOSURE TO AIRBORNE ASBESTOS FIBERS**

- A. As the work begins the competent person must conduct and record objective data to confirm the findings to the IEA, and that the PELS (Permissible Exposure Limits) are not being exceeded for this work activity.

### **3.3 EXCAVATION**

- A. Machine excavate to expose ACP.
- B. Hand excavate areas under pipe where cuts/breaks are planned.
- C. Excavation operations should be carefully executed so that pipe damage does not occur prior to removal.

### **3.4 PIPE REMOVAL**

- A. Protective clothing and equipment shall consist of at a minimum:
  - 1. Steel toe boots.
  - 2. Hard hats.
  - 3. Safety glasses.
  - 4. Rubber or leather gloves.
- B. All pipe cutting or breaking operations require adequate wetting with potable water to prevent ACP materials from being crumbled by hand pressure and the asbestos fibers becoming airborne (friable).
- C. Plan pipe cuts/breaks as necessary to accommodate the size/weight of pipe being removed.
- D. Use a hammer or wheel-type pipe cutter (or equivalent tool) to make the initial cut and drain pipe of residual liquids.
- E. Remove pipe sections at joint collars by breaking them with a sledgehammer, or cutting them with a wheel-type pipe cutter (soil-pipe cutter).
- F. Where pipe re-connection is required, trim pipe ends with a wheel-type pipe cutter. Wet, wrap and seal pipe ends in a minimum 6-mil poly film wrap that is securely fastened and taped to close the pipe end. Wetting is required to prevent A-C materials from becoming friable.
- G. When applicable, remove pipe sections from trench in an "intact" condition. Wet and containerize waste materials as you go, using lifting straps and methods that do not damage the pipe.

- H. Identify ACP materials and stock-pile the waste in a designated load-out area with the following label warnings:

**DANGER**  
Contains Asbestos Fibers  
Avoid Creating Dust  
Cancer and Lung Disease Hazard

#1. Note: The label must also identify the generator of the ACP waste.

- I. Take all necessary precautions to prevent loose removed material from leaving roof or entering building.

### **3.5 DISPOSAL**

- A. Label each container or wrapped ACM prior to disposal. Label shall be of sufficient size and contrast so as to be readily visible, legible and permanent. Label shall conform to all EPA and DOT regulations. Label shall state:

BNL/BSA  
Property Location  
Upton, NY 11973

- B. Transport packaged and labeled ACM to an approved landfill and provide a waste manifest as per NESHAPS.

**END OF SECTION**

**HDR**

**D I V I S I O N    0 3**  

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**CONCRETE**

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**SECTION 03 08 13**  
**CONCRETE TESTING AND EVALUATION - BNL**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. Test concrete materials and inspect operations as work progresses. Failure to detect defective work or material shall not prevent later rejection when such defect is discovered nor shall it obligate Architect/Engineer for final acceptance.
- B. Payment for testing:
  - 1. Pay for testing services required in paragraph "Responsibilities and Duties of Contractor."
  - 2. Routine testing of concrete furnished to job site for compliance with Contract Documents will be performed by BNL's testing agency at BNL's expense.
    - a. Routine testing consists of tests for compressive strength, slump, air, temperature and unit weight.
    - b. Tests shall be performed every 75 YD<sup>3</sup> or fraction thereof, for each mixture design placed in one day.
    - c. Composite samples shall be obtained in accordance with ASTM-C172. Obtain each sample from a different batch of concrete on a random basis. Test batch shall be selected at random before commencement of concrete placement.
    - d. Agency shall mold and cure 6 (six) specimens from each sample in accordance with ASTM-C31 and report deviations from requirements, if any.
    - e. Specimens shall be tested in accordance with ASTM-C39. A Minimum of two specimens tested at 28 days for acceptance and one at 7 days for information shall constitute a single test. Acceptance test results shall be average of strengths of two specimens tested at 28 days.

**1.2 QUALITY ASSURANCE**

- A. Standards:
  - 1. ASTM-C31: Standard Practice for Making and Curing Concrete Test Specimens in Field.
  - 2. ASTM-C42: Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.
  - 3. ACI 318: Building Code Requirements for Structural Concrete and Commentary.
  - 4. ASTM-E329: Standard Specification for Agencies Engaged in Construction Inspection and/or Testing.
- B. Contractor's testing agency:
  - 1. Qualifications: Acceptable to Architect/Engineer, with evidence of recent inspection by Cement and Concrete Reference Laboratory of National Institute of Standards and Technology and of having corrected deficiencies noted, and meet requirements of ASTM E 329.
  - 2. Authority: Agency and its representatives are not authorized to revoke, alter, relax, enlarge or release any requirement of Contract Documents, nor to approve or accept portion of Work.

**1.3 SUBMITTALS**

- A. Project information:
  - 1. Contractor's testing agency qualifications.
  - 2. Production sample test reports (when required): Include same data as for mix designs.
  - 3. Reports of Contractor-optional tests.
  - 4. Test reports on in-place testing, if such testing is performed.

## **PART 2 - PRODUCTS - NOT USED**

## **PART 3 - EXECUTION**

### **3.1 RESPONSIBILITIES AND DUTIES OF CONTRACTOR**

- A. Provide necessary testing services for qualification of proposed materials and establishment of mix designs. Services performed by Contractor's testing agency.
- B. Submit concrete materials and concrete mix designs proposed for use. Include results of testing performed to qualify materials and to establish mix designs. Place no concrete until Contractor has received approval in writing. See submittals paragraph.
- C. Use of testing service shall in no way relieve Contractor of responsibility to furnish materials and construction in full compliance with Contract Documents.
- D. To facilitate testing and inspection:
  - 1. Provide notice to BNL and BNL's testing and inspections agency of intended dates of concrete placement at least 2 weeks prior to placement.
  - 2. Furnish labor to assist BNL's testing agency in obtaining and handling samples at site or other sources of materials.
  - 3. Advise BNL's testing agency sufficiently in advance of operations to allow for completion of routine testing and for assignment of personnel.
  - 4. Provide and maintain adequate facilities for safe storage and proper curing of concrete compressive strength test specimens on site for first 8 HR or until they gain sufficient strength, as required by ASTM-C31.
- E. Pay for following additional testing services to be performed by BNL's testing agency, on occasions indicated:
  - 1. Additional testing and inspection, whenever changes in materials or proportions are requested by Contractor.
  - 2. Additional testing of materials or concrete, whenever they fail by test or inspection, to meet specification requirements.
  - 3. Other testing services needed or required by Contractor, such as:
    - a. Additional field cured test specimens as needed for control of work by Contractor such as, when concrete may be stripped, reshored, unshored, post-tensioned, etc.

### **3.2 EVALUATION AND ACCEPTANCE OF COMPRESSIVE STRENGTH TEST RESULTS**

- A. Evaluate test results for standard molded and cured test cylinders separately for each concrete mix design. For evaluation of potential strength and uniformity, each mix design shall be represented by at least five tests.
- B. Strength level of concrete will be considered acceptable so long as averages of sets of three consecutive strength test results equal or exceed specified strength ( $f'c$ ) and no individual strength test result falls below specified strength ( $f'c$ ) by more than 500 PSI.

### **3.3 TESTING CONCRETE IN PLACE**

- A. When compressive strength tests indicate potential strength deficiency of in-place concrete, testing of concrete in place may be required as an aid in evaluating actual strength. If required, Contractor shall pay for concrete tests and engineering time and analysis required to evaluate actual in-place concrete strength made necessary by deficient strength cylinder tests.
- B. Testing by rebound hammer, ultrasonic, or other non-destructive device: Such tests shall be used to determine relative strengths at various locations in structure as an aid for selecting areas to be cored. Such tests, unless properly calibrated and correlated with other test data, will not be used as a basis for acceptance or rejection.

- C. Core tests: Obtain and test largest practical diameter cores, 2 IN minimum, in accordance with ASTM-C42. If concrete in structure will be dry under service conditions, air dry cores temperature 60 to 80 degF, relative humidity less than 60 percent for 7 days before test. Test dry. If concrete in structure will be more than superficially wet under service conditions, test cores after moisture conditioning.
  - 1. Take at least three representative cores from each member or area of concrete in place that is considered potentially deficient in strength. Location will be determined by Architect/Engineer. If, before testing, one or more of cores indicates evidence of having been damaged subsequent to or during removal from structure, replace it.
  - 2. Concrete in area represented by a core test will be considered acceptable if average strength of cores is equal to at least 85 percent of, and if no single core is less than 75 percent of, specified strength ( $f'c$ ).
  - 3. Fill core holes with low slump patching compound per Section 03 35 00.

### **3.4 ACCEPTANCE OR REJECTION OF CAST-IN-PLACE CONCRETE**

- A. General:
  - 1. Completed concrete work which conforms to applicable requirements of Contract Documents will be accepted without qualification.
  - 2. Concrete work which fails to conform to one or more requirements of Contract Documents is rejected and will not be accepted until remedied in accordance with 3.4 B, 3.4 C, and 3.4 D.
  - 3. Contractor pays costs incurred in providing remedial work necessary to change rejected work to accepted work. Remedial work includes, but is not necessarily limited to, applicable repairs, replacement, reinforcement, engineering, and testing as denoted in following paragraphs.
- B. Dimensional tolerances:
  - 1. Formed surfaces resulting in concrete outlines smaller than permitted by tolerances are potentially deficient in strength and subject to provisions of Paragraph 3.4 D.
  - 2. Formed surfaces resulting in concrete outlines larger than permitted by tolerances will be rejected if strength or finish of structure is not acceptable, or function is adversely affected. Otherwise members will be accepted. If surfaces are rejected, and removal of excess material is permitted, repair of surfaces in an approved manner will constitute acceptance. If surfaces are rejected, and removal of excess material is not permitted, replacement of member(s) in an approved manner will constitute acceptance.
  - 3. Concrete member(s) cast in wrong location will be rejected if strength or finish is not acceptable, function of Building or Structure is adversely affected as determined by the Architect or Engineer or they interfere with other construction. Otherwise, member(s) will be accepted. If they are rejected, replacement of member(s) in an approved manner and in conformance with Contract Documents will constitute acceptance.
  - 4. Inaccurately formed concrete surfaces that exceed limits of tolerances or are exposed to view will be rejected. Repair of surfaces or replacement of member(s) in an approved manner and in conformance with Contract Documents will constitute acceptance.
- C. Finish:
  - 1. Slabs:
    - a. Finished slabs exceeding tolerance limits of Section 03 35 00 will be rejected if finish is not acceptable and function is adversely affected. If rejected, repair of finished surfaces or replacement of slab in an approved manner and in conformance with Contract Documents will constitute acceptance.
    - b. Repair may involve removing high spots with a terrazzo grinder, filling low spots with a patching compound, or other remedial measures as permitted.
  - 2. Formed surfaces:
    - a. Concrete exposed to view with defects which adversely affect appearance of specified finish will be rejected. Repair of surface defects in conformance with Section 03 35 00 will constitute acceptance.

- D. Strength of structure:
1. Strength of structure in place will be considered potentially deficient and will be rejected if it fails to comply with requirements which control strength of structure, including but not necessarily limited to following:
    - a. Deficient concrete strength based on compressive strength tests.
    - b. Reinforcing steel size, quantity, strength, position, or arrangement at variance with requirements on reinforcement.
    - c. Concrete which differs from required dimensions or location in such a manner as to reduce strength.
    - d. Curing less than that specified, likely to result in deficient concrete strength.
    - e. Inadequate protection of concrete from extremes of temperature during early stages of hardening and strength development.
    - f. Mechanical injury, construction fires, accidents or premature removal of formwork likely to result in deficient strength.
    - g. Substandard workmanship likely to result in deficient strength.
  2. When strength of structure is considered potentially deficient and is rejected, it will not be accepted until one of following remedies is completed. All proposed fixes to repair deficient concrete should be submitted by Contractor to Engineer for review and approval prior to any action by Contractor.
    - a. Confirmation of safety of structure by structural analysis. Submit signed and sealed calculations by a Professional Engineer registered in the State of New York.
    - b. Core tests per 3.3 C. Performed only when concrete strength is potentially deficient, and when safety of structure is not confirmed by structural analysis. Do not use if impractical to obtain or not feasible.
    - c. Confirmation of safety of structure by load tests performed and evaluated in accordance with ACI 318. Do not use if impractical to perform or not feasible.
    - d. Replacement of structure deficient in strength.
    - e. Subject to functional feasibility and BNL's approval, structure deficient in strength may be reinforced with supplement supports as directed by Architect.

## **END OF SECTION**

**SECTION 03 11 00**  
**CONCRETE FORMWORK**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. Definition(s):
  - 1. Formwork: Total system of support for freshly placed concrete including mold or sheathing which contacts concrete as well as supporting members, hardware, and necessary bracing.
  - 2. Exposed construction: Exposed to view.
  - 3. Exposed to view: Concrete surfaces seen by the public from eye level from any walking surface in a public location after completion of building.
  - 4. Public location: Building areas accessible to public and employees not responsible for maintenance. Storerooms, unfinished space and large mechanical rooms are considered public locations. Equipment closets, elevator and mechanical penthouses are not public space.
- B. Use forms, wherever necessary, to confine concrete and shape it to required dimensions. Use forms of sufficient strength to withstand pressure resulting from placement and vibration of concrete, with sufficient rigidity to maintain specified tolerances.
- C. See concrete finish requirements in Section 03 35 00.
- D. Do not use earth cuts as forms for vertical surfaces.

**1.2 QUALITY ASSURANCE**

- A. Design, engineering, and construction of formwork are responsibility of Contractor:
  - 1. Design, engineer, and construct formwork for applicable gravity and lateral loads and pressures as well as other design considerations or applicable requirements of legal local building code.
  - 2. Develop shoring and re-shoring pattern and sequence so as not to exceed safe structural capacity of supporting structural systems. Confer with Architect, if there is any question, regarding the capacity of the structural system.
- B. Design, prepare formwork drawings and construct formwork in accordance with ACI 347, Guide to Formwork for Concrete.
- C. Layout and measurement of concrete forms and embedment's, required for work, performed by a licensed surveyor employed by the contractor.

**1.3 SUBMITTALS**

- A. Shop Drawings:
  - 1. Drawings showing details of formwork, including dimensions of fiber voids, joints, supports, studding and shoring, and sequence of form, shoring, and reshoring removal.
- B. LEED Information:
  - 1. LEED Credit MR 4.1 & 4.2, Recycled Content: Product data indicating percentages by weight of post-consumer and post-industrial recycled content for products having recycled content; include statement indicating costs for each product having recycled content.
  - 2. LEED Credit MR 5.1 & 5.2 – Local Regional Materials: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.

3. LEED Credit MR 7, Certified Wood: Chain-of-custody certificates certifying that products specified to be made from certified wood comply with forest certification requirements. Include evidence that mill is certified for chain of custody by an FSC-accredited certification body; include statement indicating costs for each certified wood product.

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS**

- A. Form facing materials: As indicated under description of finishes required.
- B. Form accessories, partially or wholly embedded in concrete, such as ties and hangers: Shall be of a commercially manufactured type. Do not use non-fabricated wire. Use form ties constructed so ends or end fasteners can be removed without causing appreciable spalling of concrete faces. After ends or end fasteners of form ties have been removed, embedded portion of ties shall terminate not less than 2 diameters or twice minimum dimension of tie from formed faces of concrete to be permanently exposed to view, but in no case less than 3/4 IN. When formed face of concrete is not to be permanently exposed to view, form ties may be cut off flush with formed surfaces. Use ties with 3/4 IN diameter cones on both ends for water retaining structures.

### **2.2 FABRICATION OF FORMS**

- A. Make forms sufficiently tight to prevent loss of cement fines. Place chamfer strips in outside corners of forms to produce 45 degree beveled corners on permanently exposed surfaces. Interior corners on such surfaces and edges of formed joints will not require beveling.
- B. To maintain specified finish tolerances, camber formwork to compensate for anticipated formwork deflections prior to hardening of concrete.
- C. Provide positive means of adjustment (wedges or jacks) of shores and struts and take up settlement during concrete placing operation. Securely brace forms against lateral deflection.
- D. Provide temporary openings at base of column and wall forms and at other points where necessary to facilitate cleaning and observation immediately before concrete is placed.
- E. At construction joints, contact surface of form sheathing for flush surfaces exposed to view shall overlap hardened concrete in previous placement minimum 1 IN. Hold forms against hardened concrete to prevent offsets or loss of mortar at construction joint and to maintain a true surface.
- F. Construct wood forms for wall openings to facilitate loosening, if necessary, to counteract swelling:
  1. Wood forms shall be fabricated from FSC lumber.
- G. Fasten wedges (used for final adjustment of forms prior to concrete placement) in position after final check.
- H. Anchor formwork to shores or other supporting surfaces or members so upward or lateral movement of any part of formwork system is prevented during concrete placement.
- I. Provide runways for moving equipment with struts or legs, supported directly on formwork or structural member without resting on reinforcing steel.

### **2.3 TOLERANCES**

- A. Construct formwork so concrete surfaces will conform to tolerance limits listed: Tolerances are non-cumulative. Most restrictive tolerance governs. Tolerance limits noted are maximum deviations (plus or minus) on each side of intended line. Tolerances not shown shall conform to ACI 117:
  1. Deviation from plumb:
    - a. In lines and surfaces of columns, piers, walls, and in arrises:
      - 1) In any length: 1 in 1000 but not less than 1/8 IN.

- 2) In any story: 3/8 IN.
      - 3) Maximum for entire length: 3/4 IN.
    - b. For exposed corner columns, control-joint grooves, and other conspicuous vertical lines:
      - 1) In any length: 1 in 1000 but not less than 1/8 IN.
      - 2) In any story: 3/16 IN.
      - 3) Maximum for entire length: 1/2 IN.
  - 2. Deviation from level or from grades specified:
    - a. In slab soffits, ceilings, beam soffits and in arrises, measured before removal of supporting shores:
      - 1) In any length: 1 in 750 but not less than 1/8 IN.
      - 2) In any bay: 3/8 IN.
      - 3) Maximum for entire length: 1/2 IN.
    - b. In exposed lintels, sills, parapets, horizontal grooves, and other conspicuous horizontal lines:
      - 1) In any length: 1 in 1000, but not less than 1/8 IN.
      - 2) In any bay: 1/4 IN.
      - 3) Maximum for entire length: 1/2 IN.
  - 3. Deviations from true plane of concrete surface exposed to view caused by bulging of form facing material between supports:
    - a. 3/16 IN or 1/300 of span between supports whichever is smaller.
  - 4. Deviation from established position in plan of linear building lines, columns, walls:
    - a. In any length: 1 in 500, but not less than 1/8 IN.
    - b. In any bay: 1/2 IN.
    - c. Maximum for entire length: 3/4 IN.
  - 5. Deviation in sizes and location of sleeves, floor openings, and wall openings: 1/4 IN.
  - 6. Deviation in cross-sectional dimensions of columns and beams and in thickness of slabs and walls:
    - a. Minus: 1/4 IN.
    - b. Plus: 1/2 IN.
  - 7. Footings:
    - a. Deviations in dimensions in plan:
      - 1) Minus: 1/2 IN.
      - 2) Plus: 2 IN.
    - b. Misplacement or eccentricity:
      - 1) 2 percent of footing width in direction of misplacement but not more than 2 IN.
    - c. Thickness:
      - 1) Decrease in specified thickness: 5 percent.
      - 2) Increase in specified thickness: No limit (except that which may interfere with other construction).
  - 8. Concrete walls at stairs:
    - a. Deviations in dimensions in plan:
      - 1) Plus 1 IN towards exterior.
      - 2) Plus 1/2 IN towards interior.
  - 9. Deviation in steps:
    - a. In flight of stairs:
      - 1) Rise: 1/8 IN.
      - 2) Tread: 1/4 IN.
    - b. In consecutive steps:
      - 1) Rise: 1/16 IN.
      - 2) Tread: 1/8 IN.
    - c. Deviation from level for any step or landing: 1 in 1000 but not more than 1/8 IN.
- B. Formwork Classifications:
- 1. Concrete formwork shall meet the following classification requirements per ACI 347:
    - a. Concrete noted as "Architectural Exposed Concrete": Class A.

- b. Concrete exposed to view or to receive membrane waterproofing: Class B.
  - c. Footings: Class D.
  - d. All other concrete: Class C.
- C. Tolerances apply to concrete dimensions only, not to positioning of vertical reinforcing steel, dowels, or embedded items, except where specifically noted otherwise.
- D. Establish and maintain in undisturbed condition and until final completion of project, sufficient control points and bench marks to be used for reference purposes to check tolerances.
- E. Regardless of tolerances listed allow no portion of building to extend beyond property line of project.

## **PART 3 - EXECUTION**

### **3.1 PREPARATION OF FORM SURFACES**

- A. Clean form surfaces and embedded materials of mortar, grout and foreign material before concrete is placed.
- B. Unless otherwise specified or approved, treat surfaces of forms as follows:
- 1. Before placing of reinforcing steel or concrete, cover surfaces of forms with coating material that will effectively prevent absorption of moisture and prevent bond with concrete, and not stain concrete. A field applied form release agent or sealer or factory applied non-absorptive liner may be used.
  - 2. Do not allow excess form coating material to stand in puddles in forms nor in contact with hardened concrete against which fresh concrete is to be placed.

### **3.2 REMOVAL OF FORMS**

- A. When repair of surface defects or finishing is required at early age, remove forms as soon as concrete has hardened sufficiently to resist damage from removal operations.
- B. Remove top forms on sloping surfaces of concrete as soon as concrete has attained sufficient stiffness to prevent sagging. Perform needed repairs or treatment required on such sloping surfaces at once, followed by specified curing.
- C. Loosen wood forms for wall openings as soon as this can be accomplished without damage to concrete.
- D. Formwork for columns, walls, sides of beams, and other parts not supporting weight of concrete may be removed as soon as concrete has hardened sufficiently to resist damage from removal.
- E. Where no re-shoring is planned, leave forms and shoring used to support weight of concrete in beams, slabs and other concrete members in place until concrete has attained its specified strength. Where re-shoring is planned, supporting formwork may be removed when concrete has reached 70 percent of specified strength, provided re-shoring is installed immediately.
- F. When shores and other vertical supports are arranged so non-load-carrying form-facing material may be removed without loosening or disturbing shores and supports, facing material may be removed at earlier age as permitted.

### **3.3 RE-SHORING**

- A. When re-shoring is permitted or required, plan operations in advance. While re-shoring is underway, allow no live load on new construction.

- B. During re-shoring do not subject concrete in beam, slab, column or other structural member to combined dead and construction loads in excess of loads for developed concrete strength at time of re-shoring. Place re-shores as soon as practicable after stripping operations are complete but in no case later than end of working day on which stripping occurs. Tighten re-shores to carry required loads without overstressing construction. Leave re-shores in place until:
  - 1. Tests representative of concrete being supported have reached specified strength.
  - 2. In-place concrete is at least 7 days old.
  - 3. Loads imposed by construction operations do not exceed design loads.
- C. For floors supporting shores under newly placed concrete leave original supporting shores in place or re-shore. Re-shoring system shall have capacity sufficient to resist anticipated loads and equal to at least one half of capacity of shoring system above. Locate re-shores directly under shore position above unless otherwise permitted.
- D. In multi-story buildings extend re-shoring over sufficient number of stories to distribute weight of newly placed concrete, forms, and construction live loads in such a manner that capacity of floors as determined by design load and developed concrete strength at time of stripping and re-shoring is not exceeded.

### **3.4 REMOVAL STRENGTH**

- A. When removal of formwork or re-shoring is based on concrete reaching specified strength, concrete shall be presumed to have reached this strength when either of following conditions has been met:
  - 1. When test cylinders, field cured along with concrete they represent, have reached specified strength.
  - 2. When concrete has been cured as specified for same length of time as age at test date of laboratory-cured cylinders which reached specified strength. Determine length of time concrete has been cured in structure by cumulative number of days or fractions thereof, not necessarily consecutive, during which temperature of air in contact with concrete is above 50 degF and concrete has been damp or sealed from evaporation and loss of moisture.

**END OF SECTION**



**SECTION 03 20 00**  
**CONCRETE REINFORCING**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. Reinforcing bars, welded wire reinforcement and supplementary or miscellaneous items, and devices incidental to general use of reinforcing steel for concrete.
- B. Testing of reinforcing steel welding shall be performed by BNL's testing agency at BNL's expense.

**1.2 QUALITY ASSURANCE**

- A. Standards:
  - 1. ASTM-A185: Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete Reinforcement.
  - 2. ASTM-A497: Standard Specification for Steel Welded Wire Reinforcement, Deformed, for Concrete Reinforcement.
  - 3. ASTM A663: Standard Specification for Steel Bars, Carbon, Merchant Quality, Mechanical Properties.
  - 4. ASTM-A615: Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
  - 5. ASTM-A675: Standard Specification for Steel Bars, Carbon, Hot-Wrought, Special Quality, Mechanical Properties.
  - 6. ASTM-A706: Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement.
  - 7. ASTM-A775: Standard Specification for Epoxy-Coated Reinforcing Steel Bars.
  - 8. ASTM-A884: Standard Specification for Epoxy-Coated Wire and Welded Wire Reinforcement.
  - 9. ASTM-A-955: Standard Specification for Deformed and Plain Stainless Steel Bars for Concrete Reinforcing.
  - 10. ACI 315: Details and Detailing Concrete Reinforcement.
  - 11. ACI 440.1: Guide for the Design and Construction of Structural Concrete Reinforced with FRP Bars.
  - 12. American Welding Society ANSI/AWS-D1.4 Structural Welding Code- Reinforcing Steel.
- B. Initial test for reinforcing bar welding will be paid by BNL. Retests due to failed initial tests shall be paid by Contractor.
- C. LEED Requirement:
  - 1. Minimum 25 percent post-consumer recycled content by weight.

**1.3 SUBMITTALS**

- A. Shop drawings:
  - 1. Shop drawings indicating size, number, dimensions and locations of reinforcing steel and accessories, in sufficient detail to permit installation of reinforcing without reference to Contract drawings:
    - a. Details of concrete reinforcement and accessories not indicated on Contract Documents shall be in accordance with ACI 315.
    - b. Indicate length of all bar splices not indicated on contract documents.
- B. Product information:
  - 1. Certification that reinforcing to be welded conforms to ASTM-A706.

- C. LEED Information:
1. LEED Credits MR 4.1 & 4.2, Recycled Content: Product data indicating percentages by weight of post-consumer and post-industrial recycled content for products having recycled content; include statement indicating costs for each product having recycled content.
  2. LEED Credits MR 5.1 & 5.2, Regional Materials: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS**

- A. Acceptable manufacturers:
1. End bearing splice couplers:
    - a. Base:
      - 1) Erico Products.
  2. Tension splice couplers:
    - a. Base:
      - 1) Erico Products.
      - 2) Dayton Metal Products.
  3. Epoxy adhesive for anchoring reinforcing:
    - a. Base:
      - 1) Hilti, HIT System.
  4. Glass Fiber - Reinforced Polymer (GFRP) reinforcing bars:
    - a. Base:
      - 1) Hughes Brothers, Inc.
      - 2) Concrete Protection Products, Inc.
- B. Reinforcing - General: Conform to ASTM-A615, Grade-60.
- C. Reinforcing - Welded: Reinforcing to be welded shall conform to ASTM-A706.
- D. Reinforcing - GFRP rebar: Grade F100, E = 6000 ksi.
- E. Reinforcing - Stainless Steel rebar: Grade 60, Type 316.
- F. Welded wire reinforcement: Flat sheets conforming to ASTM-A185 and to wire size and spacing of smooth wire indicated on drawings.
- G. Smooth dowel bars for construction joints: Conform to ASTM-A663 or ASTM-A675, Grade-60. Where indicated, provide a metal dowel cap at one end of dowel to permit longitudinal movement of dowel within concrete section. Provide for movement which equals joint width plus 1/2 IN. Unless otherwise indicated, use 5/8 IN diameter dowels spaced 18 IN on center.
- H. End bearing splice couplers:
1. Erico Speed-Sleeve Splice by Erico Products.
- I. Tension splice couplers: Shall develop minimum 125 percent of yield strength of bar(s). Where drawings indicate tension splice couplers, provide one of following:
1. "Lenton" threaded tension coupler by Erico Products.
  2. "Bar-Grip" tension coupler by Dayton Metal Products of Miamisburg, OH.
  3. "Cadweld" tension splice by Erico Products.
  4. Bar-Lock lockshear bolt coupling sleeves, manufactured by Dayton Superior
- J. Epoxy anchored reinforcing: Install reinforcing anchored in concrete with epoxy adhesive, in accordance with epoxy manufacturer's instructions.

## 2.2 FABRICATION

- A. Bars used for concrete reinforcement shall meet following requirements for fabricating tolerances:
  - 1. Sheared length: Plus or minus 1 IN.
  - 2. Depth of truss bars: Plus 0, minus 1/2 IN.
  - 3. Overall dimensions of stirrups, ties, and spirals: Plus or minus 1/2 IN.
  - 4. Other bends: Plus or minus 1 IN.
- B. For bars with "End Bearing Splice Couplers," bar ends shall terminate in flat surfaces, within 1-1/2 degrees of a right angle to axis of bars and shall be fitted within 3 degrees of full bearing after assembly.

## PART 3 - EXECUTION

### 3.1 WELDING

- A. Perform welding of reinforcing steel in conformance with AWS-D1.4.
- B. Use E70 electrodes.
- C. Each welder shall place an approved identifying mark near each completed weld.
- D. Cut out welds determined to be defective and reweld and retest at Contractor's expense.
- E. Use BNL "Work Hot" permits with a fire watch.

### 3.2 PLACING REINFORCEMENT

- A. Provide minimum concrete covering for reinforcement as follows:
  - 1. Concrete deposited against earth: 3 IN.
  - 2. Formed surfaces exposed to weather or in contact with earth: 2 IN for reinforcing bars No.6 or larger; 1-1/2 IN for reinforcing bars less than No.6.
  - 3. Interior surfaces: 1-1/2 IN for beams, girders, and columns; 3/4 IN for slabs, walls and joists with No.11 bars or smaller, and 1-1/2 IN with No.14 and No.18 bars.
- B. Place bars to following tolerances:
  - 1. Minimum spacing between bars: Minus 1/4 IN.
  - 2. Deviation in placement of horizontal bars in elevated slabs and beams:
    - a. Members 4 IN deep or less: Plus or minus 1/4 IN.
    - b. Members between 4 and 12 IN deep: Plus or minus 3/8 IN.
    - c. Members more than 1 FT deep: Plus or minus 1/2 IN.
  - 3. Deviation in concrete cover:
    - a. Members 12 IN deep or less: Minus 3/8 IN.
    - b. Members more than 1 FT deep: Minus 1/2 IN.
    - c. Reduction in cover shall not exceed 1/3 of the specified cover.
    - d. Reduction in cover to formed soffits: Minus 1/4 IN.
  - 4. Vertical deviation in slabs-on-grade: Plus or minus 3/4 IN.
  - 5. Spacing of reinforcement:
    - a. In slabs and walls: Plus or minus 2 IN.
    - b. Shear reinforcing: The lesser of plus or minus 2 IN or plus or minus 1 IN per FT of member depth.
  - 6. Location of bends in bars and ends of bars:
    - a. At discontinuous ends of elements: Plus or minus 1/2 IN.
    - b. At other locations: Plus or minus 2 IN.
  - 7. Embedded length of bars and length of bar laps: Minus 1 IN.

- C. Bars may be moved as necessary to avoid interference with other reinforcing steel, conduits, or embedded items. If moved more than one bar diameter, or enough to exceed above tolerances, resulting arrangement of bars subject to approval.
- D. Assure that reinforcement, at time concrete is placed, is free of materials that may adversely affect or reduce bond. Reinforcement with rust, mill scale or a combination of both will be accepted as being satisfactory without cleaning or brushing provided dimensions and weights, including heights of deformations, of a cleaned sample is not less than required by applicable ASTM.
- E. Support reinforcement and fasten together to prevent displacement by construction loads or placing of concrete beyond tolerances indicated. On ground, provide supporting concrete blocks or other approved method. Over formwork, use concrete, metal, plastic or other approved bar chairs and spacers. Where concrete surface will be exposed to weather in finished structure, furnish accessories within 1/2 IN of concrete surface of non-corrosive material or protect against corrosion.
- F. Overlap welded wire reinforcement wherever successive mats or rolls are continuous, in such a way that overlap measured between outermost cross wires of each fabric sheet is not less than spacing of cross wires plus 2 IN. Unless shown otherwise on the drawings, support as required for reinforcing bars by methods of Paragraph E above.
- G. As indicated on drawings, offset vertical bars in columns at least one bar diameter at lapped splices. To ensure proper placement, furnish templates for column vertical bars and dowels.
- H. Splices not specifically indicated shall be subject to approval.
- I. Unless permitted by Architect/Engineer, do not bend reinforcement after embedding in hardened concrete.
- J. Unless permitted by Architect/Engineer, do not tack weld reinforcing.

**END OF SECTION**

**SECTION 03 31 00**  
**CONCRETE MATERIALS AND PROPORTIONING**

**PART 1 - GENERAL**

**1.1 DEFINITIONS**

- A. Normal Weight Concrete: Concrete for which density is not a controlled attribute.
- B. ASTM: ASTM International, 100 Barr Harbor Drive, PO Box C700 West Conshohocken, PA, 19428.
- C. ACI: American Concrete Institute, 38800 Country Club Drive, Farmington Hills MI 48331.

**1.2 QUALITY ASSURANCE**

- A. ASTM designated specifications for material quality and test methods appear throughout this specification:
  - 1. The serial designation prefixed with ASTM shall identify the specification which shall be a part of this specification.
- B. Standards for concrete work: Comply with applicable provisions of following ACI publications (latest edition) except as otherwise indicated:
  - 1. ACI 301 "Specifications for Structural Concrete for Buildings."
- C. Concrete Mixture Proportioning:
  - 1. Employ and pay for testing agency acceptable to Architect and BNL to perform materials evaluation, testing and design of concrete mixes.
  - 2. Certificates, signed by material producer and Contractor, may be submitted in lieu of material testing when approved by Architect.
- D. Concrete Testing:
  - 1. Specified in Section 03 08 13 (BNL Pays).
  - 2. Contractor to assist with related communication and temporary storage of test cylinders at jobsite.
- E. Pre-Concrete Conference:
  - 1. At least 35 days prior to the start of the concrete construction schedule, the contractor shall conduct a meeting to discuss the approved mix designs and to discuss the required methods and procedures to achieve the required concrete construction. The contractor shall send a pre-concrete conference agenda to all attendees 20 days prior to the scheduled date of the conference.
  - 2. The contractor shall require responsible representatives of every party who is concerned with the concrete work to attend the conference, including but not limited to the following:
    - a. Architect and/or Engineer.
    - b. Contractor's superintendent and quality control representative.
    - c. Laboratory responsible for the concrete design mix.
    - d. BNL's Testing Agency responsible for field quality control.
    - e. Concrete subcontractor.
    - f. Ready-mix concrete producer.
    - g. Admixture manufacturer(s) .
    - h. Concrete pumping equipment manufacturer.
  - 3. Minutes of the meeting shall be recorded, typed and printed by the contractor and distributed by him to all parties concerned within 5 days of the meeting. One copy of the minutes shall also be transmitted to BNL's representative for information purposes.

4. The minutes shall include a statement by the concrete contractor indicating that the proposed mix design, and placing, finishing and curing procedures can produce the concrete quality required by these specifications.

### 1.3 SUBMITTALS

#### A. Product Data:

1. Concrete Mix Designs:
  - a. Each Mix design shall be submitted individually. Do not combine multiple mix designs into a single submittal.
  - b. Submit the following data for each concrete mix proposed for use:
    - 1) Intended use of the mix design.
    - 2) Proportions of materials.
    - 3) Slump.
    - 4) Air content.
    - 5) 7-day and 28-day compression test results of trial mixes or standard deviation analysis of an established mix. Tests for trial mixes or for use in standard deviation analysis must have been made within 45 days of the date of the submittal. Older results will not be accepted.
  - c. Submit source and certification or proof of quality (and compatibility of admixtures) for each of the constituents of the proposed concrete mixes. Compatibility of admixture must be certified:
    - 1) Cement.
    - 2) Aggregate.
    - 3) Water.
    - 4) Admixtures:
      - a) Air Entraining Admixture.
      - b) High-Range Water Reducer.
      - c) Other.
  - d. Review and approval of mix designs by Architect does not relieve the Contractor of responsibility to provide concrete of the quality and strengths required by the Contract Documents:
    - 1) The Architect's approval is contingent upon satisfactory performance and strengths being achieved in the field.
  - e. Cold weather and hot weather concrete procedures, including which mixes are to be used; batching, mixing, and transporting procedures; curing methods; finishing methods; or certification of compliance with ACI and these specifications.

#### B. LEED Information:

1. LEED Credits MR 4.1 and 4.2, Recycled Content: Manufacturer's product data for products with recycled content indicating amount of post-consumer and post-industrial recycled content
2. LEED Credits MR 5.1 and 5.2, Regional Materials: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

#### A. General:

1. Materials ultimately used in production must be of same quality, properties and proportion as indicated in approved concrete mix design (as approved by Architect).

- B. Cement:
  - 1. Portland cement conforming to ASTM-C150, Type I or II, or blended cements conforming to ASTM-C595 UNO.
  - 2. Color: Natural gray.
  - 3. Use Type IV Portland cement in the inertia block
- C. Aggregates:
  - 1. General:
    - a. Regard fine and coarse aggregates as separate ingredients.
    - b. Each size of coarse aggregate, as well as combination of sizes when two or more are used, shall conform to grading requirements of applicable ASTM specifications.
  - 2. Normal Weight Concrete:
    - a. ASTM-C33, also aggregate shall be obtained from a source approved by the State Highway Department for use in concrete for state bridges.
- D. Potable Water:
  - 1. Conforming to ASTM C 1602/C 1602M. Potable
- E. Admixtures:
  - 1. General:
    - a. Use only when specifically required or permitted by Contract Documents, otherwise must be approved by Architect.
    - b. Trial mixes and tests shall be prepared with job materials, including admixture, to demonstrate that there will be no subsequent reduction in strength or durability of hardened concrete.
    - c. Conform to appropriate following specifications:
  - 2. In order to obtain approval for use of admixtures in concrete, demonstrate economy and efficiency of use, and prove by submission of suitable test data that admixture meets requirements of applicable ASTM specification, and certify that material furnished for project is same as that qualified by above data. Trial mixes and tests shall be prepared with job materials, including admixture, to demonstrate that there will be no subsequent reduction in strength or durability of hardened concrete.
  - 3. Calcium chloride and admixtures containing more than 0.05 percent chloride ions are not permitted.
  - 4. Air-entraining Admixtures: ASTM-C260.
  - 5. Mid-Range Water Reducer: ASTM-C494, Type A.
  - 6. High-Range Water Reducer:
    - a. ASTM-C494, Type F or G. Subject to complying with these specifications, the following manufacturers of High Range Water Reducing Admixtures are approved:
      - 1) "Daracem – 100" or Adva Flow Series by Grace Construction Products.
      - 2) "Rheobuild 1000 , Glenium Series or PS 1466 " by BASF Construction Chemicals.
      - 3) "Eucon 37" or "Eucon SPJ" by Euclid Chemical.
      - 4) "PSP-N," "PSP-N2," "PSP-R," and "PSP-L" by Procrete Industries.
  - 7. Water-reducing, Retarding, and Accelerating Admixtures: ASTM-C494.
  - 8. Supplementary Cementitious Materials:
    - a. Fly ash - ASTM-C618, Class C or Class F:
      - 1) Samples shall be obtained, prepared, and tested in accordance with ASTM-C311.
    - b. Ground Granulated Blast-Furnace Slag: ASTM C989, Grade 100 or 120.
  - 9. Shrinkage Reducing Admixture, ECLIPSE by Grace Construction Products.

## 2.2 PROPORTIONING CONCRETE MIXES

- A. General:
  - 1. Contractor and concrete supplier are responsible to provide concrete, in-place, which satisfies all the requirements listed in the following table.
  - 2. Contractor and concrete supplier are also responsible to adjust the concrete mixes, as needed, to:

- a. Correct for non-conformance.
  - b. Correct for a variation in the quality of a constituent.
  - c. Compensate for extreme conditions in the field.
- B. Establish concrete material proportions by any of the proportioning methods described in ACI-301 guidelines.

| <b>Concrete Properties Table – IP Units</b>      |                              |                              |                                |              |                       |                   |                    |
|--|------------------------------|------------------------------|--------------------------------|--------------|-----------------------|-------------------|--------------------|
| <b>Use</b>                                       | <b>28-day strength (KSI)</b> | <b>Dry Unit Weight (PCF)</b> | <b>Max Aggregate Size (IN)</b> | <b>Air %</b> | <b>Max. W/C Ratio</b> | <b>Slump (IN)</b> | <b>Cement type</b> |
| Footings ,<br>Below Grade<br>Piers               | 4.0                          | 147                          | 1-1/2                          | 4.5          | 0.60                  | 4                 | I                  |
| Walls  | 4.0                          | 147                          | 1                              | 4.5          | 0.50                  | 5                 | I                  |
| Interior slabs-<br>on-grade                      | 4.0                          | 147                          | 1 1/2                          |              | 0.45                  | 3                 | I                  |
| Structural floors,<br>girders, slabs,<br>columns | 4.0                          | 147                          | 3/4                            |              | 0.45                  | 9 *               | I                  |
| Columns & Air<br>spring support<br>piers         | 4.0                          | 147                          | 3/4                            |              | 0.35                  | 9 *               | I                  |
| Inertia Block                                    | 4.0                          | 147                          | 1-1/2                          |              | 0.60                  | 4                 | IV                 |
| All other uses                                   | 4.0                          | 147                          | 3/4                            | 6            | 0.50                  | 4                 | I                  |

\* Slump after dosing with water reducer.

C. Instructions for use of Table:

1. General:
  - a. Provide concrete mixes with properties indicated in locations identified in “use” column.
2. 28-day Strength:
  - a. Installed concrete must meet or exceed the minimum 28-day compressive strength indicated.
  - b. Laboratory mix design strengths must exceed this strength by the appropriate amount per ACI-301.
  - c. Determine strength in accordance with ASTM-C192 and ASTM-C39.
3. Dry Unit Weight:
  - a. If no value is listed, assume normal weight.
  - b. Correlate fresh weight with air dry weight of same mix to use as basis of acceptance on job site. Test in accordance with ASTM-C567 and ASTM C 138.
  - c. Dry unit weight for concrete for Radiation Shielding shall be minimum air dry unit weight permitted. Use heavy aggregate if necessary.
4. Maximum Aggregate Size:
  - a. Maximum size of coarse aggregate determined in accordance with:
    - 1) ASTM-C33 for normal weight concrete.
  - b. Some mixes are designated “3/4 IN or 1 IN,” permitting the contractor / supplier option.
5. Air Content:
  - a. Required percentage of entrained and entrapped air as measured by ASTM-C231, ASTM-C173, or ASTM-C138, as appropriate.
  - b. Tolerance of air content as delivered is  $\pm 1-1/2$  percent for normal weight and  $\pm 2$  percent for lightweight concrete.
  - c. When left blank, required air content is not specified.
6. Water Reducer:
  - a. Mid Range Water Reducer or High Range Water Reducer shall be provided as necessary to achieve slump indicated

- b. Contractor, as option, may elect to use Water Reducers to improve workability or permit pumping.
- 7. Maximum W/C Ratio:
  - a. Maximum ratio of pounds of water allowed to pounds of cementitious material used in the concrete mix.
- 8. Slump:
  - a. Mixes without Water Reducers:
    - 1) Slump tolerance: Up to 1 IN above maximum indicated is allowed, provided the average of 5 consecutive batches does not exceed the indicated amount by more than a 1/2 IN.
  - b. Mixes with Water Reducers:
    - 1) Slump indicated is "after" dosing.
    - 2) Slump tolerance "after" dosing: +1-1/2 IN and -1 IN is permitted for each batch.
  - c. Determine slump in accordance with ASTM-C143.
  - d. Where slump is not specified, provide concrete with slump in accordance with approved mix designs
- 9. Cement:
  - a. Type: Provide cement type indicated.
  - b. As option, the contractor/supplier may use Fly Ash or Ground Blast Furnace Slag for partial replacement of cement:
    - 1) For each unit of cement that is removed, replace with two units of Class F Fly Ash or one unit of Class C Fly Ash.
    - 2) For each unit of cement that is removed, replace with one unit of Ground Blast Furnace Slag.
    - 3) Maximum amount of cement replaced shall not exceed that specified in table 4.2.2.9 of ACI 301.
    - 4) W/C ratio shall be based on total cementitious material content.
- D. Admixtures:
  - 1. Use admixtures in accordance with manufacturer's instructions.
  - 2. Use only approved admixtures.
  - 3. High Range Water Reducer (Super Plasticizer) shall be dispersed at the job site by one individual designated by the Contractor and trained by a representative of the supplier. The Contractor shall establish a dosing area on-site with holding tanks and metering devices. A manufacturer's field representative experienced in the use of Super Plasticizer shall be present at start-up and shall remain until satisfactory concrete is achieved.
  - 4. Shrinkage reducing admixture (dosage at 2 percent by weight of cement) to limit shrinkage to 0.045 percent after 28 days shall be used in conjunction with super plasticizer for low shrinkage concrete at inertia block.

## **PART 3 - EXECUTION**

### **3.1 PREPARATION**

- A. Material Safety Data Sheet and storage labeling shall be available at the job site and conform to current governing regulations.

### **3.2 STORAGE OF MATERIALS**

- A. Store cement in weather tight buildings, bins, or silos which will exclude moisture and contaminants.
- B. Arrange aggregate stockpiles and use in a manner to avoid excessive segregation and to prevent contamination with other materials or with other sizes of like aggregates:
  - 1. To insure that this condition is met, perform test for determining conformance to requirements for cleanliness and grading on samples secured from aggregates at point of batching.

2. Do not use frozen or partially frozen aggregates.
- C. Allow sand to drain until it has reached relatively uniform moisture content before use.
- D. Store admixtures in manner to avoid contamination, evaporation, or damage:
  1. For those used in form of suspensions or non-stable solutions, provide agitating equipment to assure uniform distribution of ingredients.
  2. Protect liquid admixtures from freezing and temperature changes which would adversely affect their characteristics.

### **3.3 MIXING AND DELIVERY**

- A. Batch, mix and transport concrete in accordance with ASTM-C94.
- B. Batch and mix admixtures in accordance with manufacturer's instructions.
- C. Concrete shall have a slump of 2 to 4 IN when it arrives at job site:
  1. Water additions at job site shall be limited to comply with W/C Ratio requirements.
  2. Do not allow water to be added to the mix unless the amount allowed is clearly indicated on the truck delivery ticket.
- D. Following addition of High Range Water Reducer, mix for a minimum of 70 revolutions or 5 minutes to assure a consistent mixture.
- E. Reduction of required average strength:
  1. During construction, and after sufficient data becomes available, laboratory strength of mixes may be reduced in accordance with Section 3.11 of AC1-301, subject to approval by the Architect.

**END OF SECTION**

**SECTION 03 31 10**  
**CONCRETE MIXING, PLACING, JOINTING AND CURING**

**PART 1 - GENERAL**

**1.1 DEFINITIONS**

- A. Placement plan: Contractor's construction joint pattern and placement sequencing superimposed on a structural plan.
- B. Screed: Vibrating straight edge tool used to strike off fresh concrete to desired elevation, slope, etc.
- C. Screed rail: Accurately set support (often pipe) for screeds to follow as concrete is struck off.

**1.2 QUALITY ASSURANCE**

- A. Materials standards:
  - 1. ASTM-C171: Standard Specification for Sheet Materials for Curing Concrete.
  - 2. ASTM-C309: Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
  - 3. ASTM-C1315: Standard Specification for Liquid Membrane Forming Curing Compounds Having Special Properties for Curing and Sealing Concrete.
  - 4. ASTM-D1751: Standard Specification for Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types).
  - 5. ASTM-D1752: Standard specification for Preformed Sponge Rubber and Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction.
- B. Production standards:
  - 1. ASTM-C94: Standard Specification for Ready-mixed Concrete.
  - 2. ASTM C 138 Standard Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete.
  - 3. ACI 305.1: Hot Weather Concreting.
  - 4. ACI 306.1: Cold Weather Concreting.
  - 5. ACI 308R-01: Guide to Curing Concrete.
  - 6. ACI 309R-05: Guide for Consolidation of Concrete.
  - 7. ACI 304R-00: Guide for Measuring, Mixing, Transporting, and Placing Concrete.
  - 8. ACI 304.2R-96: Placing Concrete by Pumping Methods - Committee Report, 1996, Committee 304.

**1.3 SUBMITTALS**

- A. Shop drawings:
  - 1. Placement plans: Indicate proposed locations of construction joints and placement sequencing.
  - 2. Screeding and finishing plan.
- B. Samples:
  - 1. Joint filler.
  - 2. Waterstops.
- C. Product information:
  - 1. Joint filler technical data.
  - 2. Curing compound technical data:
    - a. Interior slabs: Include floor covering manufacturer's writer approval for use.
  - 3. Waterstop technical data.
  - 4. Bonding agent technical data.

- D. LEED Information:
1. LEED Credits MR 4.1 and 4.2, Recycled Content: Manufacturer's product data for products with recycled content indicating amount of post-consumer and post-industrial recycled content.
  2. LEED Credits MR 5.1 and 5.2, Regional Materials: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS**

- A. Acceptable Manufacturers:
1. Strippable Curing Compound (Interior applications):
    - a. The compound shall conform to ASTM C309 (VOC content no greater than 100 g/l). For use on slabs receiving subsequent applied finishes and where noted on the drawings. Install in strict accordance with the manufacturer's recommendation and supervision.
    - b. Acceptable Manufacturers:
      - 1) Kurez W VOX
  2. Chemical Curing Compound (Exterior applications):
    - a. Base:
      - 1) L&M Construction Chemicals; L&M Cure W.
    - b. Optional:
      - 1) Dayton Superior.
      - 2) Euclid.
      - 3) Sonneborne.
      - 4) WR Meadows.
  3. Self-Expanding Rubber Strip Waterstops:
    - a. Base:
      - 1) Greenstreak.
    - b. Optional:
      - 1) Progress Unlimited, Inc.
      - 2) Deneef Construction Chemicals.
      - 3) Adeka (Mitsubishi).
  4. Acoustic Insulation Joint Filler:
    - a. Base:
      - 1) Emseal, Inc.
- B. Concrete Materials and Proportioning: See Section 03 31 00.
- C. Premolded Joint Filler: Conforming to ASTM-D1751 or ASTM-D1752.
- D. Chemical bonding agent conforming to ASTM C881.
- E. Acoustic Isolation Joint Filler: Conforming to STC 45 rating or better.

### **2.2 WATERSTOPS**

- A. Self-Expanding Rubber Strip Waterstops:
1. Bentonite-free hydrophilic polymer modified chloroprene rubber, suitable for adhesive bonding to concrete.
  2. Profile: Rectangular or trapezoidal strip unless otherwise indicated.
  3. Minimum Dimensions: 3/8 IN x 3/4 IN thick.
  4. Provide in maximum practicable length to minimize end joints.

5. Butt splice joints at intersections and at ends of pieces in accordance with manufacturer's instructions:
  - a. Make joints to develop effective watertightness fully equal to that of continuous waterstop material, to permanently develop not less than 50 percent of mechanical strength of parent section, and permanently retain flexibility.

### **PART 3 - EXECUTION**

#### **3.1 MIXING AND PRODUCTION OF CONCRETE**

- A. Batch, mix and transport ready-mixed concrete in accord with ASTM-C94:
  1. Plant equipment and facilities shall conform to "Check List for Certification of Ready Mixed Concrete Production Facilities" of National Ready Mixed Concrete Association, 900 Spring Street, Silver Spring, MD 20910.
- B. Site batched and mixed concrete will be permitted only after ability to control quality has been demonstrated to satisfaction of Architect.

#### **3.2 MIXING - CONTROL OF ADMIXTURES**

- A. Admixtures shall be added in accordance with Manufacturers recommendations
- B. If two or more admixtures are used, verify compatibility with manufacturers

#### **3.3 MIXING - TEMPERING AND CONTROL OF MIXING WATER**

- A. Mix concrete only in quantities for immediate use. Discard concrete which has set.
- B. When concrete arrives at project with slump below that suitable for placing, water may be added only if neither maximum permissible water-cement ratio nor maximum slump is exceeded:
  1. Incorporate water by additional mixing equal to at least half of total mixing required.
  2. Do not add water after discharge commences.
  3. Remeasure slump after additional water has been added.
  4. Show compliance with water/cement ratio limits with records of actual proportions batched at the plant and actual measured additional water used.

#### **3.4 MIXING - WEATHER CONDITIONS**

- A. Cold weather:
  1. Comply with ACI 306.
  2. In cold weather, temperature of concrete when delivered at the point of disposition shall conform to following limitations:
  3. For sections with least dimension greater than 36 IN, comply with table 3.1 of ACI 306R.

| <b>Minimum Concrete Temperature Required at Time of Pour</b> |  |   |
|--|--|---|
| <b>Air Temperature @ time of pour</b>                        | <b>For sections with least dimension less than 12 IN</b> | <b>For sections with least dimension 12 IN to 36 IN</b> |
| Above 30 DegF  | 60 DegF  | 55 DegF   |
| 0 to 30 DegF   | 65 DegF  | 60 DegF   |
| Below 0 DegF   | 70 DegF  | 65 DegF   |

| <b>Minimum Concrete Temperature Required within 24 Hours of Pour</b> |  |   |
|--|--|---|
| <b>Air Temp within 24 Hours of pour</b>                              | <b>For sections with least dimension less than 12 IN</b> | <b>For sections with least dimension 12 IN or greater</b> |
| Below 32   | 60 DegF  | 50 DegF   |

4. If water or aggregate is heated above 100 degF, combine water with aggregate in mixer before cement is added:

- a. Do not mix cement with water or with mixtures of water and aggregate having a temperature greater than 100 degF.
  - b. Final temperature of combined mix shall not exceed 90 degF or be high enough to cause flash set or loss of slump or workability.
- B. Hot weather:
- 1. Comply with ACI 305 if high temperature, low slump, flash set, or cold joints are encountered.
  - 2. Cool ingredients before mixing, or add flake ice or well-crushed ice of a size that will melt completely during mixing for all or part of mixing water. Account for water contribution by ice when calculating the quantity of mixing water and insure that specified W/C ratio is not exceeded.

### 3.5 PREPARATION BEFORE PLACING

- A. Equipment:
- 1. Remove hardened concrete and foreign material from inner surfaces of conveying equipment.
  - 2. Provide spare vibrator on job site during concrete placing operations.
  - 3. In cold weather, have protective blankets ready and heaters operational and in-place before placing concrete.
- B. Forms:
- 1. Complete formwork: Remove frost, snow, ice, water and foreign material; secure reinforcement in place, position expansion joint material, anchors, and other embedded items and have entire preparation inspected prior to concrete placement.
  - 2. In hot weather when temperature of reinforcing or forms is greater than 120 degF spray forms and reinforcement with water just prior to placing concrete.
- C. Screeds and screed rails:
- 1. General:
    - a. Develop a screed system to accurately strike off fresh concrete to the surfaces defined on the drawings.
    - b. Anticipate the deflection of all formwork and support systems. Provide and place extra concrete as necessary to produce finish surfaces with specified tolerances at designated elevations and contours at no additional cost to the BNL.
    - c. When form work is cambered whether shored or un-shored and screeding is performed perpendicular (i.e., up and over) to the crown of the camber set screed rails to follow the camber and provide a slab of uniform thickness:
      - 1) When screeding parallel with the camber set one screed at midspan along the crown of the camber and one along the girder or support.
      - 2) Two passes of the screed is necessary to cover one full bay.
    - d. Other screeding methods may be used provided the deflection of un-shored formwork is taken into consideration.
    - e. On unshored steel framing systems, accurately strike off concrete to produce a level surface after steel supporting system has deflected due the dead weight of the fresh concrete. Slab thickness on cambered steel shall not be less than that indicated on plan.
    - f. If not required in the documents and subjected to the approval of the Architect, the Contractor as option may camber the formwork.
    - g. All concrete shall be struck off with a vibrating screed.
    - h. Use of a "wet screed" system will not be permitted unless:
      - 1) The concrete is struck with a pneumatically vibrated "float screed."
      - 2) A highway straight edge is used to true the surface perpendicular to the direction of the screeding.
      - 3) A satisfactory finish is produced on a trial slab.
    - i. Submit a screeding and finishing plan for approval:

- 1) A representative trial slab pour shall be provided to demonstrate that the specified tolerances and a satisfactory surface can be provided by the proposed method of screeding and finishing.
- D. Subgrade for slabs on grade:
1. Subgrade shall be well drained and of adequate and uniform load bearing nature:
    - a. Keep in-place density of subgrade soils at least to minimum indicated.
  2. Keep subgrade free of frost before concrete placing begins:
    - a. If temperature inside a building where concrete is to be placed is below freezing, raise temperature and maintain above 50 degF long enough to remove frost from subgrade and reinforcing.
  3. Keep subgrade moist at time of concreting:
    - a. If necessary, dampen with water in advance of concreting.
    - b. Allow no free water standing on subgrade nor muddy or soft spots when concrete is placed.

### **3.6 PROTECTION**

- A. Unless adequate protection is provided and approval is obtained, do not place concrete when temperature is below freezing or during rain, sleet or snow.
- B. Do not allow rainwater to increase mixing water nor to damage surface finish.
- C. Concrete damaged by rain or weather and judged defective by Architect shall be removed and replaced by Contractor at no additional cost to BNL or corrected by procedures listed in Section "Testing and Acceptance."

### **3.7 CONVEYING**

- A. Handle concrete from mixer to place of final deposit as rapidly as practicable by methods which prevent segregation or loss of ingredients and assure that quality is maintained.
- B. Use equipment conforming to ASTM-C94.
- C. Use horizontal belt conveyors or mount at a slope which will not cause excessive segregation or loss of ingredients:
  1. Protect concrete against undue drying or rise in temperature.
  2. Handle to prevent segregation.
  3. Do not allow mortar to adhere to belt.
  4. Discharge long runs into a hopper or through a baffle.
- D. Use metal or metal-lined chutes with slope between 1 vertical and 2-3 horizontal:
  1. Chutes more than 20 FT long and chutes not meeting slope requirements may be used provided they discharge into a hopper before distribution.
- E. Pumping or pneumatic conveying equipment shall be of suitable kind with adequate pumping capacity:
  1. Control pneumatic placement so that segregation is not apparent in discharged concrete.
  2. Loss of slump in pumping or pneumatic conveying equipment shall not exceed 2 IN.
  3. Do not convey concrete through pipe made of aluminum or aluminum alloy.

### **3.8 DEPOSITING IN FORMS**

- A. Work includes:
  1. Deposit concrete continuously or in layers of such thickness that no concrete is deposited on concrete which has hardened sufficiently to cause formation of seams or planes of weakness within section.
  2. Place at such a rate that concrete which is being integrated with fresh concrete is still plastic.
  3. Do not deposit concrete which has partially hardened or has been contaminated by foreign materials.

4. Remove temporary spreaders in forms when concrete placing has reached an elevation rendering their service unnecessary.
  5. Temporary spreaders may remain embedded in concrete only if made of metal or concrete and if prior approval has been obtained.
- B. Do not start placing concrete in supported elements until concrete previously placed in columns and walls is no longer plastic and has been in place at least two hours.
- C. Deposit concrete as nearly as practicable in its final position to avoid segregation due to re-handling or flowing:
1. Do not subject concrete to procedure which will cause segregation.
  2. Concrete shall not drop more than 6 FT unless approved by the Architect/Engineer. For greater heights, provide special mix design, chutes, spouts, tremies, or other approved method.
- D. Concrete buckets shall be equipped with rubber discharge tubes:
1. Tube size shall be effective in directing flow of concrete directly downward between reinforcing.
  2. Unless it can be demonstrated, no segregation will occur with greater distances, maximum free fall distance of concrete below flexible tube is limited to 4 FT.
- E. Consolidation:
1. Consolidate concrete by vibration, so that concrete is thoroughly worked around reinforcement, around embedded items and into corners of forms eliminating air or stone pockets which may cause honeycombing, pitting, or planes of weakness.
  2. Use internal vibrators having a minimum frequency of 8000 vibrations per minute to consolidate concrete effectively.
  3. Do not use vibrators to transport concrete within forms.
  4. Insert vibrators and withdraw at points approximately 18 IN apart.
  5. At each insertion allow duration sufficient to consolidate concrete but not sufficient to cause segregation; generally from 5 to 15 sec.
  6. Where concrete is to have an as-cast finish, bring a full surface of mortar against form by vibration process, supplemented if necessary by spading, to work coarse aggregate back from formed surface.

### 3.9 SLAB PLACEMENT

- A. Coordinate mixing and placing with finishing:
1. Do not place concrete on subgrade or forms more rapidly than it can be spread, straight edged, and darbled or bull floated.
  2. Perform these operations before bleed water has an opportunity to collect on surface.
- B. To obtain good surfaces and avoid cold joints, plan size of finishing crews with due regard for effects of concrete temperature and atmospheric conditions on rate of hardening of concrete:
1. If construction joints become necessary, construct as required under joints and embedded items.
- C. Jointing:
1. Locate joints in slabs on grade as indicated. If saw-cut joints are required or permitted, time cutting properly with set of concrete by one of the following methods:
    - a. Start cutting as soon as concrete has hardened sufficiently to prevent aggregates being dislodged by saw. Complete sawing within 12 hours after placement.
    - b. The Soff Cut saw shall be used within two hours of final finishing:
      - 1) Cut depth not less than 10 percent of slab thickness with a 1-inch minimum.
      - 2) Remove debris in path of cut and under Skid Plate before cutting. Skid Plate must remain flat on surface.
      - 3) Use Soff-Cut blades and Skid Plates, using a new Skid Plate with each new blade.
      - 4) Install Soff-Cut joint protector at saw-cut intersection prior to cross-cut.
      - 5) Remove dry powder without disturbing finish.

- 6) Avoid traffic across saw cut until sufficient strength is gained to protect joint edges.
- c. If an alternate method or timing is proposed, submit detailed plans for review and acceptance.
- 2. Complete before shrinkage stresses become sufficient to produce cracking.
- D. Consolidation:
  - 1. Thoroughly consolidate concrete in slabs.
  - 2. Use internal vibration in beams and girders of framed slabs and along bulkheads of slabs on grade.
  - 3. Obtain consolidation of slabs with vibrating screeds, roller pipe screeds, internal vibrators, or other approved means.

### **3.10 JOINTS AND EMBEDDED ITEMS**

- A. Construction joints (other than slab on grade):
  - 1. Locate joints not indicated so as to least impair strength of structure:
    - a. Place joints in locations approved by Architect/Engineer.
  - 2. In general, locate near middle of spans of slabs, beams, and girders unless a beam intersects a girder at this point, in which case, offset joint in girder a distance equal to twice width of beam:
    - a. Locate joints in walls and columns at underside of floors, slabs, beams, or girders and at tops of footings or floor slabs.
    - b. Place beams, girders, brackets, column capitals, haunches, and drop panels at same time as slabs.
    - c. Make joints perpendicular to main reinforcement.
  - 3. Continue reinforcement across joints.
  - 4. Clean surface of concrete at joints thoroughly and remove laitance:
    - a. Prior to placing adjoining concrete, dampen (but do not saturate) hardened concrete of construction joints.
- B. Joints in slabs-on-grade:
  - 1. Construction joints:
    - a. Place keyed dowelled or diamond plate construction joints as indicated on plans and at locations where a slab placement is terminated or interrupted.
    - b. Size of placements and sequence of slab placement is Contractor's option, except construction joints shall be located at a control joint location.
    - c. Construction joints act as control joints.
  - 2. Control joints:
    - a. Provide contraction (control) joints as indicated.
    - b. If not shown, provide along column centerlines.
    - c. Where column centerline spacing or spacing between column centerlines and walls exceeds 30 FT, provide an intermediate joint(s) at intervals not exceeding 30 FT.
    - d. Also provide joints where change in slab width occurs, such as at block-outs, pits, etc.
    - e. If saw cut joints are used, cut as soon as concrete has hardened sufficiently to prevent aggregates being dislodged by saw.
  - 3. Isolation joints:
    - a. Provide isolation joints around columns, and between slab on grade and walls.
    - b. Also provide isolation joints around equipment or machinery isolation pads, pits, pipes, etc., unless detailed otherwise.
- C. Expansion joints:
  - 1. Do not permit reinforcement or other embedded metal items bonded to concrete (except dowels in floors bonded on only one side of joints) to extend continuously through expansion joint.
  - 2. Locate expansion joints as indicated.

- D. Acoustic Isolation Joint:
  1. Do not permit any reinforcing or other bonded items to extend through joint.
  2. Remove all forming material and clean joint thoroughly prior to cover installation. Locate as indicated.
- E. Place sleeves, inserts, anchors, and embedded items required for adjoining work or for its support, prior to concreting:
  1. Give Contractors whose work is related to concrete or supported by it ample notice and opportunity to introduce and/or furnish embedded items before concrete placement.
  2. Position expansion joint material, waterstops, and other embedded items accurately and support against displacement.
  3. Fill voids in sleeves, inserts and anchor slots temporarily with readily removable material to prevent entry of concrete.

### **3.11 BONDED JOINTS**

- A. When concrete is placed against existing concrete surfaces, obtain bond by one of following methods:
  1. Roughen surface of concrete in an approved manner which will expose aggregate uniformly and not leave laitance, loosened particles of aggregate or damaged concrete at surface:
    - a. Dampen (but do not saturate) hardened concrete of joints in exposed work; joints in middle of beams, girders, joists, and slabs; and joints in work designed to contain liquids.
    - b. Thoroughly cover with a coat of cement grout of similar proportions to mortar in concrete.
    - c. Use grout as thick as possible on vertical surfaces and at least 1/2 IN thick on horizontal surfaces.
    - d. Place fresh concrete before grout has attained its initial set.
  2. Prepare joints receiving an adhesive bonding agent and apply adhesive in accordance with manufacturer's recommendations prior to placing of fresh concrete.
  3. Prepare surfaces of joints which have been treated with a chemical retarder in accordance with manufacturer's recommendations prior to placing of fresh concrete.

### **3.12 SLAB FINISHING**

- A. See Section 03 35 00.

### **3.13 CURING AND PROTECTION**

- A. Work includes: Beginning immediately after placement, protect concrete from premature drying, hot or cold temperatures, and mechanical injury, and maintain with minimal moisture loss at relatively constant temperature for period necessary for hydration and hardening of concrete. Materials and methods of curing subject to approval.
- B. Preservation of Moisture:
  1. Interior Slabs:
    - a. Application of sheet curing materials.
    - b. Application of strippable curing compound:
      - 1) Submit written approval from floor covering manufacturer prior to use.
      - 2) Apply in accord with recommendations of manufacturer immediately after water sheen, which may develop after finishing, has disappeared.
      - 3) Apply continuous film at manufacturer's specified rate.
      - 4) Completely remove prior to application of floor covering material.
  2. Other concrete surfaces not in contact with forms apply one of following procedures immediately after completion of placement and finishing:
    - a. Ponding or continuous sprinkling.
    - b. Application of absorptive mats or fabric kept continuously wet.
    - c. Application of sand kept continuously wet.
    - d. Continuous application of mist spray (not exceeding 150 degF).

- e. Application of sheet curing materials.
  - f. Application of other moisture-retaining covering as approved.
  - g. Application of curing compound:
    - 1) Apply in accord with recommendations of manufacturer immediately after water sheen, which may develop after finishing, has disappeared.
    - 2) Apply continuous film at manufacturer's specified rate.
    - 3) Do not use on surface against which additional concrete or other material is to be bonded, unless it is proven that curing compound will not prevent bond or positive measures are taken to remove curing compound completely from areas to receive bonded applications.
  - 3. Minimize moisture loss from surfaces placed against wooden forms or metal forms exposed to heating by sun by keeping forms wet until they can be safely removed:
    - a. After form removal cure concrete until end of time prescribed.
  - 4. Continue curing in accordance with ACI 318 (7 days for most concrete):
    - a. If tests made of cylinders, kept adjacent to structure and cured by same methods, indicate average compressive strength has reached 70 percent of specified strength, ( $f_c'$ ), moisture retention methods may be terminated.
    - b. If one of curing procedures indicated above is used initially, it may be replaced by one of other procedures indicated any time after concrete is 1 day old, provided concrete is not permitted to become surface dry during transition.
- C. Temperature, wind and humidity:
- 1. Cold weather:
    - a. When mean daily outdoor temperature is less than 40 degF maintain temperature of concrete between 50 and 70 degF for required curing period.
    - b. When necessary make arrangements for heating, covering, insulating, or housing concrete work adequate to maintain required temperature without injury.
    - c. Do not use combustion heaters during first 24 hours unless precautions are taken to prevent exposure of concrete to exhaust gases which contain carbon dioxide.
  - 2. Hot weather:
    - a. When necessary make provision for windbreaks, shading, fog spraying, sprinkling, ponding, or wet covering with a light colored material.
    - b. Take such protective measures as quickly as concrete hardening and finishing operations will allow.
  - 3. Rate of temperature change:
    - a. Keep changes in temperature of air immediately adjacent to concrete during and immediately following curing period as uniform as possible.
    - b. Do not exceed 5 degF in any 1 hour or 50 degF in any 24-hour period.
- D. Protection from mechanical injury:
- 1. During curing period, protect concrete from damaging mechanical disturbances, such as load stresses, heavy shock, and excessive vibration.
  - 2. Protect finished concrete surfaces from damage by construction equipment, materials, or methods, and by rain or running water.
  - 3. Do not load self-supporting structures in such a way as to overstress concrete.
- E. Protection of slabs-on-grade from frost:
- 1. Interior slabs exposed to freezing temperatures shall be adequately protected so that frost does not develop in supporting subgrade.

### **3.14 ELEVATOR DOOR FRAMES**

- A. Elevator Door Frames in concrete shafts:
  - 1. Block-out as required by Elevator Manufacturer to allow for door frames to be set.
  - 2. After door frames have been set, set forms across void between frame and edge of block-out.
  - 3. Fill in with concrete fill.

**END OF SECTION**

**SECTION 03 33 00**  
**ARCHITECTURAL CAST-IN-PLACE (ACIP) CONCRETE**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. Definitions:
  - 1. Architectural Cast-in-Place (ACIP) Concrete: Concrete which is exposed to view as an interior surface in completed structure, and specifically indicated as such.
- B. The requirements of this section shall augment the general requirements specified in Section 03 11 00, Section 03 20 00, Section 03 31 00, Section 03 31 10 and Section 03 35 00.

**PART 2 - PRODUCTS**

**2.1 CONCRETE MATERIAL DESCRIPTIONS**

- A. General:
  - 1. Refer to Section 03 31 00 for general requirements and material quality standards.

**2.2 FORM MATERIALS**

- A. General:
  - 1. Refer to Section 03 11 00 for general requirements.
  - 2. Comply with the following additional requirements listed below.
- B. Form Ties
  - 1. Material: Stainless steel snap ties.
- C. Form Sealants:
  - 1. Use non-staining type sealant.
- D. Form Facing Materials:
  - 1. Smooth rubbed finish:
    - a. Use smooth forms, liner sheets, or prefabricated panels, true to line, in order that surfaces produced will require little dressing to arrive at true surfaces.

**2.3 FABRICATION - FORMS**

- A. General:
  - 1. Refer to Section 03 11 00 for general requirements.
  - 2. Comply with the following additional requirements listed below.
- B. Design:
  - 1. Design forms to produce required finish.
  - 2. Limit deflection of facing materials to 0.0025 times span.
  - 3. Design forms to permit easy removal.
  - 4. Use only wooden wedges.
- C. Secure liner panels in forms by cementing or stapling, but not by methods which will permit impressions of nail heads, screw heads, washers, or like to be imparted to surface of concrete.

## **PART 3 - EXECUTION**

### **3.1 FORM WORK**

- A. General:
  - 1. Comply with general requirements specified in Section 03 11 00.
  - 2. Comply with the following additional requirements listed below.
- B. Do not reuse forms if there is any evidence of surface wear or defect which would impair quality of surface.
  - 1. Thoroughly clean and properly coat forms before reuse.
- C. Observe formwork continuously while concrete is being placed to see that there are no deviations from desired elevation, alignment, plumb-ness, or camber.
  - 1. If, during construction, any weakness develops and false-work shows undue settlement or distortion, stop work, remove affected construction if permanently damaged.
  - 2. Strengthen false-work.

### **3.2 PLACING OF CONCRETE**

- A. General:
  - 1. Comply with general requirements specified in Section 03 31 10.
  - 2. Comply with the following additional requirements listed below.
- B. Work coarse aggregate back from forms, leaving a full surface of mortar avoiding production of surface voids, in order to result in a smooth rubbed finish.
- C. Do not allow vibrators to contact formwork for exposed concrete surfaces.
- D. Consolidate concrete by vibrating the forms or by other approved methods that produce an acceptable finish.

### **3.3 REMOVAL OF FORMS**

- A. General:
  - 1. Comply with general requirements specified in Section 03 31 10.
  - 2. Comply with the following additional requirements listed below.
- B. Do not pry against face of concrete.
- C. Repair finish defects including form seam marks, fins, projections large air bubbles, bug-holes etc.

### **3.4 FINISHES**

- A. General:
  - 1. Comply with general requirements specified in Section 03 35 00.
  - 2. Finished faces: Free of joint marks, grain, and other obvious defects.
  - 3. Comply with the following additional requirements listed below.
- B. Exposed Face Surfaces:
  - 1. As-Cast Surface Finish (smooth-off-mold):
    - a. Provide surfaces free of excessive air voids, sand streaks, and honeycombs.
    - b. No dressing shall be allowed.

### **3.5 PATCHING FINISHES**

- A. General:
  - 1. Total patched area may not exceed 1 in 500 of surface area.
  - 2. Closely match color and texture of surrounding surfaces.
    - a. Determine mix formula for patching mortar by trial to obtain a good color match with concrete when both patch and concrete are cured and dry.

- b. After initial set, dress surfaces of patches manually to obtain same texture as surrounding surfaces.

### **3.6 CURING PATCHES**

- A. Cure patches in architectural concrete surface for 7 days.
  1. Protect from premature drying.

**END OF SECTION**



**SECTION 03 35 00**  
**CONCRETE FINISHING AND REPAIR OF SURFACE DEFECTS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. Definitions:
1. Floor finish tolerances shall be based on F-Number System defined within ASTM-E1155 as summarized below:
    - a. Floor Flatness F-Number: Ff defines the maximum floor curvature allowed over 24 IN computed on the basis of successive 12 IN elevation differentials.
    - b. Floor Levelness F-Number: Fl defines the relative conformity of the floor surface to a horizontal plane measured over a 10 FT distance.
    - c. Above number pair shall always be stated in form: Ff/Fl.
    - d. Specified overall value is enumerated and is based on the composite of all measured value in a placement.
    - e. Minimum local value (MLV) describes the flatness or levelness below which repair or replacement is required. MLV is based on an individual placement and applies to a minimum local area not crossing construction or control joints.

**1.2 QUALITY ASSURANCE**

- A. Standards:
1. ASTM-E1155: Standard Test Method for Determining Floor Flatness and Levelness - Using F-Number System.
- B. Trial concrete panels: Provide trial panels to permit evaluation of finishing properties and appearance of concrete proposed for use. Panels shall be at least 8 x 8 FT, of specified thickness, and made with proposed materials and proportions, using equipment and personnel comparable with those to be employed on work. Concrete used shall be demonstrated to be capable of being finished at a slump not exceeding that specified. Panels shall be constructed and approved prior to proceeding with finish in specified location. Approved panels shall serve as standards by which corresponding finishes in structure will be accepted or rejected. Panels shall be constructed at an approved location, not as part of structure, and shall be protected from construction operations, weather, and other damage until acceptance of completed concrete work, after which they shall be removed from site.
1. Provide one 12 IN thick approved panel for each slab finish specified. Panel(s) shall be on grade.
  2. Provide one 10 IN thick approved panel for smooth form finish. Panel shall be vertical.
  3. Provide one 10 IN thick approved panel for each rubbed finish specified. Panel(s) shall be vertical.

**1.3 SUBMITTALS**

- A. Product Information:
1. Bonding agent technical data.
  2. Patching compound technical data.

**PART 2 - PRODUCTS**

**2.1 MATERIALS**

- A. Bonding agent: Approximately one (1) part Portland cement to one (1) part fine sand passing a No.30 mesh sieve. Mix to consistency of thick cream.

- B. Patching compound: Same materials and approximately same proportions as used for concrete, except omit coarse aggregate. Shall consist of not more than one (1) part Portland cement to two and one half (2-1/2) parts sand loose volume. For exposed concrete, part of Portland cement shall be white to produce a color matching color of surrounding concrete, as determined by a trial patch. Add no more water than necessary for handling and placing. Mix compound in advance and allow to stand with frequent manipulation, without addition of water, until it has reached stiffest consistency that will permit placing.
- C. Grout for cork floated rubbed finish: Mix one (1) part Portland cement and one (1) part fine sand with sufficient water to produce a stiff grout.
- D. Proprietary materials: At Contractor's option, proprietary compounds for adhesion, patching, or finishing may be used in lieu of or in addition to foregoing grouts. Use such compounds in accordance with manufacturer's recommendations.

## **PART 3 - EXECUTION**

### **3.1 FINISHING - GENERAL (EXCEPT TOP SURFACE OF SLABS)**

- A. After removal of forms, repair and give surfaces of concrete finishes indicated.
- B. Unspecified finish: If finish is not designated, use following finishes as applicable:
  1. Unpainted concrete surfaces not exposed to public view: Rough form finish.
  2. Unpainted concrete surfaces exposed to public view: Smooth form finish.
  3. Unformed surfaces (except slabs): As indicated.
  4. Concrete surfaces to be waterproofed in Section 07 13 26: Smooth form finish.

### **3.2 REPAIR OF SURFACE DEFECTS**

- A. Repair surface defects immediately after form removal. Remove honeycombed and other defective concrete down to sound concrete. Chip if necessary to make edges perpendicular to surface or slightly undercut. No feather edges will be permitted. Dampen area to be patched and an area at least 6 IN wide surrounding it to prevent absorption of water from patching compound. After surface water has evaporated from area to be patched, brush bonding agent into surface. When bonding agent begins to lose water sheen, apply patching compound. Thoroughly consolidate compound into place and strike off so as to leave patch slightly higher than surrounding surface. To permit initial shrinkage, leave undisturbed for at least 1 HR before final finish. Keep patched area damp for 7 days. Do not use metal tools in finishing a patch which will be exposed.
- B. Tie holes: Unless stainless steel, non-corrosive, or acceptably coated ties are used, tie holes shall be filled. Clean and thoroughly dampen tie holes; fill solid with patching compound.

### **3.3 AS-CAST FINISHES**

- A. Rough form finish: No selected form facing materials are specified for rough form finish surfaces. Concrete surfaces must conform to tolerances in Section 03 11 00 "Concrete Formwork." Patch defects and tie holes. Chip or ruboff fins exceeding 1/4 IN in height. Otherwise, leave surfaces with texture imparted by forms.
- B. Smooth form finish: Use form facing material to produce a smooth, hard, uniform texture on concrete. It may be plastic coated plywood, metal, plastic liners, or other approved material capable of producing desired finish. Arrange facing material orderly and symmetrical, with number of seams kept to practical minimum. Support by studs or other backing capable of preventing excessive deflection. Do not use material with raised grain, patches, or other defects which will impair texture of concrete surface.
  1. Patch tie holes and defects. Remove fins completely.

2. When surface texture is impaired and form joints misaligned by more than 1/8 IN grind bushhammer, or correct affected concrete as directed by Architect. Slurry grout areas evidencing minor mortar leakage to match adjacent concrete. Repair major mortar leakage as a defective area.
- C. Finishing of related unformed surfaces: (Except Slabs).
1. Strike smooth tops of walls or buttresses, horizontal offsets, and similar unformed surfaces occurring adjacent to formed surfaces after concrete is placed.
  2. Float to a texture reasonably consistent with that of formed surfaces.
  3. Continue final treatment on formed surfaces uniformly across unformed surfaces.

### 3.4 SLAB FINISHING

- A. General:
1. Place slabs to finish tolerances specified.
  2. Slab finish: Use following finishes at building locations noted.
    - a. Scratched finish: Surfaces intended to receive bonded applied cementitious applications, such as setting beds, grout, etc.
    - b. Floated finish (magnesium):
      - 1) Surfaces intended to receive roofing, waterproofing membranes or thin-set epoxy terrazo.
      - 2) Surfaces of ramps, docks, stairs in which no other covering is specified.
    - c. Troweled finish:
      - 1) Floors intended as walking surfaces or to receive floor coverings.
- B. Finishing tolerances:
1. For shored construction, measurements for conformance with finishing tolerances shall be made as soon as slab can tolerate foot traffic, and before shores are removed.
  2. Horizontal finishes will be accepted provided:
    - a. Applicable specification requirements are satisfied.
    - b. Water does not pond in areas sloped to drain.
    - c. Floor finish tolerances Ff/FI conforms to that specified for particular finish and minimum local valves are not less than 75 percent of the floor finish tolerance specified.
  3. Accumulated deviation from intended true plane of finished surface does not exceed 1 IN.
  4. Accuracy of floor finish does not adversely affect installation and operation of movable equipment, floor supported items or items fitted to floor (doors, tracks, etc.).
- C. Finishes:
1. Scratched finish: After concrete has been placed, consolidated, struck off, and leveled to a Ff15/FI13 tolerance, roughen surface with stiff brushes or rakes before final set.
  2. Floated finish: After concrete has been placed, consolidated, struck off, and leveled, do not work further until ready for floating. Using a magnesium float, begin floating when water sheen has disappeared and surface has stiffened sufficiently to permit operation. During or after first floating, check planeness of entire surface with a 10 FT straightedge applied at not less than two different angles. Cut down high spots and fill low spots during this procedure to produce a surface within Ff20/FI15 tolerance throughout. Refloat slab immediately to a uniform sandy texture.
  3. Troweled finish: First float-finish surface. Next power trowel, and finally hand trowel. First troweling after power floating shall produce a smooth surface which is relatively free of defects but which may still indicate some trowel marks. Perform additional trowelings by hand after surface has hardened sufficiently. Final trowel when a ringing sound is produced as trowel is moved over surface. Thoroughly consolidate surface by hand troweling. Leave finished surface essentially free of trowel marks, uniform in texture and appearance and plane to a Ff25/FI20 tolerance, unless noted otherwise. On surfaces intended to receive floor coverings, grind off defects which would indicate through floor covering. On surfaces intended to receive waterproofing membranes grind off defects that might tear or otherwise damage membrane. Surfaces at ULV chamber shall be finished to a Ff60/FI40 tolerance.

4. Broom or belt finish: Immediately after concrete has received float finish, give it a coarse scored texture by drawing a broom or burlap belt across surface transverse to slope or traffic flow.

**END OF SECTION**

# HDR

D I V I S I O N    0 4  
MASONRY



**SECTION 04 05 10**  
**MASONRY CLEANING**

**PART 1 - GENERAL**

**1.1 SUBMITTALS**

- A. Project information:
  - 1. Name of proposed product and manufacturer.
  - 2. Certification that the proposed product(s) are compatible for materials on subject project.
- B. LEED Information:
  - 1. LEED Credits MR 5.1 and 5.2, Regional Materials: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.

**1.2 JOB CONDITIONS**

- A. Protect adjacent surfaces and materials below from damage due to cleaning operations.

**PART 2 - PRODUCTS**

**2.1 MATERIALS**

- A. Acceptable manufacturers:
  - 1. Cleaners:
    - a. Base:
      - 1) ProSoCo.
    - b. Optional:
      - 1) L&M Construction Products.

**2.2 PRODUCTS**

- A. General:
  - 1. Do not use products which are “not recommended” by manufacturer of material to be cleaned.
- B. Concrete Masonry (CMU) Cleaners:
  - 1. General:
    - a. Clean all CMU which will remain exposed to view (including CMU walls which are scheduled for painting).
  - 2. Lightweight and Normal Weight CMU:
    - a. Base Product: “Sure Klean Custom Masonry Cleaner” by ProSoCo.
- C. Cast-in-Place Concrete Cleaner:
  - 1. General:
    - a. Clean all Cast-in-Place concrete walls which will remain exposed to view (including CIP walls which are scheduled for painting).
    - b. Clean with most effective products which are appropriate for texture(s) and color(s) specified.
  - 2. Smooth Textures:
    - a. Base Product: “Sure Klean Burnished Custom Masonry Cleaner” or “Light-duty Concrete Cleaner” both by ProSoCo.

- D. Architectural Precast Concrete (APC) Cleaner:
  - 1. General:
    - a. Clean with most effective products which are appropriate for texture(s) and color(s) specified.
  - 2. Smooth Textures:
    - a. Base Product: "Sure Klean Burnished Custom Masonry Cleaner" or "Light-duty Concrete Cleaner" both by ProSoCo.

## **PART 3 - EXECUTION**

### **3.1 INSPECTION**

- A. Examine surfaces to be cleaned.
  - 1. If necessary point with mortar.
- B. Waiting Time before cleaning:
  - 1. Mortar Types N and O: Allow mortar to cure for 14 to 28 days prior to cleaning.
  - 2. Mortar Types M and S: Allow mortar to cure for 7 to 14 days prior to cleaning.
  - 3. Colored Mortar (all strengths): Allow mortar to fully cure (28 days) prior to cleaning.
- C. Remove excess mortar using wooden paddles and scrapers.
- D. Do not proceed with cleaning until unsatisfactory conditions have been corrected.
- E. Test 4 x 4 FT area of each surface type for compatibility with cleaner, using recommended dilutions, prior to full scale cleaning operations.
- F. Cleaning indicates acceptance of surfaces and responsibility for performance.

### **3.2 PREPARATION**

- A. Protect adjacent surfaces, not scheduled for cleaning.
- B. Prepare surfaces as recommended by manufacturer.

### **3.3 CLEANING**

- A. Clean surfaces as recommended by manufacturer.
- B. Do not use wire brushes.
- C. If metal tools are used, use only tools free of rust.
- D. Thoroughly rinse and pre-soak walls.
- E. Flush loose mortar and dirt from surface.
- F. Wet to prevent "runoff" streaking.
- G. Apply solution using fibered wall washing brush or low-pressure spray.
  - 1. Maximum Pressure: not to exceed 400 PSI.
  - 2. Tip spray angle: Not less than 25 Degrees.
  - 3. Maximum rate of flow: 4 to 6 GPM.
  - 4. Tip shall be held at least 12 IN from surface of masonry.
  - 5. Comply with manufacturer's recommendations, where more restrictive.
- H. Scrape off mortar and re-apply cleaning solution.
- I. After scrubbing, clean thoroughly with low pressure water.
  - 1. Comply with low-pressure spray criteria listed above.

## **END OF SECTION**

**SECTION 04 05 05**  
**COLD AND HOT WEATHER MASONRY PROCEDURES**

**PART 1 - GENERAL - NOT USED**

**PART 2 - PRODUCTS - NOT USED**

**PART 3 - EXECUTION**

**3.1 PROCEDURES**

- A. International Building Code, Chapter 21.
- B. Local Building Code.
- C. ACI 530.1/ASCE 6/TMS 602.
- D. Brick Industry Association, Technical Note 1.
- E. National Concrete Masonry Construction, Technical Note 3-1C.

**3.2 GENERAL**

- A. At end of each day or at shutdown, cover tops of walls not enclosed or sheltered.
- B. Do not use frozen or ice coated materials.
- C. Remove and replace frozen or damaged masonry to satisfaction of Architect.

**3.3 TEMPORARY FACILITIES**

- A. Construct and maintain temporary protection required to permit continuous and orderly progress of work.
- B. Provide temperature conditioning sufficient for indicated temperatures.
- C. Provide sufficient temporary lighting to permit work to be correctly performed.

**END OF SECTION**



**SECTION 04 05 10**  
**MASONRY CLEANING**

**PART 1 - GENERAL**

**1.1 SUBMITTALS**

- A. Project information:
  - 1. Name of proposed product and manufacturer.
  - 2. Certification that the proposed product(s) are compatible for materials on subject project.
- B. LEED Information:
  - 1. LEED Credits MR 5.1 and 5.2, Regional Materials: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.

**1.2 JOB CONDITIONS**

- A. Protect adjacent surfaces and materials below from damage due to cleaning operations.

**PART 2 - PRODUCTS**

**2.1 MATERIALS**

- A. Acceptable manufacturers:
  - 1. Cleaners:
    - a. Base:
      - 1) ProSoCo.
    - b. Optional:
      - 1) L&M Construction Products.

**2.2 PRODUCTS**

- A. General:
  - 1. Do not use products which are “not recommended” by manufacturer of material to be cleaned.
- B. Concrete Masonry (CMU) Cleaners:
  - 1. General:
    - a. Clean all CMU which will remain exposed to view (including CMU walls which are scheduled for painting).
  - 2. Lightweight and Normal Weight CMU:
    - a. Base Product: “Sure Klean Custom Masonry Cleaner” by ProSoCo.
- C. Cast-in-Place Concrete Cleaner:
  - 1. General:
    - a. Clean all Cast-in-Place concrete walls which will remain exposed to view (including CIP walls which are scheduled for painting).
    - b. Clean with most effective products which are appropriate for texture(s) and color(s) specified.
  - 2. Smooth Textures:
    - a. Base Product: “Sure Klean Burnished Custom Masonry Cleaner” or “Light-duty Concrete Cleaner” both by ProSoCo.

- D. Architectural Precast Concrete (APC) Cleaner:
  - 1. General:
    - a. Clean with most effective products which are appropriate for texture(s) and color(s) specified.
  - 2. Smooth Textures:
    - a. Base Product: "Sure Klean Burnished Custom Masonry Cleaner" or "Light-duty Concrete Cleaner" both by ProSoCo.

## **PART 3 - EXECUTION**

### **3.1 INSPECTION**

- A. Examine surfaces to be cleaned.
  - 1. If necessary point with mortar.
- B. Waiting Time before cleaning:
  - 1. Mortar Types N and O: Allow mortar to cure for 14 to 28 days prior to cleaning.
  - 2. Mortar Types M and S: Allow mortar to cure for 7 to 14 days prior to cleaning.
  - 3. Colored Mortar (all strengths): Allow mortar to fully cure (28 days) prior to cleaning.
- C. Remove excess mortar using wooden paddles and scrapers.
- D. Do not proceed with cleaning until unsatisfactory conditions have been corrected.
- E. Test 4 x 4 FT area of each surface type for compatibility with cleaner, using recommended dilutions, prior to full scale cleaning operations.
- F. Cleaning indicates acceptance of surfaces and responsibility for performance.

### **3.2 PREPARATION**

- A. Protect adjacent surfaces, not scheduled for cleaning.
- B. Prepare surfaces as recommended by manufacturer.

### **3.3 CLEANING**

- A. Clean surfaces as recommended by manufacturer.
- B. Do not use wire brushes.
- C. If metal tools are used, use only tools free of rust.
- D. Thoroughly rinse and pre-soak walls.
- E. Flush loose mortar and dirt from surface.
- F. Wet to prevent "runoff" streaking.
- G. Apply solution using fibered wall washing brush or low-pressure spray.
  - 1. Maximum Pressure: not to exceed 400 PSI.
  - 2. Tip spray angle: Not less than 25 Degrees.
  - 3. Maximum rate of flow: 4 to 6 GPM.
  - 4. Tip shall be held at least 12 IN from surface of masonry.
  - 5. Comply with manufacturer's recommendations, where more restrictive.
- H. Scrape off mortar and re-apply cleaning solution.
- I. After scrubbing, clean thoroughly with low pressure water.
  - 1. Comply with low-pressure spray criteria listed above.

## **END OF SECTION**

**SECTION 04 05 13**  
**PORTLAND CEMENT-LIME (PCL) MORTARS & GROUT**

**PART 1 - GENERAL**

**1.1 DEFINITIONS**

- A. PCL Mortar: Portland Cement-Lime Mortar.
- B. PCL Grout: Portland Cement-Lime Grout.
- C. The use of “masonry cement” alone, or in combination with and PCL mixes, is prohibited.
- D. “Factory Pre-Blended”: Mortar Mix in which ALL of the dry ingredients (including sand, cement, lime, pigments etc) are precision blended in controlled environment. Pre-blended mixes are shipped to job site in bulk form where they are dispensed for use on job. Only water may be added at site for mixture to meet this definition.

**1.2 QUALITY ASSURANCE –GENERAL**

- A. Materials standards: ASTM Standards indicated.
- B. Cold Weather Procedure: Specified in Section 04 05 05.
- C. Hot Weather Procedures:
  - 1. When ambient temperature is >100 DegF, or >90 DegF with a wind >8 MPH:
    - a. Monitor mortar temperature and maintain it between 70 to 120 DegF.
    - b. Limit spreading of bed mortar to 4 FT (max) and place masonry units within 1 minute of spreading.

**1.3 QUALITY ASSURANCE - MORTAR**

- A. Mortar for unit masonry: ASTM-C270, Property Method; Types as indicated.
- B. Standards and testing: Brick Industry of America (BIA).
- C. Mortar testing:
  - 1. Perform in accordance with ASTM-C780; Method A7, 2 IN cubes.
  - 2. Retest when initial test fails.
  - 3. Retests at Contractor’s expense.

**1.4 QUALITY ASSURANCE – GROUT**

- A. Grout for Unit Masonry: ASTM-C476.
- B. Method of Sampling and Testing Grout:
  - 1. Perform in accordance with ASTM-C1019.
  - 2. Retest when initial test fails.
  - 3. Retests at Contractor’s expense.

**1.5 SUBMITTALS**

- A. Samples:
  - 1. Ribbon samples of colored mortar(s) for pre-approval.
- B. Project Information:
  - 1. Design mix reports for each type of Mortar or Grout used.
    - a. Include description of contents, proportions, and results of tests specified.
    - b. Provide independent laboratory analysis of materials.

- C. LEED Information:
  - 1. LEED Credits MR 4.1 and 4.2, Recycled Content: Product data indicating percentages by weight of post-consumer and post-industrial recycled content for products having recycled content; include statement indicating costs for each product having recycled content.
  - 2. LEED Credits MR 5.1 and 5.2, Regional Materials: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS –PCL MORTAR**

- A. Acceptable manufacturers:
  - 1. Factory Pre-blended Mortar:
    - a. Base:
      - 1) Spec Mix.
    - b. Optional:
      - 1) ProMix (U-mix).
      - 2) Quickcrete.
      - 3) ProSpec (Bonsal).
- B. Factory Pre-blended Mortar Mix:
  - 1. Use approved mix designs which comply with ASTM-C270, Property Method.
  - 2. Blend cementitious materials, aggregate and admixtures in factory under controlled conditions, which requires only the addition of water at the project site.
  - 3. Oven-dry aggregates prior to measuring and include in the pre-blended mix.
  - 4. Use of Mortar in Fire Rated Walls: Wherever a fire resistance rating is indicated for masonry wall provide mortar of type that has been tested and listed for construction indicated.

### **2.2 PCL MORTAR – DESCRIPTION OF COMPONENT MATERIALS**

- A. Portland Cement: ASTM-C150, Type I or II.
  - 1. Air-entraining cement is not permitted.
  - 2. Portland Cement Color(s): As indicated below for each application.
  - 3. Maximum percent of alkalis: 0.60.
  - 4. The use of blended hydraulic cements, including: Portland blast-furnace slag cement, Portland-pozzolan cement, slag cement, and natural cement is not permitted.
- B. Hydrated lime: ASTM-C207, Type S.
- C. Mortar aggregate:
  - 1. ASTM-C144.
  - 2. Aggregate Color(s): As indicated below for each application.
- D. Water: Clean and potable.
- E. Do not use the following ingredients:
  - 1. Do not use antifreeze additives.
  - 2. Do not use Calcium Chloride, Thiocyanates, or other materials containing chloride ions.
  - 3. Other admixtures: Not permitted without prior approval by Architect.
  - 4. Do not use ready mix mortar (ASTM-C1142).
  - 5. DO NOT USE MASONRY CEMENT.

**2.3 SCHEDULE OF MORTAR TYPES**

- A. All PCL Mortar mixes to comply with ASTM-C270, Property Specification using Component Materials listed above:
  - 1. Limit Air Content to 10% (maximum).
  - 2. Use appropriate Type as indicated by the following Table 4110A for each condition.
  - 3. Note: Not all conditions may apply to this Project.

| <b>TABLE 4110A - Basic Mortar Type Selection</b> |   |                                  |
|--|---|----------------------------------|
| <b>Location(s)</b>                               | <b>Building Segment</b>   | <b>Mortar Type per ASTM-C270</b> |
| <b>EXTERIOR MASONRY,</b><br>at or below grade    | Foundation walls<br>Retaining walls<br>Sewers & manhole, and paving   | <b>S</b>                         |
| <b>EXTERIOR MASONRY,</b><br>above grade          | Reinforced or Load Bearing brick / block walls<br>Glass Unit Masonry<br>Veneer Masonry, Parapets, and Chimneys >30 FT above grade<br>Other areas with severe exposure | <b>S</b>                         |
|  | Non-load bearing brick/block walls<br>Veneer Masonry, where <30 FT above grade  | <b>S</b>                         |
|  | Parapets and chimneys where <30 FT above grade  | <b>S</b>                         |
| <b>INTERIOR MASONRY</b>                          | Load bearing brick/block walls<br>Non-load bearing brick/block walls<br>Glass Unit Masonry<br>Brick/block veneers   | <b>S</b>                         |

**2.4 SCHEDULE OF MORTAR COLORS**

- A. Use the following mortar colors in conjunction with Table 4110A to determine mixes of appropriate combinations of Type and Color for each project condition.
- B. Mortar Color MC-1:
  - 1. Location(s) used:
    - a. CMU walls, ( See Section 04 22 00).
  - 2. Method:
    - a. Factory Pre-blended Mortar.
  - 3. Mortar Color:
    - a. To be selected by Architect.
  - 4. Portland Cement Color:
    - a. Natural.
  - 5. Aggregate Color:
    - a. Natural.

**2.5 MATERIALS – PCL GROUT**

- A. Acceptable manufacturers:
  - 1. Site-Mixed PCL Grout:
    - a. Base:
      - 1) Products as indicated.
- B. Site-mixed PCL Grout:
  - 1. Use approved mix designs.
  - 2. Mix on-site using approved materials as indicated.
  - 3. Factory Pre-blended (dry) grout mixes may also be used at contractor’s option.
  - 4. Ready-mixed product, delivered to site, for direct placement in walls, may also be used at contractor’s option.

- C. PCL Grout Mixes – General:
1. Comply with ASTM-C476.
  2. Portland Cement: ASTM-C150, Type I or II.
    - a. Air-entraining cement is not permitted.
    - b. Maximum percent of alkalies: 0.60.
    - c. The use of blended hydraulic cements, including: Portland blast-furnace slag cement, Portland-pozzolan cement, slag cement, and natural cement is not permitted.
  3. Grout aggregate: ASTM-C404.
    - a. Maximum Aggregate Size (for course grout): 3/8 IN.
    - b. The use of blast furnace slag is not permitted.
  4. Hydrated lime:
    - a. ASTM-C207, Type S.
  5. Water: Clean and potable.
  6. Other admixtures: Not permitted without prior approval by Architect.
  7. Compressive Strength: as indicated by GROUT MIX SCHEDULE (below) for each type.
  8. Slump for Grout Measured in accordance with ASTM-C143:
    - a. Minimum: 8 IN.
    - b. Maximum: 10 IN.

## 2.6 PCL GROUT MIX SCHEDULE

- A. Grout Mix GM-1:
1. Site-mixed Grout.
    - a. Redi-mixed or Factory pre-blended may be used at contractor's option.
  2. Compressive Strength (28-day):
    - a. Minimum 2000 PSI.
  3. Location(s) used:
    - a. Fill for CMU walls.
    - b. Hollow Metal Door Frames.
    - c. Elevator Frames and sills.
    - d. Other indicated locations.
  4. Grout Color: Natural Grey (no pigment).
  5. Portland Cement Color: Natural.
  6. Aggregate Color: Natural.
  7. Grout mixtures shall NOT contain gypsum.

## PART 3 - EXECUTION

### 3.1 INSTALLATION – GENERAL

- A. Comply with provisions of ACI 530 and ACI 530.1, except where exceeded by requirements of the contract documents.

### 3.2 MORTAR INSTALLATION - GENERAL REQUIREMENTS

- A. Mix materials minimum of 5 minutes, but not more than 10 minutes.
- B. Adjust consistency to satisfaction of mason subject to compliance with specified criteria.
- C. Comply with BIA Standard MI-72.
- D. Install in accordance with BIA Standards.
- E. Strike all joints to create a uniformly concave final joint.
- F. If mortar begins to stiffen, it may be re-tempered in accordance with ASTM-C270, Subparagraph 7.4.
- G. Use mortar within 2-1/2 hours of initial mixing.

- H. Remove units which are disturbed after laying. Clean off original mortar and reset with fresh mortar.

### **3.3 GROUT INSTALLATION - GENERAL REQUIREMENTS**

- A. Mix materials minimum of 5 minutes, but not more than 10 minutes.
- B. Use grout within 1-1/2 hours after initial mixing.
- C. Use coarse grout in spaces larger than 2 IN in both directions.
- D. Use fine grout in spaces with least dimension is less than 2 IN.

### **3.4 GROUT INSTALLATION - FRAMES**

- A. Use fine grout for hollow metal door frames.
  - 1. Grout frames of elevator hoistway openings.
  - 2. Grout hollow metal door frames where the net opening is 4 FT and greater.

### **3.5 GROUT INSTALLATION - WALLS**

- A. See Section 04 22 00.

### **3.6 FIELD QUALITY CONTROL - MORTAR**

- A. Perform 1 set of field tests of mortar per day's work.
- B. Obtain mortar sample from freshly mixed batch of mortar.
- C. Obtain sample from discharge point of mixer, before mason adjusts water content.

### **3.7 FIELD QUALITY CONTROL – GROUT**

- A. Perform 1 set of field tests of grout per day's work.
- B. Obtain mortar sample from freshly mixed batch of grout.
- C. Obtain sample from discharge point of mixer, before mason adjusts water content

**END OF SECTION**



**SECTION 04 05 23**  
**MASONRY ACCESSORIES**

**PART 1 - GENERAL**

**1.1 QUALITY ASSURANCE**

- A. Welding Standard: Perform welding in accordance with applicable provisions of AWS Structural Welding Code D1.1.
- B. ASTM standards indicated.
- C. Building Code:
  - 1. 2006 International Building Code.
  - 2. And local amendments.

**1.2 DEFINITIONS**

- A. Expansion Joints (versus Control Joints, Construction Joints etc):
  - 1. Movement joints used in brickwork are defined as "Expansion Joints" per BIA "Technical Notes 18A".
    - a. Construct such Expansion Joints per BIA Technical Note 18A.
  - 2. Movement joints used in CMU work are defined as "Control Joints" by NCMA Tek #10-2B.
    - a. Construct such Control Joints per Tek #10-2B and other NCMA standards.

**1.3 SUBMITTALS**

- A. Project information:
  - 1. List of products proposed for use.
- B. LEED Information:
  - 1. LEED Credits MR 4.1 and 4.2, Recycled Content: Product data indicating percentages by weight of post-consumer and post-industrial recycled content for products having recycled content; include statement indicating costs for each product having recycled content.
  - 2. LEED Credits MR 5.1 and 5.2, Regional Materials: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.

**1.4 PRODUCT DELIVERY, STORAGE, AND HANDLING**

- A. Store materials under cover in a dry place and in a manner to prevent damage.
- B. Immediately before placing, clean reinforcement of substances detrimental to good bond.

**PART 2 - PRODUCTS**

**2.1 MATERIALS**

- A. Acceptable manufacturers:
  - 1. Masonry Anchors (adjustable wall ties):
    - a. Base:
      - 1) Hohmann & Barnard (H&B).
    - b. Optional:
      - 1) Wirebond.

- 2) Sandell.
- 2. Through-wall Flashing - Flexible Membrane with Metal Plate System (Flexible Membrane):
  - a. Base:
    - 1) Hohmann & Barnard (H&B).
  - b. Optional:
    - 1) Sandell Manufacturing Company, Inc.
    - 2) Grace Construction Products.
- 3. Through-wall Flashing - Flexible Membrane with Metal Plate System (Drip plate, stainless steel):
  - a. Base:
    - 1) Hohmann & Barnard (H&B).
  - b. Optional:
    - 1) Sandell Manufacturing Company, Inc.
- 4. Termination Bars:
  - a. Base:
    - 1) Hohmann & Barnard (H&B).
  - b. Optional:
    - 1) Sandell Manufacturing Company, Inc.
- 5. Head Vent, (pre-manufactured):
  - a. Base:
    - 1) Hohmann & Barnard (H&B).
  - b. Optional:
    - 1) Sandell Manufacturing Company, Inc.
- 6. Rope Wicks (used in conjunction with Head Vent above):
  - a. Base: Products listed.
- 7. Cavity Protection Material:
  - a. Base:
    - 1) Mortar Net.
- 8. Horizontal Reinforcing:
  - a. Base:
    - 1) Hohmann & Barnard (H&B).
  - b. Optional:
    - 1) Dur-O-Wall.
    - 2) Sandell Manufacturing Company, Inc.
    - 3) Wire-Bond, Masonry Reinforcing Corp of America.
    - 4) Heckman.
- 9. Pre-molded Control Joint Strips (at CJ's in CMU walls):
  - a. Base:
    - 1) Hohmann & Barnard (H&B).
  - b. Optional:
    - 1) Everlastic.
    - 2) Sandell Manufacturing Company, Inc.
    - 3) Wire-Bond, Masonry Reinforcing Corp of America.
    - 4) Heckman.
- 10. Galvanizing Repair Paint:
  - a. Base:
    - 1) ZRC Worldwide.
  - b. Optional:
    - 1) Tnemec.
- 11. Compressible Filler:
  - a. Base:
    - 1) Hohmann & Barnard (H&B).
  - b. Optional:
    - 1) Sandell Manufacturing Company, Inc.
- 12. Air Retarder:
  - a. Specified in Section 09 21 27.

13. Loose Lintels:
  - a. Specified in Section 05 50 10.
14. Structural Steel Lintels and Shelf Angles:
  - a. Specified in Section 05 12 10.

## 2.2 MASONRY WALL ANCHORS

- A. Utilize the following type of anchor devices where terminal ends of masonry walls (i.e. CMU) abut Steel Columns. Do not use corrugated anchor devices.
  1. Offset Strap anchor:
    - a. Base Product: "359-FH" by H&B.
    - b. Material:
      - 1) Type 304 Stainless Steel.
    - c. Mechanically attached to steel column.
  2. Wire tie:
    - a. Base Product: "302W" by H&B.
    - b. Material: Same as listed for strap.
    - c. Width: As required for width of CMU.
    - d. Length: 12 IN.
    - e. Diameter: 3/16 IN.
- B. Rigid Steel Anchors (where CMU walls intersect other CMU walls):
  1. Minimum 1/8 IN x 1 IN x 12 IN.
  2. Galvanized G90.
  3. Ends bent down 2 IN.

## 2.3 HORIZONTAL REINFORCING

- A. General:
  1. Cold drawn steel wire, ASTM-A82.
  2. Side Rods Diameter: 3/16 IN.
  3. Cross Rods Diameter: 9 GA.
  4. Materials:
    - a. In walls:
      - 1) Mill Galvanized, ASTM-A641, Class 3 (0.80 OZ/SF).
    - b. In walls surrounding wet areas with humidity over 70 percent (pools, showers, kitchens, food processing):
      - 1) Hot-dip Galvanized, ASTM-A153, Class B2 (1.50 OZ/SF).
- B. Horizontal Reinforcing – Free-standing CMU Walls:
  1. Scope: Free standing, single-wythe CMU walls not serving as a back-up wall for masonry veneers.
  2. Description: Horizontal reinforcing composite:
    - a. Width(es) as required
  3. Base Product: "#220 Lox-All Ladder Mesh" by H&B.
- C. Horizontal Reinforcing – CMU Back-up Walls:
  1. Scope: CMU walls serving as back-up wall for masonry veneers.
  2. Description: Horizontal reinforcing pattern for CMU back-up, with projecting wire loops to accommodate vertically adjustable veneer wire ties.
    - a. Length of projection as required for cavity width indicated.
    - b. Include compatible wire ties for masonry veneer.
  3. The veneer anchor tie shall consist of Wire Ties which interlock into the ladder/truss reinforcing product(s) specified.
  4. "Eye and Pintle" or similar design which permits vertical movement while restraining lateral movement.
  5. Devices used must allow for vertical adjustability during installation, and long-term differential movement.

6. Tie Component:
    - a. Material: As specified for ladder/truss reinforcing product.
    - b. Diameter: 3/16 IN.
  7. Base Product: “#270 Ladder Adjustable Eye Wire” by H&B.
- D. Horizontal Reinforcing – Masonry Veneers:
1. Single, continuous wire.
  2. Diameter: 3/16 IN.

## 2.4 VERTICAL REINFORCING

- A. Reinforcing Bars:
1. ASTM-A615, Grade-60.
  2. Size: #4's minimum, or as otherwise indicated.
  3. Refer to Section 03 20 00, and Drawings.

## 2.5 MISCELLANEOUS ANCHORAGES

- A. General:
1. Include miscellaneous anchorages as required or indicated, such as those necessary to secure stone/APC copings and sills.
  2. Type:
    - a. As indicated.
  3. Material: Same as indicated for veneer anchors above.

## 2.6 THROUGH-WALL FLASHING SYSTEM – FLEXIBLE MEMBRANE WITH METAL DRIP PLATE

1. Description:
    - a. Material: Flexible, UV-resistant, chemical-resistant, impact-resistant polymer with DuPont “Elvaloy KEE” resin.
    - b. Provide with removable paper backing to expose pressure-sensitive adhesive surface.
  2. Thickness: 40 mil.
  3. Width as required.
  4. Factory precut wherever possible.
  5. Base Product: “Flex-Flash” by H&B.
  6. Optional Products: “Hyload S/A Membrane” by Hyload Inc.
  7. End dams:
    - a. Provide at ends of runs.
    - b. Base Product: “MFL Metal Flashing” by H&B.
      - 1) 26 gage type 304 stainless steel.
    - c. Optional Product: “Flex-Flash” by H&B.
    - d. Optional Product: “Hyload S/A Membrane” by Hyload Inc.
- B. Stainless Steel Drip Plate (for use with Flexible Membrane flashing.):
1. Description: Stainless steel sheet flashing, with end drip projecting 1/4 to 3/8 IN past the face of masonry.
  2. Material: Type 304 Stainless Steel Flashing.
  3. Thickness: 24 GA.
  4. Foam Seal, 1/8 IN thick, on bottom side.
  5. Self-adhesive top surface (w/release paper).
  6. Size and profiles as indicated.
    - a. Provide special profiles where lipped brick are indicated.
  7. Base Product: “FTSA and/or FTSA-LB” by H&B.
- C. Termination Bar:
1. Use to secure top edge of Flexible Membrane flashing to back-up wall.
  2. Material: Stainless steel.
  3. Surface type.
  4. Base Product: “T2” by H&B.

- D. Flashing Adhesive:
  - 1. As recommended by manufacturer for bedding, sealing laps, and sealing to vertical surfaces.

## **2.7 CAVITY VENTS AND WEEPS**

- A. Vent / Weeps:
  - 1. Head Vent:
    - a. Polypropylene honeycomb vent/weep for installation in head joint in brick masonry to provide ventilation of cavity, weeping cavity moisture, and restricting ingress of insects and debris.
    - b. Standard size: 3/8 IN x 2-1/2 IN x 3-3/8 IN.
    - c. Color: Gray.
    - d. Base Product: "QV – Quadro-Vent" by H&B.
  - 2. Rope Weeps:
    - a. Field cut cotton sash cord, nominal 3/8 IN.
    - b. Use in combination with Head Vent, where indicated
      - 1) See Part 3 for locations.

## **2.8 CAVITY PROTECTION MATERIAL**

- A. Non-directional extruded high density polyethylene or polyester fiber:
  - 1. Thickness:
    - a. 2.0 IN.
  - 2. 10 IN high.
  - 3. Base Product: Mortar Net.

## **2.9 MISCELLANEOUS ITEMS**

- A. Bond Breaker Strips: Asphalt saturated felt, unperforated; ASTM-D226, Type 1.
- B. Pre-Molded Control Joint Strips (at CJ's in CMU walls):
  - 1. Solid rubber strips with a Shore A durometer hardness of 60 to 80.
  - 2. Designed to fit standard sash block and maintain lateral stability in masonry wall.
  - 3. Size and configuration as indicated.
  - 4. Base Product: "#RS Standard" by H&B.
    - a. Exception: Where Sash Blocks are not used: Use "#RS-8" or "#RS-12" as appropriate for wall thickness.
  - 5. Use symmetrical design for intermediate control joints, and asymmetrical design (Tee-configuration) where CMU wall abuts or intersects a perpendicular element.
  - 6. Do not bridge CJ's with Horizontal ladder/truss:
    - a. Install 2 smooth dowels or other approved device across Control Joints which resist shear loads but allow in-plane expansion, contraction and linear shrinkage movements.
- C. Galvanizing Repair Paint:
  - 1. High zinc dust content paint for re-galvanizing welds and abrasions in galvanized steel.
  - 2. Base Product: "ZRC Galvilite" by ZRC Worldwide.
  - 3. Optional: "Organic Zinc Coating 90-93" by Tnemec.
- D. Compressible Filler:
  - 1. Closed cell neoprene sponge.
  - 2. Thickness: 1/4 IN.
  - 3. Base Product: "NS" by H&B.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION – GENERAL**

- A. Keep vertical joint behind weeps free of mortar.

- B. Comply with provisions of ACI 530 and ACI 530.1, except where exceeded by requirements of the contract documents.

### **3.2 INSTALLATION – MASONRY WALL ANCHORS**

- A. Anchoring CMU Walls to building superstructure or to other intersecting CMU walls:
  - 1. Where masonry walls abut concrete or steel structural elements including shear walls, columns, and spandrel beams, anchor thereto with specialized anchors types indicated.
  - 2. Where bearing walls meet or intersect, erect walls separately and anchor together with rigid steel anchors spaced not more than 24 IN apart vertically.
    - a. Embed end bends of anchors in cores of masonry units filled with mortar or grout.
  - 3. Where non-bearing walls meet or intersect other walls, erect walls separately and anchor together with wire mesh ties spaced not more than 16 IN apart vertically.
    - a. Embed ties centered in mortar within joint.
  - 4. Fill solid with mortar or grout masonry unit cells within vertical planes of anchors, or use solid masonry units above and below anchors.

### **3.3 INSTALLATION - DOVETAIL ANCHORS**

- A. General:
  - 1. Installation of Dovetail Slots AND Anchor Devices (all inclusive):
    - a. All Dovetail anchor components, including slots (embedded channels), provided by this Section 04 05 23.
- B. Dovetail Anchors used at Masonry Veneer:
  - 1. Use Dovetail anchors as veneer anchors where back-up construction is Cast-in-Place Concrete, including but not limited to:
    - a. Concrete Shear walls.
    - b. Concrete Columns.
    - c. Concrete Spandrel Beams.
  - 2. General Spacing:
    - a. Provide sufficient anchors to have minimum of 1 anchor per 1.77 FT<sup>2</sup> of veneer wall area; with neither vertical nor horizontal spacing exceeding 16 IN OC.
  - 3. General Horizontal Spacing of slots:
    - a. Concrete Walls:
      - 1) External Corners: First vertical row shall start within 4 IN of external corners and no more than 16 IN on center thereafter.
      - 2) Internal Corners: First vertical row shall start within 8 IN of internal corners and no more than 16 IN on center thereafter.
    - b. Concrete Columns:
      - 1) Where Face Width of column is less than 24 IN: Locate a vertical row 6 IN from each corners.
      - 2) Where Face Width of column is greater than 24 IN: Locate a vertical row 6 IN from each corners and no more than 16 IN O.C. center thereafter.
    - c. Concrete Spandrel Beams:
      - 1) Locate as described for Concrete Walls (above).
  - 4. Vertical Extent of slots:
    - a. Bottom and top edges of Dovetail Slots shall terminate no more than 4 IN from sills, heads, lintels, parapets, shelf angles, through-wall flashing and similar horizontal elements.
  - 5. Edge Condition Spacing:
    - a. Locate horizontally within 8 IN of corners, control joints, expansion joints, jambs of doors, jambs of windows, and other similar edges of masonry veneer walls.
- C. Dovetail Anchors used to anchor CMU walls to intersecting concrete structural items:
  - 1. Use where CMU walls intersect Cast-in-Place concrete walls.
  - 2. Use where CMU walls abut Cast-in-Place concrete columns or other structural elements.
  - 3. Other similar elements and where indicated.

4. Must permit vertical differential movement.

### 3.4 INSTALLATION – REINFORCING

- A. Reinforcing at CMU Walls: See Section 04 22 00.

### 3.5 INSTALLATION THROUGH-WALL FLASHING

- A. Through-Wall Flashing:

1. General:
  - a. Install to provide positive drainage of cavity moisture.
  - b. Coordinate with built in items and brick ledges.
2. Drip Plate:
  - a. Adhere to Ledge Angle, with drip flange extending past the face of the masonry.
3. Flashing Membrane:
  - a. Extend the bottom edge of flashing over the top surface of Drip Plate.
    - 1) Terminate rubberized flashing membranes 1/2 IN from exterior face of wall.
    - 2) Bond Flashing to Drip Plate.
    - 3) Lap flashing ends minimum of 6 IN and bond 2 pieces together.
  - b. Extend top edge of flashing membrane up face of wall minimum 8 IN.
  - c. Termination of top edge:
    - 1) Where Metal Stud/Gypsum sheathing is the back-up wall:
      - a) Cut Air Retarder as required and temporarily fold up the wall.
      - b) Bond flashing membrane to directly face of sheathing.
      - c) Mechanically secure its top edge with Termination Bar.
      - d) Return Air Retarder back down so that it overlaps Flashing Membrane (shingle style).
      - e) Minimum overlap: 6 IN.
    - 2) Where Masonry wall is the back-up wall:
      - a) Install upper edge of flashing using a Termination Bar.
      - b) Optional: A Reglet may be used in lieu of the Termination Bar.
    - 3) Where Cast-in-place Concrete items are the back-up:
      - a) Secure upper edge of flashing with Termination Bar.
      - b) Optional: A Reglet may be used in lieu of the Termination Bar.
    - 4) Calk top edge of Termination Bar to back-up.
  - d. Provide End Dams as described below, and as indicated.
4. Seal under Ledge Angle with approved backer and sealant (Sealant specified in Section 07 92 13).
5. Use Compressible Filler below relieving angles.
6. Where items penetrate through-wall flashing systems, such as anchors used to secure stone/APC copings and sills:
  - a. Adequately seal around penetrating item.

- B. End Dams (Flexible Membrane Flashing):

1. Configuration:
  - a. Extend lateral ends of flashing beyond openings.
  - b. Return it up and back into head joints.
  - c. Bond to head face of installed masonry units.
  - d. Install sill (stone, brick or other) after End Dam is in place.
  - e. Minimum Height at sides: 4 IN high.
  - f. Comply with BIA TechNote 21B and 7.
2. Provide End Dams made from flexible membrane flashing at the following locations:
  - a. Jamb edges of Sills for doors, windows, louvers and other similar openings.
  - b. Jamb edges of Lintels for doors, windows, louvers and other similar openings.
  - c. Step-flashing (where flashing steps up to follow grade).
  - d. At terminal ends of masonry veneer walls (i.e. where masonry wall meets curtainwall or other material).

- e. Other similar locations and where indicated.
- C. Head Vents and Rope Wick combination:
1. Locations:
    - a. Base of brick masonry cavity wall and through-wall flashings:
      - 1) Rope Wicks:
        - a) Minimum Length: 16 IN.
        - b) Locate in first brick course ABOVE through-wall flashing at base of wall.
        - c) Space 16 IN apart horizontally.
        - d) Set outer end of ropes approximately flush with exposed face of masonry veneer.
        - e) Loose-lay inner end of ropes at bottom of cavity, running parallel to back face of masonry veneer.
        - f) Leave rope wicks in place after mortar has set.
      - 2) Head Vent:
        - a) Locate in second brick course ABOVE through wall flashing at base of wall.
        - b) Install Head Vent at 24 IN apart horizontally.
    - b. Brick masonry cavity walls at shelf angles and through-wall flashing:
      - 1) Rope Wicks:
        - a) Minimum Length: 16 IN.
        - b) Locate in first brick course ABOVE shelf angle and through-wall flashing.
        - c) Space 16 IN apart horizontally.
        - d) Set outer end of ropes approximately flush with exposed face of masonry veneer.
        - e) Loose-lay inner end of ropes at bottom of cavity, running parallel to back face of masonry veneer.
        - f) Leave rope wicks in place after mortar has set.
      - 2) Head Vent:
        - a) Locations:
          - (1) Locate in second brick course ABOVE shelf angle and through-wall flashing.
          - (2) Locate in second brick course BELOW shelf angle and through-wall flashing:
        - b) Install Head Vent at 24 IN apart horizontally.
        - c) Align head vents installed above and below shelf angle and through-wall flashing with each other.
    - c. Brick masonry cavity walls at continuous lintel angles and through-wall flashing:
      - 1) Rope Wicks:
        - a) Minimum Length: 16 IN.
        - b) Locate in first brick course above continuous lintel angle and through-wall flashing.
        - c) Space 16 IN apart horizontally.
        - d) Set outer end of ropes approximately flush with exposed face of masonry veneer.
        - e) Loose-lay inner end of ropes at bottom of cavity, running parallel to back face of masonry veneer.
        - f) Leave rope wicks in place after mortar has set.
      - 2) Head Vent:
        - a) Locate in second brick course above continuous lintel angle and through-wall flashing.
        - b) Install Head Vent at 24 IN apart horizontally.
    - d. Brick masonry joints at top of brick cavity wall:
      - 1) Head Vent:
        - a) Locate in second brick course below coping and through-wall flashing, or metal cap flashing.
        - b) Install Head Vent at 24 IN apart horizontally.

### **3.6 INSTALLATION OF OTHER ITEMS**

- A. Cavity Protection Material:
  - 1. Install per manufacturer's recommendations at ledge angles and bottom of wall.
  - 2. Provide thickness appropriate for cavity.
- B. Galvanizing Repair Paint:
  - 1. Apply wherever galvanized masonry accessories are welded or where the galvanic coating is scratched, abraded or otherwise damaged.
- C. Compressible Filler:
  - 1. Install in the masonry joint below relief angles to preclude mortar from being installed in the joint.
  - 2. Install sealant per Section 07 92 13 in joint to insure water-tightness.

**END OF SECTION**



**SECTION 04 22 00**  
**CONCRETE MASONRY (CMU)**

**PART 1 - GENERAL**

**1.1 SUBMITTALS**

- A. Project Information:
  - 1. Units to be used in Fire Rated walls: Certification of level of fire-resistance provided by units proposed (determine by either Equivalent Thickness method referenced).
  - 2. Precast Concrete Lintels.
- B. LEED Information:
  - 1. LEED Credits MR 4.1 and 4.2, Recycled Content: Product data indicating percentages by weight of post-consumer and post-industrial recycled content for products having recycled content; include statement indicating costs for each product having recycled content.
  - 2. LEED Credits MR 5.1 and 5.2, Regional Materials: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.

**1.2 PRODUCT DELIVERY, STORAGE, AND HANDLING**

- A. Deliver units on pallets with tight covers or deliver in cubes and store covered on dunnage.
- B. Protect materials from elements.

**1.3 JOB CONDITIONS**

- A. Protect against weather, when work is not in progress.
- B. Cover top of walls with waterproof membrane, extend at least 4 FT down both sides of walls; anchor in place.
- C. Provide cold weather protection; Section 04 05 05.

**PART 2 - PRODUCTS**

**2.1 GENERAL**

- A. Units to be used in Fire-Resistive wall assemblies:
  - 1. Where units are used in assemblies with Fire-Resistive Rating:
    - a. Provide units with aggregate type, and equivalent thickness that yield fire-resistances indicated for each wall assemblies.
    - b. Acceptable calculation methodologies for determining Equivalent Thickness:
      - 1) NCMA TEK 7-1A.
      - 2) ACI 216.1 / TMS 0216.
    - c. Units tested per ASTM-E119 are also acceptable.
  - 2. Provide solid units, or grouted hollow units, under lintels.
  - 3. Provide matching concrete bricks as required.
  - 4. Do not use chipped, cracked, spalled units exposed in finish work.
  - 5. Provide reinforced concrete masonry lintels fabricated from precast or site cast load bearing masonry units, filled and reinforced as indicated.

## **2.2 CONCRETE MASONRY UNITS - GENERAL-PURPOSE**

- A. Concrete Masonry Units (CMU):
  - 1. Modular units complying with ASTM-C90.
  - 2. Aggregate:
    - a. Light Weight: In accordance with ASTM-C331.
  - 3. Sizes and shapes as indicated or required for conditions.
  - 4. Face shell and web thickness: Table 3, ASTM-C90.
  - 5. Color(s):
    - a. Standard grey.
- B. Ground face concrete masonry units (GFCMU):
  - 1. Where ground face units are indicated, provide integrally colored concrete blocks with burnished exposed faces.
    - a. Concrete mix shall include additive to prevent efflorescence.
    - b. Exposed faces shall be ground to expose aggregate and finished with factory-applied heat-treated moisture-resistant clear satin gloss acrylic.
    - c. Units shall comply with ASTM-C90, Type 1, and the following requirements:
      - 1) ASTM-C744: Adhesion, abrasion, color change and resistance to crazing.
      - 2) ASTM-C67: Freezing and thawing.
    - d. Unit size: Modular of depth indicated.
  - 2. Base product: Hagerstown Block Company.
    - a. Colors: GR-685.
- C. Corner Units:
  - 1. Use square-nosed units at external corners and at jambs of openings.
- D. Weight Classification:
  - 1. Light weight.
- E. Unit Size(s) (LxWxH):
  - 1. Manufactured to dimensions indicated on Drawings.
- F. Pattern and Texture(s):
  - 1. Smooth face (standard texture).

## **2.3 CONCRETE LINTELS AND SILLS**

- A. General:
  - 1. Fabricate concrete lintels and sills in plant or site cast.
  - 2. Use concrete having minimum 28 day compressive strength of 4000 PSI.
  - 3. Exposed surfaces to have surface texture and color to match adjacent concrete masonry units.
  - 4. Fabricate lintels to modular sizes to match coursing.
  - 5. Mark tops of lintels with lintel schedule number.
- B. Fabricate lintels by one of following methods:
  - 1. Use masonry lintel units and reinforced concrete fill.
  - 2. Cast lintels monolithically with reinforcement.
  - 3. Provide vertical dummy joints matching pattern of vertical joints and scoring in concrete masonry walls in which installed.

## **2.4 REINFORCING**

- A. Horizontal Reinforcing products including wire ladder truss: Specified in Section 04 05 23.
- B. Reinforcing Bars (vertical and horizontal): Specified in Section 03 20 00.

## **2.5 ACCESSORY ITEMS**

- A. Masonry accessories: See Section 04 05 23.

- B. Mortar and grout: See Section 04 05 13.
- C. Sealants: As specified in Section 07 92 13 and Section 07 92 16.
- D. Grout fill: As specified in Section 04 05 13.
- E. Masonry Veneer Anchors: Specified in Section 04 05 23.

## **PART 3 - EXECUTION**

### **3.1 INSPECTION**

- A. Verify suitability of substrate to accept work.
- B. Verify that anchors and flashings are correct.
- C. Installation constitutes acceptance of substrate and responsibility for performance.

### **3.2 INSTALLATION - GENERAL**

- A. General:
  - 1. Comply with provisions of ACI 530 and ACI 530.1, except where exceeded by requirements of the contract documents.
  - 2. Build walls to thickness indicated.
  - 3. Build single wythe walls to actual masonry thickness.
  - 4. Perform cutting with masonry saws.
  - 5. Cut as required to provide pattern indicated.
  - 6. Use solid units where cutting or laying would expose holes.
  - 7. Do not install damaged units.
  - 8. Do not wet concrete masonry units.
  - 9. Avoid use of less than half size units.
  - 10. Build chases and recesses as indicated and required for work of other trades.
- B. Install in running bond unless otherwise indicated.
- C. Identification of Fire and Smoke Walls:
  - 1. Identify partitions indicated on Drawings as having a required fire or smoke rating.
  - 2. Identification: Same as indicated on drawing legend.
  - 3. Location: 10 FT on center, both sides of partition, above ceiling line:
    - a. Above access panels in hard ceiling.
  - 4. Lettering: 2 IN Helvetica, painted with aid of stencils.
  - 5. Color: Red.

### **3.3 LAYING AND TOOLING**

- A. Lay out walls in advance for uniform and accurate spacing of bond patterns and joints.
- B. Properly locate openings, movement type joints and offsets.
- C. Lay masonry units with face shells of bed joints fully mortared:
  - 1. Webs shall be fully mortared in all courses of piers, columns, an pilasters, and in the starting course on foundations, and when necessary to confine grout or loose filled insulation.
  - 2. Head joints shall be mortared a minimum distance from each face equal to the face shell thickness.
  - 3. Vertical cells to be grouted shall be aligned and unobstructed openings.
- D. Maintain nominal 3/8 IN joint widths:
  - 1. Cut joints flush where concealed.
  - 2. Tool exposed joints.
  - 3. Compress mortar in below ground joints.

- E. During tooling of joints, enlarge voids or holes, except weepholes, and completely fill with mortar.
- F. Point up joints at corners, openings and adjacent work to provide neat, uniform appearance.
- G. Remove masonry disturbed after laying:
  - 1. Clean and relay in fresh mortar.
  - 2. Do not pound units to fit.
  - 3. If adjustments are required, remove units, clean, and reset in fresh mortar.
- H. Where work is stopped and later resumed, rake back 0.5 masonry unit length in each course; do not tooth:
  - 1. Remove loose units and mortar prior to laying fresh masonry.
- I. As work progresses, build in items indicated and specified:
  - 1. Fill in solidly with mortar around built-in items.
  - 2. Grout fill space between metal frames and masonry.
  - 3. Where built-in items are to be embedded in cores of hollow masonry units, place layer of metal lath in joint below and fill core with grout.
- J. Remove masonry protrusions extending 1/2 IN or more into cells or cavities to be grouted.

### **3.4 REINFORCING**

- A. General:
  - 1. In addition to the following general requirements, provide reinforcing size type and spacing as indicated on Drawings and Details.
- B. General Reinforcing Requirements:
  - 1. Reinforce masonry openings over 12 IN wide, where control and expansion joints are not provided, with horizontal joint reinforcing placed in 2 horizontal joints above lintel and below sill:
    - a. Extend reinforcing minimum of 24 IN beyond jambs of opening.
  - 2. Embed horizontal reinforcing in bed joint mortar for entire length with minimum cover of 5/8 IN on exterior side of walls and 1/2 IN at other locations:
    - a. Provide same minimum cover for other embedded items.
  - 3. Minimum laps for horizontal reinforcing: 6 IN.
  - 4. Do not bridge Control Joints or Expansion Joints with horizontal reinforcing:
    - a. Install smooth dowels or other approved device across Control Joints which resist shear loads but allow in-plane expansion, contraction and linear shrinkage movements.
  - 5. Provide continuous horizontal joint reinforcing in walls all concrete masonry walls:
    - a. See elsewhere for reinforcing requirements for anchored veneers.
  - 6. Unless otherwise indicated:
    - a. Install horizontal reinforcing within 8 IN of first bed joint.
    - b. Running Bonds: Install horizontal reinforcing at 16 IN OC vertically thereafter.
    - c. Stacked Bonds: Install reinforcing 8 IN OC vertically thereafter where stack bond masonry is indicated.
  - 7. Make corners and wall intersections by use of prefabricated "L" and "T" sections:
    - a. Cut and bend as required.
  - 8. At intersecting load bearing walls install rigid steel anchors not over 24 IN OC vertically:
    - a. Embed ends in grout filled cores.
- C. Horizontal Reinforcing Bars:
  - 1. Install where indicated.
  - 2. Sizes as indicated.
- D. Vertical Reinforcing Bars at CMU Walls other than Anchored Veneers:
  - 1. Install vertical reinforcing bars as indicated.
  - 2. When not indicated, provide the following minimum vertical reinforcing:
    - a. Provide one No.5 continuous at 48 IN on center.

- b. Provide one No.5 Continuous at each corner, at each side of each opening, at each side of each control joint, and at the ends of walls.

### **3.5 GROUT FILL**

- A. Do not place grout until entire portion of wall to be grouted has attained sufficient strength to resist grout pressure.
- B. Use mechanical means to remove air pockets and void for proper consolidation of fill.
- C. Grout walls incrementally as CMU is placed. Minimize lift heights to ensure that walls will remain safe and stable until grout has attained sufficient strength to resist overturning or collapse:
  1. Consider detrimental lateral loads which could be anticipated including storms, winds, seismic, soil etc.
  2. Adequately brace as needed.
- D. Where vertical or horizontal reinforcing bars are required, place and inspect prior to filling operation.
- E. Fill cores containing vertical reinforcing.
- F. Place in maximum 4 FT lifts.
- G. Leave lifts minimum 1-1/2 IN below top of course to form key with next lift.

### **3.6 CONTROL JOINTS (CJ)**

- A. Provide Control Joints (and other movement joints) as indicated.
- B. Where not indicated:
  1. Locate CJ's at natural planes of weakness in masonry wall such as:
    - a. Changes in wall height.
    - b. Changes in wall thickness, such as at pipe and duct chases and pilasters.
    - c. At (above) movement joints in foundations and floors on which wall is bearing.
    - d. At (above) movement joints in roofs and floors that bear on wall.
    - e. Openings: Within 8 IN of one or both jambs of door, window, louver and similar openings:
      - 1) Place CJ at one side of openings less than 6 FT wide.
      - 2) Place CJ at both sides of openings greater than 6 FT wide.
    - f. Corners: Within 4 FT of corners (on at least one leg):
      - 1) Opposing leg: No more than 20 FT from corner.
    - g. Intersections: Within 12 FT of wall intersections.
  2. In addition to of the above, locate CJ's at no more than the following absolute maximum (horizontal) distances:
    - a. Walls less than 16 FT-8 IN tall: Not more than 1-1/2 times the wall height.
    - b. Walls greater than 16 FT-8 IN tall: No more than 25 FT O.C.
- C. Installation/construction of CJ's:
  1. Utilize sash blocks or similar shapes which have slotted end to accept gaskets:
    - a. Pre-molded Control Joint Strips: Specified in Section 04 05 23.
  2. Cut ladder/truss type horizontal reinforcing as it crosses CJ's.
  3. While mortar is still fresh, rake out mortar from joint, leaving a completely clean joint.
  4. After wall has cured, install backer rod and sealant on both wall faces:
    - a. Sealant and Backer Rod: Specified in Section 07 92 13 and Section 07 92 16.

### **3.7 LINTELS, FLASHING AND SEALANTS**

- A. Installation of flashing, weeps and similar masonry accessories: Specified in Section 04 05 23.
- B. Sealant installation requirements:
  1. Sealant and Backer Rod: Specified in Section 07 92 13 and Section 07 92 16.

2. Remove mortar in joint under relieving lintel and at ends.
  3. Seal joints between CMU's and relieving lintels.
  4. Seal Expansion and Control Joints.
- C. Provide precast masonry lintels wherever openings more than 12 IN wide are indicated without other structural support or other supporting lintels:
1. Thoroughly cure lintels before handling and installation.
  2. See lintel schedule for size and type required.

### **3.8 INSTALLATION TOLERANCES**

- A. Maximum variation from plumb in vertical lines and surfaces of columns, walls and arises:
1. 1/4 IN in 10 FT.
  2. 3/8 IN in a story height not over 20 FT.
  3. 1/2 IN in 40 FT or more.
- B. Maximum variation from plumb for external corners, control joints, expansion joints and other conspicuous lines:
1. 1/4 IN in any story or 20 FT maximum.
  2. 1/2 IN in 40 FT or more.
- C. Maximum variation from level of grades for exposed lintels, sills, parapets, horizontal grooves and other conspicuous lines:
1. 1/4 IN in any bay or 20 FT.
  2. 1/2 IN in 40 FT or more.
- D. Maximum variation from plan location of related portions of columns, walls and partitions:
1. 1/2 IN in any bay or 20 FT.
  2. 3/4 IN in 40 FT or more.
- E. Maximum variation in cross section of columns and thicknesses of walls from dimensions indicated:
1. Minus 1/4 IN.
  2. Plus 1/2 IN.

### **3.9 REPAIR, POINTING AND CLEANING**

- A. Remove and replace loose, stained, or damaged units:
1. Provide new units to match.
  2. Install in fresh mortar.
  3. Point to eliminate evidence of replacement.
- B. Clean in accordance with Section 04 05 10.

**END OF SECTION**

**SECTION 04 42 03**  
**INDIANA LIMESTONE**

**PART 1 - GENERAL**

**1.1 DEFINITIONS**

- A. Indiana Limestone:
  - 1. Oolitic Limestone, as quarried in Lawrence, Monroe, and Owen counties Indiana and complying with ASTM-C568 and with standards in ILI's "Indiana Limestone Handbook".
- B. Dimension Stone Cladding:
  - 1. Stone cladding panels generally having face dimensions much larger than their thickness and are supported from the building frame by metal anchors. Anchors shall be mechanically secured to holes or kerfs in stone units. Joints shall typically be mortar. Dimension stone cladding units shall be cut to size and mechanically finished; honed on exposed surfaces.

**1.2 SCOPE**

- A. Installation configuration(s) of Indiana Limestone on this project:
  - 1. Dimensional Limestone Cladding (panels).

**1.3 QUALITY ASSURANCE**

- A. Installer Qualifications: A qualified installer who employs experienced stonemasons and stone fitters.
- B. Source Limitations:
  - 1. Indiana Limestone: Obtain stone from one quarry with resources to provide materials of consistent quality in appearance and physical properties.
- C. Materials, anchors and installation standards:
  - 1. "Indiana Limestone Handbook" by Indiana Limestone Institute of America (ILIA); current edition.
  - 2. Other published standards by Indiana Limestone Institute.

**1.4 DESIGN REQUIREMENTS**

- A. Design of Dimensional Stone panels, anchors and supports shall be provided under the direct supervision of, and sealed by a registered Engineer, licensed to practice Structural Engineering in the State of New York.
- B. Engineering Requirements:
  - 1. Design panels, anchors and connection hardware for dead load, wind load and seismic load in accordance with applicable building codes.
  - 2. Demonstrate, by engineering calculation, that proposed anchors and connection hardware can safely support the anticipated loads.
    - a. When approved by Architect, load tests may be substituted for calculations.

**1.5 SUBMITTALS**

- A. Shop Drawings:
  - 1. Setting Drawings (Dimensional Stone):
    - a. Indicate layout, pertinent dimensions, anchorages, mark numbers, and jointing methods.
    - b. Engineering design calculations and test results.

- B. Samples:
  - 1. Samples for initial aesthetic approval; minimum 12 IN square samples of material proposed for use.
    - a. Submit samples in sufficient quantity to show extreme variation which may reasonably occur in each kind of stone, regarding color, texture and quality.
    - b. Architect reserves right to approve more limited range of variation.
- C. LEED Information:
  - 1. LEED Credits MR 4.1 and 4.2, Recycled Content: Product data indicating percentages by weight of post-consumer and post-industrial recycled content for products having recycled content; include statement indicating costs for each product having recycled content.
  - 2. LEED Credits MR 5.1 and 5.2, Regional Materials: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.

## **1.6 MOCK-UP**

- A. Construct on-site minimum 4 x 6 FT mockup showing coursing, texture and color patterns.
  - 1. Include examples of typical details, treatment and anchoring.
- B. Approved mockup may become part of the completed Work.

## **1.7 DELIVERY, STORAGE, AND HANDLING**

- A. Limestone material:
  - 1. During transport and storage, separate units from one another by wood strips or wedges.
  - 2. Rest units on wood or other approved types of material.
  - 3. Do not allow limestone material to rest directly on earth.
  - 4. Store so that markings corresponding to setting drawings are easily discernible.
  - 5. Cover limestone with waterproof covering and protect from weather and dirt.
  - 6. Handle thin units carefully, and store in vertical position.
- B. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

## **1.8 PROJECT CONDITIONS**

- A. Cold-Weather Requirements for Mortar installation:
  - 1. Comply with requirements in Section 04 05 05.
  - 2. Do not use frozen materials or materials mixed or coated with ice or frost.
  - 3. Do not build on frozen substrates.
  - 4. Remove and replace stone masonry damaged by frost or freezing conditions.
  - 5. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.
  - 6. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 DegF and above and will remain so until masonry has dried, but not less than 7 days after completing cleaning.
- B. Hot-Weather Requirements for Mortar installation:
  - 1. Comply with requirements in Section 04 05 05.
  - 2. Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

## **1.9 COORDINATION**

- A. Coordinate with installers of building superstructure and back-up walls.
- B. Advise installers of other work about specific requirements for placement of anchors, flashing, and similar items to be built into stone masonry.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Acceptable Manufacturers:
1. Indiana Limestone:
    - a. Base:
      - 1) Indiana Oolitic Limestone, as quarried in Lawrence, Monroe, and Owen counties, Indiana.

### 2.2 INDIANA LIMESTONE

- A. General:
1. Oolitic Limestone, as quarried in Lawrence, Monroe, and Owen counties, Indiana.
  2. Material complying with standards in ILI's "Indiana Limestone Handbook".
  3. Material complying with ASTM-C568.
- B. Classification and Type:
1. II Medium-Density, Oolitic limestone.
- C. Grade and Color:
1. Select, buff.
  2. Color terms are defended by classification system established by ILI for Indiana Oolitic Limestone.
  3. Match Architect's samples for color, finish, and other stone characteristics relating to aesthetic effects.
- D. Physical Properties:

| MINIMUM PHYSICAL PROPERTIES<br>"Indiana Limestone" |             |                |
|--|-------------|----------------|
| Property   | Test Method | Required Value |
| Absorption by weight (Max)                         | ASTM-C97    | 7 1/2 %        |
| Minimum Density                                    | ASTM-C97    | 144 LBS/CU FT  |
| Minimum Compressive Strength                       | ASTM-C170   | 4000 PSI       |
| Modulus of Rupture (min)                           | ASTM-C99    | 700 PSI        |

### 2.3 MECHANICAL ANCHORS FOR DIMENSIONAL STONE

- A. General:
1. Contractor shall design and provide anchors used in Dimensional Stone cladding.
    - a. Anchorages indicated on Contract Documents are intended to convey basic concept.
  2. Contractor to determine the actual spacing, type and configuration of anchorages through proper engineering design.
  3. Anchorage design shall comply with local building codes and design practice listed in "Indiana Limestone Handbook".
  4. Factory-fabricate Limestone panels units to accommodate anchor devices to be used.
  5. Material for all anchor types: Type 304 or 316 Stainless Steel unless otherwise indicated.
- B. Anchors for general use:
1. Size: Sufficient to extend at least halfway, but not less than 1-1/2 IN, through stone masonry and with at least 5/8 IN cover on outside face.
  2. Sufficient length to anchor to backing.
  3. Sufficient size and configuration for support of stone and applicable superimposed loads.
- C. Cramps:
1. 3/16 x 1 x 8 IN long after ends are turned up 1-1/2 IN.

2. Where doweling is required in addition to cramping, form cramps with dowel welded to underside of cramp.
- D. Suspension anchorage or bolt hangers:
  1. Minimum Diameter: 3/4 IN min.
  2. Lewis or Cinch anchor type with sufficient depth of anchorage in stone to develop hanger strength.
- E. Dowels: Manganese bronze, sizes and lengths required for purpose.
- F. Bolts, nuts, and washers: Stainless steel type 304.
- G. Miscellaneous: Use special anchors as approved for projecting pieces of stone or for anchorage to structural steel.

## **2.4 RELATED MATERIALS**

- A. Portland Cement, Lime Mortars and Grout: Specified in Section 04 05 13, and further modified as follows:
  1. Do not use calcium chloride.
  2. Limit cementitious materials in mortar to Portland cement and lime; alternative cementitious materials are not permitted.
  3. Grouts and mortars containing gypsum are not permitted.
- B. Flashings and other masonry accessories: Specified in Section 04 05 23.
- C. Masonry Cleaning Products: Specified in Section 04 05 10.
- D. Insulation: Specified in Section 07 21 00.
- E. Air Barrier/Weather-resisting membrane: Specified in Section 07 27 16.
- F. Caulking, sealants and backer-rods: Specified in Section 07 92 13.

## **2.5 FABRICATION - GENERAL**

- A. General:
  1. Fabricate stone to comply with sizes, shapes, and tolerances recommended by applicable stone association or, if none, by stone source, for faces, edges, beds, and backs.
    - a. Comply with recommendations in ILI's "Indiana Limestone Handbook."
  2. Select and cut stone to produce pieces of thickness, size, and shape indicated, including details on Drawings.
    - a. Dress joints (bed and vertical) straight and at right angle to face unless otherwise indicated.
  3. Carefully inspect stone at quarry or fabrication plant for compliance with requirements for appearance, material, and fabrication.
    - a. Replace defective units before shipment.
    - b. Clean sawed backs of stone to remove rust stains and iron particles.
  4. Make arises sharp and true with edges slightly eased.
  5. Cut accurately to shape and dimensions with joints as indicated.
    - a. Form exposed faces true and without wind.
    - b. Make beds and joints straight, at right angles to face.
  6. Saw or dress backs parallel to wall face.
  7. Cut stone to set on its natural bed.
- B. Finish exposed faces and edges of stone to comply with requirements indicated for finish and to match approved samples and mockups.

## **2.6 FABRICATION – DIMENSIONAL STONE**

- A. General:

1. Fabricate stone units in sizes and shapes required to comply with requirements indicated, including details on Drawings and Shop Drawings.
  2. Comply with recommendations in ILI's "Indiana Limestone Handbook."
  3. Cut stone to produce uniform joints of widths indicated.
  4. Dress joints (bed and vertical) straight and at right angle to face, unless otherwise indicated. Shape beds to fit supports.
  5. Cut and drill sinkages and holes in stone for anchors, fasteners, supports, and lifting devices as indicated or needed to set stone securely in place.
- B. Control depth of stone and back check to maintain minimum clearance of 1 IN between backs of stone units and surfaces or projections of structural members, insulation (if any), backup walls, and other work behind stone.
- C. Quirk-miter corners, unless otherwise indicated; provide for cramp anchorage in top and bottom bed joints of corner pieces.
- D. Contiguous Work: Provide chases, reveals, reglets, openings, and similar features as required to accommodate contiguous work.
- E. Fabricate molded work, including washes and drips, to produce stone shapes with a uniform profile throughout entire unit length, with precisely formed arris slightly eased to prevent snipping, and with matching profile at joints between units.
- F. Clean backs of stone to remove rust stains, iron particles, and stone dust.
1. Inspect finished stone units at fabrication plant for compliance with requirements for appearance, material, and fabrication.
  2. Replace defective units.
- G. Grade and mark stone for overall uniform appearance when assembled in place.
1. Natural variations in appearance are acceptable if installed stone units match range of colors and other appearance characteristics represented in approved samples and mockups.
- H. Thickness of Dimensional Stone Panels: As indicated, but not less than the following:
1. Thickness: 4 IN plus or minus 1/4 IN.

## **2.7 SCHEDULE OF FINISHES AND TEXTURES**

- A. General:
1. Finish exposed faces and edges of stone to produce finishes indicated, and which match approved Samples and Mockups.
- B. Typical Finish:
1. Smooth.
- C. Finish for Sills:
1. Smooth.
- D. Finish for Lintels:
1. Smooth.
- E. Finish for Copings:
1. Smooth.
  2. Note: Finish exposed ends of copings same as front and back faces.

## **2.8 FABRICATION TOLERANCES**

- A. Fabricate stone to comply with sizes, shapes, and tolerances recommended by Indiana Limestone Association.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Examine surfaces indicated to receive stone for compliance with requirements for installation tolerances and other conditions affecting performance.
  - 1. Verify suitability of substrates to accept installation of stonework.
- B. Verify that dovetail slots, inserts, reinforcement, veneer anchors, flashing, and other embedded items are installed in substrates and required for or extending into stone are correctly installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.
  - 1. Start of installation constitutes acceptance of substrate conditions and responsibility for performance.

### **3.2 PREPARATION**

- A. Clean dirty or stained stone surfaces by removing soil, stains, and foreign materials before setting.
  - 1. Clean stone by thoroughly scrubbing with fiber brushes and then drenching with clear water.
  - 2. Do not use wire brushes.
  - 3. Use only mild cleaning compounds that contain no caustic or harsh materials or abrasives.

### **3.3 INSTALLATION – GENERAL**

- A. Keep vertical joint behind weeps free of mortar.
- B. Comply with provisions of ACI 530 and ACI 530.1.

### **3.4 SETTING DIMENSION STONE CLADDING**

- A. Coat limestone with dampproofing to extent indicated below:
  - 1. Stone at Grade: Beds, joints, and back surfaces to at least 12 IN above finish-grade elevations.
  - 2. Stone Extending below Grade: Beds, joints, back surfaces, and face surfaces below grade.
    - a. Allow cementitious dampproofing formulations to cure before setting dampproofed stone.
    - b. Do not damage or remove dampproofing while handling and setting stone.
- B. Execute dimension stone cladding installation by skilled mechanics and employ skilled stone fitters at Project site to do necessary field cutting as stone is set.
  - 1. Use power saws with diamond blades to cut stone.
  - 2. Produce lines cut straight and true, with edges eased slightly to prevent snipping.
- C. Contiguous Work: Provide reveals, reglets, and openings as required to accommodate contiguous work.
- D. Set stone to comply with requirements indicated on Drawings and Shop Drawings.
  - 1. Install anchors, supports, fasteners, and other attachments indicated or necessary to secure dimension stone cladding in place.
  - 2. Shim and adjust anchors, supports, and accessories to set stone accurately in locations indicated with uniform joints of widths indicated and with edges and faces aligned according to established relationships and indicated tolerances.
- E. Provide expansion, control, and pressure-relieving joints of widths and at locations indicated.
  - 1. Seal expansion, control and similar other joints with sealant specified in Section 07 92 13.
  - 2. Keep expansion joints free of mortar and other rigid materials.
- F. Install concealed flashing at continuous shelf angles, lintels, ledges, and similar obstructions to downward flow of water to divert water to building exterior.

- G. Keep cavities open where unfilled space is indicated between back of stone units and backup wall; do not fill cavities with mortar or grout.
  - 1. Place weep holes in joints where moisture may accumulate, including base of cavity walls, above shelf angles, and flashing.
  - 2. Install weep and vent tubes.
  - 3. Locate weep holes at intervals not exceeding 24 IN.
  - 4. Place cavity vents at tops of cavities, below shelf angles and flashing.
    - a. Locate vents in joints at intervals not exceeding 20 FT vertically.
    - b. Locate vents in joints at intervals not exceeding 60 IN horizontally.
- H. Mortar Setting:
  - 1. Set stone in full bed of mortar with head joints filled, unless otherwise indicated.
  - 2. Use setting buttons of adequate size, in sufficient quantity, and of thickness required to maintain uniform joint width and to prevent mortar from extruding.
  - 3. Hold buttons back from face of stone a distance at least equal to width of joint, but not less than depth of pointing materials.
  - 4. Do not set heavy units or projecting courses until mortar in courses below has hardened enough to resist being squeezed out of joint.
  - 5. Support and brace projecting stones until wall above is in place and mortar has set.
  - 6. Provide compressible filler in ends of dowel holes and bottoms of kerfs to prevent end bearing of dowels and anchor tabs on stone.
  - 7. Fill remainder of anchor holes and kerfs with mortar.
  - 8. Embed ends of sills in mortar; leave remainder of joint open until final pointing.
- I. Mortar Pointing
  - 1. To accommodate pointing mortar, rake out setting joints 5/8 to 3/4 IN before it has cured.
  - 2. Remove wedges and/or shims which protrude in to the cavity to be pointed.
  - 3. Rake joints to uniform depths with square bottoms and clean sides.
  - 4. Brush mortar joint clean.
  - 5. Prepare stone-joint surfaces for pointing with mortar by removing dust and mortar particles.
  - 6. Prior to pointing, wet cavity thoroughly.
  - 7. Fill with Pointing Mortar specified in Section 04 05 13.
  - 8. Where setting mortar was removed to depths greater than surrounding areas, apply pointing mortar in layers not more than 3/8 IN deep until a uniform depth is formed.
  - 9. Point stone joints by placing and compacting pointing mortar in layers not more than 3/8 IN deep.
  - 10. Compact each layer thoroughly and allow to become thumbprint hard before applying next layer.
  - 11. Tool joints with a round jointer having a diameter 1/8 IN larger than width of joint, when pointing mortar is thumbprint hard.
- J. Lewis Pins (temporary or permanent):
  - 1. Do not use Lewis Pins for units less than 3-1/2 IN thick.
  - 2. Do not install Lewis Pins closer than 2-1/2 IN from finished faces.

### **3.5 INSTALLATION TOLERANCES – DIMENSIONAL STONE CLADDING**

- A. Maximum Variation from Plumb:
  - 1. Vertical lines and surfaces of walls: 1/4 IN in 10 FT, 3/8 IN in 20 FT, or 1/2 IN in 40 FT or more.
  - 2. External corners, corners and jambs within 20 FT of an entrance, expansion joints, and other conspicuous vertical lines: 1/8 IN in 10 FT, 1/4 IN in 20 FT, or 3/8 IN in 40 FT or more.
- B. Maximum Variation from Level:
  - 1. Lintels, sills, water tables, parapets, horizontal bands, horizontal grooves, and other conspicuous horizontal lines: 1/8 IN in 10 FT, 1/4 IN in 20 FT, or 3/8 IN.

- C. Maximum Variation of Linear Building Line:
  - 1. Positions shown in plan and related portions of walls and partitions: 1/4 IN in 20 FT or 1/2 IN in 40 FT or more.
- D. Variation in Cross-Sectional Dimensions:
  - 1. Maximum thickness variation of walls from dimensions indicated: Plus or minus 1/4 IN.
- E. Maximum Variation in Joint Width:
  - 1. Do not vary from average joint width more than plus or minus 1/8 IN or more than 25% of nominal joint width, whichever is less.
- F. Maximum Variation in Plane between Adjacent Stone Units (Lipping): 1/16 IN.

### **3.6 PROTECTION**

- A. Protection of installed Limestone work:
  - 1. During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work.
  - 2. Cover partially completed stone masonry when construction is not in progress.
  - 3. Extend cover a minimum of 24 IN down both sides and hold cover securely in place.
- B. Stain Prevention:
  - 1. Immediately remove mortar and soil to prevent them from staining the face of limestone.
  - 2. Protect base of walls from rain-splashed mud and mortar splatter by coverings spread on the ground and over the wall surface.
  - 3. Protect sills, ledges, and projections from mortar droppings.
  - 4. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.

### **3.7 ADJUSTING AND CLEANING**

- A. Remove and replace stone masonry which is damaged or unsuitable.
  - 1. Remove broken, chipped, stained, or otherwise damaged stone.
  - 2. Stone may be repaired if methods and results are approved by Architect.
  - 3. Repair defective joints.
  - 4. Remove stone masonry not matching approved samples and mockups.
  - 5. Remove Stone masonry not complying with other requirements indicated.
  - 6. Remove and replace units having stains which cannot be removed by cleaning.
- B. Replace in a manner that results in stone masonry matching approved samples and mockups, complying with other requirements, and showing no evidence of replacement.
- C. In-Progress Cleaning:
  - 1. Clean stone masonry as work progresses.
  - 2. Remove mortar fins and smears before tooling joints.
- D. Final Cleaning:
  - 1. After mortar is thoroughly set and cured, clean stone masonry in accordance with the following:
    - a. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
    - b. Test cleaning methods on mockup; leave one-half of panel un-cleaned for comparison purposes.
      - 1) Obtain Architect's approval of sample cleaning before cleaning stone masonry.
    - c. Protect adjacent materials from contact with cleaner by covering them with liquid strippable masking agent, polyethylene film, or waterproof masking tape.
  - 2. Clean limestone masonry to comply with recommendations in ILI's "Indiana Limestone Handbook."

## **END OF SECTION**

**HDR**

**D I V I S I O N    0 5**  

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**METALS**

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**SECTION 05 12 10**  
**STRUCTURAL STEEL**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. Structural steel work covered herein shall be the fabrication and erection of steel framing and bracing members including connections and steel material either supporting or connected to steel members shown on the structural plans and not specified in other sections.

**1.2 QUALITY ASSURANCE**

- A. Quality standards latest edition of the following standards plus any corresponding published revisions at the time of bidding shall be the applicable standard. The Local Building Code shall govern when conflicts occur:
1. Building Code of New York State, 2007 Edition.
  2. American Institute of Steel Construction (AISC):
    - a. "Load and Resistance Factor Design Specification for Structural Steel Building" or as an alternate the "Specification for Structural Steel Buildings"- allowable stress design and plastic design may be used (referred to herein as the AISC Specification).
    - b. Code of Standard Practice for Steel Buildings and Bridges (referred to as AISC Code of Standard Practice).
    - c. Quality Certification Program.
  3. American Welding Society:
    - a. Structural Welding Code - Steel ANSI/AWS-D1.1 (referred to herein as the AWS Code). The AWS Code shall govern the techniques and quality of welding and testing procedures. Statements contained in the AWS Code requiring information to Bidders and/or Contract Documents to define nondestructive testing or statements defining responsibilities and obligations for services and payment shall be disregarded.
  4. Research Council on Structural Connections: Load and Resistance Factor Design Specifications for Structural Joints Using ASTM-A325 or A490 Bolts (referred to herein as the RCSC Specification).
  5. Steel Structures Painting Council (SSPC): Steel Structures Painting Manual Vol. 2, "System and Specifications" (referred to herein as the SSPC Specification).
- B. Qualifications:
1. Steel fabricator:
    - a. Certified by AISC Quality Certification Program for Structural Steel Fabricators and is designated as AISC Certified Fabricator, Standard for Steel Building Structures.
    - b. Fabricators not certified shall have minimum 10 years experience and shall employ an approved testing agency to inspect fabrication work performed off site. The testing agency shall furnish weekly inspection reports and a final report to BNL and the Architect certifying the work was performed in accordance with the specifications and approved shop drawings.
  2. Steel erector:
    - a. Minimum 10 years experience in erection of structural steel.
    - b. Certified as Certified Steel Erector by AISC quality Certification Program.
  3. Certification by other equivalent programs subject to approval of the Structural Engineer.
- C. Source quality control:
1. Provide access and facilities for testing agency during shop and field inspections.

- D. Testing and inspection: Testing, (except testing to qualify welders and as needed for Contractor's own quality control), will be performed at no cost to Contractor by a Testing/Inspection Agency employed by BNL. BNL's Testing/Inspection Agency may use nondestructive testing methods in addition to visual inspection to verify weld quality. Repair rejected welds as directed by Testing/ Inspection Agency at no additional cost to BNL.
- E. Provide testing and inspection agency with sufficient notification and access so that inspection and testing can be accomplished.
- F. Previous acceptance of material or finished members by testing and inspection agency or Architect/Engineer shall not prevent its rejection at later date if it does not comply with specifications.
- G. Tolerances:
  - 1. Rolling: ASTM-A6.
  - 2. Fabrication and Erection tolerances: AISC Code of Standard Practice.
- H. Complete final design of connections not defined on Contract Documents.
  - 1. Design connections at each end of member for loads (in Kips) noted in parenthesis. If load not indicated, design for capacity of member.
  - 2. Connection arrangement and detail shall be consistent with similar connections where indicated on Contract Documents.
  - 3. Connection design shall satisfy applicable Building Codes and shall use latest approach to design as offered by AISC.

### **1.3 SUBMITTALS**

- A. Shop drawings:
  - 1. Indicate details including cuts, copes, connections, holes and welds. Indicate shop and field welds using AWS symbols. Indicate connections where high strength bolts are required.
- B. Product data:
  - 1. Source and certification of quality for high-strength bolts, nuts and washers.
  - 2. Technical data on base plate grout.
- C. Project information:
  - 1. Fabricator's AISC Certification or name of independent testing agency for use by non-certified fabricator along with proof that fabricator has 10 years experience in fabrication of structural steel for buildings.
  - 2. Inspection reports and certification of shop fabrication by independent testing laboratory for non-certified fabricator.
  - 3. Steel erector's AISC Certification or proof that steel erector has 10 years experience in erection of structural steel.
  - 4. Connection design calculations.
  - 5. Welding Procedure Specification ( WPS) for shop and field welds.
- D. Contract closeout information:
  - 1. Certificate by fabricator that steel was fabricated in accordance with the approved construction documents.
  - 2. Certificate by erector that steel was erected in accordance with the approved erection plans and specifications.
- E. LEED Information:
  - 1. LEED Credits MR 4.1 and 4.2, Recycled Content: Product data indicating percentages by weight of post-consumer and post-industrial recycled content for products having recycled content; include statement indicating costs for each product having recycled content.

2. LEED Credits MR 5.1 and 5.2, Regional Materials: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.

#### **1.4 PRODUCT DELIVERY, STORAGE, AND HANDLING**

- A. Handle and store steel members above ground on platforms, skids or other supports.
- B. Keep members free of dirt, grease and other foreign material and protect against corrosion.

### **PART 2 - PRODUCTS**

#### **2.1 MATERIALS**

- A. Steel, structural “W” shapes and tee’s: ASTM-A992 (50 ksi yield point).
- B. Other steel shapes and plate: ASTM-A36.
- C. Tubing square or rectangular: ASTM-A500, Grade-B (46 KSI minimum).
- D. Bolts, nuts, and washers, high-strength. Conform to RCSC Specification. Provide only U.S. manufactured and tested bolts, nuts, and washers:
  1. Bolts, conform to ASTM A325 or ASTM A490, Type I.
  2. Nuts: ASTM-A563.
  3. Washers: ASTM-F436, Type I.
- E. Bolts, nuts and washers, standard strength: Provide only U.S. manufactured and tested bolts, nuts, and washers:
  1. Bolts: ASTM-A325, Type I.
  2. Nuts: ASTM-A563.
  3. Washers plain: ASTM F436, Type I.
- F. Anchor bolts, standard strength:
  1. Bolts or rod for threading: ASTM-F1554-36 ksi.
  2. Nuts and washers:
    - a. Nuts: ASTM-A563.
    - b. Washers plain: ASTM-F436, Type I.
  3. Thread tolerance: ANSI/ASME-B18.1, Class 2A.
- G. Welding electrodes:
  1. Shielded metal-arc: AWS A5.1 or AWS A5.5, E70XX.
  2. Submerged-arc: AWS A5.17 or A5.23, F7X-EXXX..
  3. Gas metal-arc: AWS A5.18, E70S-X or E70U-1.
  4. Flux cored-arc: AWS A5.20, E70T-X (except 2, 3, 10, GS).
- H. Grout:
  1. Pourable, non-shrink, ASTM C1107, Grade A, B, or C and formulation suitable for the application. Use only non-metallic, non-corrosive formulations.
  2. “Duragrout” as manufactured by L&M Construction Chemicals, or equal.
  3. Minimum Strength: 4000 psi at 7 days and 8000 psi at 28 days.
- I. Expansion anchors:
  1. Expansion anchors shall be a single-end expansion shield anchor which complies with the descriptive part of Federal Specification FF-S325, Group II, Type 4, Class 1 for concrete expansion anchors. Anchors shall be Hilti Kwik Bolt TZ Expansion anchor by Hilti fastening systems of Tulsa, OK (ICC Report No. ESR-1917) or equal.

- J. Adhesive anchors:
  - 1. Reinforcing, bar dowels, reinforcing bars, threaded rods, bolts, etc., indicated to be epoxy dowelled into concrete or solid masonry:
    - a. HIT HY-150 adhesive by Hilti Fastening Systems of Tulsa, OK (ICC Report No. ER-5193, ASTM-E1512) or approved equal.
    - b. HIT RE-500-SD epoxy anchoring system by Hilti Fastening Systems of Tulsa, OK (ICC Report No. ESR-2322, ASTM C881) or approved equal. Use where approved by Engineer.
- K. Slide bearings at expansion joints:
  - 1. Masticord with teflon slide plates as manufactured by JVI MC., Skokie Illinois, or equal. Size, thickness, and configuration as shown on the drawings.

## 2.2 FABRICATION

- A. General:
  - 1. Fabricate and assemble material in shop to greatest extent possible.
  - 2. Use A325 bolts unless otherwise indicated.
  - 3. One sided or other types of eccentric connections not indicated, will not be permitted without prior approval.
  - 4. Bevels for field welds may be flame cut provided such cutting is done automatically. Leave free of burrs and slag.
  - 5. Grind flush web fillets at webs notched to receive backup plates for flange groove welds.
  - 6. Flame cut edges of stiffener plates at field or shop butt welds. Do not shear.
  - 7. Accurately mill bearing ends of columns.
  - 8. Beams and girders over 50 FT in length shall be cambered in an amount required by the Architect. Members less than 50 FT in length shall be cambered when indicated on the drawings or otherwise fabricate such that after erection any natural camber due to rolling or assembly is upward.
  - 9. Cut, drill, or punch holes at right angles to surface of metal:
    - a. Do not make or enlarge holes by burning.
    - b. Make holes clean cut, without torn or ragged edges.
    - c. Remove outside burrs resulting from drilling or reaming operations with tool making 1/16 IN bevel.
    - d. Provide holes in members to permit connection of work of other trades.
  - 10. Make allowance for draw in of tension bracing.
  - 11. Make splices only as indicated.
- B. Welding:
  - 1. Welding, techniques of welding employed, appearance and quality of welds, and methods used to correct defective work shall comply with AWS Code, and requirements indicated.
  - 2. Test and qualify welding operators and tackers in compliance with AWS Code for position and type of welding to which they will be assigned:
    - a. Conduct tests in presence of approved testing agency.
    - b. Certification within last 12 months from a welding inspector will be acceptable provided samples of welder's work are satisfactory.
    - c. At discretion of testing agency, shop personnel continuously employed at welding process for which they have been qualified may be accepted from older qualification tests.
  - 3. Qualify joint welding procedures or test in accordance with AWS qualification procedures.
  - 4. Before start of welding work, meet with testing agency and welders to review and verify procedures.
  - 5. Comply with AWS Code to minimize shrinkage and distortion stress.
  - 6. Where groove welds have back-up plates, make first 3 passes with 1/8 IN round electrodes.
  - 7. Use back-up plates in accordance with AWS Code, extending minimum of 1 IN either side of joint.
  - 8. Make flange welds before making web welds.

9. For manual shielded metal-arc welding: Comply with Article 4.6 of AWS Code.
10. Low hydrogen electrodes: Dry and store electrodes in compliance with AWS Code.
11. Do not perform welding when ambient temperature is lower than 0 degF, or where surfaces are wet or exposed to rain, snow, or high wind, or when welders are exposed to inclement conditions.
12. Before starting welding:
  - a. Carefully plumb and align members.
  - b. Fully tighten bolts.
  - c. Assembly and surface preparation shall comply with AWS Code.
  - d. Preheat base metal to temperature stated in AWS Code:
    - 1) When no preheat temperature is given and base metal is below 32 degF, preheat base metal to at least 70 degF.
    - 2) Maintain temperature during welding.
    - 3) Preheating shall bring surface of base metal within distance from point of welding equal to thickness of thicker part being welded or 3 IN, whichever is greater, to specified preheat temperature.
    - 4) Maintain this temperature during welding.
  - e. Each welder is to provide identifying mark at welds worked on.
  - f. Prior to starting welding obtain a BNL welding permit.

### 2.3 ARCHITECTURALLY EXPOSED MEMBERS

- A. Locations:
  1. All structural steel exposed to view in the finished work. Exposed and exposed to view means visible from locations inside or outside of the building (except from Mechanical/Electrical Rooms) normally accessible to the public or building occupants other than maintenance personnel, without any limitations on distance.
- B. Fabrication, in addition to the other standard requirements for fabricating structural steel, the following additional requirements apply:
  1. Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges. Ease exposed edges to a radius of approximately 1 mm unless otherwise indicated. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
  2. Weld corners and seams continuously, complying with AWS recommendations where exposed to view. Grind exposed welds smooth and flush to match and blend with adjoining surfaces.
  3. Where finishing is required, complete assembly, including welding of units, before start of finishing operations. Provide finish surfaces of members exposed in final work free of markings, burrs, and other defects, including all accessories such as clevises, sleeve nuts, etc.
  4. Assemble and weld built-up sections by methods which will produce true alignment of axes without warp and without distortion of plane surfaces.
  5. Remove all erection bolts and fill all holes with weld metal and grind smooth.
  6. Assemble all bolted connections with bolt heads on exposed surface, where bolted connections indicated or allowed.
  7. Handle, store, and erect all exposed members with special care, to avoid bending, twisting or otherwise distorting members.
  8. Coping and Blocking Tolerance: Maintain a uniform gap of  $1/8 \text{ IN} \pm 1/32 \text{ IN}$  at all copes and blocks.
  9. The tolerance for as-fabricated straightness of rolled and built-up members shall be one-half of the standard camber and sweep tolerances in ASTM-A6. All exposed members shall be plumbed, leveled and aligned to a tolerance not exceeding one-half the tolerance specified for other structural steel members.
  10. Touch-up primer as specified. In addition to other requirements, carefully sand edges of undamaged primer to feathered edge, and apply primer to repaired area with smooth transition between shop painted and repaired areas.

## 2.4 SURFACE PREPARATION AND SHOP-APPLIED COATINGS

- A. Surfaces not to be coated:
  - 1. Do not coat following surfaces:
    - a. Surfaces to be fireproofed with spray-on material.
    - b. Machined surfaces, surfaces adjacent to field welds, contact surfaces of bolt connections where connection is specified as slip critical, and top flanges of beams to receive shear connectors.
    - c. Other members for which no coating is specified.
  - 2. Clean thoroughly before shipping; remove loose mill scale, rust, dirt, oil and grease.
- B. Hot-dip Galvanized (HDG) members:
  - 1. Galvanize following members:
    - a. Members set in, or in contact with, exterior surface material, including:
      - 1) Masonry ledge angles.
      - 2) Embedded items in exterior surfaces.
    - b. Exterior exposed structure not indicated otherwise to be shop finished.
    - c. Other members indicated.
  - 2. Clean thoroughly before galvanizing.
  - 3. Galvanize in accordance with ASTM-A123.
- C. Exterior Surfaces to be shop-primed for finish paint:
  - 1. Primer: Tnemec, Tneme-Zinc, Series 90-97.
  - 2. Primer: Sherwin-Williams Pro-Cryl Universal Acrylic Primer, B66-310 Series.
  - 3. Primer: Coordinate with finish systems specified in Section 09 91 13.
  - 4. Apply primer for exterior finish paint to following surfaces:
    - a. Steel exposed permanently to weather and not galvanized.
  - 5. Clean in accordance with SSPC-SP6, Commercial Blast Cleaning.
  - 6. Apply in accordance with paint manufacturer's instructions:
    - a. Apply minimum 0.0025 IN, dry film thickness.
  - 7. Finish Paint (applied in field): Specified in Section 09 91 13.
- D. Interior Surfaces to be shop-primed for finish paint:
  - 1. Primer: Tnemec, Tneme-Zinc, Series 90-97.
  - 2. Primer: Sherwin-Williams Pro-Cryl Universal Acrylic Primer, B66-310 Series.
  - 3. Primer: Coordinate with finish systems specified in Section 09 91 23.
  - 4. Apply primer for interior finish paint to following surfaces not receiving other coating:
    - a. Surfaces exposed on interior.
  - 5. Clean thoroughly before priming; remove mill scale, rust, dirt, oil, and grease in accordance with SSPC-SP3.
  - 6. Apply in accordance with paint manufacturer's instructions:
    - a. Apply minimum 0.002 IN, dry film thickness.
  - 7. Finish Paint (applied in field): Specified in Section 09 91 23.

## PART 3 - EXECUTION

### 3.1 ERECTION

- A. Safety:
  - 1. Contractor is solely responsible for safety. Construction means and methods and sequencing of work is the prerogative of the Contractor.
- B. Capacity of partially complete construction:
  - 1. Consider that full structural capacity of many structural members is not realized until structural assembly is complete; That is, until slabs, decks and diagonal braces are installed. Partially complete structural members shall not be loaded out of sequence without an investigation.

2. Until elements of the permanent lateral bracing system of the structure are complete, temporary lateral bracing for the partially complete structure will be required.
  3. For determination of temporary bracing and guying requirements, do not assume any rigidity of steel column base plates and anchor bolts or of other steel member connections without complete engineering analysis of all components.
- C. Temporary bracing:
1. Adequate temporary bracing to provide stability and resist loads to which the partially complete structure may be subjected to including construction activities and operation of equipment is the responsibility of the Contractor.
  2. If not obvious from the drawings, confer with the Architect to identify those structural elements that must be complete before the structure's permanent lateral bracing system is effective. The design of the temporary bracing system must consider the sequence and schedule of placement of such elements and effects of loads imposed on the structural steel frame by partially or completely installed work of other trades. Do not remove temporary bracing until the permanent lateral bracing system is effective.
- D. General:
1. Set base and bearing plates accurately and grout immediately as indicated:
    - a. Use metal wedges, shims or setting nuts as required.
    - b. Pack grout solidly between plate and bearing surface.
  2. Clean bearing and contact surfaces before assembly.
- E. Where A325SC (slip critical) bolts are indicated, install with washers. Install and tighten in accordance with the RCSC Specifications or in accordance with manufacturer's instructions when twist-off bolts are used.
- F. Field weld as specified in paragraph "Welding."
- G. Do not use gas cutting to correct fabrication errors on major members:
1. Gas cutting on minor members may be permitted when members are not loaded, only after approval by Architect.
- H. Tighten and leave in place erection bolts used in welded construction.
- I. Provide beveled washers to give full bearing to bolt head or nut where bolts are to be used on surfaces having slopes greater than 1:20 with a plane normal to bolt axis.
- J. After installation, touch up damaged or abraded areas of primed steel using same materials used for shop priming:
1. Clean field welds, bolted connections and abraded areas before touching up.
  2. Touch-up galvanized surfaces with SSPC-Paint 20 applied in conformance with manufacturer's recommendations.

## **END OF SECTION**



## **SECTION 05 21 10**

### **STEEL JOISTS**

#### **PART 1 - GENERAL**

##### **1.1 QUALITY ASSURANCE**

- A. Fabrication standards for joists and accessories: Steel Joist Institute “Standard Specification and Load Tables” for open web, long span and deep long span steel joists; American Institute of Steel Construction (AISC) “Specifications for Design, Fabrication and Erection of Structural Steel for Buildings,” (referred to as AISC Specifications).
- B. Standard for welders and welding work: AWS “Standard Qualification Procedure.”
- C. Architect reserves right to observe joists in manufacturer’s shop during fabrication.
- D. Architect reserves right to observe and require testing of joists welded in place.
  - 1. Remove and replace work found not to comply with Contract requirements.

##### **1.2 SUBMITTALS**

- A. Shop Drawings:
  - 1. Show complete details including layout, special connections, bridging, jointing and accessories.
- B. Project Information:
  - 1. Manufacturer’s certification that steel joists comply with specified requirements and steel joist institutes standard load tables.
  - 2. Manufacturer's certification along with calculations that joists for special loads indicated on drawings have been designed and are capable of supporting all design loads for the spans as shown on the drawings.
    - a. Certification and calculations sealed by a registered professional engineer in the state of New York.
    - b. Certification and calculations shall be submitted prior to or along with shop drawings as a condition for approval of the shop drawings.
    - c. Load combinations as specified by the building code. Where special loads only are shown, combine with typical loads or capacities for adjacent joists.
- C. LEED Information:
  - 1. LEED Credits MR 4.1 and 4.2, Recycled Content: Product data indicating percentages by weight of post-consumer and post-industrial recycled content for products having recycled content; include statement indicating costs for each product having recycled content.
  - 2. LEED Credits MR 5.1 and 5.2, Regional Materials: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.

##### **1.3 PRODUCT DELIVERY, STORAGE, AND HANDLING**

- A. Deliver, store and handle steel joists as recommended by SJI and AISC.
- B. Store joists clear of earth on platforms, skids or other supports.

##### **1.4 JOB CONDITIONS**

- A. Do not overload joists. Note: Joists may not be able to carry design loads until deck is fully installed.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Steel: Comply with latest edition of relevant SJI and AISC Specifications.
- B. Unfinished threaded fasteners: ASTM-A307, Grade-A, regular hexagon type, low carbon steel, with ANSI-B27.2, Type B, carbon steel washers.
- C. High-strength threaded fasteners: ASTM-A325 or ASTM-A490 as required, heavy hexagon structural bolts with nuts and hardened washers.
- D. Prime Paint: Comply with SJI and AISC except that asphalt type paint is not acceptable.
  - 1. Shop coat of red lead or rust-inhibitive paint standard with manufacturer.
  - 2. Comply with SSPC-15.
- E. Bedding Mortar:
  - 1. Portland cement and sand, mixed at a ratio of 1 part cement to 3 parts sand, measured by volume, with only enough water for placement and hydration.
  - 2. Shrinkage-resistant compound complying with Corps of Engineer's CRD-C588, Type M.

### 2.2 FABRICATION

- A. Fabricate in accord with SJI and AISC specifications and as follows:
  - 1. Do not splice principal tension members. Use only full length pieces.
  - 2. Make shop connections and splices using either arc or resistance welding. Do not shop bolt connections.
  - 3. Design and fabricate for maximum deflection of 1/360 of clear span under design live load.
  - 4. Design joists for minimum 20 psf net wind uplift load.
  - 5. Shop holes, field holes, and enlargement of holes will not be permitted unless approved by Architect.
  - 6. Fabricate bearing ends to provide following minimum bearing unless otherwise indicated.

| BEARING MATERIAL | CURVED TOP CHORD JOISTS |
|------------------|-------------------------|
| Steel            | 6 IN                    |

- B. Where special or concentrated loads are indicated, reinforce joist and develop details as necessary for support.
- C. Provide extended bottom chords where indicated. Comply with SJI and AISC requirements and load tables.
- D. Provide extended top chords where indicated. Comply with SJI and AISC requirements and load tables.
- E. Provide ceiling extensions in areas having ceilings attached directly to joist bottom chord.
  - 1. Provide either an extended bottom chord or a separate unit of sufficient strength to support ceiling construction.
  - 2. Extend ends to within 1/2 IN of wall surface.
- F. Remove loose scale, heavy rust, and other foreign materials from fabricated joists and accessories.
- G. Apply one shop coat of steel joist primer paint to steel joists and accessories, by spray, dipping, or other method to provide continuous dry paint film thickness of not less than 0.50 mil.

## **PART 3 - EXECUTION**

### **3.1 INSPECTION**

- A. Examine areas and conditions under which steel joists are to be installed for conditions detrimental to proper and timely completion of work.
- B. Do not proceed with work until unsatisfactory conditions have been corrected.
- C. Do not start placement of steel joists until supporting work is in place and secured.

### **3.2 ERECTION**

- A. Do not install joists damaged so that strength is impaired.
- B. Where not specifically indicated otherwise, place and secure steel joists in accord with SJI and AISC "Specifications" and as herein specified.
- C. Field weld joists to supporting steel framework in accord with SJI and AISC - Specifications for type of joists used. Coordinate welding sequence and procedure with placing of joists.
- D. Place joists on supporting work, adjust and align in accurate location and spacing before permanently fastening.
  - 1. Provide end bearing and anchorages to secure joists to supporting members in accord with SJI and AISC Specifications, unless otherwise indicated.
  - 2. When joists do not bear flush on supporting member, take corrective measures to ensure full bearing, as directed by Architect.
- E. Provide bridging in accord with SJI and AISC Specifications, where not specifically indicated otherwise, except as modified herein.
  - 1. Provide diagonal type bridging as indicated.
  - 2. Provide additional bridging at each line between exterior and first interior joist and then at every 12th joist space.
  - 3. Do not use sag rods as substitute for bridging.
- F. Completely install bridging immediately after erection, before loads are applied.
  - 1. Anchor ends of bridging lines at top and bottom chords where terminating at beams.
  - 2. Provide bridging connections at top and bottom chords capable of safely resisting a force of 500, 1000 and 1500 LB for open web, long span and deep long span joists respectively.
- G. Remove or repair damaged joists or other work, to satisfaction of Architect.
- H. After installation, paint field bolt heads and nuts, welds and abraded or rusty surfaces on joists and steel supporting members.
  - 1. Wire brush surfaces and clean with solvent before painting.
  - 2. Use same type of paint as used for shop painting.

**END OF SECTION**



**SECTION 05 31 23**  
**METAL ROOF DECKING**

**PART 1 - GENERAL**

**1.1 QUALITY ASSURANCE**

- A. Comply with provisions of following codes and standards, except as otherwise indicated.
  - 1. AISI "Specification for Design of Cold-Formed Steel Structural Members."
  - 2. Steel Deck Institute (SDI), "Steel Roof Decking Design Manual."
  - 3. AWS "Sheet Steel in Structures, Specification for Welding" AWS D1.3.
  - 4. International Conference of Building Officials (ICBO).
- B. Qualify welding processes and operations in accordance with AWS "Standard Qualification Procedure."

**1.2 SUBMITTALS**

- A. Shop Drawings:
  - 1. Complete layout indicating types of deck panels, anchorage, supplementary framing, cut openings, accessories, and thicknesses.
- B. Product Data:
  - 1. Manufacturer's load tables for deck to be furnished on this project.
- C. LEED Information:
  - 1. LEED Credits MR 4.1 and 4.2, Recycled Content: Product data indicating percentages by weight of post-consumer and post-industrial recycled content for products having recycled content; include statement indicating costs for each product having recycled content.
  - 2. LEED Credits MR 5.1 and 5.2, Regional Materials: For products and materials required to comply with requirements for regional materials. Manufacturer's certification indicating final point of assembly for products and materials located within 500 miles of Project site. Indicate distance of raw material origin from project site. Include manufacturer's name, address and phone number. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.

**1.3 PRODUCT DELIVERY, STORAGE, AND HANDLING**

- A. Protect materials from rusting, dirt or damage.

**1.4 JOB CONDITIONS**

- A. Do not overload supporting members. Until entire assembly is complete, structural elements may not be stable or capable of supporting code or stated design loads.

**PART 2 - PRODUCTS**

**2.1 METAL ROOF DECKING - 1-1/2 IN DEEP**

- A. Acceptable manufacturers:
  - 1. Metal roof decking, 1-1/2 IN deep:
    - a. Base:
      - 1) BHP Steel Building Products; Type B-36.
      - 2) Consolidated Systems B-Dek
      - 3) Roof Deck; Type B-2.
      - 4) United Steel Deck; Type B.

- 5) Verco Manufacturing; Type HSB-36.
  - 6) Vulcraft; Type 1.5B.
  - 7) Wheeling Corrugating; Types B, BW, BW-36.
- B. Metal roof decking, 1-1/2 IN deep wide rib type B (non-interlocking type), sheet steel: 20 GA, minimum, with minimum uncoated thickness of 0.0341 IN.
1. Galvanized decking: ASTM-A653, G90 zinc coating, Fy= 33 KSI, Structural Quality.

## 2.2 OTHER MATERIALS

- A. Welding rod:
- B. Mechanical Fasteners:
1. Definition: Corrosion-resistant, low-velocity, power-actuated or pneumatically driven carbon-steel fasteners; or self-drilling, self-threading screws.
  2. Acceptable manufacturers:
    - a. Powder actuated:
      - 1) Base:
        - a) Hilti Inc., steel deck fastener.
      - b. Pneumatically driven:
        - 1) Base
          - a) Punetek, Inc.
      - c. Self drilling, self threading screws: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 diameter min size.
        - 1) Base;
          - a) Hilti, Inc
          - b) Elco Textron
          - c) Buildex
- C. Steel shapes, miscellaneous: ASTM-A36.
- D. Galvanizing for metal accessories: ASTM-A653, G90.
- E. Galvanizing repair paint: High zinc-dust content paint, Mil-P-21035 (ships).
- F. Metal closure strips: Galvanized sheet steel, minimum 0.034 IN thick before coating, ASTM-A653, G90 galvanized. See Part 3 - Execution for locations.

## 2.3 FABRICATION

- A. Form in lengths to span 3 or more support spacings, with flush, telescoped or nested 2 IN end laps.
1. Use deck configurations complying with SDI "Basic Design Specifications" and as indicated.
- B. Form metal closure strips to configuration required to provide tight-fitting closures at open ends and sides of decking.

## PART 3 - EXECUTION

### 3.1 INSPECTION

- A. Examine areas and conditions under which deck units are to be installed for conditions detrimental to proper and timely completion of work.
- B. Do not proceed with work until unsatisfactory conditions have been corrected.
- C. Start of installation constitutes acceptance of responsibility for correct installation and performance.

### 3.2 INSTALLATION - GENERAL

- A. Install roof deck units and accessories as indicated.
- B. Do not start placement of roof deck units until supporting members are installed complete.
- C. Place each deck unit on supporting structural frame, adjust to final position, accurately align with ends bearing on supporting members.
  - 1. Lap units at ends no less than 2 IN.
  - 2. Do not stretch or contract side-lap interlocks.
  - 3. Place deck units flat and square and secure to framing without warp or excessive deflection.
  - 4. Install deck ends over supporting frame with a minimum end bearing of 1-1/2 IN.
- D. Plug weld sizes specified are effective fusion diameter of welds.
  - 1. Weld metal shall penetrate layers of deck material at ends laps and have good fusion to supporting members.
- E. Remove and replace decking which is structurally weak or unsound or which has burn holes due to improper welding or which Architect declares defective.
- F. Cut and fit roof units and accessories around other work projecting through or adjacent to roof decking.
  - 1. Make cutting and fitting neat, square and trim.
  - 2. Neatly and accurately install reinforcing at openings except:
    - a. Circular openings less than 6 IN diameter.
    - b. Rectangular openings having no side dimension greater than 6 IN.
  - 3. Reinforce openings between 6 IN and 12 IN with 20 GA flat steel sheet 12 IN greater in each dimension than opening. Place sheet around opening and fusion weld to top surface of deck at each corner and each side midway between each corner.
  - 4. For roof openings larger than 12 IN and at roof drains: Support deck edges as indicated on Drawings
- G. Install metal closure strips for support of roof insulation.
  - 1. Provide where rib openings in top surface of roof decking occur adjacent to edge and openings.
  - 2. Weld closure strips into position.
- H. Install metal closure strips at open uncovered ends and edges of roof decking, and in voids between decking and other construction.
  - 1. Weld into position to provide a complete decking installation.

### 3.3 FASTENING OF DECKING

- A. Welded connection requirements:
  - 1. Fasten roof-deck panels to steel supporting members by arc spot (puddle) welds 5/8 IN effective diameter or arc seam welds with an equal perimeter that is not less than 1-1/2 IN long.
    - a. Weld Spacing:
      - 1) Weld edge and interior ribs of deck units with a minimum of two welds per deck unit at each support.
      - 2) Space welds: As indicated on drawings.
  - 2. Side-Lap and Perimeter Edge Fastening:
    - a. Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of 1/2 of the span or 18 IN, and as follows:
    - b. Mechanically fasten with self-drilling, No.10 diameter or larger, carbon-steel screws.
    - c. Mechanically clinch or button punch.
    - d. Fasten perimeter edges with a minimum of 1-1/2 IN -long welds at 12 IN o.c.

B. Mechanical connection requirements

1. Mechanical fasteners (powder actuated or pneumatically driven steel pins) may be used in lieu of welding indicated to fasten deck to supports subject to approval by the Architect. Locate mechanical fasteners and install according to manufacturer's written instructions and as specified below.
  - a. Pin size, spacing, and accessories:
    - 1) Pin diameter and length per manufacturer's instructions for numbers of layers, deck gage, and steel flange thickness at a given condition.
    - 2) Connect edge and interior ribs of deck units with a minimum of two pins per deck unit at each support.
      - a) Space pins 18 IN apart, maximum.
    - 3) Install steel washers or provide pins with integral washers at each pin location. Washer size per manufacturer requirements.
  2. Side-Lap and Perimeter Edge Fastening:
    - a. Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of 1/2 of the span or 18 IN, and as follows:
    - b. Mechanically fasten with self-drilling, No. 10 diameter or larger, carbon-steel screws.
    - c. Mechanically clinch or button punch.

**3.4 CLEAN AND TOUCH-UP**

- A. Wire brush, clean and paint scarred areas, welds and rust spots on top surfaces of decking units and supporting steel members.
- B. Touch-up damaged galvanized surfaces with galvanizing repair paint applied in accordance with manufacturer's instructions.
- C. Touch-up shop painted surfaces with same paint used in shop, as recommended by deck manufacturer.

**END OF SECTION**

**SECTION 05 45 23**  
**EQUIPMENT SUPPORT SYSTEM**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. Equipment and utility support structures constructed of slotted channel framing for support of utilities and OFOI equipment, where indicated on drawings.
- B. Cleanroom Ceiling Grid Support framing. Refer to Section 13 62 17, Cleanroom Ceiling System (CRCS).

**1.2 QUALITY ASSURANCE**

- A. Manufacturer shall have been active in metal framing business for at least five years and shall maintain quality assurance program that will permit manufacturer, if requested, to submit mill test reports for material furnished to assure that material meets specification criteria.
  - 1. Specifications for Design of Cold Formed Steel Structural Members: AISI.
  - 2. Manual of Steel Construction: AISC.
  - 3. Resistance welding: AWS-C1.1-66.
  - 4. Welding sheet steel in structures: AWS-D1.3-80.
- B. As a part of this work: Provide engineering design and calculations, performed and sealed by registered Engineer, licensed to practice Structural Engineering in the State of New York.
- C. Design criteria:
  - 1. Support structure: Building structure as indicated in the Structural Drawings.
  - 2. Universal grid system. Provide universal grid system with continuous support channels of spacing indicated in direction noted for each space. Locate first and last support channels 6 IN from inside face of walls parallel with universal grid direction. For equipment support systems requiring higher loadings, see Drawings. System to allow attachment of equipment support rails at any point without drilling or welding.
    - a. Maximum Spacing:
  - 3. Anchorage: Attach to structure by means of embedded concrete inserts or by direct attachment to structural framing. If expansion anchors are used to anchor metal framing to support structure locate in manner that anchor bolt is loaded in shear.
    - a. Expansion anchors in tension are not permitted.
    - b. Attach to ceiling system using threaded rods at 24 IN to 48 IN O.C.
  - 4. Design Loading:
    - a. Vertical: Design equipment support structure to support a minimum concentrated load of 400 LBS at any point.
    - b. Lateral: Design bracing for support structure to resist a lateral load equivalent to 2 percent of the Vertical Design Load.
  - 5. Safety factor: Design support structure for minimum safety factor of at least 3 based on ultimate strength under static loading conditions. Do not allow structure to deflect more than 1/720 span in either plane (vertical or horizontal) when maximal loading conditions, due to equipment operation, are applied.
- D. Allowable tolerances:
  - 1. Install supporting framework plumb and true.
  - 2. Assure mounting surfaces of support structure are horizontal within 1/32 IN in 24 IN and within 1/16 IN in 18 FT length.
  - 3. Elevation of one rail mounting surface to other within 1/16 IN in 24 IN length of rails.

### 1.3 SUBMITTALS

- A. Shop drawings:
  - 1. Indicate plan layout drawn to scale, typical elevations, anchoring methods.
  - 2. Indicate connections to Cleanroom Ceiling Grid.
  - 3. Indicate part numbers and attachment hardware.
- B. Product data:
  - 1. Catalog data: Properties of section, parts details.
- C. Project information:
  - 1. Address of nearest stocking dealer.
  - 2. Engineering design calculations (sealed by registered Engineer, licensed to practice Structural Engineering in the State where project is located).
- D. Environmental Information:
  - 1. LEED Credit MR 4.1 and 4.2, Recycled Content: Product data indicating percentages by weight of post-consumer and post-industrial recycled content for products having recycled content; include statement indicating costs for each product having recycled content.
  - 2. LEED Credit MR 5.1, Local/Regional Materials: Manufacturer's certification indicating final point of assembly for products and materials located within 500 miles of Project site. Include manufacturer's name, address and phone number.

### 1.4 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site in original sealed cartons with manufacturer's labels.

### 1.5 JOB CONDITIONS

- A. Field measurements:
  - 1. Take field measurements to assure support system can be installed without interference with structural framing, mechanical systems, plumbing, or other obstructions.
  - 2. Report major interferences to Architect.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Acceptable manufacturers:
  - 1. Equipment Support System:
    - a. Base:
      - 1) Unistrut
      - a) Part numbers shown in this specification and on drawings are for Unistrut parts. Equivalent parts provided by Optional Manufacturers listed below are acceptable.
    - b. Optional:
      - 1) B-Line.
      - 2) Hilti.
      - 3) Thomas and Betts, Superstrut.
- B. Framing material: ASTM-A1011 Grade-33 or ASTM-A1008 Grade-A, G90.
- C. Finish at Ceiling Grid Supports (all areas except Clean Zone):
  - 1. Framing members and fittings: Galvanized per ASTM-A123, ASTM-A153, G90.
  - 2. Hardware: Electrogalvanized, ASTM-B633 Type-3-SC1
- D. Finish at laboratories – exposed: Powder coated (white) on all framing member.
- E. Finish at Clean Zone Cleanroom Ceiling Grid Support:

1. The 'Clean Zone' is the area where all air-management system ventilation is designated 'clean'.
  2. Framing members and fittings: Perma-Gold zinc galvanized finish.
  3. End caps and frame caps: Provide end caps Unistrut P2859 on the end of all cut struts.
- F. Bracing: Provide bracing to resist lateral loads where framing is suspended more than 12 IN from ceiling or structure.
- G. Accessories:
1. Provide fittings, fasteners, clamps, and miscellaneous items to provide a complete and secure installation.
    - a. Provide part numbers indicated on drawings where shown. Finish to match framing members.
  2. Provide channel covers at exposed surfaces after supports are installed.
    - a. Channel covers: Unistrut P3184F.
  3. Finish on all accessories shall match finish on framing system members as indicated above.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- A. Report modification of installation required by coordination with trades and other supports to Architect.
- B. Install equipment support structure in accordance with approved shop drawings.
- C. Install equipment support system in Clean Zone, aligned with ceiling grid system.
- D. Install under supervision of manufacturer.

**END OF SECTION**



**SECTION 05 50 10**  
**MISCELLANEOUS METAL FABRICATIONS**

**PART 1 - GENERAL**

**1.1 QUALITY ASSURANCE**

- A. Materials and operations standards:
  - 1. AAMA, Architectural Aluminum Manufacturer's Association.
  - 2. AISC, American Institute of Steel Construction.
  - 3. ASTM, American Society for Testing and Materials.
  - 4. AWS, American Welding Society.
  - 5. F.S., Federal Specifications.
  - 6. NAAMM, National Association of Architectural Metals Manufacturers.

**1.2 SUBMITTALS**

- A. Shop drawings.
- B. LEED Information:
  - 1. LEED Credits MR 4.1 and 4.2, Recycled Content: Product data indicating percentages by weight of post-consumer and post-industrial recycled content for products having recycled content; include statement indicating costs for each product having recycled content.
  - 2. LEED Credits MR 5.1 and 5.2, Regional Materials: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.

**1.3 JOB CONDITIONS**

- A. Provide sleeves, embedded anchors and other built in items in time for installation, or pay costs of cutting in items later, and grouting.
- B. Verify field conditions prior to fabrication.

**PART 2 - PRODUCTS**

**2.1 MATERIALS**

- A. Acceptable manufacturers:
  - 1. Materials listed:
    - a. Base: As noted.
  - 2. Galvanizing Repair Paint:
    - a. Base:
      - 1) ZRC Worldwide.
    - b. Optional:
      - 1) Tnemec.
  - 3. Shop Primer:
    - a. Base:
      - 1) Sherwin-Williams.
    - b. Optional:
      - 1) Tnemec.

4. Coal Tar Epoxy (dissimilar material protection coating):
  - a. Base:
    - 1) Tnemec.
  - b. Optional:
    - 1) ICI Dulux Paint Centers.
5. Non-shrink Grout:
  - a. Base:
    - 1) Minwax.
  - b. Optional:
    - 1) Sauereisen.
6. Slip-Resistant Nosings for Cast-in-Place Concrete Stairs:
  - a. Base:
    - 1) Balco/Metalines.
  - b. Optional:
    - 1) Amstep Products.
    - 2) Wooster Products.

## 2.2 MATERIAL DESCRIPTIONS

- A. Structural steel:
  1. Steel, Structural "W" shapes and tee's: ASTM-A992 (50ksi yield point)
  2. Other steel shapes and plate: ASTM-A36
  3. Pipe: Round ASTM A53 Grade B
  4. Tubing, square or rectangular: ASTM-A500, grade-B (46ksi minimum)
- B. Cast steel: ASTM-A27, Grade-65-35; and ASTM-A148, Grade-80-50.
- C. Steel forgings: ASTM-A668.
- D. Bolts: ASTM-A307, ASTM-A325, ASTM-A354.
- E. Filler metal: AWS Standards.
- F. Cast iron: ASTM-A48, Class 30, minimum 30,000 PSI tensile.
- G. Malleable iron: ASTM-A47 and ASTM-A197.
- H. Aluminum: ASTM-B308 for particular alloy in standard shapes and extrusions, and ASTM-B26 for castings.
- I. Stainless steel: ASTM-A484 and ASTM-A276:
  1. Concealed: Type 302 or Type 304.
  2. Exposed: Type 304:
    - a. Finish: ASTM-A480 AISI finish #4, unless otherwise indicated.
- J. Anchorage devices - masonry:
  1. Standard manufactured items.
  2. Lead expansion shields for machine screws and bolts 1/4 IN and smaller: Head out embedded nut type.
  3. For machine screws and bolts larger than 1/4 IN: Manufacturers' standard.
  4. Bolt anchor expansion shields for lag bolts: Zinc alloy, long shield anchors.
  5. Bolt anchor expansion shields for bolts: Closed end bottom bearing type.
- K. Fasteners:
  1. Galvanized or stainless where built into exterior walls.
  2. Select fasteners for type, grade and class required.
  3. Bolts and Nuts: Regular hexagon head ASTM-A307, Grade-A.
  4. Lag Bolts: Square or octagonal head type.
  5. Machine Screws: Cadmium plated steel.
  6. Wood Screws: Flat head carbon steel.
  7. Plain Washers: Round, carbon steel.

- 8. Lock Washers: Helical spring carbon steel.
- L. Non-shrink grout:
  - 1. Compressive strength: 8,475 PSI at 7 days.
  - 2. Base Product: "Super Por-Rok" by Minwax.

### **2.3 FABRICATION**

- A. Form to shapes indicated with straight lines, sharp angles, smooth curves.
- B. Drill or punch holes with smooth edges for temporary field connections and attachment of work by other trades.
- C. Make permanent shop and field connections with continuous fillet type welds.
- D. Grind exposed welds smooth.
- E. Conceal fastenings where practicable.
- F. Shop fabricate in as large assemblies as practicable.
- G. Meet requirements specified under Structural Steel for fabricating items of structural nature or use.
- H. Qualify welding processes and welding operators in accord with AWS.

### **2.4 SURFACE PREPARATION AND SHOP-APPLIED COATINGS**

- A. General:
  - 1. All items in this section shall be shop finished by one of the methods described in this article:
    - a. Exceptions:
      - 1) Do not coat surfaces scheduled to be fireproofed with spray-on material.
      - 2) Do not coat machined surfaces, surfaces adjacent to field welds, contact surfaces of bolt connections where connection is specified as slip critical, and top flanges of beams to receive shear connectors.
      - 3) Do not coat other items for which no coating is specified.
- B. Shop Primer for Interior Steel Items:
  - 1. Primer: Sherwin-Williams Pro-Cryl Universal Acrylic Primer, B66-310 Series.
  - 2. Apply primer for interior finish paint to following surfaces not receiving other coating:
    - a. Surfaces exposed on interior.
  - 3. Clean thoroughly before priming; remove mill scale, rust, dirt, oil, and grease in accordance with SSPC-SP3.
  - 4. Apply in accordance with paint manufacturer's instructions:
    - a. Apply minimum 0.002 IN, dry film thickness.
  - 5. Finish Paint (applied in field): Specified in Section 09 91 23.
- C. Hot-dip Galvanized (HDG) Coating for Exterior items:
  - 1. Galvanize (HDG) the following items:
    - a. Items to be installed on site, roof or other areas that are "outside" of building enclosure walls. This shall include items "attached to" exterior walls of building.
    - b. Items to be installed in "wet" or humid (>70% RH) areas of building.
    - c. Partial listing of items to receive HDG:
      - 1) Masonry lintels, ledge angles and shelf angles.
      - 2) Pipe Bollards.
      - 3) Exterior Ladders, Stairs and railings.
      - 4) Exterior gratings and substructure.
      - 5) Exterior equipment supports.
      - 6) Similar items which are exposed to weather or built-in to Exterior walls.
      - 7) Other items indicated.
  - 2. Clean thoroughly before galvanizing.

3. Galvanize in accordance with ASTM-A123.

## 2.5 PAINTING

- A. Paint exterior steel items in field as specified in Section 09 91 13.
- B. Paint interior steel items in field as specified in Section 09 91 23.

## 2.6 METAL FABRICATIONS - PARTIAL LIST

- A. General:
  1. Supply items required to complete construction and installation.
  2. Minimum Workmanship Standards (unless noted otherwise): Class 1 (Architectural) in accordance with NAAMM AMP-555, Code of Standard Practice for the Architectural Industry.
  3. Anchorage accessories:
    - a. Items required to secure wood to metal, wood to masonry, metals to masonry or concrete, metal to metal or metal to other items.
  4. Verify completeness of following listings:
- B. Ladders:
  1. General:
    - a. Design to comply with the following regulations:
      - 1) ANSI-A14.3.
      - 2) OSHA 29 1910.27.
    - b. Material:
      - 1) Exterior Ladders: Galvanized steel, painted by Section 09 91 13.
      - 2) Interior ULV Chamber Lab Ladders: Extruded aluminum with as milled finish, unpainted.
      - 3) Other Interior Ladders: Shop-primed steel, painted by Section 09 91 23.
    - c. Side rail members: Minimum 1/2 x 2 IN.
    - d. Rungs: Minimum 7/8 IN round or square bars.
    - e. Punch rungs through side rails and weld.
    - f. Size to support concentrated moving load of 300 LB.
    - g. Minimum clearance from centerline of rung to wall or obstruction: 7 IN.
    - h. Minimum ladder width: 16 IN between side rails.
    - i. Rung spacing: 12 IN O.C.
    - j. Apply abrasive warning tape Type 2 to top and bottom rung of all ladders.
  2. Elevator Pit Ladders:
    - a. Comply with general items above, except as amended by the following:
    - b. Extend from bottom of pit to 4 FT above floor level.
    - c. Rungs: Minimum 3/4 IN round or square bars.
    - d. Maximum projection from wall: 5 IN or as otherwise limited by locally adopted codes and elevator running clearances.
    - e. Comply with ANSI/ASME-A17.1.
    - f. Coordinate final dimensions and locations with Elevator contractor.
- C. Metal Gratings:
  1. Complying with NAAMM "Metal Bar Grating Manual."
  2. Material and Thickness (except were otherwise indicated):
    - a. Exterior Gratings: Galvanized steel, nominal 1-1/2 IN thick.
    - b. Interior ULV Chamber Lab Gratings: Aluminum, nominal 1-1/2 IN thick.
  3. Load Capacity: Support minimum uniform load of 200 PSF.
  4. Provide hold down clips.
  5. Serrated or slip resistant tops.
  6. Furnish with frames and support items of comparable material and finish.
- D. Steel Support Angles, Members and Loose Lintels:
  1. ASTM-A36 steel, Sizes and configurations as indicated.

2. Items to be HDG (galvanized):
    - a. Items to be permanently exposed to weather, high-humidity, or wet conditions.
    - b. Items set into exterior walls.
  3. Shop Prime interior steel items, except galvanized steel items.
- E. Miscellaneous Equipment Supports:
1. ASTM-A36 steel, Sizes and configurations as indicated.
  2. Examples of items included:
    - a. Supports for Folding Partitions, Operable Walls, Coiling Doors and Grilles.
    - b. Ceiling hung toilet partitions.
    - c. Other miscellaneous support items as indicated.
  3. Items to be HDG (galvanized):
    - a. Items to be permanently exposed to weather, high-humidity, or wet conditions.
    - b. Items set into exterior walls.
  4. Shop Prime interior steel items, except galvanized steel items..

## **2.7 BOLLARDS**

- A. General:
1. Provide where indicated.
  2. Supply items required to complete construction and installation.
  3. Minimum Workmanship Standards (unless noted otherwise): Class 1 (Architectural) in accordance with NAAMM AMP-555, Code of Standard Practice for the Architectural Industry.
- B. Utility Bollards:
1. 6 IN diameter extra strength, HDG (galvanized), steel pipe.
  2. Length: Unless otherwise indicated; minimum 42 IN projection above ground and minimum 36 IN embedment into concrete.
  3. Fabricate with welded on anchors.
  4. Fill pipe with minimum 3000 PSI concrete with rounded top.
  5. Field Paint as specified in Division 09.

## **2.8 SLIP-RESISTANT NOSING**

- A. Slip-Resistant Nosings for Cast-in-Place Concrete Stairs:
1. Abrasive type with steel wing anchors and recessed screws to allow replacement of units:
  2. Space anchors not over 24 IN on center.
  3. Minimum 3 anchors per nosing.
  4. Furnish units full width of treads.
  5. Base Product: "4140" by Balco Inc.
  6. Optional:
    - a. Amstep Products/Div American Safety Tech.
    - b. Wooster Products.

# **PART 3 - EXECUTION**

## **3.1 INSPECTION**

- A. Verify suitability of substrate to accept installation.
- B. Installation constitutes acceptance of responsibility for performance.
- C. Ensure that adequate Wall Backing (as specified in Section 09 22 16) has been installed where required for wall-mounted items specified in this Section.

## **3.2 INSTALLATION**

### **A. General:**

1. Set work level, true to line, plumb.
2. Shim and grout as necessary.
3. Weld field connections and grind smooth.
4. Where practical, conceal fastenings.
5. Secure metal to wood with lag screws of adequate size with appropriate washers.
6. Secure metal to concrete with embedded anchors, setting compounds, caulking and sleeves, or setting grout.
  - a. Use expansion bolts, toggle bolts, or screws for light duty service.
7. Meet structural requirements for erecting items of structural nature.
8. Do not field splice fabricated items unless size requires splicing.
9. Weld splices.
10. Provide fabricated items complete with attachment devices as required to install.

### **B. Galvanic Repair:**

1. After galvanized units have been erected and anchored apply galvanizing repair paint in accordance with manufacturer's recommendations.
2. Surface preparation: Remove contaminates in accord with SSPC SP-1.

### **C. Bollards:**

1. Direct-buried:
  - a. Prepare hole in earth which is at least:
    - 1) Hole Depth: 6 IN deeper than embedment length specified for bollard.
    - 2) Hole Diameter: 24 IN in diameter for 6 IN diameter pipes.
      - a) For other size pipe bollards: 4x pipe diameter.
  - b. Set pipe bollards plumb and to the exposure height indicated.
2. Surface-Bolted and other means of attachment:
  - a. Install as detailed.
3. Fill annular space with concrete fill having a compressive strength of at least 3000 PSI.
4. Paint or cover with decorative sleeves as scheduled.

## **3.3 FIELD PAINTING**

### **A. All items in this section which are exposed to view:**

1. Painting of exterior items: Specified in Section 09 91 13.
2. Painting of interior items: Specified in Section 09 91 23.

**END OF SECTION**

**SECTION 05 50 13**  
**STEEL STAIRS AND RAILINGS**

**PART 1 - GENERAL**

**1.1 SYSTEM DESCRIPTION**

- A. Design Responsibility:
  - 1. Engineering design submittal must be performed by, or under direct supervision of, a registered Engineer, licensed to practice Structural Engineering in State of New York.
  - 2. Submittal must include calculations for all load-bearing components of stairs and landings:
    - a. Indicate design live loads on submittal.
  - 3. Submittal to be reviewed by A/E for general conformance with design intent shown by Contract Documents:
    - a. Physical adequacy of Structural design and conformance with applicable building Codes are responsibility of stair fabricator.

**1.2 QUALITY ASSURANCE**

- A. Materials and operations standards:
  - 1. AAMA, Architectural Aluminum Manufacturer's Association.
  - 2. AISC, American Institute of Steel Construction.
  - 3. ASTM, American Society for Testing and Materials.
  - 4. AWS, American Welding Society.
  - 5. F.S., Federal Specifications.
  - 6. NAAMM, National Association of Architectural Metals Manufacturers.

**1.3 SUBMITTALS**

- A. Shop Drawings and Design Calculations, structurally designed, detailed, and sealed by a Professional Engineer registered in the State of New York.
- B. Project Information:
  - 1. Engineering design calculations, sealed by registered Engineer, licensed to practice Structural Engineering in state where project is located.
- C. LEED Information:
  - 1. LEED Credits MR 4.1 and 4.2, Recycled Content: Product data indicating percentages by weight of post-consumer and post-industrial recycled content for products having recycled content; include statement indicating costs for each product having recycled content.
  - 2. LEED Credits MR 5.1 and 5.2, Regional Materials: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.

**1.4 JOB CONDITIONS**

- A. Provide sleeves, embedded anchors and other built in items in time for installation, or pay costs of cutting in items later, and grouting.
- B. Verify field conditions prior to fabrication.

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS**

- A. Acceptable Manufacturers:
  - 1. Pre-manufactured Steel Stairs:
    - a. Base:
      - 1) Sharon Stair.
    - b. Optional:
      - 1) American Stair.
  - 2. Galvanizing Repair Paint:
    - a. Base:
      - 1) ZRC Worldwide.
    - b. Optional:
      - 1) Tnemec.
  - 3. Shop Primer:
    - a. Base:
      - 1) Sherwin-Williams.
    - b. Optional:
      - 1) Tnemec.
  - 4. Coal Tar Epoxy (dissimilar material protection coating):
    - a. Base:
      - 1) Tnemec.
    - b. Optional:
      - 1) ICI Dulux Paint Centers.
  - 5. Non-shrink Grout:
    - a. Base:
      - 1) Minwax.
    - b. Optional:
      - 1) Sauereisen.
  - 6. Abrasive Warning Tape:
    - a. Base:
      - 1) 3M.
  - 7. Slip-Resistant Nosing with Photoluminescent:
    - a. Base:
      - 1) "4140" by Balco, Inc.

### **2.2 COMPONENT MATERIALS**

- A. Structural steel: ASTM-A36, ASTM-A501, ASTM-A575 or ASTM-A108.
- B. Cast steel: ASTM-A27, Grade-65-35; and ASTM-A148, Grade-80-50.
- C. Steel forgings: ASTM-A668.
- D. Bolts: ASTM-A307, ASTM-A325, ASTM-A354.
- E. Filler metal: AWS Standards.
- F. Cast iron: ASTM-A48, Class 30, minimum 30,000 PSI tensile.
- G. Malleable iron: ASTM-A47 and ASTM-A197.
- H. Steel pipe: ASTM-A53.
- I. Stainless steel: ASTM-A484 and ASTM-A276:
  - 1. Concealed: Type 302 or Type 304.
  - 2. Exposed: Type 304:
    - a. Finish: ASTM-A480.
    - b. AISI finish #4, unless otherwise indicated.

- J. Non-shrink Grout:
  1. Compressive strength: 8,475 PSI at 7 days.
  2. Base Product: "Super Por-Rok" by Minwax.
- K. Anchorage devices - masonry:
  1. Standard manufactured items.
  2. Lead expansion shields for machine screws and bolts 1/4 IN and smaller: Head out embedded nut type.
  3. For machine screws and bolts larger than 1/4 IN: Manufacturers' standard.
  4. Bolt anchor expansion shields for lag bolts: Zinc alloy, long shield anchors.
  5. Bolt anchor expansion shields for bolts: Closed end bottom bearing type.
- L. Fasteners:
  1. Galvanized or stainless where built into exterior walls.
  2. Select fasteners for type, grade, and class required.
  3. Bolts and Nuts: Regular hexagon head ASTM-A307, Grade-A.
  4. Lag Bolts: Square or octagonal head type.
  5. Machine Screws: Cadmium plated steel.
  6. Wood Screws: Flat head carbon steel.
  7. Plain Washers: Round, carbon steel.
  8. Lock Washers: Helical spring carbon steel.

## 2.3 STEEL STAIRS

- A. General:
  1. Supply items required for complete construction and installation.
  2. Minimum Workmanship Standards, unless noted otherwise:
    - a. Enclosed Stairs: "Commercial Class" per NAAMM AMP-510, Metal Stairs Manual.
    - b. Non-enclosed monumental stairs: "Architectural Class" per NAAMM AMP-510, Metal Stairs Manual.
  3. Anchorage accessories:
    - a. Items required to secure wood to metal, wood to masonry, metals to masonry, or concrete, metal-to-metal or metal to other items.
- B. Pre-manufactured Steel Stairs: Comply with following minimum requirements:
  1. General arrangement with rise, run, landing dimensions, etc., similar to stairs indicated.
  2. Design auxiliary framing not indicated and modifications to framing required for stairs.
  3. Fabricate and design stair and landing assembly in accordance with NAAMM Metal Stairs Manual and latest AISC Manual of steel construction.
  4. Fabricate and design stair and landing assembly to support larger of following loads, whichever results in strongest components:
    - a. Design Concentrated Moving Load: 300 LBS.
    - b. Design Uniform Load: 100 PSF.
  5. Stringers:
    - a. Minimum Member Thickness: 3/16 IN steel plate.
  6. Treads:
    - a. Minimum Sheet Thickness: 14 GA or greater, according to design loading.
    - b. Type:
      - 1) Concrete-filled steel pans with self-furring diamond mesh lath welded in pan and on-site job-filled with concrete.
  7. Risers:
    - a. Minimum Sheet Thickness: 14 GA or greater, according to design loading.
  8. Landings:
    - a. Minimum Sheet Thickness: 10 GA or greater, according to design loading.
    - b. Include steel stiffeners; shapes and sizes as appropriate to type specified.
    - c. Type:
      - 1) Concrete-filled steel pans with angle stiffeners, as required, and self-furring diamond mesh metal lath welded in pan, and job-filled with concrete.

9. Metal Lath, Diamond Mesh:
  - a. Self-furring Diamond Mesh Metal Lath:
    - 1) Self-furring diamond mesh design comprised of dimples, crimps, or vee-grooves designed to hold metal lath 1/4 to 3/8 IN away from tread and landing steel pans.
10. Form surface of nosings with slip resistant aluminum extruded nosing with photoluminescent insert.
11. Modify standard railings to meet code requirements and details.

## 2.4 HANDRAILS AND GUARDRAILS

- A. General:
  1. Supply items required to complete construction and installation.
  2. Minimum Workmanship Standards, unless noted otherwise:
    - a. Consistent with NAAMM Class specified for Stairs.
  3. Use galvanized steel for exterior use.
  4. Form to profiles indicated.
  5. Anchorage accessories:
    - a. Items required to secure wood to metal, wood to masonry, metals to masonry or concrete, metal-to-metal or metal to other items.
- B. Design Criteria - 2006 IBC:
  1. Handrails and top rail of Guardrails, Uniform Load: 50 LBS/LF applied in any direction.
  2. Handrails, Concentrated Load: 250 LBS applied in any direction at any point along the rail.
    - a. Note: A higher ADA loading requirement for Handrails supersedes that of Building Code.
  3. Guardrail, Concentrated Load: 200 LBS applied in any direction at any point along the rail.
  4. Uniform and Concentrated Loads need not be concurrently applied.
  5. Intermediate rails, pickets, panels, balusters, and other infill materials:
    - a. Design to withstand a horizontally applied normal load of 50 pounds on an area not to exceed 1 square foot including openings and space between rails.
  6. Utilize above listed loads for design of indicated members and their direct or indirect connection to building superstructure.
- C. Handrails and Guardrails:
  1. Minimum clearance from wall: 38 1-1/2 IN.
  2. Maximum projection from wall: 4-1/2 IN.
  3. Set mounting brackets and posts maximum 8 FT O.C.
  4. Return ends of wall mounted rails to wall.
  5. Make rails smooth with no projections that would prevent a hand from sliding along entire length.
  6. Handrail Member Size:
    - a. Round Tubing: HSS 1.50.x 0.083; ASTM-A500.
  7. Guardrail Member Sizes:
    - a. General:
      - 1) Following member sizes are "minimum."
      - 2) Sizes shall be increased where appropriate to resist Design Loads.
      - 3) Refer to Drawings for depiction of Guardrails.
  8. Posts:
    - a. Round Tubing:
      - 1) HSS 1.66.x 0.140; ASTM-A500.
      - 2) Schedule 40 Pipe: 1-1/4 IN STD; ASTM-A53 is also acceptable.
  9. Toprails and Bottomrails:
    - a. Round Tubing:
      - 1) HSS 1.66.x 0.140; ASTM-A500.
      - 2) Schedule 40 Pipe: 1-1/4 IN STD; ASTM-A53 is also acceptable.
  10. Pickets:
    - a. Square Bar: 1/2 x 1/2 IN.

## **2.5 MISCELLANEOUS ITEMS**

- A. Abrasive warning tape:
  - 1. Self-adhering, tape with slip resistive mineral surface.
  - 2. Color: Safety Yellow.
  - 3. Width: 2 IN, except where noted otherwise.
  - 4. Tape Type 1:
    - a. Base Product: "Safety-Walk 530 Conformable" by 3M.
    - b. Backing: Aluminum foil.
    - c. Thickness: 0.035 IN.
    - d. Use Type 1 at top and bottom rungs of all ladders.
- B. Slip-resistant nosing with photoluminescent insert:
  - 1. Base Product: "4140" by Balco, Inc.
  - 2. Material: Mill finish aluminum with photoluminescent insert.
  - 3. Width: 3 IN, with 1 IN insert strip.

## **2.6 SELF-CLOSING GATES – EGRESS CONTROL FOR STAIRS**

- A. Self-closing Gate:
  - 1. Configuration indicated.
  - 2. Hardware:
    - a. Spring butt hinges, Type 5: Specified in Section 08 71 00.
    - b. Rubber bumper; utilize wall-mounted style of Door Stop: Specified in Section 08 71 00.

## **2.7 FABRICATION**

- A. Form to shapes indicated with straight lines, sharp angles, and smooth curves.
- B. Drill or punch holes with smooth edges for temporary field connections and attachment of work by other trades.
- C. Make permanent shop and field connections with continuous fillet type welds.
- D. Grind exposed welds smooth.
- E. Conceal fastenings where practicable.
- F. Shop fabricate in as large assemblies as practicable.
- G. Meet requirements specified under Structural Steel for fabricating items of structural nature or use.
- H. Qualify welding processes and welding operators in accord with AWS.

## **2.8 SURFACE PREPARATION AND SHOP APPLIED COATINGS**

- A. General:
  - 1. All items in this section shall be shop finished by one of methods described in this Article.
- B. Shop Primer for Interior (non-wet) Items:
  - 1. Primer: Sherwin-Williams Pro-Cryl Universal Acrylic Primer, B66-310 Series.
  - 2. Apply primer for interior finish paint to following surfaces not receiving other coating:
    - a. Surfaces exposed on interior.
  - 3. Clean thoroughly before priming; remove mill scale, rust, dirt, oil, and grease in accordance with SSPC-SP3.
  - 4. Apply in accordance with paint manufacturer's instructions.
    - a. Apply minimum 0.002 IN, dry film thickness.
  - 5. Finish Paint; applied in field: Specified in Section 09 91 23.
- C. Hot-dip Galvanized (HDG) Coating for Exterior items:
  - 1. Galvanize (HDG) following items:

- a. Items to be installed on site, roof or other areas that are "outside" of building enclosure walls. This shall include items "attached" to exterior walls of building.
- b. Items to be installed in "wet" or humid (>70% RH) areas of building.
2. Clean thoroughly before galvanizing.
3. Galvanize in accordance with ASTM-A123.

## **2.9 PAINTING**

- A. Paint exterior steel items in field as Specified in Section 09 91 13.
- B. Paint interior steel items in field as Specified in Section 09 91 23.

## **PART 3 - EXECUTION**

### **3.1 INSPECTION**

- A. Verify suitability of substrate to accept installation.
- B. Installation constitutes acceptance of responsibility for performance.
- C. Ensure that adequate Wall Backing (as specified in Section 09 22 16) has been installed where required for handrails and similar wall-mounted items specified in this Section.

### **3.2 INSTALLATION**

- A. General:
  1. Set work level, true to line, and plumb.
  2. Shim and grout as necessary.
  3. Weld field connections and grind smooth.
  4. Where practical, conceal fastenings.
  5. Secure metal to wood with lag screws of adequate size with appropriate washers.
  6. Secure metal to concrete with embedded anchors, setting compounds, caulking and sleeves, or setting grout:
    - a. Use expansion bolts, toggle bolts, or screws for light duty service.
  7. Meet structural requirements for erecting items of structural nature.
  8. Do not field splice fabricated items unless size requires splicing.
  9. Weld splices.
  10. Provide fabricated items complete with attachment devices as required to install.
- B. Galvanic Repair:
  1. After galvanized units have been erected and anchored apply galvanizing repair paint in accordance with manufacturer's recommendations.
  2. Surface preparation: Remove contaminates in accord with SSPC SP-1.
- C. Handrails:
  1. Furnish handrails complete with brackets.
  2. Coordinate locations and installation of Wall Backing specified in Section 09 22 16.
  3. Wherever pickets or posts are indicated to be set in sleeves, provide galvanized steel sleeves having a minimum wall thickness of 1/8 IN.
  4. Set pickets or posts in sleeves with non-shrink grout.
  5. Where setting is required for exterior, hold non-shrink grout back 1/4 IN from surface.
  6. Fill flush with sealant.
- D. Abrasive warning tapes:
  1. Apply where indicated near end of construction, after job site has been cleaned and nearly ready for occupancy.
  2. Clean and prepare surfaces to receive tape prior to application.
  3. Apply tape only when ambient temperature is within manufacture's recommended limits.
  4. Where tape is damaged by construction activities, remove, re-clean, and re-apply.

- E. Slip-resistant nosing with photoluminescent insert:
  - 1. Install nosing per manufacturer's recommendation.

### **3.3 FIELD PAINTING**

- A. All items in this section which are exposed to view:
  - 1. Painting of exterior items: Specified in Section 09 91 13.
  - 2. Painting of interior items: Specified in Section 09 91 23.

**END OF SECTION**



**SECTION 05 52 16**  
**EXTERIOR METAL RAILINGS**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Furnish all labor, materials, tools, equipment, and services for exterior metal railings, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

**1.2 QUALITY ASSURANCE**

- A. References standards:
  - 1. Architectural Aluminum Manufacturer's Association (AAMA) for aluminum.
  - 2. American Society for Testing and Materials (ASTM).
- B. Design Responsibility - General:
  - 1. Engineering design submittal must be performed by, or under the direct supervision of, a registered Engineer, licensed to practice Structural Engineering in State of New York.
  - 2. Submittal must include calculations for all rails, posts, pickets, and other load-resisting components:
    - a. Note design live loads on submittal.
  - 3. Submittal to be reviewed by Architect for general conformance with design intent as indicated:
    - a. Physical adequacy of Structural design, and conformance with applicable building Codes are the responsibility of the railing fabricator.
  - 4. Component sizes shall comply as indicated except larger/stronger members may be used where additional strength is required:
    - a. Demonstrate by calculations performed by qualified Engineer employed by the fabricator.
- C. Code Compliance:
  - 1. Design exterior railing system to comply with:
    - a. Building Code as locally adopted.
    - b. ADA requirements.
- D. Top rails of guardrail systems shall be capable of withstanding the following loads applied as indicated:
  - 1. Concentrated load of 250 LB applied at ant point and in any direction.
  - 2. Uniform load of 50 LB per linear FT applied horizontally and concurrently with uniform load of 100 LB per linear FT applied vertically downward.
  - 3. Concentrated load need not be assumed to act concurrently with uniform loads.
- E. Handrails not serving as top rails shall be capable of withstanding the following loads applied as indicated:
  - 1. Concentrated load of 250 LB applied at any point and in any direction.
  - 2. Uniform dead load of 50 LB per linear FT applied in any direction.
  - 3. Concentrated load need not be assumed to act concurrently with uniform loads.
- F. Guardrail systems shall be capable of withstanding a horizontal concentrated load of 250 LB applied to any member in the system:
  - 1. Above load need not be assumed to act concurrently with loads on top rails of railing system in determining stress on guard.

### 1.3 SUBMITTALS

- A. Product Data:
  - 1. Manufacturer's product data, including description of materials, components, fabrication, and finishes.
- B. Shop Drawings:
  - 1. Including elevations, sections, and details, indicating materials, components, sizes, dimensions, tolerances, hardware, fasteners, finishes, options, accessories, and installation.
  - 2. Indicate component details, materials, finishes, connection and joining methods.
  - 3. Show details of attaching railing system to supports.
- C. Project Information:
  - 1. Engineering design calculations, sealed by registered Engineer, licensed to practice Structural Engineering in state where project is located.
- D. Contract Closeout Information:
  - 1. Maintenance Instructions.
  - 2. Warranty.
- E. LEED Information:
  - 1. MR 4.1 and 4.2, Recycled Content: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content; include statement indicating costs for each product having recycled content.
  - 2. MR 5.1 and 5.2, Regional Materials: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.

## PART 2 - PRODUCTS

### 2.1 ACCEPTABLE MANUFACTURERS

- A. Exterior Metal Railing System:
  - 1. Base:
    - a. Julius Blum & Co.
  - 2. Optional:
    - a. J.G. Braun.
    - b. Blumcraft of Pittsburgh.
    - c. HDI Railings
- B. Dissimilar metal protection coating:
  - 1. Base:
    - a. Tnemec.
- C. Grout, non-shrink:
  - 1. Base:
    - a. Minwax.
  - 2. Optional:
    - a. Sauereisen Cements Co.

### 2.2 MATERIALS

- A. Aluminum:
  - 1. Alloy 6063-T52 for extruded pipe sections and posts in accord with ASTM-B221.
  - 2. Finish:
    - a. Clear anodized AA-M12-C22-A41 in accord with AAMA 606.1.

- B. Anchorage devices:
  - 1. Furnish anchorage devices compatible with system and substrate.
- C. Grout, non-shrink:
  - 1. Compressive strength: 58,435 kPa 8,475 PSI at 7 days.
  - 2. Base Product: Minwax, Super Por-Rok.

## **2.3 FABRICATION**

- A. Form to shapes and profiles indicated with straight lines, sharp angles, smooth curves.
- B. Drill or punch holes with smooth edges for temporary field connections and attachment of work by other trades.
- C. Furnish minimum 5 IN matching sleeves or inserts for post systems set in concrete:
  - 1. Set inserts for posts at maximum 8 FT O.C. unless closer spacing is indicated.
- D. Conceal fastenings where practicable.
- E. Shop fabricate in as large assemblies as practicable.
- F. Provide dissimilar metal protection coating:
  - 1. When dissimilar metals come in contact.
  - 2. When aluminum is anchored to or in contact with concrete or masonry.
- G. Cut material square and remove burrs from exposed edges with no chamfer.
- H. Make rails smooth with no projections preventing a hand from sliding along entire length.
- I. Make exposed joints butt tight and flush.
- J. Close exposed ends of pipes or rails with end caps.

## **PART 3 - EXECUTION**

### **3.1 INSPECTION**

- A. Verify suitability of substrate to accept installation.
- B. Installation constitutes acceptance of responsibility for performance.

### **3.2 INSTALLATION**

- A. Set work level, true to line, plumb.
- B. Shim and grout as necessary.
- C. Where practical, conceal fastenings.
- D. Secure metal to concrete with embedded anchors, setting compounds, caulking and sleeves, or setting grout.
- E. Meet structural requirements for erecting items of structural nature.
- F. Do not field splice fabricated items unless size requires splicing.
- G. Wherever posts are indicated to be set in sleeves, provide galvanized steel sleeves having a minimum wall thickness of 1/8 IN:
  - 1. Set posts in sleeves with non-shrink grout.
  - 2. Hold non-shrink grout back 1/4 IN from surface.
  - 3. Fill flush with sealant.
- H. Provide fabricated items complete with attachment devices as required to install.

### **3.3 CLEANING AND PROTECTION**

- A. Protect railing systems during construction.
- B. Clean prior to final acceptance.

**END OF SECTION**

**SECTION 05 60 00**  
**ALUMINUM LOUVER FENCING**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section includes: Ornamental fixed louver modular fencing panels fabricated with extruded aluminum louvers and flat aluminum bars including extruded aluminum fence posts and aluminum louver gates.
- B. Related sections:
  - 1. Section 03 31 00 - Concrete Materials and Proportioning.
  - 2. Section 04210 - Brick Masonry.

**1.2 REFERENCES**

- A. American Society for Testing and Materials (ASTM) Publications:
  - 1. ASTM B209 - Aluminum and Aluminum-Alloy Sheet and Plate.
  - 2. ASTM B221 - Aluminum-Alloy Extruded Bar, Rod, Wire, Shape, and Tube.
  - 3. ASTM B117 - Standard Practice for Operating Salt Spray (Fog) Apparatus.
  - 4. ASTM D822 - Tests on Paint and Related Coatings Using Filtered Open-Flame Carbon-Arc Exposure Apparatus.
  - 5. ASTM D2794 - Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact).
  - 6. ASTM D3363 - Test Method for Film Hardness by Pencil Test.

**1.3 SUBMITTALS**

- A. Provide in accordance with Section 01 30 00 - Submittal Procedures:
  - 1. Product data for components and accessories.
  - 2. Shop drawings showing layout, dimensions, spacing of components, and anchorage and installation details.
  - 3. Sample: 8 IN x 10 IN minimum size sample of fence panel illustrating design, fabrication workmanship, and selected color coating.
  - 4. Copy of warranty specified in this specification under "WARRANTY" Article for review by Architect.
- B. Environmental Information:
  - 1. LEED Credit MR 4.1 and 4.2, Recycled Content: Product data indicating percentages by weight of post-consumer and post-industrial recycled content for products having recycled content; include statement indicating costs for each product having recycled content.
  - 2. LEED Credit MR 5.1 and 5.2, Local/Regional Materials: Manufacturer's certification indicating point of extraction of raw material and final point of assembly for products and materials located within 500 miles of Project site. Include manufacturer's name, address and phone number.

**1.4 WARRANTY**

- A. Provide in accordance with Section 01 77 00 - Contract Closeout:
  - 1. 10 years warranty for factory finish against cracking, peeling, and blistering under normal use.

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS**

- A. Basis-of-Design Product: The design for the Aluminum Louver Fencing is based on fencing produced by Ametco Manufacturing Corporation, 4326 Hamann Parkway, P.O. Box 1210, Willoughby, Ohio 44096; 800-362-1360. Subject to compliance with requirements, provide the named product or a comparable, approved product.
- B. Extruded aluminum: ASTM B221, Alloy 6063, Temper T-6.
- C. Sheet aluminum: ASTM B209 6063, Temper T-6.
- D. Grout: Non-shrink type, pre-mixed compound consisting of non-metallic aggregate, cement, and water reducing and plasticizing additives.

### **2.2 FENCE SYSTEM**

- A. Type: Ornamental fencing system consisting of horizontal, fixed louver, modular fence panels fabricated with extruded aluminum framing bars and supported by extruded aluminum fence posts; Total Eclipse Aluminum Fixed Louver Fencing as manufactured by Ametco Manufacturing Corporation.
- B. Fence panel:
  - 1. Total Eclipse: Inclined, flanged louver blade providing 100 percent visual blocking.
  - 2. Fixed louver bars: Extruded aluminum louver bars, 1-31/32 IN wide, spaced at 1-13/16 IN. Extend louver flange to allow 100 percent direct visual screening.
  - 3. Cross bars: 1/2 x 1/8 IN flat bars welded perpendicular to back side of louver bars and spaced at 18 IN.
  - 4. Framing bars: Extruded aluminum flat bars welded to ends of louvers.
  - 5. Panel height: As indicated on Drawings.
  - 6. Panel width: As indicated on Drawings.
- C. Posts:
  - 1. Type: Extruded aluminum solid shapes. Length: As indicated on Drawings.

### **2.3 ACCESSORIES**

- A. Fasteners: Stainless steel bolts of type, size, and spacing as recommended by fence manufacturer for specific condition.

### **2.4 FACTORY FINISH**

- A. Aluminum fence panels and posts shall receive polyester powder coating.
- B. Polyester powder coating: Electrostatically applied colored polyester powder coating heat cured to chemically bond finish to metal substrate.
  - 1. Minimum hardness measured in accordance with ASTM D3363: 2H.
  - 2. Direct impact resistance tested in accordance with ASTM D2794. Withstand 160 IN-LBS.
  - 3. Salt spray resistance tested in accordance with ASTM B117: No undercutting, rusting, or blistering after 500 hours in 5 percent salt spray at 95 degF and 95 percent relative humidity and after 1000 hours less than 3/16 IN undercutting.
  - 4. Weatherability tested in accordance with ASTM D822: No film failure and 88 percent gloss retention after 1 year exposure in South Florida with test panels tilted at 45 degrees.
- C. Color: Custom color to be selected by Architect.

## **PART 3 - EXECUTION**

### **3.1 PREPARATION**

- A. Prior to fabrication, field verify required dimensions.

### **3.2 INSTALLATION**

- A. Install fencing in accordance with manufacturer's installation instructions and approved shop drawings.
- B. Install fence posts plumb and level. Surface mount posts to tops of footings.
- C. Do not installed bent, bowed, or otherwise damaged panels. Remove damaged components from site and replace.
- D. Secure fence panels with standard stainless steel bolts to fence posts after posts have been attached to footings.
- E. Touch-up damaged finish with paint supplied by manufacturer and matching original coating.

**END OF SECTION**



**SECTION 05 73 00**  
**CUSTOM METAL RAILINGS**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Furnish all labor, materials, tools, equipment, and services for Custom Metal Railings, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

**1.2 QUALITY ASSURANCE**

- A. References standards:
  - 1. Architectural Aluminum Manufacturer's Association (AAMA) for aluminum.
  - 2. American Society for Testing and Materials (ASTM).
  - 3. National Association of Architectural Metals Manufacturers (NAAMM) for metal finishes.
  - 4. American National Standards Institute (ANSI).
  - 5. American Iron and Steel Institute (AISI) for stainless steel.
  - 6. Copper Development Association (CDA) for bronze.
- B. Design Responsibility - General:
  - 1. Engineering design submittal must be performed by, or under the direct supervision of, a registered Engineer, licensed to practice Structural Engineering in State of New York
  - 2. Submittal must include calculations for all Rails, Posts, Balusters, Pickets, Infill members, and other load-resisting components:
    - a. Note design live loads on submittal.
  - 3. Submittal to be reviewed by A/E for general conformance with design intent shown by Contract Documents:
    - a. Physical adequacy of Structural design, and conformance with applicable building Codes are the responsibility of the railing fabricator.
  - 4. Component sizes shall comply as indicated except larger/stronger members may be used where additional strength is required:
    - a. Demonstrate by calculations performed by qualified Engineer employed by the fabricator.
- C. Code Compliance:
  - 1. Design Custom Railing system to comply with:
    - a. Building Code as locally adopted.
    - b. ADA requirements.
- D. Top rails of guardrail systems capable of withstanding the following loads applied as indicated:
  - 1. Concentrated load of 250 LB applied at ant point and in any direction.
  - 2. Uniform load of 50 LB per linear FT applied horizontally and concurrently with uniform load of 100 LB per linear FT applied vertically downward.
  - 3. Concentrated load need not be assumed to act concurrently with uniform loads.
- E. Handrails not serving as top rails capable of withstanding the following loads applied as indicated:
  - 1. Concentrated load of 250 LB applied at any point and in any direction.
  - 2. Uniform dead load of 50 LB per linear FT applied in any direction.
  - 3. Concentrated load need not be assumed to act concurrently with uniform loads.
- F. Infill area of guardrail systems capable of withstanding a horizontal concentrated load of 250 LB applied to one SF at any point in the system:

1. Above load need not be assumed to act concurrently with loads on top rails of railing system in determining stress on guard.

### **1.3 SUBMITTALS**

- A. Product Data:
  1. Manufacturer's product data, including description of materials, components, fabrication, and finishes.
- B. Shop Drawings:
  1. Including elevations, sections, and details, indicating materials, components, sizes, dimensions, tolerances, hardware, fasteners, finishes, options, accessories, and installation.
  2. Indicate component details, materials, finishes, connection and joining methods.
  3. Show details of attaching railing system to supports.
- C. Samples:
  1. Minimum 2 IN x 4 IN sample of specified finish.
- D. Project Information:
  1. Engineering design calculations, sealed by registered Engineer, licensed to practice Structural Engineering in state where project is located.
- E. Contract Closeout Information:
  1. Maintenance Instructions.
  2. Warranty.

## **PART 2 - PRODUCTS**

### **2.1 ACCEPTABLE MANUFACTURERS**

- A. Glass-supported Railing System at Stair #1:
  1. Base:
    - a. Blumcraft of Pittsburgh.
  2. Optional:
    - a. Julius Blum & Co.
    - b. J.G. Braun.
    - c. HDI Railings.
- B. Glass-supported Railing System at Stair #3:
  1. Base:
    - a. HDI Railings.
  2. Optional:
    - a. Julius Blum & Co.
    - b. J. G. Braun.
    - c. Blumcraft of Pittsburgh.
- C. Dissimilar metal protection coating:
  1. Base:
    - a. Tnemec.
- D. Grout, non-shrink:
  1. Base:
    - a. Minwax.
  2. Optional:
    - a. Sauereisen Cements Co.

### **2.2 MATERIALS**

- A. Structural steel: ASTM-A36, ASTM-A501, ASTM-A575 or ASTM-A108.

- B. Aluminum:
  - 1. Alloy 6063-T52 for extruded pipe sections and posts in accord with ASTM-B221.
  - 2. Finish:
    - a. Clear anodized AA-M12-C22-A41 in accord with AAMA 606.1.
- C. Stainless steel:
  - 1. AISI Type 304.
  - 2. ASTM-A480 finish: No. 4 brushed.
- D. Glass:
  - 1. See Section 08 81 04.
- E. Anchorage devices:
  - 1. Furnish anchorage devices compatible with system and substrate.
- F. Grout, non-shrink:
  - 1. Compressive strength: 8,475 PSI at 7 days.
  - 2. Base Product: Minwax, Super Por-Rok.
- G. Grout, epoxy: Recommended by railing manufacturer.

### **2.3 GLASS-SUPPORTED RAILING SYSTEMS**

- A. Base Shoe:
  - 1. Manufacturer's standard aluminum rectangular type.
  - 2. Overall Size: 2-1/2 IN wide X 4 IN wide.
  - 3. Complete with required setting blocks, fillers and gaskets.
- B. Glass:
  - 1. Kind: Tempered plate glass complying with ANSI Z97.1.
  - 2. Thickness: 3/4 IN with polished exposed edges.
  - 3. Color: Clear.
- C. Glass-Mounted Handrail:
  - 1. Provide where indicated.
  - 2. Diameter: 1-1/2 IN.
  - 3. Material: Stainless steel.
- D. Glass-mounted Bracket:
  - 1. Provide components for level and sloping railings as required.
- E. Include all finished end caps, mitered sections, sleeves, gaskets, fasteners and other items required.
- F. Include supplemental brackets and wall return sections where railings extend past glass rail and pass in front of gypsum or other wall types.
- G. Metal Cladding:
  - 1. Material: Stainless steel.
  - 2. See Drawings for locations, sizes and details.

### **2.4 FABRICATION - GENERAL**

- A. Form to shapes and profiles indicated with straight lines, sharp angles, smooth curves.
- B. Drill or punch holes with smooth edges for temporary field connections and attachment of work by other trades.
- C. Furnish minimum 5 IN matching sleeves or inserts for post systems set in concrete:
  - 1. Set inserts for posts at maximum 8 FT O.C.
- D. Conceal fastenings where practicable.
- E. Shop fabricate in as large assemblies as practicable.

- F. Provide dissimilar metal protection coating:
  - 1. When dissimilar metals come in contact.
  - 2. When metal or aluminum is anchored to or in contact with concrete or masonry.
- G. Cut material square and remove burrs from exposed edges with no chamfer.
- H. Make rails smooth with no projections preventing a hand from sliding along entire length.
- I. Make exposed joints butt tight and flush.
- J. Close exposed ends of pipes or rails with end caps.
- K. Base Product:
  - 1. At Stair #1: RG-450EN by Blumcraft of Pittsburgh.
  - 2. At Stair #3: d Line by HDI Railings.

## **PART 3 - EXECUTION**

### **3.1 INSPECTION**

- A. Verify suitability of substrate to accept installation.
- B. Installation constitutes acceptance of responsibility for performance.

### **3.2 INSTALLATION**

- A. Set work level, true to line, plumb.
- B. Shim and grout as necessary.
- C. Where practical, conceal fastenings.
- D. Secure metal to concrete with embedded anchors, setting compounds, caulking and sleeves, or setting grout.
- E. Meet structural requirements for erecting items of structural nature.
- F. Do not field splice fabricated items unless size requires splicing.
- G. For posts set in sleeves at Stair #3, provide galvanized steel sleeves having a minimum wall thickness of 1/8 IN:
  - 1. Set posts in sleeves with non-shrink or epoxy grout.
- H. Provide fabricated items complete with attachment devices as required to install.
- I. Set work level, true to line, plumb.
- J. Shim and grout as necessary.
- K. Secure metal to concrete with embedded anchors, setting compounds, caulking and sleeves, or setting grout.
- L. Install per manufacturer's specifications and approved shop drawings.
- M. Set glass plumb within a tolerance of 1/16 IN in 12 IN.
- N. Fit exposed connections accurately together to form tight hairline joints except as required for expansion.

### **3.3 CLEANING AND PROTECTION**

- A. Protect railing systems during construction.
- B. Clean prior to final acceptance.

## **END OF SECTION**

**HDR**

**D I V I S I O N    0 6**  
**WOOD, PLASTICS, AND COMPOSITES**



**SECTION 06 10 53**  
**CARPENTRY**

**PART 1 - GENERAL**

**1.1 QUALITY ASSURANCE**

- A. Lumber grading rules and species:
  - 1. US Department of Commerce, DOC PS-20 – American Softwood Lumber Standard.
  - 2. Western Wood Products Association (WWPA).
  - 3. Southern Forest Products Association (SFPA).
- B. Certification of wood from sustainable forests:
  - 1. Forest Stewardship Council.
  - 2. Smart Wood.
  - 3. Sustainable Forest Initiative as indicated for Alternate No. 7.
- C. Plywood grading rules and recommendations:
  - 1. For softwood plywood: US Department of Commerce DOC PS-1 – Construction and Industrial Plywood.
  - 2. For hardwood plywood: US Department of Commerce DOC PS-51-71.
  - 3. American Plywood Association (APA).
- D. Factory marking:
  - 1. Identify type, grade, moisture content, inspection service, producing mill, and other qualities.
  - 2. Mark each piece of fire retardant treated material with Underwriters Laboratory Classification mark, and fire-retardant treatment, pressure-applied blue stain color code for identification.
  - 3. Standards for fire hazard classification and weathering for fire retardant treated material: Underwriters' Laboratories (UL), American Wood Preservers Institute (AWPI), and American Society for Testing and Materials (ASTM).
    - a. ASTM-E84: Standard Test Method for Surface Burning Characteristics.
    - b. ASTM-D2898: Standard Method of Accelerated Weathering of Fire Retardant Treated Wood for Fire Testing.
  - 4. International Building Code requirements for identification and labeling.
- E. Preservative and fire retardant treatment standards: American Wood Preservers Association (AWPA):
  - 1. AWPA-U1: Treated Wood.
  - 2. AWPA P5: Standard for Waterborne Preservatives.
- F. Sustainable Forest Certification:
  - 1. A voluntary third party certification in conformance with Scientific Certification System (SCS) that timber harvested meets forest management and ecological standards.
  - 2. Documentation from Sustainable Forest Initiative that wood products comply with applicable standards of Sustainable Forest Initiative as indicated for Alternate No. 7.

**1.2 SUBMITTALS**

- A. Project information:
  - 1. Certification of fire retardant treated material.
  - 2. Certification of preservative treated material.
  - 3. Certification by Forestry Stewardship Council that the lumber furnished is from certified sustainable forest.
  - 4. Certification by Sustainable Forest Initiative as indicated for Alternate No. 7.

- B. LEED Information:
  1. LEED Credit MR 4.1 and 4.2, Recycled Content: Product data indicating percentages by weight of post-consumer and post-industrial recycled content for products having recycled content; include statement indicating costs for each product having recycled content.
  2. LEED Credit MR 5.1 and 5.2, Regional Materials: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.
  3. LEED Credit MR 6.0, Rapidly Renewable Materials: Manufacturers' product data for products manufactured from rapidly renewable material; indicate type of rapidly renewable material.
  4. LEED Credit MR 7, Certified Wood: Certificates of chain-of-custody signed by manufacturers certifying that products specified to be made from certified wood obtained from forests certified by an FSC-accredited certification agency to comply with FSC 1.2, "Principles, and Criteria." Include evidence that mill is certified for chain-of-custody by an FSC-accredited certification body.
  5. LEED Credit EQ 4.1, Low-Emitting Materials, Adhesives: Manufacturers' product data for construction adhesive, including printed statement of VOC content. .
  6. LEED Credit EQ 4.4, Low-Emitting Materials, Composite Wood and Agrifiber Products: Composite wood manufacturer's product data for each composite wood product used indicating that the bonding agent used contains no urea formaldehyde.
- C. Sustainable Design Information:
  1. Manufacturers data indicating wood products comply with standards of Sustainable Forest Initiative as indicated for Alternate No. 7.

### **1.3 PRODUCT DELIVERY, STORAGE, AND HANDLING**

- A. Store in dry, weathertight, ventilated spaces.
- B. Do not bring items into building until receiving spaces have humidity controlled to between 25 percent and 65 percent.
- C. Stack to provide air circulation.
- D. Store and protect materials in areas where moisture content can be maintained.
- E. Time delivery and installation to avoid delaying progress of other work.
- F. Handle treated material and repair damage in accordance with AWPA-M-4.

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS - ROUGH CARPENTRY**

- A. Acceptable manufacturers:
  1. Fire-retardant treated dimension lumber and plywood:
    - a. Base:
      - 1) Hoover Wood Treated Products, Inc.
    - b. Optional:
      - 1) Chemical Specialties.
      - 2) Arch Wood Protection (Dricon).
  2. Preservative Treated Lumber (CCA):
    - a. Base:
      - 1) Hoover Treated Wood Products.
- B. Dimensional Lumber & Plywood (non-treated):
  1. General:

- a. Thoroughly seasoned, well-fabricated materials of longest practical lengths and sizes.
  - b. Free of non-correctable warp.
  - c. Discard material which would impair quality of work.
  - 2. Lumber Grading: Comply with dry size requirements of PS-20, Douglas fir WWPA No.3, or SFPA No.2.
  - 3. Plywood Grading: PS1, A-C Grade, formaldehyde-free resins at interior applications.
  - 4. Usage (except where treated types are indicated):
    - a. General framing.
    - b. Blocking, backing, nailers, grounds, and similar members.
    - c. Other locations where indicated.
- C. Fire-retardant Treated (FRT) Lumber & Plywood:
- 1. General:
    - a. Fire-retardant-treated wood:
      - 1) ASTM-E84:
        - a) Flame spread index of 25 or less and no evidence of significant progressive combustion when the test is continued for an additional 20-minute period.
        - b) Flame front shall not progress more than 10.5 FT beyond the centerline of the burners at any time during the test.
    - b. Free of halogens, sulfates, chlorides, arsenic, ammonium phosphate, formaldehyde, and urea formaldehyde.
    - c. Manufactured under the independent third party inspection of Underwriters Laboratories Inc. (UL).
    - d. Kiln dried after treatment to maximum moisture content of 19 percent for lumber and 15percent for plywood. Label each piece kiln dried after treatment "KDAT."
    - e. Lumber Grading:
      - 1) Comply with dry size requirements of PS-20, Douglas fir WWPA No.3, or SFPA No.2.
      - 2) Thoroughly seasoned, well-fabricated materials of longest practical lengths and sizes.
      - 3) Free of non-correctable warp.
      - 4) Discard material which would impair quality of work.
    - f. Plywood Grading: PS1, A-C Grade.
  - 2. FRT material for interior, above-grade Locations (typical):
    - a. Base Product: "Pyro-Guard" by Hoover, or "Dricon FRT" by Dricon.
    - b. Natural wood products treated to add fire-retardant qualities.
    - c. Maximum equilibrium moisture content: Not more than 28 percent when tested in accordance with ASTM-D3201 at 92 percent relative humidity.
    - d. Usage (Interior above-grade FRT):
      - 1) Above-grade framing, blocking, and sill plates within non-load bearing interior partitions that are fire rated 2 hours or less.
      - 2) Above-grade framing, blocking, and sill plates within non-load bearing exterior walls that are not fire-rated.
      - 3) Platforms and Stages.
      - 4) Wood in concealed spaces.
      - 5) Framing, blocking, cants and nailers within roof covering and waterproofing systems.
      - 6) Interior sleepers and sill plates in contact with concrete slabs-on-grade.
      - 7) Interior wood items in direct contact with exterior concrete and exterior masonry walls.
      - 8) Window frame blocking within exterior walls.
      - 9) Formaldehyde-free plywood backing panels for electrical, tele-communication equipment.
      - 10) Similar locations where wood products are indicated and Building Code does not permit non-FRT products.
      - 11) Exception: Upgrade to Exterior grade where schedules in the following article.

- D. Preservative Treated Lumber & Plywood (CCA):
1. Natural wood products treated to add decay and termite resistance.
  2. Base Product: "CCA" by Hoover.
  3. Standards:
    - a. Treated wood: AWPA U-1.
    - b. Preservative treatment standard: AWPA P-5.
    - c. ASTM-D1625.
    - d. ASTM-D1760.
  4. Preservative:
    - a. CCA Type C in accordance with ASTM-D1625 and Federal Specification TT-W-550.
    - b. DO NOT USE formulations containing Alkaline Copper Quaternary (ACQ).
    - c. Pressure impregnation shall be in accordance with methods detailed by ASTM-D1760 and Federal Specification TT-W-571.
    - d. Authenticate by factory marking each piece with manufacturer's mark and applicable standards.
  5. Kiln dried after treatment to maximum moisture content of 19% for lumber and 18% for plywood. Label each piece kiln dried after treatment (KDAT).
  6. Treatment must be compatible with direct exposure to precipitation, sunlight and effects of weather.
  7. Lumber Species: Southern Pine, Mixed Southern Pine, Hem-Fir, Spruce Pine Fir or other recognized species capable of meeting preservative penetration requirements.
  8. Plywood:
    - a. Grading: PS1, A-C Grade.
    - b. Veneers: Only softwood species, glued with waterproof adhesives.
  9. Usage:
    - a. Below grade, or in contact with ground.
    - b. Nailers and blocking in roofing and gutter assemblies.
    - c. Where indicated on Drawings.

## 2.2 FASTENERS

- A. General:
1. Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.
  2. Anchorage and fastening materials: Proper type, size, material, and finish for application.
  3. Where rough carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity:
    - a. Use fasteners with hot-dip zinc coating complying with ASTM-A153.
    - b. Use fasteners of Type 304 stainless steel.
- B. Nails, Brads, and Staples: ASTM-F1667.
- C. Power-Driven Fasteners: NES NER-272.
- D. Wood Screws: ASME B18.6.1.
- E. Lag Bolts: ASME-B18.2.1.
- F. Bolts: ASTM-A307, Grade A steel bolts with ASTM-A563 hex nuts and washers.
- G. Expansion Anchors:
1. Anchor bolt and sleeve assembly capable of sustaining a load equal to 6 times the load imposed when installed in unit masonry assemblies and 4 times the load imposed when installed in concrete as determined by testing per ASTM-E488 conducted by a qualified independent testing and inspecting agency.
  2. Material:
    - a. Interior Applications: Carbon-steel components, zinc plated to comply with ASTM-B633, Class Fe/Zn 5.

- b. Exterior and Wet Applications: Stainless Steel components, ASTM-F593 & F594 Alloy Group 1 or 2.
- c. Zinc plated to comply with ASTM-B633, Class Fe/Zn 5.

### **2.3 MISCELLANEOUS MATERIALS**

- A. Sill-Sealer Gaskets:
  - 1. Closed-cell neoprene foam.
  - 2. Nominal Thickness: 6.4mm 1/4 IN.
  - 3. Widths: matching width of sill members indicated.
- B. Adhesives for Gluing Furring, Sleepers, and sills and similar items to Concrete or Masonry:
  - 1. ASTM-D3498 product that is approved for use indicated by adhesive manufacturer.
  - 2. Use adhesives that have a VOC content of 70 g/L or less in accord with SCAQMD Rule #1168.
- C. Water-Repellent Preservative:
  - 1. Usage: For treatment of exposed ends of posts and beams. Do not use for treating cuts in preservative-treated lumber or fire-retardant treated lumber.
  - 2. NWWDA tested and accepted formulation containing propynyl butyl carbamate, combined with an insecticide containing chloropyrifos as its active ingredient.

## **PART 3 - EXECUTION**

### **3.1 PREPARATION - ROUGH CARPENTRY**

- A. Verify measurements, dimensions, and drawing details before proceeding.
- B. Coordinate location of furring, nailers, blocking, grounds and similar supports for attached work.
- C. Examine conditions under which work is to be installed.
- D. Correct unsatisfactory conditions.

### **3.2 INSTALLATION - ROUGH CARPENTRY**

- A. Attach work securely by anchoring and fastening as indicated or required to support applied loading.
  - 1. Provide washers under bolt heads and nuts.
  - 2. Nail plywood in accordance with APA recommendations.
  - 3. Countersink nail heads.
- B. Set work to required levels and lines, plumb, true.
- C. Cut and fit accurately.
- D. Make connections tight.
  - 1. Use common wire nails or screws for general work.
  - 2. Use finishing nails for finish work.
  - 3. Use fasteners of size that will not penetrate members where opposite side will be exposed to view or receive finish materials.
  - 4. Install fasteners without splitting wood; predrill as required.
  - 5. Do not drive threaded friction type fasteners.
  - 6. Tighten bolts and lag screws at installation and retighten as required.
  - 7. Use galvanized nails and fasteners.
- E. Provide wood grounds, nailers, or blocking as required for attachment of other work and surface applied items.
- F. Form to shapes indicated.
- G. Provide wood blocking between studs at height of door stop, behind stop, at every door opening.

- H. Grounds: Dressed, key beveled lumber minimum 1-1/2 IN wide of thickness required to bring face of ground even with finish material.
- I. Remove temporary grounds when no longer required.
- J. Install wood furring plumb and level with closure strips at edges and openings.
- K. Shim as required.
- L. Field treat cuts and holes in preservative and fire retardant treated material in accordance with AWPAM-4.
- M. Use only fasteners approved by the manufacturer of fire-retardant-treated or preservative treated wood.

### 3.3 INSTALLATION OF BLOCKING AND NAILERS FOR ROOFING AND PARAPETS

- A. General:
  - 1. Comply with ANSI/SPRI ES-1.
  - 2. Minimum Member Size: 2x6 IN (nominal size).
  - 3. Fasteners:
    - a. Corrosion resistant (long-term).
    - b. Countersink heads of all fasteners.
    - c. Fastener types as required for substrate conditions.
    - d. Diameter and spacing as required to resist forces indicated.
  - 4. Fastener Spacing:
    - a. Threaded Anchor Bolts; 3/8 IN or larger:
      - 1) Utilize 5/8 IN OD washers or larger.
      - 2) Maximum Spacing: 48 IN.
      - 3) Stagger 1/3 the nailer width.
    - b. Other fastener types:
      - 1) Maximum Spacing:
        - a) Typical: 12 IN O.C.
        - b) Up to 16 IN O.C. where necessary to match spacing of structural members.
      - 2) Stagger 1/3 the nailer width.
      - 3) At ends of nailers lengths (including butt ends and terminal ends): Install 2 fasteners and within 6 IN of ends.
  - 5. Anchor nailers to resist minimum vertical force of 300 LBS/LF in any direction.
    - a. Locate fasteners approximately 4 IN from ends but not less than 3 IN.
    - b. Use minimum of 3 anchors for each nailer.
    - c. Where members are wider than 6 IN, stagger fasteners from side to side to avoid splitting of the wood member.
    - d. Corner region enhancements:
      - 1) Double the above listed vertical force which must be resisted.
      - 2) Length and width of corners as prescribed by ANSI/SPRI RP-4:
        - a) 40 percent of the building height, but not less than 8-1/2 FT.
- B. Nailers used for perimeter securement of roofing membranes:
  - 1. Refer to "General Requirements" above.
  - 2. Install nailers where indicated and where required to secure perimeter of membrane roofing.
  - 3. Match height of nailers to adjacent insulation.
  - 4. Where multiple layers are required to match depth of insulation:
    - a. Attach base layer as indicated in "General Requirements" above.
    - b. Apply a bead of construction adhesive between laminations.
    - c. Attach subsequent layers using fastener type which is appropriate for wood-to-wood securement.
    - d. Size and locate fasteners as required to resist uplift loading indicated.
- C. Blocking used for securement of sheet metal edge flashings, parapet copings, and similar items:
  - 1. Refer to "General Requirements" above.

2. Install blocking as indicated.
- D. Wall blocking:
1. Provide in-wall wood blocking reinforcement where following items are required to be wall-mounted to interior walls:
    - a. Architectural casework, millwork, cabinets, shelving, wardrobes, and bookcases.
    - b. Handrails at stairwells.
    - c. Wall-mounted door stops.
  2. Wood Blocking:
    - a. Within firewalls: Provide fire-treated material.
- E. Metal Wall Backing: Specified in Section 09 22 16 for walls utilizing metal stud construction.

### **3.4 SPECIAL INSTALLATION REQUIREMENTS - FIRE RETARDANT TREATED WOOD**

- A. Fire retardant treated lumber and plywood used in structural applications shall be applied according to lumber and plywood strength tables provided by manufacturer.
- B. Field Cuts:
1. Dimensional Lumber: Do not rip or mill fire retardant treated lumber.
    - a. Cross cuts, joining cuts, and drilling holes are permitted.
  2. Plywood: Fire retardant treated plywood may be cut in any direction.

### **3.5 INSPECTION**

- A. Examine areas to receive work.
- B. Correct unsatisfactory conditions.
- C. Start of work constitutes acceptance of responsibility for performance.

### **3.6 ADJUST AND CLEAN**

- A. Promptly remove debris, dirt, and rubbish.
- B. After installation, adjust operating parts.
- C. Leave items in perfect operating condition.
- D. Remove and replace rejected work.
- E. Install temporary coverings to protect installed work.

**END OF SECTION**



**SECTION 06 42 16**  
**WOOD PANELING - FLUSH**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. Work includes:
  - 1. Furnish labor, materials, tools, equipment, and services for architectural woodwork indicated, to include:
    - a. Shop-finished, interior Wood Veneer-faced wall paneling, wainscots and base.
  - 2. Completely coordinate with work of other trades.
  - 3. Although such work is not specifically indicated, provide supplementary or miscellaneous items, appurtenances and devices incidental to or necessary for a sound, secure and complete installation.
- B. Related Carpentry work: Specified in Section 06 10 53.
- C. Flush Wood Doors: Specified in Section 08 14 16.
  - 1. Veneers for doors and wall paneling specified herein shall match and be provided by a single source.

**1.2 QUALITY ASSURANCE**

- A. Fabricator Qualifications:
  - 1. Firm shall be experienced in successfully producing millwork similar to that indicated for this Project, with sufficient production capacity to produce required units without causing delay in the work.
  - 2. Member of AWI, in good standing.
- B. Lumber, Hardwood: FS MM-L-736.
- C. AWI Quality Standard:
  - 1. Comply with applicable requirements of "Architectural Woodwork Quality Standards Illustrated" (QSI), current edition.
    - a. Grade: Premium.

**1.3 SUBMITTALS**

- A. Shop Drawings:
  - 1. Showing the fabrication and erection of each condition for architectural woodwork, including plans and elevations.
  - 2. Show flitch matching, jointing, grain direction, identification number for each leaf, anchorage and accessory items, finishes, framing and bracing members.
    - a. Identification number shall include the flitch and the sequence within the flitch for each leaf.
- B. Product Data.
- C. Samples:
  - 1. Veneer Flitches: Minimum 3 full length and width veneer flitches, for selection by Architect prior to preparing fabricated samples.
  - 2. Fabricated samples: Minimum 8 x 10 IN sample of veneered panel fabricated with a minimum of one veneer flitch match.
    - a. Architect review shall establish and control criteria for graining, color, texture, workmanship and joint tolerances only.
    - b. Submit additional samples as may be required for Architect's approval.

3. Include shop-applied stains and transparent finishes, where applicable, on fabricated samples.
  4. Mock-up Wall.
- D. Project Information:
1. Certification of fire-retardant treatment including name of fire-retardant salts used, compliance with applicable building code requirements and with AWPA Spec C27B for plywood, and that treatment will not bleed through or attack final finish.
- E. Contract Closeout Information.
1. Maintenance Data.
- F. LEED Information:
1. LEED Credit MR 4.1 and 4.2, Recycled Content: Product data indicating percentages by weight of post-consumer and post-industrial recycled content for products having recycled content; include statement indicating costs for each product having recycled content.
  2. LEED Credit MR 5.1 and 5.2, Regional Materials: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.
  3. LEED Credit MR 6.0, Rapidly Renewable Materials: Manufacturers' product data for products manufactured from rapidly renewable material; indicate type of rapidly renewable material.
  4. LEED Credit MR 7, Certified Wood: Certificates of chain-of-custody signed by manufacturers certifying that products specified to be made from certified wood obtained from forests certified by an FSC-accredited certification agency to comply with FSC 1.2, "Principles, and Criteria." Include evidence that mill is certified for chain-of-custody by an FSC-accredited certification body.
  5. LEED Credit EQ 4.1, Low-Emitting Materials, Adhesives: Manufacturers' product data for construction adhesive, including printed statement of VOC content.
  6. LEED Credit EQ 4.4, Low-Emitting Materials, Composite Wood and Agrifiber Products: Composite wood manufacturer's product data for each composite wood product used indicating that the bonding agent used contains no urea formaldehyde.
- G. Sustainable Design Information:
1. Manufacturers data indicating wood products comply with standards of Sustainable Forest Initiative as indicated for Alternate No 7.

#### **1.4 MOCK-UP WALL**

- A. Prior to proceeding with work, erect mock-up typical of millwork, including paneled wall section.
1. Based on Architect-approved Samples.
  2. Location to be determined by the Architect.
  3. Mock-up shall be used to obtain Architect's acceptance of visual qualities as well as materials and workmanship.
  4. Accepted mock-up shall be protected and maintained as a standard for the balance of the work, and may be part of the permanent installation.

#### **1.5 JOB CONDITIONS**

- A. Verify dimensions by accurate field measurement before fabrication wherever work adjoins other work that precede it in construction.
1. Allow for trimming and fitting of Wood Paneling and trim as may be required.
- B. Do not erect or install Paneling in areas until completion of work by other trades that might damage or disfigure the woodwork.

1. Spaces to receive installed woodwork shall have been conditioned for a minimum of 48 hours within usage temperature and humidity ranges prior to commencing work and continuing to completion of installation.
- C. Verify locations of items furnished in other sections.
- D. If necessary to vary from arrangement indicated, make such variations only after approval of Architect.

## 1.6 DELIVERY AND STORAGE

- A. Protect woodwork with appropriate heavy duty wrapping materials at the factory prior to shipment.
  1. Mark each unit with appropriate identification required for installation.
- B. Protect woodwork during handling, transit and storage to prevent damage and deterioration.
  1. Store in a conditioned space complying with installation temperature and humidity requirements of this specification.
  2. Stack in accordance with manufacturer's instructions.
  3. Maintain the same temperature and humidity conditions in building spaces as will occur after occupancy before, during, and after delivery and installation.
  4. Maintain relative humidity in storage and installation spaces between 25 and 55% (Relative Humidity) before, during, and after installation.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Acceptable manufacturers:
  1. Wood Paneling and other wood items:
    - a. Base: Materials as indicated.
  2. Mounting Clips:
    - a. Base:
      - 1) Brooklyn Hardware, LLC.
    - b. Optional:
      - 1) Monarch Manufacturing.

### 2.2 WOOD PRODUCTS

- A. General:
  1. Use items from the following list, as applicable to project:
- B. Wood Face Veneer of Panels:
  1. Quarter-cut, Clear Select White Maple.
  2. Minimum Thickness: 0.027 IN.
  3. Balance and Bookmatch in sequence within panels, and Bookmatch across the extent of any wall of the installation.
  4. Provide veneers to wood door manufacturers to achieve a blueprint match in walls with wood doors.
  5. Grain Direction:
    - a. Vertical.
  6. Width Leaf: Maximum of 6 per 48 IN width.
- C. MDF Core for Wood Veneers:
  1. Formaldehyde-free, Medium Density Fiberboard (MDF) having a density of not less than 48 LBS/FT<sup>3</sup>, and complying with ASTM-D1037, except where indicated or specified as plywood.
  2. Thickness: 3/4 IN (unless otherwise noted).

- D. Particleboard Core for Wood Veneers:
  - 1. Mat-formed wood, non-hydroscopic borate compound fire-retardant treated: ANSI A208.1-1979-M-H.
  - 2. Base Product: "Duraflake FR" by Willamette Industries, Inc.
- E. Solid Lumber Stock:
  - 1. General:
    - a. Hardwood and softwood solid stock for wood paneling and standing and running trim shall comply with AWI lumber grading rules, surfaced four sides (S4S) and worked to patterns shown or specified.
    - b. Dimension and Profile: As indicated.
  - 2. Exposed Hardwood:
    - a. Premium grade, Maple, quarter sawn.
  - 3. Exposed Hardwood (where Opaque Finish is scheduled):
    - a. Premium grade, Poplar.
  - 4. Softwood (for concealed structures and supports):
    - a. Custom grade, Western Pine.
- F. Plywood:
  - 1. General:
    - a. Thickness: 3/4 IN (unless otherwise noted).Exposed Hardwood Plywood:
      - a. HPVA HP-1, AWI Premium grade, Maple, Quarter sawn.
      - b. Manufactured without urea-formaldehyde resins.
  - 3. Softwood Plywood (for concealed structures and supports):
    - a. AWI Section 200-2, custom grade.
    - b. Manufactured without urea-formaldehyde resins.
- G. Hardwood Lumber Edge Banding:
  - 1. Edges exposed to view shall be pressure glued with hardwood stock in accordance with the drawings.
  - 2. Thickness: 3/4 IN or as required to match panel.Minimum Width: 1/2 IN.
  - 4. Dimension and Profile: As indicated.
  - 5. Edge banding to be premium grade and shall match the species of the face veneer.
- H. Veneer Edge Banding:
  - 1. Edges exposed to view shall be pressure glued with matching veneer in accordance with the drawings.
  - 2. Minimum Thickness: 0.027 IN.
  - 3. Minimum Width: As required for conditions indicated.
  - 4. Edge banding to be premium grade and shall match the species of the face veneer.
- I. Adhesive(s):
  - 1. FS MMM-A-130 contact adhesive or type to suit application.
  - 2. Plastic laminate application: Melamine, phenol-resin or resorcinol resin conforming to FS MM-A-181; type, grade and class best suited for the purpose.
  - 3. General interior use: Moisture resistant conforming to FS MMM-A-125, Type II, or FS MMM-A-188, Type I, II, or III.
  - 4. VOC content no more than 30 g/L in accord with SCAQMD Rule #1168.

## 2.3 HARDWARE

- A. Mounting Clips:
  - 1. Fully concealed devices with mating edges; used to secure of panels to parent wall.
    - a. Permits installation of panels from finished side without exposed fasteners.
    - b. Capable of supporting panel's full dead load.
    - c. Limiting lateral movement in direction perpendicular to plane of parent wall.
    - d. Permitting longitudinal movement (parallel to plane of wall) caused by normal, seasonal humidity and temperature fluctuations.
  - 2. Material: Type 6005A Aluminum, treated to T5 hardness.

3. Maximum thickness: 1/4 IN.
  4. Lift-off clearance: 5/8 IN.
  5. Fasteners:
    - a. No. 10, pan head screws, length as required.
    - b. Quantity and spacing as required.
  6. Base Product: "PanelClip" by Brooklyn Hardware, LLC.
  7. Optional: "Panel Z-Clip MF 375 – 2 IN" by Monarch Manufacturing.
- B. Fasteners:
1. Wood Screws: FS FF-S-111, type, size, material and finish as required for the condition of use.
  2. Nails: FS FF-N-105, type, size and finish as required for the condition of use.
  3. Anchors: Type, size, material and finish as required for substrate condition and adequate anchorage for the work.

## 2.4 FIRE RETARDANT TREATMENT

- A. Materials: Fire retardant materials shall meet code requirements for Class I Material, and shall comply with AWPA-P10.
- B. Treatment: Pressure treat to meet code requirements and to comply with AWPA-C20B for lumber and AWPA-C27B for plywood.
1. After fire retardant treatment, kiln dry to a maximum moisture content of 15%.
  2. Fire retardant treated wood shall not bleed through, bleach or otherwise attack final finish.

## 2.5 FABRICATION

- A. Wood Paneling shall be constructed in accordance with dimensions and design indicated.
1. Drawing details indicate the desired type and quality of construction and may be modified to conform to manufacturer's standards provided that other drawings and specification requirements are followed and that proposed alternate construction methods are approved by the Architect.
  2. Tolerances on overall assembly dimensions shall comply with the applicable AWI standards.
- B. Workmanship:
1. Work shall be fabricated and rigidly assembled.
  2. Reinforcing shall be provided to ensure a rigid and secure assembly.
  3. Exposed surfaces shall be free from dents, toll marks, warpage, buckle, glue and open joints.
  4. Joints, corners and miters shall be accurately fitted.
  5. Threaded connections shall be drawn tightly so that the threads are entirely concealed.
- C. Fastening:
1. Attachment of panels to walls: By concealed Mounting Clips.
  2. Except where otherwise indicated, the methods of assembly and joining shall be at the Contractor's option provided the results are satisfactory.
  3. Manufacturer's proven methods that produce the required standards of workmanship shall be used.
  4. Conceal fastenings wherever possible.
- D. Veneered Surfaces:
1. Face veneers shall be glued by the hot press method, and glued surfaces shall be in close contact throughout.
  2. Glue stains will not be permitted.
  3. Carefully match grain and pattern of wood veneers to receive transparent finish.
  4. Carefully distribute to overall advantage any allowable defects in specified premium grade materials and workmanship.

- E. Assembly: Fit and assemble work in shop insofar as practicable.
  - 1. Mark and disassemble units that are too large for shipment to project site, retaining units in sizes that are appropriate for shipment and erection.

## **2.6 SHOP FINISHING - SCHEDULE**

- A. The following work shall be shop finished:
  - 1. Wood Paneling, Base and Wainscots:
    - a. Stain:
      - 1) To match Architect's sample.
    - b. Transparent Finish: TR-6.
- B. Stains:
  - 1. Apply shop-applied stain in clean, dustproof environment.
  - 2. Color: Match approved sample.
- C. Transparent Finish:
  - 1. Apply shop-applied transparent finish in clean, dustproof environment.
  - 2. Sand lightly between coats to provide smooth, medium, rubbed effect finish.
  - 3. Comply with requirements indicated for grade, finish system, staining, effect and sheen.
  - 4. Grade: Premium.
  - 5. Finish system: AWI System TR-6 (catalyzed polyurethane).
  - 6. Sheen:
    - a. Satin.

## **PART 3 - EXECUTION**

### **3.1 PREPARATION**

- A. Examine parts of the supporting structure and the conditions under which the Wood Paneling is to be installed, and correct conditions detrimental to the timely and satisfactory completion of the work.
  - 1. Do not proceed with the installation until unsatisfactory conditions have been corrected.
  - 2. Examination of substrates shall include checking for excessive moisture content.
- B. Verify dimensions before proceeding and obtain measurements at job site for work required to accurately fit with other construction.
- C. Coordinate work with that of other trades affected by this installation, including timely provisions of supporting and attachment steel embedded in concrete, wood grounds, nailers, and blocking.

### **3.2 INSTALLATION**

- A. Prime paint or seal surfaces in contact with cementitious materials.
- B. Install Wood Paneling in strict compliance with manufacturer's recommendations and approved shop drawings.
- C. Do not set or install any Wood Paneling until forms of wet work, such as concrete, tile work and general painting, have been completed.
  - 1. Comply with environmental requirements of this section.
- D. Assemble, fit and attach unassembled sections with concealed connections.
  - 1. Scribe and cut to fit where necessary.
- E. Firmly secure Wood Paneling to previously prepared ground, furring, framing, and other backings.
  - 1. Fit and scribe to adjacent materials accurately and without damage other materials.
- F. Provide for protection of installed work.

### **3.3 WOOD PANELING**

- A. Install wood paneling over wall surfaces by concealed clips, and in accordance with the approved Shop Drawings.
- B. Maintain the true, plumb, and level alignment of wood paneling throughout.
  - 1. Maintain reveals and exposed panel terminating edges in constant line and width.

### **3.4 FINISHES**

- A. Touch-up and restore shop-applied finishes after installation to eliminate any unsatisfactory appearance.

**END OF SECTION**



**HDR**

**D I V I S I O N    0 7**  
**THERMAL AND MOISTURE PROTECTION**



**SECTION 07 13 26**  
**SELF-ADHERING SHEET MEMBRANE WATERPROOFING**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. Apply waterproofing to:
  - 1. Exterior of walls below grade:
    - a. If not otherwise indicated, extend to provide minimum 2 IN overlap with exterior wall finish material above grade, and to cover top of footing projections at below grade terminations.
    - b. Waterproofing shall also include exterior of walls surrounding elevator pits and other areas having lowered floor slabs.

**1.2 QUALITY ASSURANCE**

- A. ASTM Standards:
  - 1. ASTM-C578: Polystyrene board insulation.
- B. ASTM-C836: Crack cycling.
  - 1. ASTM-D1970: Pliability of sheet materials at low temperatures.
  - 2. ASTM-D412: Tensile strength and ultimate elongation.
  - 3. ASTM-D570: Water absorption.
  - 4. ASTM-D4258: Surface cleaning of concrete.
  - 5. ASTM-D4263: Test for capillary moisture.
  - 6. ASTM-D4716: Test for constant head hydraulic transmissivity of geotextiles.
  - 7. ASTM-D751: Hydrostatic-head resistance.
  - 8. ASTM-E154: Puncture resistance.
  - 9. ASTM-D903: Peel Adhesion.
  - 10. ASTM-E96: Permeance.
  - 11. ASTM-D1777: Material Thickness.
  - 12. ASTM-D1621: Compressive Strength.
- C. Applicator qualifications:
  - 1. Not less than 5 similar sized projects with material specified.
  - 2. Approved in writing by waterproofing manufacturer.

**1.3 SUBMITTALS**

- A. Product data:
  - 1. Manufacturer's standard catalog cut sheets indicating product to be used and conformance to specifications.
- B. Project information:
  - 1. Manufacturer certification of installer qualifications.
  - 2. Product test reports from qualified independent testing agency evidencing compliance of waterproofing with physical properties and other requirements based on comprehensive testing in accordance with specified test methods within previous 5 years.
- C. Contract closeout information:
  - 1. Warranty.
- D. LEED Information:
  - 1. LEED Credits MR 4.1 and 4.2, Recycled Content: Product data indicating percentages by weight of post-consumer and post-industrial recycled content for products having recycled content; include statement indicating costs for each product having recycled content.

2. LEED Credits MR 5.1 and 5.2, Regional Materials: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.

#### **1.4 WARRANTY**

- A. Provide written warranty signed jointly by installer and manufacturer.
- B. Warrant waterproof integrity of installation, adhesion to substrate and against surface degradation.
- C. Warranty installation for period of 5 years from date of acceptance.

#### **1.5 PRE-INSTALLATION MEETING**

- A. Hold pre-installation meeting directed by Contractor prior to beginning of waterproofing to discuss following as a minimum:
  1. Contract Document requirements.
  2. Extent of waterproofing.
  3. Substrate conditions, preparation, pretreatment and curing periods.
  4. Waterproofing manufacturer's specifications and details.
  5. Special details, flashings, and termination provisions.
  6. Installation procedures and schedule.
  7. Inspection, testing, and repairs.
  8. Protection from damage by other work and environmental exposures.
- B. Attendance is recommended for:
  1. Contractor.
  2. Waterproofing installer's superintendent.
  3. Waterproofing manufacturer's representative.
  4. Supervisors of installers of substrates to receive waterproofing.
  5. Supervisors of installers of construction to overlay waterproofing system.
  6. Supervisors of other trades whose work may effect waterproofing system.
  7. Independent testing agency's supervisor.
- C. Minimum two weeks prior to pre-construction meeting, waterproofing installer shall forward following to Contractor for review:
  1. Installation drawings.
  2. Manufacturer's product data.
  3. Product test reports.
  4. Sample warranty.
  5. Other information deemed pertinent for sound and secure application.
- D. Include review of specifications, details, application requirements, and preparatory work.

#### **1.6 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver materials to project site in original packages with seals unbroken, labeled with manufacturer's name, product, date of manufacture, and directions for storage.
- B. Store materials in their original undamaged packages in a clean dry, protected location and within temperature range required by waterproofing manufacturer.
  1. Protect stored materials from direct sunlight.

#### **1.7 JOB CONDITIONS**

- A. Verify suitability of substrate to accept installation.
  1. Fill voids, thoroughly dry surface and remove dust.
  2. Cure concrete surfaces for minimum 7 days prior to application of waterproofing.

- B. Install only when surface temperatures are above 40 degF.
- C. Do not install on wet or frosted surface, or when rain or snow is expected.
- D. Provide adequate ventilation during installation.

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS**

- A. Acceptable manufacturers:
  - 1. Waterproofing system:
    - a. Base:
      - 1) Carlisle Coatings and Waterproofing Incorporated (CCW).
    - b. Optional:
      - 1) Grace Construction Products.
      - 2) Polyguard Products, Inc.
      - 3) W. R. Meadows.
- B. Waterproofing system:
  - 1. Self-adhesive rubberized asphalt composite sheet membrane:
    - a. Total minimum thickness: 60 mil thick, composite sheet consisting of:
      - 1) Minimum 56 mil thick rubberized asphalt membrane laminated to;
      - 2) Minimum 4 mil thick cross-laminated polyethylene film with release liner on adhesive side.
    - b. Base Product: CCW MiraDRI 860/861.
  - 2. Sheet shall be formulated for use with ambient and substrate temperatures at time of installation, and for use with primer or surface conditioner complying with VOC limits of authorities having jurisdiction.
  - 3. Provide waterproofing complying with following physical properties:
    - a. Membrane Tensile strength: Minimum 325 PSI; ASTM-D412.
    - b. Ultimate elongation: Minimum 300 percent; ASTM-D412.
    - c. Low Temperature Pliability: No effect when tested in accordance with ASTM-C836 or ASTM-D146.
    - d. Membrane Puncture Resistance: Minimum 50 LBS; ASTM-E154.
    - e. Peel Adhesion, concrete: 7 LBS/IN when tested in accordance with ASTM-D903 or ASTM-D1000.
    - f. Lap Adhesion, membrane: 5 LB/IN when tested in accordance with ASTM-D1876 or D1000.
    - g. Vapor Transmission, Maximum Permeance: 0.05 Perms.
    - h. Water absorption: Maximum 0.10 percent when tested in accordance with ASTM-D570 or ASTM-D1970.
    - i. Hydrostatic-head resistance: Minimum FT; ASTM-D751.
- C. Auxiliary materials:
  - 1. Furnish auxiliary materials recommended by waterproofing manufacturer for intended use, compatibility with waterproofing sheet membrane and application temperature:
    - a. Furnish liquid-type auxiliary materials that also comply with VOC limits of authorities having jurisdiction.
  - 2. Surface Primer: Liquid primer recommended by manufacturer of sheet waterproofing material for substrate and application temperatures.
  - 3. Sheet flashing:
    - a. Self-adhering, polymer-modified rubberized-asphalt composite sheet of same material, construction, and thickness as waterproofing sheet membrane.
  - 4. Liquid membrane:
    - a. Elastomeric, 2-component, liquid, cold fluid-applied, trowel grade, or low viscosity as recommended by waterproofing manufacturer for application.

- b. Base Product: CCW LIQUI-DECK substrate preparation compound.
  - 5. Liquid mastic and adhesives, and adhesive tapes recommended by waterproofing manufacturer.
    - a. Base Product: CCW-704 mastic.
  - 6. Penetration seal:
    - a. Self-adhering reinforced membrane, 2-1/2 IN wide, with a tack-free protective adhesive coating on 1 side and a release film on self-adhering side.
- D. Protection course fabric:
  - 1. Vertical applications:
    - a. Base Product: CCW 200V.
    - b. 2-Ply polyester fabric.
- E. Drainage Composite panels:
  - 1. Composite 3-dimensional non-biodegradable panels with permeable geotextile bonded to dimpled, molded plastic drainage core designed to effectively convey water:
    - a. Geotextile: Non-woven or woven fabric of polypropylene or polyester fibers, or combination of both.
    - b. Select geotextile fabric porosity as recommended for soil/backfill that will be encountered on project.
  - 2. Vertical Applications:
    - a. Base Product: CCW MiraDRAIN 6200:
      - 1) Material Thickness: 0.40 IN (7/16 IN nominal); ASTM-D1777.
      - 2) Compressive strength: 15,000 PSF, (104 PSI); ASTM-D1621
      - 3) Core Flow Rate (installed vertically): 12.5 GPM/FT of width; ASTM-D4716.
  - 3. Approved by the waterproofing manufacturer for the intended use and compatibility with the waterproofing system.
- F. Rigid Board Insulation: Specified in Section 07 21 00.

## **PART 3 - EXECUTION**

### **3.1 PREPARATION**

- A. Cure normal weight concrete minimum of 7 days, and 14 days for lightweight concrete with moisture content acceptable to waterproofing manufacturer.
  - 1. Verify substrate is visibly dry and free of moisture.
  - 2. Test for capillary moisture by plastic sheet method according to ASTM-D4263.
- B. Clean, prepare and treat substrate according to manufacturer's written instructions, to provide clean, dust-free, and dry substrate for waterproofing application.
- C. Mask off adjoining surfaces not receiving waterproofing to prevent spillage affecting other construction.
- D. Remove grease, oil, form release agents, paints, and other penetrating contaminants from concrete.
- E. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids.
- F. Prepare, treat, and cover expansion joints and discontinuous joints according to the manufacturer's written instructions.
- G. Prepare, fill, prime, and treat joints and cracks in substrate:
  - 1. Remove dust and dirt from joints and cracks according to ASTM-D4258.
- H. Prime as recommended by manufacturer.

### **3.2 MEMBRANE INSTALLATION – PENETRATION, TRANSITION AND TERMINATION DETAILS**

- A. Construction joint, control joints, cracks and voids exceeding 1/16 IN: Fill with liquid membrane and install 8 IN membrane strip.
- B. Expansion joints where anticipated movement is less than 1/2 IN: Install 3-ply membrane system as recommended by manufacturer.
- C. Vertical Inside and Outside Corners: Prepare, prime, and treat inside corners according to waterproofing manufacturer's writing instructions:
  - 1. Install 12 IN membrane strip centered over vertical corners.
- D. Horizontal Inside corners including foundation wall to footing intersections: Prepare, prime, and treat inside corners according to waterproofing manufacturer's written instructions:
  - 1. Install 3/4 IN fillets of liquid membrane.
  - 2. Extend liquid membrane each direction from corner or install membrane strip centered over corner.
- E. Horizontal outside corners: Prepare and treat outside corners according to waterproofing manufacturer's written instructions.
  - 1. Apply double layer overlapping membranes.
- F. Drains:
  - 1. Apply a double layer of membrane extending 12 IN beyond drain.
  - 2. Install field sheet centered over drain.
- G. Pipes, posts, conduits, and similar penetrations:
  - 1. Apply a double layer of membrane extending out at least 6 IN from the penetrating item in all directions.
  - 2. Seal with mastic or liquid membrane product.
  - 3. Coordinate detailing at penetrations made after waterproofing system is complete with subcontractors responsible for penetrations.
- H. Prepare, treat, and seal vertical and horizontal surfaces at terminations and penetrations through waterproofing and at protrusions according to waterproofing manufacturer's written instructions.
  - 1. At top of wall conditions: Terminate membrane below final grade.
    - a. Apply mastic to terminations and joints.

### **3.3 SELF-ADHERING COMPOSITE SHEET APPLICATION**

- A. Install self-adhering composite sheet according to waterproofing manufacturer's written instructions.
- B. Apply primer to substrate at required rate and allow to dry:
  - 1. Limit priming to areas that will be covered by waterproofing membrane in same day.
  - 2. Re-prime areas exposed for more than 24 hours.
- C. Apply and firmly adhere sheet membrane over area to receive waterproofing:
  - 1. Accurately align sheets and maintain uniform 2-1/2 IN minimum lap widths and end laps.
  - 2. Overlap and seal seams and stagger end laps to ensure watertight installation.
  - 3. Roll laps of membrane installed on vertical surfaces, and roll membrane on sloping and horizontal surfaces.
- D. Apply continuous sheet membrane over membrane strips bridging each type of joint to dimensions required by manufacturer.
- E. Seal exposed edges of membrane terminations.
- F. Install sheet membrane and auxiliary materials to tie in adjacent waterproofing.
- G. Repair tears, voids, and lapped seams in waterproofing not meeting requirements:
  - 1. Slit and flatten fishmouths and blisters.

2. Patch with sheet membrane extending 6 IN beyond repaired areas.
- H. Waterproofing Membrane must not be left exposed to construction traffic or ultraviolet rays for a period exceeding 10 days without protection.

### **3.4 PROTECTION COURSE INSTALLATION**

- A. Install protection course over waterproofing membrane using tape or adhesive according to manufacturer's written instructions and before commencing subsequent construction operations.
- B. Do not penetrate waterproofing, and do not use stick clips to install protection course.
- C. Minimize exposure of membrane

### **3.5 DRAINAGE PANEL INSTALLATION**

- A. Place and secure drainage panels according to manufacturer's written instructions.
- B. Use adhesives and mechanical fasteners recommended by manufacturer and that do not penetrate waterproofing.
- C. Do not penetrate waterproofing, and do not use stick clips to install protection course.
- D. Lap edges and ends of geotextile to maintain continuity.
- E. Protect installed panels during subsequent construction.
- F. Adhesively attach drainage board at top-of-wall termination.
  1. Hold top of composite drainage board 6 IN below finish grade.
  2. Fold fabric over and tuck into wall in such a way that will avoid intrusion of backfill material in to the drainage channels.

### **3.6 PROTECTING AND CLEANING**

- A. Protect waterproofing from damage and wear during application and remainder of construction period, according to manufacturer's written instructions.
- B. Protect installed system from damage due to ultraviolet light exposure, physical abuse, and other causes.
  1. Provide temporary coverings where system will be subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.
- C. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

**END OF SECTION**

**SECTION 07 21 00**  
**BUILDING INSULATION**

**PART 1 - GENERAL**

**1.1 QUALITY ASSURANCE**

- A. Insulation reference standards:
1. UL requirements.
  2. ASTM-C518.
  3. ASTM-C612.
  4. ASTM-C665.
  5. ASTM-C739.
  6. ASTM-E84.
  7. ASTM-E90.
  8. ASTM-E119.
  9. ASTM-E136.
  10. ASTM-E970.

**1.2 SUBMITTALS**

- A. Project Information:
1. Manufacturer of listed products.
- B. LEED Information:
1. LEED Credits MR 4.1 and 4.2, Recycled Content: Product data indicating percentages by weight of post-consumer and post-industrial recycled content for products having recycled content; include statement indicating costs for each product having recycled content.
  2. LEED Credits MR 5.1 and 5.2, Regional Materials: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.
  3. LEED Credit EQ 4.1, Adhesives: Manufacturers' product data for construction adhesive, including printed statement of VOC content.

**PART 2 - PRODUCTS**

**2.1 MATERIALS**

- A. Acceptable Manufacturers:
1. Rigid Board Insulation, Extruded Polystyrene (XPS):
    - a. Base:
      - 1) Dow Chemical.
    - b. Optional:
      - 1) Pactiv Building Products (GreenGuard).
      - 2) Owens-Corning.
  2. Fiberglass Batt Insulation:
    - a. Base:
      - 1) Owens-Corning.
    - b. Optional:
      - 1) Thermafiber.
      - 2) John Mansville.
      - 3) Knauf Insulation.

3. Vapor Retarder (VR):
  - a. Base:
    - 1) Griffolyn (Reef Industries).
  - b. Optional:
    - 1) Lamtec.

## 2.2 MATERIALS

- A. Rigid Board Insulation - Extruded Polystyrene (XPS):
  1. Foamed, extruded polystyrene complying with ASTM-C575.
  2. Minimum Compressive Strength:
    - a. 25 PSI.
  3. Minimum Surface Burning Characteristics (per ASTM-E84):
    - a. Flame Spread: <75.
    - b. Smoke Developed: <450.
  4. Water vapor permanence for 1 IN product: 1.00 perm, maximum.
  5. Water absorption: Maximum 0.15 percent.
  6. Thermal resistance: R-value of 5.0 per inch at 75 degF mean temperature.
  7. Integral high density skin.
  8. Base Products: Styrofoam, GreenGuard, or Foamular.
  9. Minimum thickness:
    - a. 2 IN.
    - b. Other thicknesses as indicated or required.
  10. Adhesives for adhering polystyrene insulation: As recommended by insulation manufacturer with VOC content no greater than 50 g/L in accord with SCAQMD Rule #1168.
- B. Rigid Mineral Board Insulation:
  1. Mineral fiber board complying with ASTM-C612, Type IVA or Type IVB, Category 2.
  2. Minimum compressive strength:
    - a. 50 PSI.
  3. Minimum surface burning characteristics in accordance with ASTM-E84:
    - a. Flame Spread: <25.
    - b. Smoke Developed: <50.
  4. Water vapor sorption: Maximum 2.0 percent.
  5. Thermal Resistance: R-value of minimum 4.0 per inch at 75 degF mean temperature.
  6. Unfaced, unless required by manufacturer for adhesive application.
  7. Adhesives for adhering mineral board: As recommended by insulation manufacturer for substrates indicated.
- C. Fiberglass Batt Insulation (un-faced):
  1. Inorganic fibers and resinous binders formed into flexible blankets or semi-rigid sheets,
  2. Un-faced, Type I in accordance with ASTM-C665.
  3. Minimum Surface Burning Characteristics (per ASTM-E84): Flame Spread: <25; Smoke Developed: <50.
  4. Combustion characteristics: Noncombustible; unfaced per ASTM-E136.
  5. Minimum 25 percent total recovered material content per EPA/CPG guidelines.

| <b>Un-faced Thermal Batts for Metal Studs/Joists</b> |                |
|--|----------------|
| <b>Thickness</b>                                     | <b>R-Value</b> |
| 3-5/8"   | R-13           |
| 6-1/2"   | R-19           |
| 8-1/4"   | R-25           |
| 10-1/4"  | R-30           |
| 13"  | R-38           |

6. Nominal Thickness / Thermal Resistance Value (measured at 75 DegF):
    - a. Nominal Thickness: 6-1/2 IN / R-19.
  7. Minimum 25 percent total recovered material content per EPA/CPG guidelines.
- D. Vapor Retarder (VR):
1. 5-ply, linear low density polyethylene film.
  2. Dual scrim-reinforced.
  3. Permeance: Not exceeding 0.053 Perm (US).
  4. Surface Burning Characteristics:
    - a. Class 1 / Class A per ASTM-E84.
    - b. Maximum Flame Spread: 5.
    - c. Maximum Smoke Developed: 135.
  5. Base Product: "Type 90 FR" by Griffolyn.
  6. Optional Product: "R-3035HD" by Lamtec.
  7. Seaming Tape:
    - a. Self-adhering, asphaltic mastic.
    - b. Base Product: "Fab Tape" by Griffolyn.
    - c. Optional Product: "#491 FSK" by Ideal, or similar product as recommended by Fortifiber for its FSK vapor retarder.
  8. Repair Tape, for punctures and other damaged areas:
    - a. Base Product: "Griff Tape" by Griffolyn.
    - b. Optional Products: Same products listed for optional seaming tapes.

## **PART 3 - EXECUTION**

### **3.1 INSPECTION**

- A. Verify suitability of substrate to accept installation.
- B. Installation indicates acceptance of responsibility for performance.

### **3.2 INSTALLATION - GENERAL**

- A. Insulate full thickness over surfaces to be insulated.
- B. Fit tightly around obstructions, fill voids.
- C. Cover penetrations with insulation.
- D. Seal joints with sealant or tape as applicable.
- E. Seal or tape to abutting materials to maintain vapor tightness.
- F. Install vapor retarder over exposed insulation.
- G. Comply with manufacturer's instructions for installation unless more stringent requirements are specified.
- H. If manufacturer's instructions are not available, or not applicable, consult manufacturer's technical representative for specific recommendations prior to installation.
- I. Apply single layer to achieve total thickness.
- J. Do not use broken or torn pieces of insulation.
- K. Install so completed installation is vapor tight.
- L. Repair areas as required to insure vapor tight integrity.
- M. Do not allow foam type insulation to remain exposed to inside of building.
- N. Provide minimum cover of 1/2 IN gypsum wallboard over exposed foam surfaces.

### **3.3 INSTALLATION - RIGID MINERAL BOARD INSULATION IN CAVITY WALLS**

- A. Do not proceed with installation until subsequent work which conceals insulation is ready to be performed.
- B. Extend insulation full thickness in one layer over entire area to be insulated.
- C. Adhere insulation to masonry wall per insulation manufacturer's recommendations.
- D. Press courses of insulation between wall ties (horizontal reinforcing) with edges butted tightly both ways.
- E. Calk and tape joints.

### **3.4 INSTALLATION - RIGID BOARD INSULATION (XPS) AT FOUNDATIONS**

- A. General:
  - 1. Install XPS insulation at foundation at building perimeter.
  - 2. Install both at vertically at foundation elements AND horizontally under slab-on-grade as defined in this article.
  - 3. Minimum Thickness (unless otherwise indicated): 2 IN.
- B. Foundation Insulation (vertical):
  - 1. Install insulation underground inside or outside foundation walls.
  - 2. Extend down for distance indicated in one layer
    - a. If not indicated, extend down to design frost line.
  - 3. Install in mastic with tight joints on walls.
  - 4. Protect from damage and/or displacement during backfilling.
  - 5. Do not apply to exterior portions of foundation that will be exposed to view (those portions above final grade line).
- C. Slabs-on-Grade (horizontally):
  - 1. Extend insulation horizontally under floor slabs for a minimum of 24 IN in from exterior walls.
  - 2. Install tightly butted under slabs.
  - 3. Protect from damage and displacement during placement of concrete slabs.

**END OF SECTION**

**SECTION 07 27 16**  
**SELF-ADHERING AIR BARRIER - VAPOR-RESISTIVE**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section provides for flexible rubberized asphalt, self-sealing air and vapor barrier and accessories.

**1.2 REFERENCES**

- A. American Society for Testing and Materials:
1. ASTM- E96 - Test Methods for Water Vapor Transmission of Materials.
  2. ASTM- D570 - Test Method for Water Absorption of Plastics.
  3. ASTM- E154 - Test Method for Water Vapor Retarders used in contact with Earth Under Concrete Slabs, on Walls or as Ground Cover.
  4. ASTM- D1004 - Test Method for Initial Tear Resistance of Plastic Film and Sheeting.
  5. ASTM- D1938 - Test Method for Tear Propagation Resistance of Plastic Film and Thin Sheeting by Single-Tear Method.
  6. ASTM- D1876 - Test Method for Peel Resistance of Adhesives.
  7. ASTM- D1970 - Standard Specifications for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection.
  8. ASTM- D412 - Test Methods for Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers – Tension.
  9. ASTM-E2357, Standard Test Method for Determining Air Leakage of Air Barrier Assemblies.

**1.3 SUBMITTALS**

- A. Product Data.
- B. Project Information:
1. Test reports.
- C. LEED Information:
1. LEED Credits MR 4.1 and 4.2, Recycled Content: Product data indicating percentages by weight of post-consumer and post-industrial recycled content for products having recycled content; include statement indicating costs for each product having recycled content.
  2. LEED Credits MR 5.1 and 5.2, Regional Materials: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.

**1.4 DELIVERY, STORAGE, AND HANDLING**

- A. Comply with manufacturer's recommendations for storage and handling of each product.

**PART 2 - PRODUCTS**

**2.1 MATERIALS**

- A. Acceptable Manufacturers:
1. Self-adhering Air and Vapor Barrier System:
    - a. Base:

- 1) Grace Construction Products.
- b. Optional:
  - 1) Carlisle Coatings and Waterproofing, Incorporated.
  - 2) Henry.
  - 3) Tremco.

## 2.2 GENERAL

- A. 36 mils of self-adhesive rubberized asphalt integrally bonded to 4 mils of cross-laminated, high-density polyethylene film to provide min. 40-mil-thick membrane. Membrane shall be interleaved with disposable silicone-coated release paper until installed.
- B. Performance Requirements:
  - 1. Water Vapor Transmission: ASTM- E96, Method B - 0.05 perms maximum.
  - 2. Water Absorption: ASTM- D570 - Max. 0.1 percent by weight.
  - 3. Membrane Air Leakage: Not to exceed 0.0008 CFM/SQ FT when tested per ASTM-E2357.
  - 4. Puncture Resistance: ASTM- E154 - 40 LBS.
  - 5. Tear Resistance:
    - a. Initiation - ASTM- D1004 - min. 7.0 lbs. M.D.
    - b. Propagation - ASTM- D1938 - min. 4.0 LBS M.D.
  - 6. Lap Adhesion at 25 degF: ASTM-D 1876 - 5.0 LBS/IN of width.
  - 7. Low Temperature Flexibility - ASTM D 1970 - Unaffected to -45 degF.
  - 8. Tensile Strength: ASTM- D412, Die C Modified - Min. 400 PSI.
  - 9. Elongation, Ultimate Failure of Rubberized Asphalt: ASTM- D 412 - Die C - Min. 200%.
- C. Base Product: Perm-A-Barrier Wall Membrane manufactured by Grace Construction Products.
- D. Air and Vapor Barrier Accessories:
  - 1. Surface Conditioner:
    - a. Water-based latex liquid for substrate preparation.
      - 1) Flash Point: No flash to boiling point.
      - 2) Solvent Type: Water.
      - 3) VOC Content: Not to exceed 125 g/l.
      - 4) Application Temperature: 25 degF and above.
      - 5) Freeze/Thaw Stability: 5 cycles min.
      - 6) Freezing point (as packaged): 14 degF.
    - b. Base Product: Perm-A-Barrier Surface Conditioner manufactured by Grace Construction Products.
  - 2. Termination Mastic:
    - a. Rubberized asphalt-based mastic with 200 g/l max. VOC Content.
  - 3. Primer:
    - a. Water-based latex primer
      - 1) Specially designed for glass mat surfaced exterior gypsum boards
      - 2) VOC Content: Not to exceed 10 g/l.
    - b. Base Product: Perm-A-Barrier WB Primer by Grace Construction Products.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine conditions, with installer present, for compliance with requirements for installation, tolerances and other specific conditions affecting performance of air and vapor barrier.

### 3.2 SUBSTRATE PREPARATION

- A. Substrate to be smooth and free of voids, spalled areas, loose aggregate and sharp protrusions that would hinder adhesion or regularity of air and vapor barrier membrane.

- B. Remove deleterious materials from surfaces to be covered.

### 3.3 INSTALLATION

- A. General: Install air and vapor barrier to dry surfaces at air and surface temperatures of 25 degF and above in accordance with manufacturer's recommendations, at locations indicated on Construction Documents.
- B. Air and Vapor Barrier Membrane:
  - 1. Precut pieces of air and vapor barrier into easily handled lengths.
  - 2. Remove silicone-coated release paper and position membrane carefully before placing length horizontally against surface.
  - 3. Begin installation at base of wall placing top edge of membrane immediately below masonry reinforcement or ties protruding from substrate.
  - 4. When properly positioned, place against surface by pressing firmly into place. Roll membrane with extension-handled countertop roller immediately after placement.
  - 5. Overlap horizontally adjacent pieces 2 IN and roll seams.
  - 6. Subsequent sheets of membrane applied above shall be positioned immediately below masonry reinforcement or ties. Bottom edge shall be slit to fit around reinforcing wires or ties, and membrane shall overlap membrane sheet below by 2 IN. Roll firmly into place.
  - 7. Seal around masonry reinforcing or ties and penetrations with termination mastic.
  - 8. Continue membrane into openings in wall, such as doors, windows, etc., and terminate at points that will prevent visibility from interior.
  - 9. Coordinate installation of air and vapor barrier with roof installer to ensure continuity of membrane with rooftop air and vapor membrane.
  - 10. At end of each working day seal top edge of air and vapor barrier to substrate with termination mastic.
  - 11. Do not allow rubberized asphalt surface of air and vapor barrier membrane to come in contact with polysulfide sealants, creosote, uncured coal tar products or EPDM.
  - 12. Do not expose air and vapor barrier membrane to sunlight for more than thirty days prior to enclosure.
  - 13. Inspect installation prior to enclosing and repair punctures, damaged areas and inadequately lapped seams with patch of membrane sized to extend 6 IN in directions from perimeter of affected area.
- C. Accessories:
  - 1. When required by dirty or dusty site conditions or by surfaces having irregular or rough texture or if it becomes difficult to adhere air and vapor barrier to substrate, apply surface conditioner by spray, brush, or roller at rate recommended by manufacturer, prior to membrane installation. Allow surface conditioner to dry completely before membrane application.
  - 2. Apply bead or trowel coat of mastic along membrane edges, seams, cuts, and penetrations.
  - 3. Apply primer by brush or heavy nap, natural-material roller at rate recommended by manufacturer prior to membrane installation. Allow primer to dry completely before membrane application.

**END OF SECTION**



**SECTION 07 41 13**  
**STRUCTURAL STANDING SEAM METAL ROOF SYSTEM**

**PART 1 - GENERAL**

**1.1 QUALITY ASSURANCE**

- A. The contractor shall furnish a manufacturer's standard product which satisfies all requirements and has been verified by load testing and independent design analyses to meet the specified design requirements.
1. The structural standing seam metal roof (SSSMR) system shall be the product of a recognized manufacturer who has manufactured SSSMR systems for a period of not less than 10 years and has provided in at least five projects similar in size and complexity to this project.
  2. The installer shall be certified by the SSSMR system manufacturer and shall have installed at least three projects that are of comparable size, scope and complexity as this project for the particular roof system furnished.
- B. Design Requirements:
1. The design of the SSSMR system shall be provided by the Contractor as a complete system.
    - a. Members and connections not indicated on the drawings shall be designed by the Contractor.
    - b. Roof panels, components, transitions, accessories, and assemblies shall be supplied by the same manufacturer.
  2. Design criteria shall be in accordance with Metal Building Manufacturer's Association-01 and American Society of Civil Engineers (ASCE) 7, unless otherwise specified.
  3. The dead load shall be in the weight of the SSSMR system.
    - a. Collateral loads such as sprinklers, mechanical and electrical systems, and ceilings shall not be attached to the panels.
  4. Live Loads:
    - a. Concentrated loads: Panels and concealed anchor clips shall be capable of supporting a 300 LB temporary concentrated load at the panel midspan in the installed condition.
      - 1) The load shall be applied over the entire panel width.
      - 2) The panels shall support this concentrated load without displaying permanent distortions that would affect the weathertightness of the SSSMR system.
    - b. Uniform Loads: The panels and concealed anchor chips shall be capable of supporting a minimum uniform live load of 30 PSF.
  5. Roof Snow Loads: Design for snow loads shall comply with applicable code requirements.
  6. Wind Loads: Design wind uplift pressure for the roof system shall comply as indicated on the contract drawings or, if not indicated, as required by applicable code.
    - a. Design uplift force for each connection assembly shall be that pressure given for the area under consideration, multiplied by the tributary load area of connection assembly.
    - b. Safety factors listed below shall be applied to the design force and compared against the ultimate capacity; prying shall be considered when figuring fastener design loads.
      - 1) Single fastener in each connection: 3.0.
      - 2) Two or more fasteners in each connection: 2.25.
  7. Thermal Loads: Roof panels shall be free to move in response to the expansion and contraction forces resulting from a total temperature range of 220 degF during the life of the structure.
    - a. All panel fixed points shall be noted on submittal shop drawings in determining any and all controlled directions of thermal movement.
    - b. Testing and a test report shall be provided in accordance with the design analysis requirements of this specification showing resistance to wear-through caused by thermal movement.

- 1) An assembled specimen of at least 3 panels wide spanning 3 or more supports with a 10 LB positive load at each clip shall be subject to 100 cycles, minimum 1 IN in each direction for a total of 2 IN thermal movement.
  - 2) Upon completion, the panel shall show no signs of wear-through from the top nor shall the contact surfaces between the clip and panel show any more than 25 percent loss in metal thickness.
  - 3) Laboratory test reports shall be independently certified by a registered professional engineer licensed to practice in the State of New York.
8. Framing Members Supporting the SSSMR System: Any additions and revisions to framing members supporting the SSSMR system to accommodate the manufacturer's design shall be the Contractor's responsibility and shall be submitted for review and approval.
- a. Additional or revised framing member and their connections shall be designed in accordance with AISC-S335, AISI SG-673 or SJI-01, as applicable to the specific framing of members.
  - b. Maximum deflection under applied live load, snow, or wind load shall not exceed 1/180 of the span length.
9. Roof Panels:
- a. Steel panels shall be designed in accordance with AISI SG-673.
  - b. Aluminum panels shall be designed in accordance with AA-01; section modules and moment of inertia of aluminum sheet shall be determined for actual cross section dimensions by the conventional methods for actual design stresses and by effective width concept for deflection in accordance with AA SAS-30.
  - c. The structural section properties used in the design of the panels shall be determined using the unloaded shape of the roof panels.
  - d. The calculated panel deflection from concentrated loads shall not exceed 1/180 of the span length.
  - e. The calculated panel deflection under applied live load, snow, or wind load shall not exceed 1/180 times the span length.
  - f. Deflections shall be based on panels being continuous across three or more supports.
  - g. Deflections shall be calculated and measured along major ribs of the panels.
10. Accessories and their fasteners shall be capable of resisting the specified design wind uplift forces and shall allow for thermal movement of the roof panel system.
- a. Exposed fasteners shall not restrict free movement of the roof panel system resulting from thermal forces.
  - b. Provide a minimum of two fasteners per clip.
  - c. Single fasteners with a minimum diameter of 3/8 IN will be allowed when the supporting structural members are prepunched or predrilled.
- C. Performance Requirements:
1. The wind uplift resistance of the SSSMR shall be established by test in accordance with the requirements of ASTM-E1592.
  2. Two tests shall be required:
    - a. Test 1 should simulate the edge condition with one end having crosswise restraint and other end free of crosswise restraint.
    - b. For the edge condition, the maximum span of length shall be 30 IN.
    - c. Test 2 should simulate the interior condition with both ends free of crosswise restraint.
    - d. For the interior condition, the maximum span length shall be 60 IN.
    - e. External reinforcement to improve uplift resistance, such as clamps on the ribs, is acceptable.
    - f. Bolts through seams are not acceptable.
- D. LEED Requirements:
1. Aluminum: Either:
    - a. Minimum 60 percent post-industrial recycled content by weight; or
    - b. Minimum 30 percent post-consumer recycled content by weight; or

- c. Sum of percentage of post-consumer recycled content by weight and one-half of the percentage of post-industrial recycled content by weight shall equal minimum 30 percent.

## **1.2 SUBMITTALS**

- A. Shop Drawings:
  1. Complete layout indicating types of roofing, anchorage, supplementary framing, cut opening, accessories, and deck thickness.
- B. Samples:
  1. Color samples of finishes, for selection by Architect.
- C. Project Information:
  1. Calculations, test reports and other data required for quality assurance.
- D. Contract Closeout Information:
  1. Warranty.
- E. LEED Requirements:
  1. Aluminum: Either:
    - a. Minimum 60 percent post-industrial recycled content by weight; or
    - b. Minimum 30 percent post-consumer recycled content by weight; or
    - c. Sum of percentage of post-consumer recycled content by weight and one-half of the percentage of post-industrial recycled content by weight shall equal minimum 30 percent.
- F. LEED Information:
  1. LEED Credit SS 7.2, Heat Islands, Energy Star Roof: Manufacturer's certification indicating extent of compliance of roofing materials and assembly with EPA Energy Star criteria.
    - a. Submit Solar Reflectance value as tested in accordance with ASTM-C1549 or ASTM-E903.
  2. LEED Credit MR 4.1 and 4.2, Recycled Content: Product data indicating percentages by weight of post-consumer and post-industrial recycled content for products having recycled content; include statement indicating costs for each product having recycled content.
  3. LEED Credit MR 5.1, Local/Regional Materials: Manufacturer's certification indicating final point of assembly for products and materials located within 500 miles of Project site. Include manufacturer's name, address and phone number.

## **1.3 PRODUCT DELIVERY, STORAGE AND HANDLING**

- A. Protect materials from rusting, dirt or damage.

## **1.4 JOB CONDITIONS**

- A. Do not overload supporting members.
- B. Until entire assembly is complete, structural elements shall be assumed to not be stable or capable of supporting code or stated design loads.

## **1.5 WARRANTY**

- A. Provide 20-year warranty signed jointly by roofing materials manufacturer, installer and Contractor.
- B. Warrant watertightness of roof and associated flashing for a period indicated.
- C. Warrant color integrity of finish for same period.

## **PART 2 - PRODUCTS**

## 2.1 METAL ROOFING

- A. Acceptable manufacturers:
  - 1. Metal roofing system:
    - a. Base:
      - 1) Zip-rib, Merchants & Evans.
    - b. Optional:
      - 1) Peterson Aluminum Corporation.
      - 2) IMETCO.
  - 2. Sheathing:
    - a. Sheathing Board:
      - 1) Base:
        - a) Georgia Pacific Gypsum Corporation.
    - b. Sheathing Vapor Retarder Cover:
      - 1) Base:
        - a) Griffolyn, Reef Industries.
      - 2) Optional:
        - a) Fortifiber, with tape by Ideal.
  - 3. Snow guards:
    - a. Base:
      - 1) Zaleski Snow Guards.
    - b. Optional:
      - 1) Vermont Slate and Copper Services.
      - 2) Snojax.
      - 3) LMCurbs.
- B. Metal Roof System Materials:
  - 1. Roof Panels shall either be steel or aluminum and shall have a factory color finish.
    - a. Length of sheets shall be sufficient to cover the entire length of any unbroken roof slope when such slope, continuous from ridge to eave without end laps is 60 FT or less.
    - b. When length of run exceeds 60 FT and panel laps are provided, each sheet in the run shall extend over three or more supports.
    - c. Width of sheets shall provide 16 IN coverage in place and shall include two intermediate stiffeners of not less than 3/8 IN height located in the flat pan.
    - d. SSSMR system shall have standing seams rolled during installation by an electrically driving seaming machine.
    - e. Height of standing seams shall not be less than 2 1/2 IN and shall have a continuous groove capillary break.
    - f. Individual panels shall be removable for replacement of damaged material.
  - 2. Steel Panels: Zinc-coated steel conforming to ASTM-A924 and ASTM-A653; aluminum-zinc alloy coated steel conforming to ASTM-A792, AZ 55 coating; or aluminum-coated steel conforming to ASTM-A463, Type 2, coating designation T2 65.
    - a. Panel thickness shall have a minimum thickness of 18 GA.
    - b. Panels shall be within 95 percent of tested thickness.
  - 3. Aluminum Panels: Alloy conforming to ASTM-B209, temper as required for the forming operation.
    - a. Panels shall be a minimum of 0.04 IN thick.
    - b. Panel thickness shall be within 95 percent of tested thickness.
  - 4. Concealed anchor clips shall be the same as the tested roofing system.
    - a. Clip bases shall have factory punched or drilled holes for attachment.
    - b. Clip assemblies shall be fabricated of 300 series stainless steel and shall be multiple pieces with allowance for the total thermal movement required to take place within the clip.
  - 5. Accessories shall be compatible with the covering furnished.
    - a. Flashing, trim, metal closure strips, caps, roof curbs, and similar metal accessories shall not be less than the minimum thickness specified for roofing panels.

- b. Exposed metal accessories shall be finished to match the panels furnished.
  - c. Molded closure strips shall be closed-cell or solid-cell synthetic rubber or neoprene, or polyvinyl chloride premolded to match configuration of the covering and shall not absorb or retain water.
  - d. Thermal spacer blocks and other thermal barriers at concealed clip fasteners shall be recommended by the manufacturer.
6. Fasteners:
- a. Fasteners for steel roof panels shall be zinc-coated steel, aluminum, corrosion resisting steel, or nylon capped steel.
  - b. Fasteners for aluminum roof panels shall be aluminum or corrosion resisting steel.
  - c. Fasteners for structural connection shall provide both tensile and shear ultimate strengths of not less than 750 LB per fastener.
  - d. Fasteners for accessories shall be the manufacturer's standard.
  - e. Exposed roof fasteners shall be sealed or have sealed washers on the exterior side of the covering to waterproof the fastener penetration.
  - f. Washer material shall be compatible with the covering and shall have a minimum diameter of 1/8 IN for structural connections; and gasketed portion of fasteners or washers shall be neoprene or other equally durable elastomeric material approximately 1/8 IN thick.
  - g. Exposed fasteners shall be factory finished to match the color of the panels.
  - h. Screws for attaching anchor devices shall not be less than No. 14; other screws shall be as recommended by the manufacturer to meet the strength design requirements of the panels.
  - i. Bolts shall not be less than 1/4 IN diameter, shouldered or plain shank as required, with locking washers and nuts.
  - j. Blind screw-type expandable fasteners shall be not less than 1/4 IN diameter, and blind (pop) rivets shall not be less than 0.275 IN diameter.
7. Subpurlins shall have a minimum thickness of 0.063 IN and a minimum yield strength of 50,000 PSI.
- a. Spacing of subpurlins shall comply with the SSSMR manufacturer's requirements to accommodate all loading requirements including thermal movements.
- C. Factory Color Finish:
- 1. Roof panels shall have a factory applied polyvinylidene fluoride finish on the exposed side.
  - 2. Exterior finish shall consist of a baked-on fluoropolymer topcoat with an appropriate prime coat.
  - 3. Color shall be selected by Architect.
  - 4. Exterior coating shall be a nominal 1 mil thickness consisting of a polyvinylidene fluoride topcoat of not less than 0.7 mil dry film thickness and the paint manufacturer's recommended primer of not less than 0.3 mil dry film thickness.
  - 5. Interior's dry film finish shall consist of a backer prime coat with a dry film thickness of not less than 0.3 mil.
  - 6. Exterior color finish shall meet the following test requirements:
    - a. Salt spray test: Sheets shall withstand a salt spray test for a minimum of 1000 hours in accordance with ASTM-B117, including the scribe requirement in the test. Immediately upon removal from the test, the coating shall receive a rating of not less than 8F (few No. 8 blisters) as determined by ASTM-D714, and a rating of 6 (1/8 IN failure at scribe) as determined by ASTM-D1654.
    - b. Formability Test: When subjected to testing in accordance with ASTM-D522, the coating film shall show no evidence of fracturing to the naked eye.
    - c. Accelerated Weathering, Chalking resistance and Color Change: Three sheets shall be tested for a minimum of 1000 hours in accordance with ASTM-G23, Method 2, using a Type EH apparatus with cycles of 60 minutes radiation and 60 minutes condensing humidity. Coating shall withstand the weathering test without cracking, peeling, blistering, loss of adhesion of the protective coating, or corrosion of the base metal. Protective coating shall be readily removed from the base metal with tape in accordance

with ASTM-D3359, Test Method B, shall be considered as an area indicating loss of adhesion. Following the accelerated weathering test, the coating shall have a chalk rating not less than No. 8 in accordance with ASTM-D4214 test procedures, and the color change shall not exceed 5 CIE or Hunter Lab color difference (delta E) units in accordance with ASTM-D2244.

- d. Humidity Test: When subjected to a humidity cabinet test in accordance with ASTM-D2247 for 1000 hours, a scored panel shall show no signs of blistering, cracking, creepage or corrosion.
- e. Impact Resistance: Factory-painted sheet shall withstand direct and reverse impact in accordance with ASTM-D2794 equal to 1.5 times metal thickness with no loss of adhesion.
- f. Abrasion Resistance: When subjected to the falling sand test in accordance with ASTM-D968, the coating system shall withstand a minimum of 1.77 CF of sand before the appearance of the base metal, either the metallic coating on steel or the aluminum base metal.
- g. Pollution Resistance: Coating shall show no visual effects when immersion tested in a 10 percent hydrochloric acid solution for 24 hours in accordance with ASTM-D1038.

**D. Ice Shield:**

- 1. Base Product:
  - a. "Grace Ice & Water Shield" manufactured by Grace Construction Products.
- 2. Optional:
  - a. Other products approved in writing by Architect prior to bidding.
- 3. Complying with ASTM-D1970; Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection.
- 4. Primer: Perm-A-Barrier WB Primer.
- 5. Properties:
  - a. Cold-applied, self-adhering membrane composed of a high density, cross-laminated polyethylene film coated on one side with a layer of rubberized asphalt adhesive.

| <b>Minimal Physical Properties – Ice Shield</b> |                               |                       |
|---|-------------------------------|-----------------------|
| <b>Property</b>                                 | <b>Test Method</b>            | <b>Required Value</b> |
| Color   | ---                           | Gray-Black            |
| Thickness, Membrane                             | ASTM-D3767<br>(Method A)      | 40 mil                |
| Tensile Strength, Membrane                      | ASTM-D412<br>(Die C Modified) | 250 PSI               |
| Elongation, Membrane                            | ASTM-D412<br>(Die C Modified) | 250%                  |
| Low Temperature Flexibility                     | ASTM-D1970                    | Unaffected @ -20°F    |
| Adhesion to Plywood                             | ASTM-D903                     | 3.0 LB/IN Width       |
| Permeance (Max)                                 | ASTM-E96                      | 0.05 Perms            |
| Material Weight Installed (Max)                 |                               | 0.3 lb/ft2            |

**E. Snow Guards:**

- 1. SMACNA Figure 8-12B.
- 2. Base Product: "Sno-Barricade" by Sno Gem.
- 3. Spacing as recommended by manufacturer.

**F. Insulation:**

- 1. Thermal resistance of insulation shall not be less than R-value of 19.
- 2. R-values shall be determined at a mean temperature of 75 degF in accordance with ASTM-C518.
- 3. Insulation shall be a standard product with the insulation manufacturer, factory marked or identified with insulation manufacturer's name or trademark and R-value.

4. Identification shall be on individual pieces or individual packages.
  5. Insulation, including facings, shall have a flame spread not in excess of 75 and a smoke developed rating not in excess of 150 when tested in accordance with ASTM-E84.
  6. The stated R-value of the insulation shall be certified by an independent Registered Professional Engineer if tests are conducted in the insulation manufacturer's laboratory.
  7. Polyurethane or polyisocyanurate shall conform to ASTM-C1289, Type V having a minimum 7/16 inch thick oriented strand board or water board top facing.
    - a. For faced polyisocyanurate, maximum design R-value for 1 IN of insulation used shall be 7.2.
- G. Sealant:
1. Sealants shall be elastomeric type containing no oil or asphalt.
  2. Exposed sealant shall be colored to match the applicable building color and shall cure to a rubber like consistency.
  3. Sealant placed in the roof panel standing seam ribs shall be provided in accordance with the manufacturer's recommendations.
- H. Gaskets and Insulating Compounds:
1. Gaskets and insulating compounds shall be nonabsorptive and suitable for insulating contact points if incompatible materials.
  2. Insulating compounds shall be nonrunning after drying.
- I. Sheathing:
1. Sheathing board: Gypsum sheathing for underlayment of metal roof system where indicated to be installed directly over metal roof decking.
    - a. Water-resistant gypsum core with fiberglass facings.
    - b. Minimum 5/8 IN thick.
    - c. Base product: Georgia Pacific Dens-Deck Roof Board.
  2. Sheathing Vapor Retarder Cover:
    - a. Sheet: 2-ply polyethylene bonded over layer of scrim reinforcing, fire retardant type with compatible fire retardant adhesive.
      - 1) Surface burning characteristics: Class A in accordance with ASTM-E84.
      - 2) Puncture propagation tear: Minimum 26 LB in accordance with ASTM-D256.
      - 3) Puncture Strength: Minimum 26 LB in accordance with ASTM-D4833.
      - 4) Permeance: Maximum 0.026 Perm in accordance with ASTM-E96.
      - 5) Tensile strengths: Minimum 100 LB and 4500 PSI in accordance with ASTM-D882.
    - b. Seaming tape: Self-adhering asphaltic mastic tape.
    - c. Base products:
      - 1) Sheet: Griffolyn TX-1200 FR.
      - 2) Seaming tape: Griffolyn Fab Tape.
      - 3) Repair tape: Griffolyn Griff Tape.
- J. EPDM Rubber Boots:
1. Flashing devices around pipe penetrations shall be flexible, one-piece devices molded from weather-resistant EPDM rubber.
  2. Rubber boots shall have base rings made of aluminum or corrosion resisting steel that conforms to the contours of the roof panel to form a weather-tight seal.
- K. EPDM Rubber Boots:
1. Flashing devices around pipe penetrations shall be flexible, one-piece devices molded from weather-resistant EPDM rubber.
  2. Rubber boots shall have base rings made of aluminum or corrosion resisting steel that conforms to the contours of the roof panel to form a weather-tight seal.

## **PART 3 - EXECUTION**

### **3.1 SHEATHING INSTALLATION**

- A. Provide where metal roof system is indicated to be provided over metal roof decking.
- B. Lay sheathing board tightly butted and cut to fit around penetrations.
- C. Attach sheathing board to metal roof deck in accordance with manufacturer's recommendations.
- D. Adhere sheathing vapor retarder cover continuously to sheathing board prior to installation of insulation board and roof system.
  - 1. Join sections of vapor retarder cover with minimum 4 IN laps sealed with adhesive, and seal seams and penetrations with seaming tape.
  - 2. Repair holes, punctures and other damage with repair tape.

### **3.2 INSULATION INSTALLATION**

- A. Insulation shall be installed as indicated and in accordance with manufacturer's instructions.
- B. Board insulation installation:
  - 1. Board insulation shall be laid in close contact.
  - 2. Board shall be secured in place by roof system fasteners that extend through insulation, sheathing and metal roof decking, as recommended by manufacturer.

### **3.3 INSTALLATION – ICE SHIELD**

- A. Install in strict accordance with manufacturer's printed application procedures, precautions, and limitations.
- B. Coverage:
  - 1. Place first coarse starting at the eave.
  - 2. Overlap subsequent layers a minimum of 2 IN.
- C. Extent of Ice Shield coverage:
  - 1. Eave and Gable overhangs:
    - a. Extend from the fascia's edge to a point at least 24 inches inside the exterior wall line of the building.
  - 2. Ridges and Valley: 36 IN wide strip centered at all valleys and ridges.
  - 3. Details: Use 24 to 36 IN width surrounding all items which interrupt the continuity of the roof area including, but not limited to the following:
    - a. Penetrations, dormers, chimneys, skylights, curbs, adjoining walls and similar items.
    - b. Other areas indicated.

### **3.4 ROOF SYSTEM INSTALLATION**

- A. Installation shall be in accordance with the manufacturer's erection instructions and drawings.
  - 1. Dissimilar materials which are not compatible when contacting each other shall be insulated from each other by means of gaskets or insulating compounds.
  - 2. Molded closure strips shall be installed wherever covering sheets terminate in open-end configurations, exclusive of flashings.
  - 3. The closure strip installation shall be weather tight and sealed.
  - 4. Screws shall be installed with a clutching screw gun, to assure screws are not stripped.
  - 5. Field test shall be conducted on each gun prior to starting installation and periodically thereafter to assure it is adjusted properly to install particular type and size of screw as recommended by manufacturer's literature.
  - 6. Improper or mislocated drill holes shall be plugged with an oversize screw fastener and gasketed washer; sheets with an excess of such holes or with such holes in critical locations shall not be used.
  - 7. Exposed surfaces and edges shall be kept clean and free from sealant, metal cuttings, hazardous burrs, and other foreign material.

8. Stained, discolored, or damaged sheets shall be removed from the site.
- B. Field Forming of Panels:
1. If lengths of panels are not permitted by law for shipping, roofing panels may be formed from factory-color finished steel coils at the project site; same care and quality control measures that are taken in shop forming of roofing panels shall be observed at the project site.
  2. In cold weather conditions preheating of the steel coils to be field formed shall be performed as necessary just as prior to the rolling operations.
- C. Subpurlins:
1. Unless otherwise shown, subpurlins shall be anchored to the structural framing members with bolts or screws.
  2. Subpurlin spacing shall not exceed 30 IN on centers at the same corner, edge and ridge zones, and 60 IN maximum on centers for the remainder of the roof; corner, edge, and ridge zones shall comply as defined in ASCE 7.
- D. Roof Panel Installation:
1. Roof panels shall be installed with the standing seams in the direction of the roof slope.
  2. The side seam connections for installed panels shall be completed at the end of each day's work.
  3. Method of applying joint sealant shall conform to the manufacturer's recommendation to achieve a complete weather-tight installation.
  4. End laps of panels shall be provided in accordance with the manufacturer's instructions.
  5. Closures, flashings, EPDM rubber boots, roof curbs, and related accessories shall be installed according to the manufacturer's drawings.
  6. Fasteners shall not puncture covering sheets except as provided for in the manufacturer's instructions for erection and installation.
  7. Expansion joints for the standing seam roof system shall be installed at locations indicated on the contract drawings and other locations indicated on the manufacturer's approved shop drawings.
- E. Concealed Anchor Clips:
1. Concealed anchor chips shall be fastened directly to the structural framing members.
  2. The maximum distance, parallel to the seams, between clips shall be 30 IN on center at the corner, edge, and ridge zones, and 60 IN maximum on centers for the remainder of the roof.

### **3.5 INSTALLATION – SNOW GUARDS**

- A. Locate snow guard arrays per SMACNA Figure 8.12E and as recommended by manufacturer.

### **3.6 CLEANING AND TOUCH UP**

- A. Exposed SSSMR systems shall be cleaned at completion of installation. Debris that could cause discoloration and harm to the panels, flashings, closures and other accessories shall be removed.
- B. Grease and oil films, excess sealants, and handling marks shall be removed and the work shall be scrubbed clean.
- C. Exposed metal surfaces shall be free of dents, creases, waves, scratch marks, and solder or weld marks.
1. Immediately upon detection, abraded or corroded spots on shop-painted surfaces shall be wire brushed and touched up with the same material used for the shop coat.
  2. Factory color finished surfaces shall be touched up with the manufacturer's recommendation touch up paint.

## **END OF SECTION**



**SECTION 07 42 13**  
**FOAM-FILLED (INSULATED) METAL WALL PANELS**

**PART 1 - GENERAL**

**1.1 QUALITY ASSURANCE**

- A. Installer Qualifications: Manufacturer or installer franchised or approved in writing by manufacturer.
- B. Design Criteria:
  - 1. Deflection:
    - a. Not exceeding L/180 at 30 PSF wind load.
    - b. Test according to ASTM-E72.
  - 2. Air Infiltration:
    - a. Maximum 0.06 CFM/SF per ASTM-E283 at a static air-pressure difference of 6.24 LBF/SF, using minimum 10 feet by 10 feet test that includes horizontal and vertical joints.
  - 3. Water Infiltration:
    - a. Panel System:
      - 1) Static pressures: ASTM-E331.
      - 2) Dynamic pressures: AAMA-501.1, 15 PSF.
    - b. Joints, horizontal and vertical, static pressure: ASTM-E331, 40 PSF, minimum 10 x 10 FT mockup.
    - c. Horizontal joint, pressure equalization: AAMA-508, including static and dynamic testing with imperfect air barriers.

**1.2 SUBMITTALS**

- A. Shop drawings.
- B. Samples:
  - 1. 12 x 12 IN for color selection.
- C. Project Information:
  - 1. Certification of installer qualifications.
  - 2. Test reports.
- D. Contract Closeout Information:
  - 1. Warranty.
- E. LEED Information:
  - 1. LEED Credits MR 4.1 and 4.2, Recycled Content: Product data indicating percentages by weight of post-consumer and post-industrial recycled content for products having recycled content; include statement indicating costs for each product having recycled content.
  - 2. LEED Credits MR 5.1 and 5.2, Regional Materials: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.

**1.3 WARRANTY**

- A. Provide 2-year warranty on wall panels, flashing, and associated work.
- B. Warranty to cover water integrity of panel system against leaks through wall.
- C. Finish Warranty: 20 years.

## 1.4 PRE-INSTALLATION MEETING

- A. Agenda:
  - 1. Contract Document requirements.
  - 2. Plans and elevations.
  - 3. Wall and flashing details.
  - 4. Wall panel manufacturer's specifications and details.
  - 5. Wall panel installer recommendations.
  - 6. Available on site storage.
  - 7. Protection from damage by other trades.
- B. Attendance to include:
  - 1. Construction Manager.
  - 2. Contractor.
  - 3. Wall panel installer's superintendent.
  - 4. Wall panel manufacturer's representative.
  - 5. Sheet metal installer performing metal flashing work.
  - 6. Masonry installer.
  - 7. Carpentry installer.
- C. Minimum two week prior to meeting, forward pertinent information to Construction Manager for review.
- D. Minimum two weeks prior to meeting, forward pertinent information to Contractor for review.
  - 1. Installation drawings.
  - 2. Sample of proposed materials.
  - 3. Manufacturer's product data.
  - 4. Sample warranty.
  - 5. Other pertinent information.
- E. Pre-installation meeting will serve to review details, application requirements and what work should be completed prior to beginning of wall panel operation.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Acceptable Manufacturers:
  - 1. Foam-filled (Insulated) Metal Wall Panel System:
    - a. Base:
      - 1) Centria.
- B. Foam-filled (Insulated) Metal Wall Panels:
  - 1. Metal inner and outer panels with foam insulation.
  - 2. Thickness: Minimum 3 IN.
    - a. Complying with FM property loss prevention Data Sheet I-57.
  - 3. Width: 12 IN.
  - 4. Core: Foamed in place urethane or isocyanurate.
    - a. ASTM-E84 flame spread: Under 75; smoke developed: Under 450; fuel contributed: Under 50.
  - 5. R Value: Minimum 19.
  - 6. Edges: Interlocking combination shiplap and tongue and groove.
  - 7. Joints: Factory concealed sealant at side and end laps.
  - 8. Face sheets:
    - a. Exterior:
      - 1) Minimum 22 GA G-90 galvanized steel.
      - 2) Smooth, flat with stiffening beads spread at 4 IN o.c.
    - b. Interior:

- 1) Minimum 26 GA G-90 galvanized steel.
- 2) Non-directional embossed, flat.
- c. Base Product Profile: Centria Formawall Graphix Series:
9. Finishes:
  - a. Exterior: Metallic 3-coat.
  - b. Interior: Primed with siliconized polyester finish.
  - c. Color #A: As selected by Architect from Sundance color series.
  - d. Color #B: Custom color to be selected by Architect.
- C. Perimeter trim pieces, flashing and accessories:
  1. Gauges to match exterior face sheet.
  2. As necessary to complete panel installation.
  3. Shop fabricated and insulated corners to match panels.
  4. Match color and finish of exterior face sheet.
- D. Fastening system: Non-ferrous concealed in finished work.
- E. Subgirts and supports: G60 galvanized subgirts and intermediate support items as required for installation.
  1. Minimum 16 GA studs.

### **PART 3 - EXECUTION**

#### **3.1 INSPECTION**

- A. Verify suitability of substrate to receive installation.
- B. Installation constitutes acceptance of responsibility for performance.

#### **3.2 ERECTION**

- A. Erect system complete, per reviewed shop drawings.
- B. Erect with concealed fasteners, locking entire unit to structural supports to prohibit negative pulloff under design loads.

#### **3.3 WATER TEST**

- A. Upon completion of installation: Test water penetration in accordance with AAMA Standard AAMA 501.2 "Specifications for Field Check of Metal Curtain Walls for Water Leakage."
- B. Test entire surface.
- C. Repair leaks.

#### **3.4 PROTECTION**

- A. Provide required temporary closures and flashings to maintain weather integrity, during and after erection.

**END OF SECTION**



**SECTION 07 42 16**  
**PREFORMED METAL SIDING**

**PART 1 - GENERAL**

**1.1 QUALITY ASSURANCE**

- A. Installer qualifications: Manufacturer or installer franchised or approved in writing by manufacturer.
- B. Design Criteria:
  - 1. Deflection:
    - a. Not exceeding L/180 at 30 PSF wind load.
    - b. Test in accordance with ASTM-E72.
  - 2. Air Infiltration:
    - a. No air leakage with 30 PSF wind load and 2 IN of water pressure.
    - b. Test in accordance with ASTM-E283.
- C. Exterior Finish Performance Criteria:
  - 1. No metal/primer corrosion or delamination under following conditions:
    - a. After 1000 hours at 135 degF and 100 percent relative humidity.
    - b. After 2-1/2 hours in a 2 PSI, 212 degF autoclave.
    - c. After 500 cycles from 0 to 180 degF at exterior face, holding 15 minutes at each extreme.

**1.2 SUBMITTALS**

- A. Shop drawings.
- B. Samples:
  - 1. 12 x 12 IN for color selection.
- C. Project Information:
  - 1. Certification of installer qualifications.
  - 2. Test reports.
- D. Contract Closeout Information:
  - 1. Warranty.
- E. LEED Information:
  - 1. LEED Credits MR 4.1 and 4.2, Recycled Content: Product data indicating percentages by weight of post-consumer and post-industrial recycled content for products having recycled content; include statement indicating costs for each product having recycled content.
  - 2. LEED Credits MR 5.1 and 5.2, Regional Materials: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.

**1.3 WARRANTY**

- A. Provide 5 year warranty, on wall panels, flashing and associated work.
- B. Warranty to cover water integrity of panel system against leaks through wall.
- C. Warranty signed by Contractor and installer.

## 1.4 PRE-INSTALLATION MEETING

- A. Contractor:
  - 1. Prior to beginning of operations, schedule pre-installation meeting, at mutually agreeable time, to include:
    - a. BNL.
    - b. Architect.
    - c. Contractor.
    - d. Siding installer's superintendent.
    - e. Siding manufacturer's representative.
    - f. Sheet metal installer performing metal flashing work.
    - g. Masonry installer.
    - h. Carpentry installer.
    - i. Anyone else involved in or performing work effecting siding system.
- B. Minimum 2 weeks prior to meeting, forward pertinent information to Contractor for review.
  - 1. Installation drawings.
  - 2. Manufacturer product data.
  - 3. Samples of proposed materials.
  - 4. Sample warranty.
  - 5. Other pertinent information.
- C. Minimum meeting agenda include following discussion:
  - 1. Contract Document requirements.
  - 2. Plans and elevations.
  - 3. Wall and flashing details.
  - 4. Siding manufacturer's specifications and details.
  - 5. Available on site storage.
  - 6. Protection from damage by other trades.
- D. Pre-installation meeting will serve to clarify specifications, details, application requirements and what work should be completed prior to beginning of siding operation.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Acceptable manufacturers:
  - 1. Preformed Metal Siding:
    - a. Base:
      - 1) Centria, profile series.
- B. Panels: ASTM-A653 steel sheets, G90 coated.
- C. Design:
  - 1. Metal Siding Profile A: CS200
    - a. Thickness: Minimum 22 GA.
    - b. Width: Nominal 12 IN.
    - c. Depth: Nominal 7/8 IN.
  - 2. Metal Siding Profile B: CS210
    - a. Thickness: Minimum 22 GA.
    - b. Width: Nominal 12 IN.
    - c. Depth: Nominal 7/8 IN.
  - 3. Smooth.
  - 4. Shiplap, tongue and groove edges which interlock.
  - 5. Joints factory caulked or gasketed.

- D. Exterior profile: Minimum 22 GA.
- E. Exterior finish:
  - 1. Minimum 70 percent Kynar 500.
  - 2. Color as selected.
- F. Interior profile: Minimum 22 GA.
- G. Interior finish: Prime coat of manufacturers standard light color.
- H. Perimeter trim pieces, flashing and accessories:
  - 1. As required to complete entire wall panel installation.
  - 2. Shop fabricated corners.
  - 3. Match color and finish of wall panels.
- I. Fastening system: Nonferrous.

## **PART 3 - EXECUTION**

### **3.1 INSPECTION**

- A. Verify suitability of substrate to receive installation.
- B. Installation constitutes acceptance of responsibility for performance.

### **3.2 INSTALLATION**

- A. Erect system, per reviewed shop drawings.
- B. Erect with concealed fasteners.
- C. Use fasteners which lock entire unit to structural supports and prohibit negative load pulloff under design loads.
- D. Soffit Access Panels and Doors: Locate where required by Section 26 00 10, or where indicated on drawings. See Section 08 31 16 for product description.

### **3.3 WATER TEST**

- A. After completion of walls, perform field water test.
- B. Using minimum 5/8 IN ID. Garden hose, with water at maximum pressure, spray entire surface of exterior walls.
- C. Repair leaks.

### **3.4 PROTECTION**

- A. Provide required temporary closures and flashings to maintain weather integrity, during and after erection.

**END OF SECTION**



**SECTION 07 42 43**  
**ALUMINUM COMPOSITE MATERIAL (ACM) SYSTEM**

**PART 1 - GENERAL**

**1.1 QUALITY ASSURANCE**

- A. ASTM Standards:
  - 1. ASTM-E84.
  - 2. ASTM-C297.
  - 3. ASTM-D2794.
  - 4. ASTM-D1308.
- B. Aluminum Association Standards:
  - 1. AA-C22-A41.
  - 2. AA-C22-A44.
- C. American Society of Civil Engineers:
  - 1. ASCE-7, current edition.
- D. National Coil Coaters Association (NCCA):
  - 1. NCCA II-6.
  - 2. NCCA II-12.
  - 3. NCCA II-16.
- E. Fabricator Qualifications:
  - 1. Five years experience in cladding fabrication.
- F. Installer Qualifications:
  - 1. Franchised or certified by cladding manufacturer.

**1.2 MOCK-UP WALL**

- A. Construct Mock-up Wall assembly on site for Architect review.
  - 1. 4 x 6 FT minimum to include standard horizontal, vertical joints as well as end conditions where occurs at dissimilar materials.
  - 2. Assembly may be built into permanent construction provided area is readily identifiable during construction.
  - 3. Mock-up Wall to include:
    - a. Connection to adjacent construction.
    - b. Inside corner.
    - c. Outside corner.
    - d. Joint detail.
  - 4. Mock-up Wall constitutes standard of quality for balance of cladding work.
  - 5. If not acceptable, reconstruct.
  - 6. Do not proceed with work until sample wall approved by Architect.

**1.3 WARRANTY**

- A. 20-year warranty against failure of PVDF finish.

**1.4 SUBMITTALS**

- A. Shop Drawings:
  - 1. Installation details.
- B. Product Data.

- C. Samples:
  - 1. Manufacturers complete range of PVDF colors for selection.
  - 2. Three 12 x 12 IN samples of panel in finish selected by Architect.
  - 3. Sealant colors.
- D. Project Information:
  - 1. Test reports.
- E. Contract Closeout Information:
  - 1. Warranty.
  - 2. Maintenance data.
- F. LEED Information:
  - 1. LEED Credits MR 4.1 and 4.2, Recycled Content: Product data indicating percentages by weight of post-consumer and post-industrial recycled content for products having recycled content; include statement indicating costs for each product having recycled content.
  - 2. LEED Credits MR 5.1 and 5.2, Regional Materials: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS**

- A. Acceptable Manufacturers:
  - 1. Aluminum Composite Material (ACM):
    - a. Base:
      - 1) Alcan Composites USA, Inc. (Alucobond).
    - b. Optional:
      - 1) Alply; Tech Wall.
      - 2) Alcoa-Reynolds Metals.
      - 3) Mitsubishi.
  - 2. Fabricator of Panels:
    - a. Base:
      - 1) Universe Corp.
    - b. Optional:
      - 1) Alply; Tech Wall.
      - 2) Other Fabricators approved by listed Manufacturer's.
  - 3. Installers:
    - a. As approved by listed Manufacturer's.
  - 4. Silicone Sealants:
    - a. Base:
      - 1) Dow Corning.
  - 5. PVDF Coating (factory-applied):
    - a. Base:
      - 1) Morton International; Fluoroceram.
    - b. Optional:
      - 1) PPG Architectural Finishes.
      - 2) ICI Dulux Paint Centers.
- B. Aluminum Composite Material (ACM) System:
  - 1. Fabricate panels from two sheets of aluminum, permanently bonded to thermoplastic core.
  - 2. Form in continuous process to dimensions indicated with no glues or adhesives between dissimilar materials.
  - 3. Aluminum face sheets: Alloy compatible with finish.

4. Face sheet thickness: 0.50mm.
  5. Alloy, temper and mill finish as recommended by panel manufacturer for strength, forming, welding and application of finish indicated, but no less than strength and durability properties specified in ASTM-B209.
  6. Minimum Thickness of Composite Panel sheet-goods:
    - a. 0.236 IN.
  7. Finish:
    - a. PVDF Coating (factory-applied):
      - 1) Minimum 70 percent PVDF coating.
      - 2) Color:
        - a) To be selected by Architect.
- C. Joints (route-and-return dry seal):
1. 2 IN route and return.
  2. Dry joint system.
  3. Factory-attached male/female joining extrusions mechanically attached to panels in shop.
  4. 1/2 IN sealant joint w/backer rod.
  5. Color: To be selected by Architect.
- D. Structural Criteria:
1. Design panel system to handle wind pressures, snow pressures, ice loads and seismic design forces as required by Building Code as locally adopted.
    - a. Panel Deflection (normal): Not more 0.01 times the least panel dimension, at full design pressure(s) and load(s).
    - b. Panel Deflection (ultimate): No disengagement, failure or gross permanent distortion of any component at 1.5 times design load(s).
    - c. Maximum Deflection of Framing Members supporting panels:
      - 1) At full design pressure: Not more than 1/175 for spans 13 FT or less and 1/240 + 0.25 IN for spans exceeding 13 FT.
      - d. At pressures less than design pressure: Not more than 1/360 or 1/8 IN whichever is less.
  2. Stiffen panels as required to handle the specified pressures and loads.
    - a. Where stiffeners are attached to panels with structural silicone:
      - 1) Minimum glue line thickness: 0.25 IN.
      - 2) Minimum sealant bond bite: Determined by calculation.
- E. Thermal Movement Criteria:
1. Design system and anchorage to provide fully for expansion and contraction caused by surface temperature ranging from -25 to 145 Deg F without causing buckling, failure of joint seals, undue stress on structural elements, damaging loads on fasteners, reduction of performance or other detrimental effects.
- F. Performance criteria of PVDF Coating:
1. No metal/primer corrosion or delamination under following conditions:
    - a. After 1,000 HR at 160 Deg F and 100 percent relative humidity.
    - b. After 2-1/2 HR in a 275 PSF, 212 Deg F autoclave.
    - c. After 500 cycles from 0 to 180 Deg F, at exterior face, holding 15 minutes at each extreme.
- G. Test for water leakage based on differential test pressure amounting to 20percent of specified performance pressure required relative to complete module of metal panel system.
1. Water leakage: No evidence of uncontrolled leakage of water when tested in accordance with AAMA 501.1.
- H. Test for Air Leakage:
1. Not to exceed 0.09 CFM/FT<sup>2</sup> when tested to ASTM-E283 at a static pressure differential of 6.24 PSF.
- I. Extrusions:
1. Aluminum alloy 6063-TS.

- J. Fasteners:
  - 1. Non-magnetic stainless steel or other non-corrosive metal fasteners to be compatible with system components.
  - 2. Provide Phillips head screws unless otherwise indicated.
  - 3. Provide Allen socket head fasteners at removable panels.
  - 4. Fastening system to be non-ferrous concealed in finished work.
- K. Expansion joints:
  - 1. Elastomeric, weather-resistant, flexible closure fabrication.
- L. Silicone Sealants:
  - 1. Comply with Section 07 92 13 and the following:
    - a. Moisture-curing silicone.
    - b. Compatible with aluminum and PVDF finishes.
    - c. Color:
      - 1) As selected from manufacturers standard line of colors.
    - d. Backer Rod: Closed cell foam rod.
- M. Subgirts and Supports:
  - 1. Aluminum subgirts and intermediate support items as required for installation.

## **2.2 PANEL FABRICATION**

- A. General:
  - 1. Fabricate panels to approximate dimensions and profiles indicated.
    - a. Adjust as required based on actual field dimensions.
    - b. Allow for thermal expansion/contraction between panels and structure.
    - c. Design panels to withstand structural loads indicated.
- B. Fabrication Tolerances:
  - 1. Shop assemble panels to tolerances specified.
  - 2. Panel lines: Sharp, true and free from warp or buckle.
  - 3. Perform shop tests in manufacturer's factory to insure that panel dimensions, square-ness and bow are within specified tolerances.
    - a. Panel bow: 0.2 percent of panel dimension in width and length up to 1/8 IN maximum.
    - b. Width or length: Plus/minus 1/32 IN up to 48 IN and plus/minus 1/16 IN when greater than 48 IN.
    - c. Thickness: Plus/minus 0.02mm.
    - d. Square-ness: Not greater than 3/16 IN difference between diagonal measurements.
    - e. Camber: No greater than 1/32 IN.

## **PART 3 - EXECUTION**

### **3.1 INSPECTION**

- A. Verify suitability of substrate to receive installation.
- B. Installation constitutes acceptance of responsibility for performance.

### **3.2 ERECTION**

- A. Install support system, metal panels, fasteners, trim, sealant and related components in accordance with final erection drawings and approved shop drawings.
  - 1. Erect with concealed fasteners.
  - 2. Provide for necessary structural and thermal movement.
- B. Install on properly prepared substrate:
  - 1. Provide blocking and bracing required for panel system.
  - 2. Repair damaged substrate material prior to installation of this system.

- C. Access Panels and Doors:
  - 1. Locate where required by Section 26 00 10, or where indicated on drawings.
  - 2. See Section 08 31 16 for product description.

### **3.3 PROTECTION**

- A. Provide required temporary closures and flashings to maintain weather integrity, during and after erection.
- B. Clean exposed surfaces promptly after installation.
  - 1. Comply with panel manufacturer's specifications for cleaning.

**END OF SECTION**



**SECTION 07 53 25**  
**FULLY ADHERED EPDM ROOFING (ALTERNATE)**

**PART 1 - GENERAL**

**1.1 QUALITY ASSURANCE**

- A. Applicator Qualifications: Manufacturer authorized roofing installer.
- B. References:
  - 1. SPRI: "Wind Load Design Guide for Low Sloped Flexible Membrane Roofing Systems."
  - 2. Factory Mutual (FM) Research Corporation: "Loss Prevention Data Sheets 1-28, 29, and 49."
  - 3. National Roofing Contractors Association (NRCA): Roofing and Waterproofing Manual.
- C. Material Standards:
  - 1. EPDM Membrane:
    - a. ASTM-D4637, "Standard Specification for EPDM Sheet used in Single-Ply Roofing."
    - b. ASTM-D4811, "Standard Specification for Non-vulcanized Rubber Sheet Used as Roof Flashing."

**1.2 DESIGN RESPONSIBILITY AND CRITERIA**

- A. Design roof system, including roof covering and metal edge securement to satisfy requirements of applicable building codes including local amendments:
  - 1. Basic Wind Speed (3-sec gust, measured at 33 FT above ground, in Exposure B):
    - a. 120 MPH.
  - 2. Exposure:
    - a. "B," Urban/Suburban/Wooded.
  - 3. Importance Factor:
    - a. Category IV.
  - 4. Requirements applicable to designated warranty.
  - 5. Roof Height(s) and Parapet Height(s): As indicated.
  - 6. Static Pressure of Building Interior: < 0.5 IN water.
- B. Fire resistance rating:
  - 1. UL 790, Class A.
  - 2. Assembly in conformance with fireproofing as specified.
- C. Design the adhered membrane roofing system to comply with:
  - 1. FM 1-120.

**1.3 SUBMITTALS**

- A. Shop Drawings:
  - 1. Roof layout showing insulation thicknesses and special details.
  - 2. Profiles of flashing assemblies.
  - 3. Installation Drawings and pertinent details.
  - 4. Indicate location of expansion joints, crickets, saddles, curbs, safety tiebacks, vents, drains and other penetrations.
  - 5. Indicate slope amount and direction, locations of crickets, and key vertical elevation points.
- B. Samples:
  - 1. Color swatches of sheet metal colors for pre-selection.
  - 2. 3 IN x 5 IN samples of sheet metal color(s) for final approval.
- C. Project Information:
  - 1. Meeting minutes from pre-installation meeting.

2. Report by manufacturer's representative that roof has been properly installed.
- D. Contract Closeout Information:
1. Warranty.
  2. Maintenance Data
- E. LEED Information:
1. LEED Credits MR 4.1 and 4.2, Recycled Content: Manufacturer's product data for products with recycled content indicating percentage by weight of post-consumer and post-industrial recycled content.
  2. LEED Credits MR 5.1 and 5.2, Regional Materials: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.

#### **1.4 WARRANTY**

- A. 15-year warranty of weathertightness signed by roofing materials manufacturer.
1. Warranty to include coverage for peak gusts of wind to:
    - a. 120 MPH at 33 FT above ground.
  2. Warranty to include the entire system: membrane, flashings, adhesives, sealants, counterflashings, insulation, fasteners, fastener plates, fastener strips, hard rubber or metal edging, metal termination bars, sheet metal copings and edge metal, and other material authorized by manufacturer.
- B. 20-year warranty on 70 percent PVDF (Kynar 500) coatings on edge metal and copings.

#### **1.5 PRE-INSTALLATION MEETING**

- A. Pre-installation meeting, directed by Contractor, prior to beginning of roofing work to discuss following:
1. Contract Document requirements.
  2. Roof plan.
  3. Roofing and flashing details.
  4. Drain and scupper elevations.
  5. Roofing manufacturer's specifications and details.
  6. UL requirements.
  7. Insulation manufacturer's recommendations.
  8. Available on site storage.
  9. Roof protection from damage by other trades.
- B. Attendance is recommended for:
1. Contractor.
  2. Roofing installer's superintendent.
  3. Roofing manufacturer's representative.
  4. Sheet metal installer performing metal flashing work.
  5. Mechanical installer.
  6. Plumbing installer.
  7. Deck installer.
  8. Other trades whose work may affect roofing system.
- C. Minimum two weeks prior to meeting forward pertinent information to Contractor for review.
1. Installation drawings.
  2. Manufacturer product data.
  3. Samples of proposed materials.
  4. Sample warranty.
  5. Other information deemed pertinent for sound and secure application.
- D. Include review of specifications, details, application requirements and preliminary work.

- E. Objectives of pre-installation meeting to include:
  - 1. Review foreseeable methods and procedures related to roofing work.
  - 2. Tour representative areas of roofing substrates (decks), inspect and discuss condition of substrate, roof drains, curbs, penetrations and other preparatory work performed by others.
  - 3. Review structural loading limitations of deck and inspect deck for loss of flatness and for required attachment.
  - 4. Review roofing system requirements (drawings, specifications and other contract documents).
  - 5. Review required submittals both completed and yet to be completed.
  - 6. Review and finalize construction schedule related to roofing work and verify availability of materials, installer's personnel, equipment and facilities needed to make progress and avoid delays.
  - 7. Review required inspection, testing, certifying and material usage accounting procedures.
  - 8. Review weather and forecasted weather conditions and procedures for coping with unfavorable conditions, including possibility of temporary roofing.
    - a. Review notification procedures for weather or non-working days.
  - 9. Record discussion of conference including decisions and agreements (or disagreements) reached.
    - a. If substantial disagreements exist at conclusion of meeting, determine how disagreements will be resolved and set date for reconvening conference.
- F. Furnish copy of record to each party who may be affected by roofing work, (whether or not they were in attendance) and to BNL and Architect.

## **1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING**

- A. Deliver, store, handle, and protect products as recommended by manufacturer.
  - 1. Prevent overloading and possible disturbance of building structure.
- B. Deliver to site in original, unopened containers labeled with the manufacturer's name, brand and installation instructions.
- C. Store cleaners and adhesive products, liquid materials and un-cured materials at temperatures between 32 and 90 degF.
  - 1. When stored at lower temperatures, liquid materials must be restored to at least 60 degF prior to use.
- D. Insulation and cover boards:
  - 1. Store on pallets off the ground.
  - 2. Cover with a breathable membrane.
- E. Lightweight materials shall be weighted down to prevent wind damage.

## **1.7 JOB CONDITIONS**

- A. Proceed with roofing work only when weather conditions are in compliance with the manufacturer's recommended limitations, and when conditions will permit the work to proceed in accordance with the manufacturer's requirements and recommendations.
- B. When positioning membrane sheets, exercise care to locate field splices away from low spots and out of drain sumps.
  - 1. All field splices should be shingled to prevent bucking of water.
- C. The surface on which the insulation or roofing membrane is to be applied shall be clean, smooth, dry, and free of projections or contaminants that would prevent proper application of or be incompatible with the new installation, such as fins, sharp edges, foreign materials, oil and grease.
- D. Contaminants such as grease, fats and oils shall not be allowed to come in direct contact with the roofing membrane.

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS**

- A. Acceptable Manufacturers:
  - 1. Roofing materials:
    - a. Base:
      - 1) Carlisle SynTec.
    - b. Optional:
      - 1) Firestone Building Products.
      - 2) GenFlex Roofing Systems.
      - 3) Versico.
  - 2. Rubber Pavers:
    - a. Base:
      - 1) Carlisle SynTec.
  - 3. Sheet Metal Coping and Edge Metal:
    - a. Base:
      - 1) Provided by manufacturer of roofing system.

### **2.2 SCHEDULE OF ROOF SYSTEMS**

- A. Fully Adhered EPDM over metal decking:
  - 1. Gypsum Sheathing.
  - 2. Insulation.
    - a. Mechanically fastened or adhered to deck.
  - 3. Cover Board for flat metal decking only.
  - 4. EPDM membrane, white (adhered).
- B. Fully Adhered EPDM over concrete deck:
  - 1. Insulation.
    - a. Mechanically fastened or adhered to deck.
  - 2. Cover Board.
  - 3. EPDM Membrane (adhered).

### **2.3 GENERAL**

- A. General:
  - 1. All components products made by, or accepted as “compatible” by membrane manufacturer.
  - 2. Unless otherwise approved by the specifier and accepted by the membrane manufacturer, products (including insulation, fasteners, fastening plates and edgings) must be manufactured and supplied by the roofing system manufacturer and covered by the warranty.

### **2.4 SHEATHING**

- A. Gypsum Sheathing (where roofing is to be installed over metal decking):
  - 1. Water-resistant gypsum core with fiberglass facings.
  - 2. Minimum Thickness:
    - a. 1/4 IN at curved metal decking.
    - b. 5/8 IN at flat decking.
  - 3. Base Product: “Dens-Deck Roof Board” by Georgia-Pacific.

### **2.5 ROOF INSULATION**

- A. General:
  - 1. Furnished by roofing manufacturer.
  - 2. UL listed for assembly indicated.
  - 3. Provide crickets and saddles as required.

4. Insulation shall be installed in multiple layers with joints staggered.
- B. Insulation Securement Method:
1. Insulation may be mechanically fastened or adhered to the substrate. A combination of both methods is also permitted.
    - a. Regardless of securement method: Comply with the code requirements and manufacturer's published specifications.
- C. Polyisocyanurate (PISO) roof insulation: ASTM-C1289.
1. Type II, Class1 rigid, closed cell foam core bonded to heavy-duty glass fiber mat facers for concrete deck and flat metal decking.
  2. Type V rigid, closed cell foam core bonded to 7/16 IN oriented strand board top facer and glass fiber mat bottom facer for curved metal decking.
  3. Minimum Insulation Thickness:
    - a. Tapered insulation thickness over concrete deck and flat metal decking:
      - 1) Minimum R=25 at roof drains.
      - 2) Taper to provide slope of 1/4 IN per FT.
      - 3) Base Product: "Sure-Seal Polyisocyanurate HPH" by Carlisle SynTec.
    - b. Uniform insulation thickness over curved metal decking: As indicated.
- D. Cover Board (Gypsum-based):
1. Water-resistant gypsum core with fiberglass facings.
  2. Minimum Thickness:
    - a. 1/4 IN.
  3. Pre-primed.
  4. Base Product: "Dens-Deck Prime Roof Board" by Georgia-Pacific.

## 2.6 ROOFING MEMBRANE

- A. EPDM Roofing membrane:
1. Material: Ethylene propylene diene terpolymer (synthetic rubber) complying with ASTM-4637.
  2. Fire Retardant.
  3. Color: Black.
  4. Thickness: 60 mil thick.
    - a. Non-reinforced (Black), complying with ANSI/RMA IPR-1.
  5. Base Product: "SureSeal" by Carlisle SynTec.
  6. Minimum Physical Properties:

| Minimum Physical Properties – Black, 60mil, Non-Reinforced EPDM Membrane |                       |                     |
|--|-----------------------|---------------------|
| Property   | Test Method           | Required Value      |
| Tolerance on Nominal Thickness (Max)                                     | ASTM-D412             | +/- 10%             |
| Tensile Strength (Min)   | ASTM-D412             | 9 MPa 1,305 PSI     |
| Ultimate Elongation (Min)  | ASTM-D412             | 350%                |
| Tearing Strength (Min)   | ASTM-D624<br>Die C    | 30.6 kN/M 175 LBS   |
| Factory Seam Strength (Min)  | ASTM-D816<br>Modified | Membrane Rupture    |
| Brittleness Point  | ASTM-D2137            | -45 deg C -49 deg F |

- B. Membrane flashings, fasteners, adhesives, tapes, cements and sealants: Roofing manufacturer's standard.

## 2.7 EDGE METAL AND COPING

- A. General:
1. Roofing Manufacturer's pre-engineered, prefabricated system for termination of roofing membrane.
  2. All fasteners must be concealed from view.

3. Concealed splice plates, with color matching snap-on covers.
  4. Anchor cleats:
    - a. Material: G90 galvanized steel.
    - b. Thickness: 20 GA.
  5. Snap-on cover:
    - a. Material: G90 galvanized steel.
    - b. Thickness:
      - 1) For dimensions less than 10 IN: 24 GA.
      - 2) For dimensions 10 to 24 IN: 22 GA.
    - c. Finish: 70 percent PVDF Kynar 500.
    - d. Color:
      - 1) To be selected from manufacturers standard colors by Architect.
  6. Wind Rating: Design for pressure indicated for balance of roof system.
  7. Coverage of these items to be included in roof system warranty.
  8. Comply with applicable standards.
- B. Roof Edge/Fascia:
1. Match profiles indicated.
  2. Include accessories such as pre-fabricated inside and outside corners, Spillover, Overflow and Downspout Scuppers, Edging Extensions, Fascia Sumps, and other items indicated.
  3. Base Product: "SecurEdge 200 Fascia" by Carlisle SynTec.
- C. Coping:
1. Match profiles indicated.
  2. Include accessories such as pre-fabricated inside and outside corners (seamed), End Caps, Saddles, Tee's, Crosses, Transition Pieces and Radiused Copings, and other items indicated.
  3. Base Product: "SecurEdge 200 Coping" by Carlisle SynTec.

## 2.8 FASTENERS

- A. Type, spacing and quantity as recommended by manufacturer.
1. Designed to resist uplift forces generated by specified wind speed.
- B. Minimum pullout values per fastener:
1. For use with 22 GA steel decks: 350 LBS each.
  2. For use with normal weight concrete decks: 800 LBS each.
- C. Fasteners shall be capable of providing a static back-out resistance of at least 10 IN-LBS.

## 2.9 PAVERS

- A. Rubber Pavers:
1. Roof pavers manufactured from recycled tires.
  2. Size: 24 x 24 IN.
  3. Weight: 24 LBS (6 PSF).
  4. Color:
    - a. Grey.
  5. Use where indicated.
  6. Base Product: "Sure-Seal Interlocking Rubber Paver" by Carlisle SynTec.

## 2.10 MISCELLANEOUS ITEMS

- A. Roofing accessories:
1. Use manufacturer's standard prefab accessories where available.
  2. Nailing strips: As detailed and required.
  3. Pipe flashings: Provide for each pipe penetration; include clamps, adhesive and sealants.
  4. Expansion joint covers.
  5. Underlayment for pavers: As recommended by roofing manufacturer.
- B. Adhesives, cleaners, and primers: As recommended by roofing manufacturer.

- C. Treated Wood Blocking: Specified in Section 06 10 53.
- D. Other Materials as required by manufacturer for complete system warranty.

## **PART 3 - EXECUTION**

### **3.1 INSPECTION**

- A. Inspect entire area to be roofed for acceptability.
  - 1. Correct, or have corrected, unsatisfactory conditions.
- B. Representative of manufacturer shall make an inspection and issue written report to Architect that roofing system has been installed properly.

### **3.2 PREPARATION**

- A. Remove standing water from area to be covered prior to starting roofing work.
- B. Install required nailers.
- C. Clear the deck of debris, ice, water and foreign material prior to installation of any roofing materials

### **3.3 INSTALLATION OF ROOFING - GENERAL**

- A. Install materials in accordance with manufacturer's instructions and recommendations.
- B. Comply with code, design and warranty requirements
- C. Comply with the manufacturer's instructions for the installation of the membrane roofing system including proper substrate preparation, jobsite considerations and weather restrictions.
- D. Install materials in accordance with procedures required for applicable assemblies.

### **3.4 INSTALLATION OF NAILERS**

- A. Install nailers at perimeter of each roof level, curbs, skylights, expansion joints, and similar penetrations.

### **3.5 INSTALLATION - WOOD BLOCKING**

- A. Install where indicated or required for proper securement of roofing system.
- B. Securement of wood blocking:
  - 1. Design to resist a minimum of 200 LBS/LF in any direction per SPRI Test Method RE-1.
- C. Install so that top of blocking is substantially flush (+/- 1/4 IN) with top of insulation.

### **3.6 INSTALLATION - INSULATION**

- A. General:
  - 1. Where required thickness of insulation is greater than 2 IN: Install insulation in at least 2 layers.
  - 2. Stagger board joints in successive layers laterally, and longitudinally.
  - 3. Butt joints tightly, and dress top surface of joints as required to preclude ponding at seams.
    - a. Joints shall not exceed 1/4 IN.
    - b. Joints and gaps greater than 1/4 IN shall be filled with the same material.
  - 4. Cut insulation neatly to fit around roof penetrations and projections.
  - 5. Secure insulation to the substrate in accordance with the manufacturer's specifications.
  - 6. Cut insulation neatly to fit around roof penetrations and projections.
- B. Insulation Securement Method:
  - 1. Mechanically fasten or adhere insulation to deck to UL and FM requirements.

- C. Cover Board:
  - 1. Install continuously over insulation and secure to substrate.

### **3.7 INSTALLATION – MEMBRANE**

- A. Unroll and position membrane without stretching.
  - 1. Allow the membrane to relax for approximately 1/2 hour before bonding.
  - 2. Fold the sheet back onto itself so half the underside of the membrane is exposed.
- B. Position sheets to accommodate contours of roof deck.
  - 1. Shingle splices to avoid bucking water.
- C. Apply the bonding adhesive in accordance with the manufacturer's published instructions, to both the underside of the membrane and the substrate.
  - 1. Allow the adhesive to dry until it is tacky but will not string or stick to a dry finger touch.
  - 2. Roll the coated membrane into the coated substrate while avoiding wrinkles.
  - 3. Brush down the bonded half of the membrane sheet with a soft bristle push broom to achieve maximum contact.
  - 4. Fold back the unbonded half of the membrane sheet and repeat the bonding procedure.
- D. Install adjoining membrane sheets in the same manner, overlapping edges approximately 4 IN.
  - 1. Do not apply bonding adhesive to the splice area.
- E. Membrane Splices:
  - 1. Overlap adjacent sheets a minimum of 3 IN and adhere with cement, seam tape or other method approved by manufacturer.
  - 2. Comply with manufacturer's instructions for splicing procedures.
- F. Perimeter Securement:
  - 1. Secure membrane along the perimeter of each roof level, roof section, curb, skylight, interior wall, penthouse, and other penetrations as recommended by membrane manufacturer.
- G. Membrane Flashing:
  - 1. Flash penetrations and walls with cured EPDM membrane or flashing.
  - 2. Exceptions:
    - a. Uncured flashings and pressure sensitive uncured flashing shall be limited to overlaying of vertical seams, flashing of inside and outside corners, scuppers, and other unusually shaped penetrations where the use of cured membrane flashing is impractical.
    - b. Manufacturer's standard pre-manufactured accessories (i.e. pre-molded pipe flashings, peel-n-stick pipe boots, and inside/outside corners, etc) shall be used wherever possible in lieu of uncured flashings.
  - 3. Terminate base-of-wall flashings in accordance with manufacturer's approved details (i.e. Carlisle U-9 Termination Detail).
  - 4. Pre-flashing at sheet metal parapet copings:
    - a. Extend EPDM membrane and/or flashing over top of parapet prior to capping with sheet metal.
  - 5. Expansion Joints:
    - a. Extend EPDM membrane across roofing expansion joints.
    - b. Include adequate slack in membrane to accommodate anticipated movement.
- H. Hot or Cold Weather Procedures:
  - 1. Comply with manufacturer's instructions.

### **3.8 INSTALLATION - EDGE METAL AND COPING**

- A. Verify that blocking has been installed and adequately secured.
- B. Sub-flash details with a layer of EPDM membrane prior to installation of edge metal or coping system.
  - 1. EPDM to be adhered to substrate.

- C. Secure anchor cleat to blocking as recommended, using corrosion-resistant fasteners.
- D. Install splice plates and snap-on covers.

### **3.9 PROTECTION**

- A. Prevent water from getting under installed membrane by using water cutoffs.
  - 1. Make water cutoffs by extending membrane beyond insulation and setting end of membrane in 4 IN wide strip of water cutoff mastic.
  - 2. Remove temporary water cutoffs prior to proceeding with next work period; remove portion of membrane in contact with mastic.
- B. Remove and replace wet insulation.
- C. Protect system and finished items from damage for balance of construction period.
  - 1. Repair/replace damaged items.

### **3.10 CLEAN UP**

- A. All debris must be disposed of in a legally acceptable manner.

**END OF SECTION**



**SECTION 07 54 25**  
**FULLY ADHERED TPO ROOFING**

**PART 1 - GENERAL**

**1.1 QUALITY ASSURANCE**

- A. Applicator qualifications: Manufacturer authorized roofing installer.
- B. References:
  - 1. SPRI: "Wind Load Design Guide for Low Sloped Flexible Membrane Roofing Systems."
  - 2. Factory Mutual (FM) Research Corporation: "Loss Prevention Data Sheets 1-28, 29, and 49."
  - 3. National Roofing Contractors Association (NRCA): Roofing and Waterproofing Manual.
- C. Material Standards:
  - 1. TPO Membrane: ASTM-D6878.
- D. Environmental Design Criteria:
  - 1. Environmental Protection Agency (EPA) Comprehensive Procurement Guidelines (CPG): Comply with recovered (recycled) content criteria of the CPG for insulation materials.
  - 2. Environmental Protection Agency (EPA) Energy Star Program: Comply with Energy Star criteria for roofing membrane albedo and the following standards:
    - a. E408, Standard Test Methods for Total Normal Emittance of Surfaces Using Inspection-Meter Techniques
    - b. E903, Standard Test Method for Solar Absorptance, Reflectance, and Transmittance of Materials Using Integrating Spheres.

**1.2 DESIGN RESPONSIBILITY AND CRITERIA**

- A. Design roof system, including roof covering and metal edge securement to satisfy requirements of applicable building codes including local amendments:
  - 1. Basic Wind Speed (3-sec gust, measured at 33 FT above ground, in Exposure B):
    - a. 120 MPH.
  - 2. Exposure:
    - a. "B," Urban/Suburban/Wooded.
  - 3. Importance Factor:
    - a. Category IV.
  - 4. Requirements applicable to designated warranty.
  - 5. Roof Height(s) and Parapet Height(s): As indicated.
  - 6. Static Pressure of Building Interior: < 0.5 IN water.
- B. Fire resistance rating:
  - 1. UL 790, Class A.
- C. Design the adhered membrane roofing system to comply with:
  - 1. FM 1-120.

**1.3 SUBMITTALS**

- A. Shop Drawings:
  - 1. Roof layout showing insulation thicknesses and special details.
  - 2. Profiles of flashing assemblies.
  - 3. Installation Drawings and pertinent details.
  - 4. Indicate location of expansion joints, crickets, saddles, curbs, safety tiebacks, vents, drains and other penetrations.
  - 5. Indicate slope amount and direction, locations of crickets, and key vertical elevation points.

- B. Samples:
  1. 5 IN x 5 IN specimens of sheet goods.
  2. Color swatches of sheet metal colors for pre-selection.
  3. 3 IN x 5 IN samples of sheet metal color(s) for final approval.
  4. Sample of Rubber Paver(s).
- C. Project Information:
  1. Meeting minutes from pre-installation meeting.
  2. Report by manufacturer's representative that roof has been properly installed.
  3. Manufacturer's certification of compliance with the following minimums for recovered (recycled) content, according to the EPA's Comprehensive Procurement Guide.
    - a. Certification of minimum 9 percent recovered material content in rigid plastic foams.
- D. Contract Closeout Information:
  1. Warranty.
  2. Maintenance Data:
    - a. Include cleaning instructions.
- E. LEED Information:
  1. LEED Credit SS 7.2, Heat Island Effect - Roof: Manufacturer's product data for roofing membrane with verification that membrane meets or exceeds reflectivity and emissivity requirements.
  2. LEED Credits MR 4.1 and 4.2, Recycled Content: Manufacturer's product data for products with recycled content indicating percentage by weight of post-consumer and post-industrial recycled content.
  3. LEED Credits MR 5.1 and 5.2, Regional Materials: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.

#### **1.4 WARRANTY**

- A. 15-year warranty of weathertightness signed by roofing materials manufacturer.
  1. Warranty to include coverage for peak gusts of wind to:
    - a. 120 MPH at 33 FT above ground.
  2. Warranty to include the entire system: membrane, flashings, adhesives, sealants, counterflashings, insulation, fasteners, fastener plates, fastener strips, hard rubber or metal edging, metal termination bars, sheet metal copings and edge metal, and other material authorized by manufacturer.
- B. 20-year warranty on 70% PVDF (Kynar 500) coatings on edge metal and copings.

#### **1.5 PRE-INSTALLATION MEETING**

- A. Pre-installation meeting, directed by Contractor, prior to beginning of roofing work to discuss following:
  1. Contract Document requirements.
  2. Roof plan.
  3. Roofing and flashing details.
  4. Drain and scupper elevations.
  5. Roofing manufacturer's specifications and details.
  6. UL requirements.
  7. Insulation manufacturer's recommendations.
  8. Available on site storage.
  9. Roof protection from damage by other trades.
- B. Attendance is recommended for:
  1. Contractor.

2. Roofing installer's superintendent.
  3. Roofing manufacturer's representative.
  4. Sheet metal installer performing metal flashing work.
  5. Mechanical installer.
  6. Plumbing installer.
  7. Deck installer.
  8. Other trades whose work may affect roofing system.
- C. Minimum two weeks prior to meeting forward pertinent information to Contractor for review.
1. Installation drawings.
  2. Manufacturer product data.
  3. Samples of proposed materials.
  4. Sample warranty.
  5. Other information deemed pertinent for sound and secure application.
- D. Include review of specifications, details, application requirements and preliminary work.
- E. Objectives of pre-installation meeting to include:
1. Review foreseeable methods and procedures related to roofing work.
  2. Tour representative areas of roofing substrates (decks), inspect and discuss condition of substrate, roof drains, curbs, penetrations and other preparatory work performed by others.
  3. Review structural loading limitations of deck and inspect deck for loss of flatness and for required attachment.
  4. Review roofing system requirements (drawings, specifications and other contract documents).
  5. Review required submittals both completed and yet to be completed.
  6. Review and finalize construction schedule related to roofing work and verify availability of materials, installer's personnel, equipment and facilities needed to make progress and avoid delays.
  7. Review required inspection, testing, certifying and material usage accounting procedures.
  8. Review weather and forecasted weather conditions and procedures for coping with unfavorable conditions, including possibility of temporary roofing.
    - a. Review notification procedures for weather or non-working days.
  9. Record discussion of conference including decisions and agreements (or disagreements) reached.
    - a. If substantial disagreements exist at conclusion of meeting, determine how disagreements will be resolved and set date for reconvening meeting.
- F. Furnish copy of record to each party who may be affected by roofing work, (whether or not they were in attendance) and to BNL and Architect.

## **1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING**

- A. Deliver, store, handle, and protect products as recommended by manufacturer.
1. Prevent overloading and possible disturbance of building structure.
- B. Deliver to site in original, unopened containers labeled with the manufacturer's name, brand and installation instructions.
- C. Store cleaners and adhesive products, liquid materials and un-cured materials at temperatures between 60 and 80 degF.
1. When stored at lower temperatures, liquid materials must be restored to at least 60 degF prior to use.
- D. Insulation and cover boards:
1. Store on pallets off the ground.
  2. Cover with a breathable membrane.
- E. Lightweight materials shall be weighted down to prevent wind damage.

## 1.7 JOB CONDITIONS

- A. When positioning membrane sheets, exercise care to locate field splices away from low spots and out of drain sumps.
  - 1. All field splices should be shingled to prevent bucking of water.
- B. When loading materials onto the roof, the Applicator must comply with the requirements of BNL to prevent overloading and possible disturbance to the building structure.
- C. Proceed with roofing work only when weather conditions are in compliance with the manufacturer's recommended limitations, and when conditions will permit the work to proceed in accordance with the manufacturer's requirements and recommendations.
- D. The surface on which the insulation or roofing membrane is to be applied shall be clean, smooth, dry, and free of projections or contaminants that would prevent proper application of or be incompatible with the new installation, such as fins, sharp edges, foreign materials, oil and grease.
- E. Contaminants such as grease, fats and oils shall not be allowed to come in direct contact with the roofing membrane.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Acceptable Manufacturers:
  - 1. Roofing materials:
    - a. Base:
      - 1) Carlisle SynTec.
    - b. Optional:
      - 1) Firestone Building Products.
      - 2) GenFlex Roofing Systems.
      - 3) Versico.
      - 4) Dow, Stevens.
  - 2. Rubber Pavers:
    - a. Base:
      - 1) Carlisle SynTec.
  - 3. O

### 2.2 SCHEDULE OF ROOF SYSTEMS

- A. Fully Adhered TPO over metal decking:
  - 1. Gypsum Sheathing.
  - 2. Insulation.
  - 3. Cover Board at flat metal decking only..
  - 4. TPO Membrane (fully adhered).
- B. Fully Adhered TPO over concrete deck:
  - 1. Insulation.
  - 2. Cover Board.
  - 3. TPO Membrane (fully adhered).

### 2.3 GENERAL

- A. General:
  - 1. All components products made by, or accepted as "compatible" by membrane manufacturer.

2. Unless otherwise approved by the specifier and accepted by the membrane manufacturer, products (including insulation, fasteners, fastening plates and edgings) must be manufactured and supplied by the roofing system manufacturer and covered by the warranty.

## 2.4 SHEATHING

- A. Gypsum Sheathing (where roofing is to be installed over metal decking):
  1. Water-resistant gypsum core with fiberglass facings.
  2. Minimum Thickness:
    - a. 1/4 IN at curved metal decking.
    - b. 5/8 IN at flat metal decking.
  3. Base Product: "Dens-Deck Roof Board" by Georgia-Pacific.

## 2.5 ROOF INSULATION

- A. General:
  1. Furnished by roofing manufacturer.
  2. UL listed for assembly indicated.
  3. Provide crickets and saddles as required.
  4. Insulation shall be installed in multiple layers with joints staggered.
    - a. The first and second layer of insulation shall be mechanically fastened or adhered to the substrate in accordance with the manufacturer's published specifications.
- B. Polyisocyanurate (PISO) roof insulation: ASTM-C1289.
  1. Type II, Class 1 rigid, closed cell foam core bonded to heavy-duty glass fiber mat facers for concrete deck and flat metal decking.
  2. Type V rigid, closed cell foam core bonded to 7/16 IN oriented strand board top facer and glass fiber mat bottom facer for curved metal decking.
  3. Minimum insulation thickness over concrete deck and flat metal decking:
    - a. Tapered insulation:
      - 1) Minimum R=25 at roof drains.
      - 2) Taper to provide slope of 1/4 IN per FT.
      - 3) Base Product: "Sure-Seal Polyisocyanurate HPH" by Carlisle SynTec.
  4. Uniform insulation thickness over curved metal decking: As indicated.
- C. Cover Board (Gypsum-based):
  1. Water-resistant gypsum core with fiberglass facings.
  2. Minimum Thickness:
    - a. 1/4 IN.
  3. Base Product: "Dens-Deck Roof Board" by Georgia-Pacific.

## 2.6 ROOFING MEMBRANE

- A. TPO Roofing membrane:
  1. Material: Thermoplastic Polyolefin (TPO) single-ply roofing membrane.
    - a. Fire Retardant.
    - b. Polyester fabric reinforced.
  2. Color: White, minimum SRI of 78 in accord with ASTM E 1980.
  3. Thickness: 60 mil thick.
  4. Base Product: "SureWeld" by Carlisle SynTec.

5. Minimum Physical Properties:

| <b>Minimum Physical Properties – 60mil, Reinforced, TPO Membrane</b> |                         |                       |
|--|-------------------------|-----------------------|
| <b>Property</b>  | <b>Test Method</b>      | <b>Required Value</b> |
| Tolerance on Nominal Thickness (Max)                                 | ASTM-D751               | +/- 10%               |
| Thickness over scrim (Min)   | ASTM-D4637              | 15 mil                |
|  | Optical                 | 18 mil                |
| Breaking Strength (Min)  | ASTM-D751               | 225 LBS               |
|  | Grab Method             | 340 LBS               |
| Ultimate Elongation – Fabric Failure (Min)                           | ASTM-D751               | 25%                   |
| Tear Strength (Min)  | ASTM-D751               | 55 LBS                |
|  | B Tongue Tear           | 130 LBS               |
| Linear Dimensional Change (Shrinkage)                                | ASTM-D1204              | +/- 1.0%              |
| Field Seam - Peel Strength (min)                                     | ASTM-D1876              | 40 LBS/IN             |
| Permeance (max)  | ASTM-E96                | <0.1 Perm (US)        |
| Puncture Resistance (min)  | FTM 101C<br>Method 2031 | 250 LBS               |
| Solar Reflectance (albedo X 100)                                     | ASTM-E903               | 80 (White Membrane)   |
|  |                         | 25 (Gray Membrane)    |
| Brittleness Point  | ASTM-D2137              | -40 DegF              |

- B. Membrane flashings, fasteners, adhesives, tapes, cements and sealants: Roofing manufacturer’s standard.

**2.7 EDGE METAL AND COPING**

A. General:

1. Roofing Manufacturer’s pre-engineered, prefabricated system for termination of roofing membrane.
2. All fasteners must be concealed from view.
3. Concealed splice plates, with color matching snap-on covers.
4. Anchor cleats:
  - a. Material: G90 galvanized steel.
  - b. Thickness: 20 GA.
5. Snap-on cover:
  - a. Material: G90 galvanized steel.
6. Snap-on cover:
  - a. Material: G90 galvanized steel.
  - b. Thickness:
    - 1) For dimensions less than 10 IN: 24 GA.
    - 2) For dimensions 10 to 24 IN: 22 GA.
  - c. Finish: 70% PVDF Kynar 500.
  - d. Color:
    - 1) To be selected from manufacturers standard colors by Architect.
7. Wind Rating: Design for same FM design pressure indicated for balance of roof system.
8. Coverage of these items to be included in roof system warranty.
9. Comply with applicable FM and SPRI standards.

B. Roof Edge/Fascia:

1. Match profiles indicated.
2. Include accessories such as pre-fabricated inside and outside corners, Spillover, Overflow and Downspout Scuppers, Edging Extensions, Fascia Sumps, and other items indicated.
3. Base Product: “SecurEdge 200 Fascia” by Carlisle SynTec.

C. Coping:

1. Match profiles indicated.

2. Include accessories such as pre-fabricated inside and outside corners (seamed), End Caps, Saddles, Tee's, Crosses, Transition Pieces and Radiused Copings, and other items indicated.
3. Base Product: "SecurEdge 200 Coping" by Carlisle SynTec.

## **2.8 FASTENERS**

- A. Type, spacing and quantity as recommended by manufacturer.
  1. Designed to resist uplift forces generated by specified wind speed.
- B. Minimum pullout values per fastener:
  1. For use with 22 GA steel decks: 350 LBS each.
  2. For use with normal weight concrete decks: 800 LBS each.
- C. Fasteners shall be capable of providing a static back-out resistance of at least 10 IN-LBS.

## **2.9 PAVERS**

- A. Rubber Pavers:
  1. Roof pavers manufactured from recycled tires.
  2. Size: 24 x 24 IN.
  3. Weight: 24 LBS (6 PSF).
  4. Color:
    - a. Grey.
  5. Use where indicated.
  6. Base Product: "Sure-Seal Interlocking Rubber Paver" by Carlisle SynTec.

## **2.10 MISCELLANEOUS ITEMS**

- A. Roofing accessories:
  1. Use manufacturer's standard prefab accessories where available.
  2. Nailing strips: As detailed and required.
  3. Pipe flashings: Provide for each pipe penetration; include clamps, adhesive and sealants.
  4. Expansion joint covers.
  5. Underlayment for pavers: As recommended by roofing manufacturer.
- B. Adhesives, cleaners, and primers: As recommended by roofing manufacturer.
- C. Treated Wood Blocking: Specified in Section 06 10 53.
- D. Other Materials as required by manufacturer for complete system warranty.

## **PART 3 - EXECUTION**

### **3.1 INSPECTION**

- A. Inspect entire area to be roofed for acceptability.
  1. Correct, or have corrected, unsatisfactory conditions.
- B. A representative of manufacturer shall make an inspection and issue written report to Architect that roofing system has been installed properly.

### **3.2 PREPARATION**

- A. Remove standing water from area to be covered prior to starting roofing work.
- B. Install required nailers.
- C. Clear the deck of debris, ice, water and foreign material prior to installation of any roofing materials

### **3.3 INSTALLATION OF ROOFING - GENERAL**

- A. Install materials in accordance with manufacturer's instructions and recommendations.
- B. Comply with code, design, and warranty requirements.
- C. Fasteners which will be exposed to view from finished spaces below:
  - 1. Project fastener through roof deck maximum 1 IN and cap.
- D. Comply with the manufacturer's instructions for the installation of the membrane roofing system including proper substrate preparation, jobsite considerations and weather restrictions.
- E. Install materials in accordance with procedures required for FM and UL assemblies.

### **3.4 INSTALLATION OF NAILERS**

- A. Install nailers at perimeter of each roof level, curbs, skylights, expansion joints, and similar penetrations.

### **3.5 INSTALLATION - WOOD BLOCKING**

- A. Install where indicated or required for proper securement of roofing system.
- B. Securement of wood blocking:
  - 1. Design to resist a minimum of 200 LBS/LF in any direction per SPRI Test Method RE-1.
- C. Install so that top of blocking is substantially flush (+/- 1/4 IN) with top of insulation.

### **3.6 INSTALLATION - INSULATION**

- A. Where required thickness of insulation is greater than 2 IN: Install insulation in at least two layers.
  - 1. Stagger board joints in successive layers laterally, and longitudinally.
  - 2. Butt joints tightly, and dress top surface of joints as required to preclude ponding at seams.
    - a. Joints shall not exceed 1/4 IN.
    - b. Joints and gaps greater than 1/4 IN shall be filled with the same material.
  - 3. Cut insulation neatly to fit around roof penetrations and projections.
- B. Secure insulation to the substrate with the required mechanical fasteners (or adhesive) in accordance with the manufacturer's specifications.
  - 1. Cut insulation neatly to fit around roof penetrations and projections.
  - 2. Install Cover Board continuously over insulation.
  - 3. Mechanically fasten (or adhere) insulation to deck to UL and FM requirements.
    - a. Where Cover Board is specified, fastener shall be attached through the cover board and layers of insulation.
- C. Fasteners which will be exposed to view from finished spaces below:
  - 1. Project fastener through roof deck maximum 1 IN and cap.

### **3.7 INSTALLATION – MEMBRANE**

- A. General:
  - 1. Unroll and position membrane without stretching.
  - 2. Secure the membrane with the required fasteners and plates.
    - a. Spacing as dictated by wind design and project conditions.
  - 3. Install adjoining membrane sheets in the same manner in accordance with the manufacturer's requirements.
  - 4. Position sheets to accommodate contours of roof deck.
    - a. Shingle splices to avoid bucking water.
  - 5. Perimeter Securement: Secure membrane along the perimeter of each roof level, roof section, curb, skylight, interior wall, penthouse, and other penetrations as recommended by membrane manufacturer.

6. Hot or Cold Weather Procedures: Comply with manufacturer's instructions.
  7. Protect membrane from stains/discoloring caused by adhesives.
- B. Adhering TPO Membrane:
1. Position TPO membrane over substrate.
  2. Fold membrane sheet back lengthwise (onto itself) so half the underside of the membrane is exposed.
  3. Apply bonding adhesive in accordance with the manufacturer's instructions, to the exposed underside of the membrane and the corresponding substrate area.
    - a. Do not apply bonding adhesive along the splice edge of the membrane to be hot air welded over the adjoining sheet.
    - b. Allow the adhesive to dry until it is tacky.
    - c. Roll the coated membrane into the coated substrate while avoiding wrinkles.
    - d. Brush down the bonded section of the membrane sheet immediately after rolling the membrane into the adhesive with a soft bristle push broom to achieve maximum contact.
    - e. Fold back the unbonded half of the sheet lengthwise and repeat the bonding procedures.
- C. Membrane Splicing/Hot Air Welding Procedures:
1. Position adjoining sheets to allow a minimum overlap of 2 IN.
  2. Hot air weld TPO membrane sheets using the Automatic Hot Air Welding Machine or Hot Air Hand Welder in accordance with the manufacturer's hot air welding procedures.
    - a. At splice intersections, roll the seam with a roller prior to membrane seam cooling.
    - b. Where 60 mil membrane is specified: Splice intersections shall be overlaid with non-reinforced TPO flashing material (of type recommended by membrane manufacturer).
  3. Probe seams once the hot air welds have thoroughly cooled (approximately 30 minutes).
  4. Repair seam deficiencies the same day they are discovered.
  5. Apply sealant (of type recommended by membrane manufacturer) on cut edges of reinforced membrane (where the scrim reinforcement is exposed) after seam probing is complete.
  6. Pull the membrane back along the welded splice so the entire underside of the membrane is exposed once the Hot Air Weld has been completed.
    - a. Apply bonding adhesive to the exposed underside of the membrane sheet and the substrate.
    - b. Allow adhesive to dry until tacky and roll the membrane into the substrate and brush down the bonded section with a bristle broom following the procedure noted above.
    - c. Continue to install adjoining membrane sheets in the same manner, overlapping edges a minimum of 2 IN and complete the bonding procedures as stated previously.
- D. Flashing:
1. Follow manufacturer's typical flashing procedures for wall, curb, and penetration flashing including metal edging/coping and roof drain applications.
  2. Flashing of parapets, curbs, expansion joints and other parts of the roof must be performed using reinforced TPO membrane.
  3. Manufacturers standard, non-reinforced TPO membrane can be used for flashing pipe penetrations, sealant pockets, scuppers, as well as inside and outside corners when the use of pre-fabricated accessories is not feasible.
  4. Terminate base-of-wall flashings in accordance with manufacturer's approved details.
  5. Pre-flashing at sheet metal parapet copings:
    - a. Extend TPO membrane and/or flashing over top of parapet prior to capping with sheet metal.
  6. Expansion Joints:
    - a. Extend TPO membrane across roofing expansion joints.
    - b. Include adequate slack in membrane to accommodate anticipated movement.

### **3.8 INSTALLATION - EDGE METAL AND COPING**

- A. Verify that blocking has been installed and adequately secured.

- B. Sub-flash details with a layer of TPO membrane prior to installation of edge metal or coping system.
- C. Secure anchor cleat to blocking as recommended, using corrosion-resistant fasteners.
- D. Install splice plates and snap-on covers.
- E. Protect finished items from damage for balance of construction period.
  - 1. Repair/replace damaged items.

### **3.9 DAILY SEAL**

- A. On phased roofing, when the completion of flashings and terminations is not achieved by the end of the work day, a daily seal must be performed to temporarily close the membrane to prevent water infiltration.
  - 1. Complete an acceptable membrane seal in accordance with the manufacturer's requirements.
- B. Remove temporary water cutoffs prior to proceeding with next work period.
  - 1. Remove and replace wet insulation.

### **3.10 CLEAN UP**

- A. All debris must be disposed of in a legally acceptable manner.

**END OF SECTION**

**SECTION 07 62 00**  
**FLASHING AND SHEET METAL**

**PART 1 - GENERAL**

**1.1 QUALITY ASSURANCE**

- A. Reference standards:
  - 1. As noted for individual items.
  - 2. ASTM Standards.
  - 3. "Architectural Sheet Metal Manual" by SMACNA, current edition.

**1.2 SUBMITTALS**

- A. Shop Drawings:
  - 1. Details.
- B. Samples:
  - 1. For finish, color and color range selection.
- C. Contract Closeout Information:
  - 1. Warranty.
- D. LEED Information:
  - 1. LEED Credits MR 4.1 and 4.2, Recycled Content: Product data indicating percentages by weight of post-consumer and post-industrial recycled content for products having recycled content; include statement indicating costs for each product having recycled content.
  - 2. LEED Credits MR 5.1 and 5.2, Regional Materials: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.

**1.3 JOB CONDITIONS**

- A. Coordinate work with roofing.
- B. Provide components necessary to create watertight junctures between roofing and sheet metal work.

**1.4 WARRANTY**

- A. Furnish 20-year finish warranty on PVDF-coated sheet metal, covering color, fade, chalking and film integrity.

**PART 2 - PRODUCTS**

**2.1 MATERIALS**

- A. Acceptable manufacturers:
  - 1. Formed Sheet Metal items:
    - a. Base:
      - 1) Ryerson/Integris Metals, ColorKlad.
    - b. Optional:
      - 1) Petersen Aluminum.
  - 2. Reglets:
    - a. Base:

- 1) Fry Reglet.
3. Other materials:
  - a. Base:
    - 1) Manufacturers as noted.

## 2.2 SHEET METAL ROOFING FABRICATIONS

- A. Formed Roof Edge Flashing (a.k.a. Gravel Stop) and Fascia Caps:
  1. Fabricate to size(s) and profile(s) indicated.
  2. Supply sections with minimum length of 96 IN, but not exceeding FT10.
  3. Joint Style:
    - a. 1/4 IN Butt Joint with 6 IN wide, exposed cover plate.
  4. Material:
    - a. PVDF-coated Galvanized Steel: Minimum 0.028 IN thick.
  5. Integral Scuppers:
    - a. Locate integral scuppers along length of roof edge, spaced as indicated.
      - 1) Space 10 FT apart where continuous gutter is indicated.
    - b. Fabricate to dimensions indicated. Include a minimum 4 IN wide flanges on 3 sides for embedment into roofing system.
    - c. Fasten gravel guard angles (where applicable) to base of scupper.
- B. Formed Sheet Metal Copings (a.k.a. cap flashing):
  1. Fabricate to size(s) and profile(s) indicated.
  2. Supply sections with minimum length of 96 IN, but not exceeding FT10.
  3. Fabricate joint plates of same sheet thickness as copings.
  4. Securement:
    - a. External Leg: Continuous cleats, no exposed fasteners.
    - b. Internal Leg: Color-matched fasteners in slotted holes.
  5. Miter corners, seal, and solder or weld watertight.
  6. Joint Style:
    - a. 1/4 IN Butt Joint with 6 IN wide, exposed cover plate.
  7. Material:
    - a. PVDF-coated Galvanized Steel: Minimum 0.040 IN thick.

## 2.3 ROOF DRAINAGE SHEET METAL FABRICATIONS

- A. Hanging Gutters:
  1. Fabricate to size(s) and profile(s) indicated, complete with end pieces, outlet tubes, and other accessories as required.
    - a. Gutters shall be complete with mitered corners, end caps, and outlets sized to fit downspouts.
  2. Material:

| Hanging Gutters - Minimum Sheet Thickness / Weight |              |             |             |             |             |
|--|--------------|-------------|-------------|-------------|-------------|
| Material   | Gutter Girth |             |             |             |             |
|  | up to 15 IN  | 16 to 20 IN | 21 to 25 IN | 26 to 30 IN | 31 to 35 IN |
| PVDF-coated Galvanized Steel                       | 0.022 IN     | 0.028 IN    | 0.034 IN    | 0.040 IN    | 0.052 IN    |
| PVDF-coated Aluminum                               | 0.032 IN     | 0.040 IN    | 0.050 IN    | 0.063 IN    | --          |
| Stainless Steel                                    | 0.016 IN     | 0.019 IN    | 0.025 IN    | 0.031 IN    | 0.038 IN    |

3. Fabricate sections in maximum lengths practical; not less than 96 IN long.
4. Furnish flat-stock gutter spacers and gutter brackets fabricated from same metal as gutters, of size recommended by SMACNA but not less than twice the gutter thickness.

5. Fabricate expansion joints, expansion-joint covers, gutter bead reinforcing bars, and gutter accessories from same metal as gutters.
  6. Gutter supports shall be adjustable minimum 1 IN wide by minimum 0.080 IN thick hanger, provided in sufficient number to be located at maximum 30 IN on center, or minimum 0.032 IN thick continuous cleats.
  7. Expansion Joints: Lap or Butt types.
- B. Sheet Metal Liners for Built-in Gutters:
1. Fabricate to size(s) and profile(s) indicated, with riveted and soldered joints, complete with end pieces, outlet tubes, and other special accessories as required.
  2. Fabricate sections in maximum lengths practical; not less than 96 IN long.
  3. Fabricate expansion joints and accessories from same metal as gutters unless otherwise indicated.
  4. Fabricate gutters with built-in expansion joints and gutter-end expansion joints at walls.
- C. Downspouts:
1. Fabricate downspouts to size(s) indicated complete with mitered elbows.
  2. Downspout Material:
    - a. PVDF-coated Galvanized Steel: Minimum 0.022 IN thick.
  3. Shape: Rectangular.
  4. Furnish with metal hangers, from same material as downspouts, and anchors.
  5. Downspouts shall be fabricated in minimum 10 FT lengths with section ends formed for minimum 13 mm 1/2 IN telescoped and locked joints.
  6. Downspouts shall be complete with wire ball strainers for gutter outlets, and indicated elbows and offsets.
  7. Downspout supports shall include minimum 0.040 IN thick clips, minimum 3mm 0.125 IN thick anchors, and minimum 0.060 IN thick by 2 IN wide leader straps or rack-and-pin type fasteners of length to allow minimum 1 IN clearance between downspout and building wall, provided in sufficient number to be located at maximum 5 FT on center.
- D. Parapet Scuppers (thru-wall):
1. Fabricate scuppers of dimensions indicated with closure flange trim to exterior, 4 IN wide wall flanges to interior, and base extending 4 IN beyond cant or tapered strip into field of roof.
    - a. Fasten gravel guard angles (where applicable) to base of scupper.
  2. Scupper Material:
    - a. PVDF-coated Galvanized Steel: Minimum 0.028 IN thick.
- E. Conductor Heads:
1. Fabricate conductor heads with flanged back and stiffened top edge and of dimensions and shapes indicated.
  2. Include outlet tube and exterior flange trim.
  3. Include built-in overflows where indicated.
  4. Conductor Head Material:
    - a. PVDF-coated Galvanized Steel: Minimum 0.028 IN thick.

## 2.4 ACCESSORIES

- A. Fasteners: Non-ferrous fasteners of same material as sheet metal which will not rust, corrode or react.
- B. Cleats (retainers): 16 GA galvanized or stainless.
- C. Dissimilar metal and cementitious materials protection:
1. Alkali resistant bituminous paint.
  2. Tnemec Tneme Tar 46-413.
- D. Base Flashing:
1. Fabricate to size(s) and profile(s) indicated.
  2. Material:

- a. PVDF-coated Galvanized Steel: Minimum 0.028 IN thick.
- E. Counterflashing:
  - 1. Fabricate to size(s) and profile(s) indicated.
  - 2. Material:
    - a. PVDF-coated Galvanized Steel: Minimum 0.022 IN thick.
  - 3. Provide interior and exterior preformed corners as required.
  - 4. Fabricate as required to fit special conditions.
- F. Flashing Receivers (reglets):
  - 1. Fabricate to size(s) and profile(s) indicated.
  - 2. Material:
    - a. PVDF-coated Galvanized Steel: Minimum 0.022 IN thick.
  - 3. Provide interior and exterior preformed corners as required.
  - 4. Fabricate as required to fit special conditions.
- G. Expansion joint cover, roofing:
  - 1. Flexible, insulated bellows.
  - 2. 36 mil thick chlorinated polyethylene sheet permanently anchored between and sealed to stainless steel flanges of design required, in maximum available lengths; insulated with 3/8 IN thick closed cell foam.
  - 3. Corners and intersections: Manufacturer's standard prefabricated units.
  - 4. Splicing strips and adhesives: Manufacturer's standard neoprene splicing strips and adhesives.
- H. Sealants: Specified in Section 07 92 13.

## **2.5 FABRICATION - SHEET METAL**

- A. General:
  - 1. Fabricate true and sharp to profiles and sizes indicated.
  - 2. Shop fabricate items to maximum extent possible.

## **PART 3 - EXECUTION**

### **3.1 INSPECTION AND PREPARATION**

- A. Verify suitability of substrates to accept work.
  - 1. Verify continuous wood blocking sloped 1:12, and covered with one layer of building paper.
- B. Installation constitutes acceptance of responsibility for performance.

### **3.2 INSTALLATION - GENERAL**

- A. Provide items to be built into other construction to Contractor in time to allow their installation.
- B. If such items are not provided in time for installation, sheet metal fabricator cut in and install.
- C. Fabricate and install in accordance with details and recommendations of SMACNA, current edition.
- D. Set shop fabricated interior and exterior preformed corners and intersections.
- E. Set top edges of flashings into reglets as indicated.
- F. Fasten materials at recommended intervals.
- G. Provide slip joints to allow for thermal movement.
  - 1. Use SMACNA Table 3-1, Design J9 - J12, with caulked lap.
  - 2. Maximum spacing: 10 FT on center.
  - 3. Provide slip joint in conjunction with splices and corners.

- H. Calk joints with 2 beads of sealant on each overlap: See Section 07 92 13.
- I. Turn down cap flashing over base flashings 4 IN and calk.
- J. Form flashings to provide spring action with exposed edges hemmed or folded to create tight junctures.
- K. Provide dissimilar metals and materials protection where dissimilar metals come in contact, or where sheet metal contacts mortar or concrete.
- L. Provide miscellaneous sheet metal items not specifically covered elsewhere, as indicated or required to provide a weathertight installation.
- M. Provide continuous cleats (retainers).

### **3.3 INSTALLATION – GUTTERS AND DOWNSPOUTS**

- A. Install gutters below slope line of roof, supported on adjustable hangers spaced maximum 30 IN on center or by continuous cleats.
- B. Join gutter sections with flat locked, riveted and sealed joints with hard setting sealant fill, except for expansion-type slip joints midway between outlets
- C. Adjust gutters to slope uniformly to downspout outlets, with high point at midway between outlets.
- D. Install downspouts supported by leader straps or concealed rack-and-pin type fasteners at top, bottom and intermediate points not exceeding 5 FT on center, with downspout held at least 25 mm 1 IN clear of building wall.

### **3.4 INSTALLATION – FORMED COPINGS AND FORMED ROOF EDGES**

- A. Install copings and roof edged with prefabricated corner sections so that no joint occurs within 30 IN from a corner.
- B. Space gutter bars and anchor bolts as recommended by coping manufacturer for installation indicated.
- C. Conceal joints with cover plates, provide stainless steel flashing covering top of wall under coping and protect top of adjacent wall counter flashing under coping leg.

### **3.5 INSTALLATION - ROOFING EXPANSION JOINT COVERS**

- A. Comply with manufacturer's instructions for handling and installation of elastic expansion joint materials.
- B. Coordinate installation and associated work to provide a complete system complying with recommendations of manufacturer and installer.
- C. Extend over curbs, parapets, gutters, valleys, fascias and other elements in construction, to provide continuous, uninterrupted, watertight expansion joint.
- D. Provide uniform hump throughout length of installation.
- E. Do not stretch elastic sheet.
- F. Anchor edges of units in compliance with manufacturer's instructions.
- G. Provide not less than 4 IN embedment in bituminous membranes, mop in with hot bitumen or with roofing cement.
- H. Cover with composition stripping.

### **3.6 CLEAN-UP**

- A. Upon completion of work, repair damaged areas.

- B. Repair finish of PVDF coated flashing which fades or is damaged.
- C. Clean stains and debris.
- D. Remove protective coverings.

**END OF SECTION**

**SECTION 07 72 33**  
**ROOF HATCHES**

**PART 1 - GENERAL**

**1.1 QUALITY ASSURANCE**

- A. ASTM-A36: "Standard Specification for Structural Steel."
- B. ASTM-A123: "Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products."
- C. Occupational Safety & Health Administration (OSHA): 29 CFR 1910.23 "Fall Protection in General Industry."

**1.2 SUBMITTALS**

- A. Shop Drawings:
  - 1. Show profiles, accessories, locations and dimensions.
- B. Product Data:
  - 1. For listed materials.
- C. Contract Closeout Information:
  - 1. Warranty.
- D. LEED Information:
  - 1. LEED Credits MR 4.1 and 4.2, Recycled Content: Product data indicating percentages by weight of post-consumer and post-industrial recycled content for products having recycled content; include statement indicating costs for each product having recycled content.
  - 2. LEED Credits MR 5.1 and 5.2, Local Regional Materials: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.

**1.3 WARRANTY**

- A. General:
  - 1. Products to be free of defects for period indicated.
  - 2. Warranty to cover repair or replacement in event of leakage, defective design, materials or construction.
  - 3. Warranty signed jointly by installer, Contractor and supplier.
- B. Roof Hatches:
  - 1. Provide 5-year warranty on Roof Hatches, including caulking and flashing.
- C. Hatch Guardrails:
  - 1. Provide 25-year warranty.

**1.4 PRODUCT HANDLING**

- A. All materials shall be delivered in manufacturer's original packaging.
- B. Store materials in a dry, protected, well-vented area.
- C. Remove protective wrapping immediately after installation.

## **1.5 JOB CONDITIONS**

- A. Verify that other trades with related work are complete before installing roof hatches and hatch guardrail system(s).
- B. Mounting surfaces shall be straight and secure; substrates shall be of proper width.
- C. Refer to the construction documents, shop drawings, and manufacturer's installation instructions.
- D. Coordinate installation with roof membrane and roof insulation manufacturer's instructions.
- E. Observe appropriate OSHA safety guidelines for this work.

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS**

- A. Acceptable Manufacturers:
  - 1. Roof Hatches:
    - a. Base:
      - 1) Bilco Company.
    - b. Optional:
      - 1) Wasco Products.
      - 2) Milcor.
  - 2. Hatch Guardrail:
    - a. Base:
      - 1) Bilco Company.
    - b. Optional:
      - 1) KeeHatch.

### **2.2 SCHEDULE OF ROOF HATCHES**

- A. Size and corresponding Base Model Number ("Bilco"):
  - 1. Size: 36 IN x 36 IN; Bilco Series "E."
- B. Roof Hatch Materials (Stainless Steel Units)
  - 1. Curb and Cover Material: 0.078 IN (14 GA) Stainless Steel, Type 304.
  - 2. Liner Material: 0.0313 IN (22 GA) Stainless Steel, Type 304.
  - 3. Finish:
    - a. Shop Finish: 2B Finish Mill Finish.
- C. Include the following at each Roof Hatch:
  - 1. Hatch Guardrail.

### **2.3 ROOF HATCHES - CONSTRUCTION**

- A. Curb:
  - 1. Height: 12 IN.
  - 2. Formed with a 3-1/2 IN flange with 7/16 IN holes provided for securing to the roof deck.
  - 3. The curb shall be equipped with an integral metal cap-flashing of the same gauge and material as the curb, fully welded at the corners that features the Posi-Flash flashing system including stamped tabs, 6 IN on center, to be bent inward to hold EPDM roofing securely in place.
- B. Cover:
  - 1. Minimum 2-1/2 IN weather flange.
- C. Insulation:
  - 1. Rigid board glass or mineral fiber, laminated between sheets of metal.

2. Insulate curbs and covers with minimum 1 IN thick insulation.
- D. Gaskets: Tubular or fingered design; neoprene, polyvinyl chloride, or molded block design sponge neoprene.
- E. Hardware:
  1. Standard self-lifting mechanism and automatic hold open devices.
  2. Pintle hinges.
  3. Operating devices: Handles and padlock hasps on inside and outside.
  4. Finish: Cadmium plated.
- F. Performance Characteristics:
  1. Construct for 40 PSF live loading with a maximum deflection of 1/50<sup>th</sup> of the span and 20 PSF wind uplift.
  2. Operation of the cover shall be smooth and easy with controlled operation throughout the entire arc of opening and closing.
  3. Entire assemble, and installation shall be weathertight with fully welded corner joints on cover and curb.
  4. Operation and weathertightness shall not be unaffected by temperature.

## 2.4 HATCH GUARDRAIL SYSTEM

- A. General:
  1. Provide one such assembly at each hatch.
  2. Use appropriate model number variations according to hatch size and ladder position.
  3. Base Product: "Bil-Guard" by Bilco.
- B. Performance characteristics:
  1. Integral color: High visibility safety yellow color.
  2. Hatch rail system shall attach to the cap flashing of the roof hatch without penetrating roofing material.
  3. Comply with OSHA 29 CFR 1910.23.
  4. Exceed OSHA strength requirements with a factor of safety of 2.
  5. UV- and corrosion-resistant construction with a 25-year warranty.
- C. Posts and Rails:
  1. Reinforced, fire retardant, yellow fiberglass tubes.
  2. Treat with a UV inhibitor.
- D. Hardware:
  1. Mounting brackets:
    - a. 1/4 IN thick hot dip galvanized steel.
  2. Hinges and post guides:
    - a. 6063T5 aluminum.
  3. Fasteners: Type 316 stainless steel.
- E. Gate:
  1. Self-closing design of material matching balance of guardrail system.
  2. Locate Gate on most safe and convenient side of each hatch (relative to ladder position) while avoiding roof obstructions.
    - a. Exception: Locations specifically indicated shall govern.

## 2.5 FABRICATION

- A. Fabricate from steel sheet and plate in shop, to sizes indicated; modify if necessary to comply with requirements.
- B. Where standard units are not available for sizes and types required, provide custom fabricated units.

## **PART 3 - EXECUTION**

### **3.1 INSPECTION - GENERAL**

- A. Verify acceptability of substrate for installation.
- B. Correct unsatisfactory conditions.

### **3.2 INSTALLATION**

- A. Roof Hatches:
  - 1. Inspection:
    - a. Coordinate with decking and roofing.
    - b. Verify as-built conditions and coordinate with hatch manufacturer's details.
    - c. Verify that hatch installation will not disrupt other trades.
    - d. Report and correct defects prior to any installation.
  - 2. Installation:
    - a. Install wood blocking, specified in Division 06, as needed to insure that the curb has a minimum exposure of 8 IN of vertical surface above adjacent roof insulation for proper flashing.
    - b. Securely anchor units by bolting or welding, as appropriate.
    - c. Flash and counter flash to provide weathertight installation.
    - d. Touch up abraded areas with zinc rich paint.
- B. Hatch Guardrails:
  - 1. Inspection:
    - a. Verify as-built conditions and coordinate with manufacturer's hatch rail system details.
    - b. Verify that hatch rail system installation will not disrupt other trades.
    - c. Report and correct defects prior to any installation.
  - 2. Installation:
    - a. The hatch rail system shall be field assembled and installed per the manufacturer's instructions.
    - b. Permanently bolt guardrail assembly to vertical face of Roof Hatch curb.
    - c. Seal per manufacture's instructions to make penetrations watertight.

### **3.3 ADJUSTMENT**

- A. After installation and before acceptance adjust to provide smooth, easy operation.

**END OF SECTION**

**SECTION 07 84 00**  
**FIRESTOPPING**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section includes Through Penetration Firestop Systems for penetrations through the following fire-resistance rated assemblies, including both blank openings and openings containing penetrating items:
  - 1. Floor assemblies.
  - 2. Roof assemblies.
  - 3. Walls and partitions.
  - 4. Smoke barriers which also call for a fire rating.
  - 5. Construction enclosing compartmentalized areas.
  - 6. Existing, fire and smoke-rated elements.
  - 7. Not included: Non-rated walls and smoke-tight partitions which do not call for a fire rating): Do not require Through Penetration Firestop assemblies.
- B. This section includes Fire-Resistive Joint Assemblies for linear voids where fire-rated floor, roof, or wall assemblies abut one another, including the following types of joints:
  - 1. Head-of-Wall joint created where walls intersect with overhead roof or floor structure (slabs, decking, beams, etc).
    - a. Fire-rated Walls: Select agency-approved assemblies and employ materials specified in this section.
    - b. Non-fire rated partitions (including Smoke Partitions): Seal to structure with Acoustical Sealant specified in Section 09 29 00.

**1.2 QUALITY ASSURANCE**

- A. Provide Firestop Systems that comply with the following requirements and those specified in "Performance Requirements" Article:
  - 1. Firestopping tests, performed by a qualified, testing and inspection agency.
    - a. Qualified testing and inspection agency: UL, or another agency performing testing and follow-up inspection services for firestop systems acceptable to local authorities having jurisdiction.
  - 2. Firestop System products bear classification marking of qualified testing and inspection agency.
  - 3. Applications that exist for which no tested system is available through a manufacturer: Provide engineering judgment derived from similar UL system designs or other tests approved by local authorities having jurisdiction, prior to installation.
    - a. Engineering judgment drawings must follow requirements set forth by the International Firestop Council.
- B. Installer Qualifications:
  - 1. Certified, licensed or otherwise qualified by the Firestopping Manufacturer as having the necessary training to install firestop products per specified requirements.
  - 2. Licensed by the State or local authority, where applicable.
  - 3. Shown to have successfully completed not less than 5 comparable scale projects.
  - 4. FM Approved in accordance with FM Standard 4991 – Approval of Firestop Contractors.
- C. Single-source: Obtain Firestop Systems for each type of penetration and construction condition indicated from a single manufacturer.
- D. Fire Test Requirements:
  - 1. Underwriters Laboratories, Inc. (UL):

- a. UL 1479, "Fire Tests of Through Penetration Firestops."
  - b. UL 2079, "Tests for Fire Resistance of Building Joint Systems."
  - c. UL 263, "Fire Tests of Building Construction and Materials."
  - d. UL 723, "Surface Burning Characteristics of Building Materials."
  - 2. American Society of Testing and Materials (ASTM):
    - a. ASTM-E814, "Fire Tests of Through Penetration Fire Stops."
    - b. ASTM-E1966, "Test Method for Fire Resistive Joint Systems."
    - c. ASTM-E119, "Fire Tests of Building Construction and Materials."
    - d. ASTM-E84, "Surface Burning Characteristics of Building Materials."
    - e. ASTM-E1399, "Cyclic Movement and Measuring the Minimum and Maximum Joint Widths of Architectural Joint Systems."
- E. References:
- 1. Underwriters Laboratories (UL) "Fire Resistance Directory":
    - a. Through Penetration Firestop Systems (XHEZ).
    - b. Joint Systems (XHBN).
    - c. Fill, Void or Cavity Materials (XHHW).
    - d. Firestop Devices (XHJJ).
    - e. Forming Materials (XHKU).
    - f. Wall Opening Protective Materials (CLIV).
  - 2. Building Code as locally adopted and amended.
  - 3. National Fire Protection Association (NFPA):
    - a. NFPA 101: "Life Safety Code."
    - b. NFPA 70: "National Electrical Code."
  - 4. Firestop Contractors International Association (FCIA):
    - a. Manual of Practice.
  - 5. International Firestop Council (IFC):
    - a. Ref. 1 Recommended IFC Guidelines for Evaluating Firestop Engineering Judgments (April 2001)
    - b. Ref. 2 Inspectors Field Pocket Guide
- F. Identification Labels for Firestop Assemblies:
- 1. Install labels which identify each Firestop installation.
  - 2. Label shall be pre-printed by supplier and include the following:
    - a. Name of supplier of Firestopping system.
      - 1) Include manufacturer's representative and phone number.
    - b. UL Design Number or other approved testing agency.
    - c. Date of installation.
    - d. Name of firestopping installer.
  - 3. Identification labels may be in the form of self-adhering stickers, tie-on ID tags, or combination of both as appropriate for permanent identification of firestop assemblies.

### 1.3 PERFORMANCE REQUIREMENTS

- A. Provide products that upon curing, do not re-emulsify, dissolve, leach, breakdown or otherwise deteriorate over time from exposure to atmospheric moisture, sweating pipes, ponding water or other forms of moisture characteristic during and after construction.
- B. Provide firestop sealants sufficiently flexible to accommodate motion such as pipe vibration, water hammer, thermal expansion and other normal building movement without damage to the seal.
- C. Pipe insulation shall not be removed, cut away or otherwise interrupted through wall or floor openings.
  - 1. Provide products appropriately tested for the thickness and type of insulation utilized.
- D. Cabling (i.e. voice, data and video cabling, etc) where frequent cable moves, add-ons, and changes are likely to occur in future:

1. Where Cable Trays are used to convey such cabling: Utilize re-enterable products (e.g. removable intumescent pillows) specifically designed for retrofit.
  2. Where Cable Trays are not used: Utilize Fire-rated Cable Pathway devices. Where not practical, re-enterable products specifically designed for retrofit may also be used.
- E. Penetrants passing through fire-resistance rated floor-ceiling assemblies contained within chase wall assemblies shall be protected with products tested by being fully exposed to the fire outside of the chase wall.
1. Systems within the UL Fire Resistance Directory that meet this criterion are identified with the words "Chase Wall Optional."
- F. Fire Resistive Joint Sealants:
1. Provide fire-resistive joint sealants sufficiently flexible to accommodate movement such as thermal expansion and other normal building movement without damage to the seal.
  2. Provide fire-resistive joint sealants designed to accommodate a specific range of movement and tested for this purpose in accordance with a cyclic movement test criteria as outlined in Standards, ASTM-E1399, ASTM-E1966 or UL 2079.
  3. Provide fire-resistive joint systems subjected to an air leakage test conducted in accordance with Standard, UL 2079 with published L-Ratings for ambient and elevated temperatures as evidence of the ability of the fire-resistive joint system to restrict the movement of smoke.

#### **1.4 SUBMITTALS**

- A. Project Information:
1. UL reports with illustration of systems and system numbers.
  2. Contractor Certification (per FM 4991).
- B. Contract Closeout Information:
1. Letter stating that installed Through Penetration Firestop Systems have been labeled.
- C. LEED Information:
1. LEED Credits MR 5.1 and 5.2, Regional Materials: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.
  2. LEED Credit EQ 4.1, Low-Emitting Materials - Adhesives & Sealants: Manufacturer's data indicating VOC content of adhesives and sealants applied under this section.

#### **1.5 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver products to Project site in original, unopened containers.
- B. Store and handle materials to prevent their deterioration or damage due to moisture, temperature changes, contaminants or other causes.

#### **1.6 PROJECT CONDITIONS**

- A. Do not install when ambient or substrate temperatures are outside limitations recommended by manufacturer.
- B. Do not install when substrates are wet due to rain, frost, condensation, or other causes.
- C. Do not use materials that contain flammable solvents.

#### **1.7 COORDINATION**

- A. Coordinate construction of openings and penetrating items to ensure that Firestopping Systems are installed according to specified requirements.
- B. Coordinate sizing of sleeves, openings, core-drilled holes or cut openings to accommodate Through Penetration Firestop Systems.

- C. Schedule installation of firestopping after completion of penetrating item installation but prior to covering or concealing of openings.

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS**

- A. Acceptable manufacturers:
  - 1. Firestopping Materials (including fillers, sealants and other items):
    - a. Base:
      - 1) Hilti.
    - b. Optional:
      - 1) Specified Technologies, Inc (STI).
      - 2) 3M.
      - 3) Tremco.
      - 4) Grace.
  - 2. Forming Materials:
    - a. Base:
      - 1) Thermafiber.
    - b. Optional:
      - 1) Roxul Inc.
      - 2) IIG Minwool.
      - 3) Rock Wool Manufacturing.

### **2.2 FIRESTOPPING – GENERAL REQUIREMENTS**

- A. Selection Responsibility:
  - 1. Contractor is responsible to select systems which are approved for conditions encountered and when installed, will maintain required fire separations.
- B. Provide firestopping systems and materials that are compatible with one another, with the substrates forming openings, and with penetrating items, under conditions of service and application.
- C. Provide components for each firestopping system that are needed to install fill materials.
- D. Materials shall be provided by a single firestopping products manufacturer as far as possible.
- E. All materials used shall be the specific items named in the UL assemblies being installed.
- F. All materials must be UL-approved for the designated fire-resistance-rated systems.
- G. Use only products that have been tested for specific fire-resistance-rated construction conditions conforming to construction assembly type, penetrating item type, annular space requirements, void width, movement capabilities, and fire-rating involved for each separate instance.

### **2.3 MATERIALS**

- A. Latex Sealants:
  - 1. Single component latex formulations that upon cure do not re-emulsify during exposure to moisture with VOC content no greater than 250 g/L.
    - a. Through Penetration Firestop Systems:
      - 1) Base Products: “FS-ONE,” “CP604,” and “CP606” by Hilti.
      - 2) Optional Products:
        - a) “SpecSeal Series SSS and LCI Intumescent Sealants,” “SpecSeal Series LC Endothermic Sealant,” and “SpecSeal Series AS Elastomeric Spray” by STI.
        - b) “IC15WB+,” “CP25WB+,” “FireDam 150+” by 3M.
    - b. Fire-resistive Joints:
      - 1) Base Products: “CP606” and “CP672” by Hilti.

- 2) Optional Products:
  - a) "SpecSeal Series ES and AS Elastomeric Sealants" by STI.
  - b) "FireDam 150+", "Fire Barrier 1000NS", "Fire Barrier 1003SL", "Fire Barrier 2000NS", "FireDam Spray 200" by 3M.
- B. Firestop Devices:
  1. Factory-assembled steel collars lined with intumescent material sized to fit specific outside diameter of penetrating item.
  2. Base Products: "SpecSeal Series SSC and LLC Firestop Collars" by STI.
  3. Optional Product: "Fire Barrier Ultra Plastic Pipe Device" by 3M.
- C. Intumescent Pads (Wall Opening Protective Materials):
  1. Intumescent, non-curing pads or inserts for protection of electrical switch and receptacle boxes, medical gas outlets, and other items recessed in to face of fire rated walls.
  2. Base Products: "FS-ONE" and "CP643N" by Hilti.
  3. Optional Products:
    - a. "SpecSeal Series SSP Firestop Putty Pads" and "SpecSeal Series EP PowerShield Insert Pads" by STI.
    - b. "Interam Ultra GS Wrap Strip", "3M Fire Barrier Moldable Putty+ pads", "3M Fire Barrier Moldable Putty Stix" by 3M.
- D. Fire-rated Cable Pathways:
  1. Usage:
    - a. Cables passing through fire-rated floors or walls shall pass through Fire-rated Cable Pathway devices made from an intumescent material that adjusts automatically to cable additions or subtractions.
  2. Product Description and Requirements:
    - a. Pathway device modules comprised of steel raceway and intumescent foam pads.
    - b. F-Rating equal to the rating of the barrier in which the device penetrates.
    - c. Pathway devices shall be capable of allowing a 0 to 100% fill of cables.
    - d. Size to accommodate the quantity and size of electrical wires and data cables indicated plus 100% expansion.
    - e. Wire devices to be provided with steel wall plates allowing for single or multiple devices to be ganged together.
  3. Base Product: "EZ-PATH Fire Rated Pathway" by STI.
  4. Optional Product: "3M Fire Barrier Pass-Through Devices" by 3M.
- E. Firestop Putty:
  1. Intumescent, non-hardening, water resistant putties containing no solvents, inorganic fibers or silicone compounds.
  2. Base Product: "CP618" and "CP619" by Hilti.
  3. Optional Products:
    - a. "SpecSeal Series SSP Firestop Putty" by STI.
    - b. "3M Fire Barrier Moldable Putty+ pads", "3M Fire Barrier Moldable Putty Stix" by 3M.
- F. Wrap Strips:
  1. Single component intumescent elastomeric strips faced on both sides with a plastic film:
  2. Base Products: "CP645" and "CP648" by Hilti.
  3. Optional Products:
    - a. "SpecSeal Series RED Wrap Strip" and "SpecSeal Series BLU Wrap Strip" by STI.
    - b. "Interam Ultra GS Wrap Strip", "3M Fire Barrier FS 195+ Wrap Strip" by 3M.
- G. Firestop Pillows:
  1. Re-enterable, non-curing, mineral fiber core encapsulated with an intumescent coating contained in a flame retardant poly bag.
  2. Base Product: "CP647" by Hilti.
  3. Optional Products:

- a. "SpecSeal Series SSB Firestop Pillows" by STI.
  - b. "3M Fire Barrier Pillows", "3M Fire Barrier Self-Locking Pillows", by 3M.
- H. Mortar:
- 1. Portland cement based dry-mix product formulated for mixing with water at Project site to form a non-shrinking, water-resistant, homogenous mortar.
  - 2. Base Product: "CP637" by Hilti.
  - 3. Optional Products:
    - a. "SpecSeal Series SSM Firestop Mortar" by STI.
    - b. "3M Fire Barrier Mortar" by 3M.
- I. Silicone Sealants:
- 1. Moisture curing, single component, silicone elastomeric sealant for horizontal surfaces (pourable or nonsag) or vertical surface (nonsag) with VOC content no greater than 250 g/L.
  - 2. Base Products: "FS-ONE," "CP601S," and "CP606" by Hilti.
  - 3. Optional Products:
    - a. "Pensil 300 Silicone Sealant" and "Pensil 300 SL Self-Leveling Silicone Sealant" by STI.
    - b. "Fire Barrier 3000WT Water Tight Silicone", "3M Fire Barrier 1000NS and 1003 SL Silicone", "3M Fire Barrier 2000+", "Fire Barrier 2000NS" by 3M.
- J. Silicone Foam:
- 1. Multi-component, silicone-based, liquid elastomers, that when mixed, expand and cure in place to produce a flexible, non-shrinking foam.
  - 2. Base Product: "CP620" by Hilti.
  - 3. Optional Products:
    - a. "Pensil 200 Silicone Foam" by STI.
    - b. "3M Fire Barrier 2001 RTV Foam" by 3M.
- K. Forming Materials:
- 1. Materials listed as components in laboratory-approved designs.
  - 2. Mineral Wool:
    - a. Base Products: "Type SAF" by Thermafiber or similar products specifically named as components in laboratory-approved designs.
    - b. Optional Product: "3M Fire Barrier Packing Material PM4" by 3M.

## 2.4 THROUGH PENETRATION FIRESTOP SYSTEMS

- A. General:
- 1. The schedules below identify requirements for acceptable Through Penetration Firestop Systems based on barrier type, fire-resistive rating, and penetrant type. It is a guide. Ultimately each system must comply with Building Code and Fire Code as locally adopted and amended.
  - 2. Requirements for "single-membrane" penetrations and Through Penetration Firestops are Identical. (Unless otherwise noted, penetrants which pass through a single membrane, shall be treated the same as if it passed through the entire fire-resistive assembly.)
  - 3. Select each Firestop System based on actual field conditions, including penetration type, shape, size(s), quantities and physical position within opening.
  - 4. Refer to Plans for indication of the required ratings of Fire-resistive wall, floor, and roof assemblies.
  - 5. Indicated ratings are minimum and may be exceeded.
  - 6. Firestop Assemblies at Fire-Rated Walls:
    - a. The minimum Fire (F) Rating for Firestop assemblies in walls shall equal that of the wall, but not less than 1-HR.
    - b. The minimum Temperature (T) Rating of Firestop assemblies in walls may equal zero.
    - c. Smoke Barrier: In addition to (F) Rating, (L) Rating of maximum 5 CFM/SF.
    - d. Non-rated walls and Smoke-Partitions with no fire-resistive requirement: Assembly with (L) rating.

7. Firestop Assemblies at Fire-Rated Floors and Roofs:
  - a. The minimum Fire (F) and Temperature (T) Ratings of Firestop assemblies used in floors (or roofs) shall equal the hourly rating of the floor (or roof) being penetrated, but not less than 1-HR.
    - 1) Exception 1: The T-rating may equal zero when the portion of the penetrant which is above the floor is contained within a wall.)
    - 2) Exception 2: Firestops are not required for floor penetrations that are within a 2-hour rated shaft enclosure.
- B. Voids in wall (no penetrating items):
  1. Fill with approved Through Penetration Firestopping System.
  2. Contractors Option: Patch void in wall with like construction and complete by sealing gaps between patch and wall with approved firestopping.
- C. Penetrating Ducts with Dampers:
  1. Utilize only firestop materials which are included in the damper's classification.
  2. Do not install Firestop Systems that might hamper the performance of fire dampers.
- D. Cable Trays and similar devices:
  1. Openings within walls and floors designed to accommodate voice, data and video cabling shall be provided with re-enterable products (e.g. Firestop Pillows) specifically designed for removal and re-installation.
- E. Electrical and Electrical Devices recessed in to face of rated walls:
  1. Items included: Switches, receptacles, J-boxes, medical gas outlets, and similar items recessed in to the face(s) of fire rated walls.
  2. Where such devices are placed on opposite sides of wall, and are less than 24 IN apart measured horizontally: Install Intumescent Pads over back of devices in approved manner.

| <b>Guide to Through Penetration Firestop Systems - WALLS</b>                                       |  |                     |                              |                              |   |
|--|--|---------------------|------------------------------|------------------------------|---|
| Penetrant Description  |  | Criteria            | Wood Stud & GWB              | Metal Stud & GWB             | CIP Concrete & Masonry                    |
|  |  |                     | UL U-300 Series              | UL U-400 Series              | UL U-900 Series                           |
| <b>No Penetrating Items</b>  |  | Single Penetrant    | W-L-0000 Series <sup>5</sup> | W-L-0000 Series <sup>5</sup> | W-J-0000 Series <sup>5</sup>              |
|  |  | Multiple Penetrants |                              |                              |   |
| <b>Metallic, Un-Insulated Pipe, Conduit, or Tubing</b> <sup>12</sup><br>(i.e. Copper, Iron, Steel) |  | Single Penetrant    | W-L-1000 Series              | W-L-1000 Series              | C-AJ-1000 or W-J-1000 Series              |
|  |  | Multiple Penetrants | W-L-8000 Series <sup>6</sup> | W-L-8000 Series <sup>6</sup> | C-AJ-8000 or W-J-8000 Series <sup>6</sup> |
|  |  | Remarks             | <Note 11>                    | <Note 11>                    | <Note 9 & 11>                             |
| <b>Non-Metallic, Un-Insulated Pipe, Conduit, or Tubing</b><br>(i.e. PVC, CPVC, Glass)              |  | Single Penetrant    | W-L-2000 Series              | W-L-2000 Series              | C-AJ-2000 or W-J-2000 Series              |
|  |  | Multiple Penetrants | W-L-8000 Series <sup>6</sup> | W-L-8000 Series <sup>6</sup> | C-AJ-8000 or W-J-8000 Series <sup>6</sup> |
|  |  | Remarks             | <Note 11>                    | <Note 11>                    | <Note 11>                                 |
| <b>Electrical Cables</b>   |  | Single Penetrant    | W-L-3000 Series              | W-L-3000 Series              | C-AJ-3000 or W-J-3000 Series              |
|  |  | Multiple Penetrants | W-L-8000 Series <sup>6</sup> | W-L-8000 Series <sup>6</sup> | C-AJ-8000 or W-J-8000 Series <sup>6</sup> |
| <b>Cable Trays w/cabling</b>   |  | Single Penetrant    | W-L-4000 Series              | W-L-4000 Series              | C-AJ-4000 or W-J-4000 Series              |
|  |  | Multiple Penetrants |                              |                              |   |
| <b>Insulated Pipes</b><br>(i.e. Copper, Glass, Steel, Iron, Plastic, Steel)                        | Systems operating between 32 to 122 DegF <sup>1</sup>          | Single Penetrant    | W-L-5000 Series              | W-L-5000 Series              | C-AJ-5000 or W-J-5000 Series              |
|  |  | Multiple Penetrants | W-L-8000 Series <sup>6</sup> | W-L-8000 Series <sup>6</sup> | C-AJ-8000 or W-J-8000 Series <sup>6</sup> |
|  | Systems operating below 32 DegF or above 122 DegF <sup>2</sup> | Single Penetrant    | W-L-5000 Series              | W-L-5000 Series              | C-AJ-5000 or W-J-5000 Series              |
|  |  | Multiple Penetrants | W-L-8000 Series <sup>6</sup> | W-L-8000 Series <sup>6</sup> | C-AJ-8000 or W-J-8000 Series <sup>6</sup> |

## Guide to Through Penetration Firestop Systems - WALLS

| Penetrant Description   | Criteria            | Wood Stud & GWB              | Metal Stud & GWB             | CIP Concrete & Masonry       |
|---|---------------------|------------------------------|------------------------------|------------------------------|
|   |                     | UL U-300 Series              | UL U-400 Series              | UL U-900 Series              |
|   | Remarks             | <Note 7>                     | <Note 7>                     | <Note 7>                     |
| <b>Miscellaneous Electrical Penetrations</b> (i.e. Bus Ducts) | Single Penetrant    | W-L-6000 Series              | W-L-6000 Series              | C-AJ-6000 Series             |
|   | Multiple Penetrants | N/A                          | N/A                          |                              |
| <b>Metal Duct</b> <sup>3</sup>                                | Single Penetrant    | W-L-7000 Series              | W-L-7000 Series              | C-AJ-7000 or W-J-7000 Series |
|   | Multiple Penetrants | N/A                          | N/A                          | N/A                          |
| <b>Electrical Boxes</b>                                       | Single Penetrant    | CEYY or CLIV Series          | CEYY or CLIV Series          | CEYY Series                  |
|   | Multiple Penetrants | N/A                          | N/A                          | N/A                          |
|   | Remarks             | <Notes 10 & 11>              | <Notes 10 & 11>              | <Notes 9>                    |
| <b>Other Recessed Devices</b> <sup>4</sup>                    | Single Penetrant    | W-L-7000 Series <sup>8</sup> | W-L-7000 Series <sup>8</sup> | <Note 8>                     |
|   | Multiple Penetrants |                              |                              |                              |

## Guide to Through Penetration Firestop Systems - FLOORS AND ROOFS

| Penetrant Description  |  | Criteria            | Framed Structure             | Cast-in-Place Concrete<br>(Any thickness)    | Cast-in-Place Concrete<br>(Min thickness > 5 IN) |
|--|--|---------------------|------------------------------|--|--|
| <b>No Penetrating Items</b>  |  | Single Penetrant    | <Note 5>                     | C-AJ-0000 or<br>F-A-0000 Series <sup>5</sup> | C-BJ-0000 Series <sup>5</sup>                    |
|  |  | Multiple Penetrants |                              |  |  |
| <b>Metallic, Un-Insulated Pipe, Conduit, or Tubing</b> <sup>12</sup><br>(i.e. Copper, Iron, Steel) |  | Single Penetrant    | F-C-1000 Series              | C-AJ-1000 or<br>F-A-1000 Series              | C-BJ-1000 or<br>F-B-1000 Series                  |
|  |  | Multiple Penetrants | F-C-8000 Series <sup>6</sup> | C-AJ-8000 or<br>F-A-8000 Series <sup>6</sup> | C-BJ-8000 or<br>F-B-8000 Series <sup>6</sup>     |
|  |  | Remarks             | --                           | <Note 9>                                     | <Note 9>   |
| <b>Non-Metallic, Un-Insulated Pipe, Conduit, or Tubing</b><br>(i.e. PVC, CPVC, Glass)              |  | Single Penetrant    | F-C-2000 Series              | C-AJ-2000 or<br>F-A-2000 Series              | C-BJ-2000 or<br>F-B-2000 Series                  |
|  |  | Multiple Penetrants | F-C-8000 Series <sup>6</sup> | C-AJ-8000 or<br>F-A-8000 Series <sup>6</sup> | C-BJ-8000 or<br>F-B-8000 Series <sup>6</sup>     |
| <b>Electrical Cables</b>   |  | Single Penetrant    | F-C-3000 Series              | C-AJ-3000 or<br>F-A-3000 Series              | C-BJ-3000 or<br>F-B-3000 Series                  |
|  |  | Multiple Penetrants | F-C-8000 Series <sup>6</sup> | C-AJ-8000 or<br>F-A-8000 Series <sup>6</sup> | C-BJ-8000 or<br>F-B-8000 Series <sup>6</sup>     |
| <b>Cable Trays w/cabling</b>   |  | Single Penetrant    | N/A                          | C-AJ-4000 or<br>F-A-4000 Series              | C-BJ-4000 or<br>F-B-4000 Series                  |
|  |  | Multiple Penetrants |                              |  |  |
| <b>Insulated Pipes</b><br>(i.e. Copper, Glass, Steel, Iron, Plastic, Steel)                        | Systems operating between 32 to 122 DegF <sup>1</sup>          | Single Penetrant    | F-C-5000 Series              | C-AJ-5000 or<br>F-A-5000 Series              | C-BJ-5000 or<br>F-B-5000 Series                  |
|  |  | Multiple Penetrants | F-C-8000 Series <sup>6</sup> | C-AJ-8000 or<br>F-A-8000 Series <sup>6</sup> | C-BJ-8000 or<br>F-B-8000 Series <sup>6</sup>     |
|  | Systems operating below 32 DegF or above 122 DegF <sup>2</sup> | Single Penetrant    | F-C-5000 Series              | C-AJ-5000 or<br>F-A-5000 Series              | C-BJ-5000 or<br>F-B-5000 Series                  |
|  |  | Multiple Penetrants | F-C-8000 Series <sup>6</sup> | C-AJ-8000 or<br>F-A-8000 Series <sup>6</sup> | C-BJ-8000 or<br>F-B-8000 Series <sup>6</sup>     |
|  | Remarks  | <Note 7>            | <Note 7>                     | <Note 7>                                     |  |
| <b>Miscellaneous Electrical Penetrations</b> (i.e. Bus Ducts)                                      |  | Single Penetrant    | N/A                          | C-AJ-6000 Series                             | C-BJ-6000 Series                                 |
|  |  | Multiple Penetrants |                              |  |  |
| <b>Metal Duct</b> <sup>3</sup>   |  | Single Penetrant    | F-C-7000 Series              | C-AJ-7000 or<br>F-A-Series                   | C-BJ-7000 Series or<br>F-B-7000 Series           |
|  |  | Multiple Penetrants | N/A                          | N/A  | N/A  |
| <b>Electrical Boxes</b>  |  | Single Penetrant    | CEYY Series                  | CEYY Series                                  | CEYY Series                                      |
|  |  | Multiple Penetrants | N/A                          | N/A  | N/A  |
| <b>Other Recessed Devices</b> <sup>4</sup>   |  | Single Penetrant    | <Note 8>                     | <Note 8>                                     | --   |
|  |  | Multiple Penetrants |                              |  |  |

**Footnotes:** (applicable to Walls AND Floors/Roofs)

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- 1 Examples of systems that operate between 32 to 122 DegF: Chilled Water Supply & Return, Heat Pump Water Supply & Return, Domestic Cold Water, Domestic Hot Water and Recirculation systems < 122 DegF.
  - 2 Examples of systems operating below 32 DegF or above : Steam Supply and Return, Steam Vents, Condensate Pump Discharge, Boiler Blow Down, Cryogenic Vents, Generator Engine Exhaust, Heating Hot Water Supply & Return, Hot-Chilled Water Supply & Return, Glycol Heating Hot Water Supply & Return, Domestic Hot Water and Recirculation systems > 122 DegF.
  - 3 This Guide's data apply only to penetrations w/out dampers. For dampered penetrations: Refer to Section 23 31 13. Where dampers occur, do not apply firestop materials which are not included in the damper's classification.
  - 4 Examples of other recessed items: Medical Gas Zone Valves, Medical Gas Outlets, Fire Valve Cabinets, Fire Hose cabinets, Fire Extinguisher Cabinets, Unit Heaters, Fire Fighter's Phone, Central Vacuum Outlets, Electrical Panels, Elevator Hall Calls and Lanterns, etc.
  - 5 Optional: Seal opening using barrier's original construction.
  - 6 Where an appropriate Series 8000 classified system is not available for multiple penetrants; Install penetrants singly with appropriate firestop system.
  - 7 For systems which operate below 32 DegF or above 122 DegF: Comply with the following additional requirements: 1) Select a Firestop system which utilizes an intumescent elastomeric wrap strip as the fill/void/cavity material; AND 2) Series 8000 systems shall not be used. Install penetrants singly with appropriate firestop system.
  - 8 Where UL-classified systems are not available for other recessed devices: Maintain continuity of rated barrier around back of recessed item.
  - 9 A classified Firestop assembly is not required in Concrete or Masonry assemblies when all of the following are met: 1) The penetrant is steel, ferrous or copper conduit, pipe, tube or vent with a diameter less than 6 IN; 2) The gross void has a maximum area of 144 SQ IN; AND 3) The annular space is completely filled with concrete, grout or mortar for the full thickness of the floor/wall barrier.
  - 10 A classified Firestop assembly is not required when all of the following are met: 1) Electrical Box is UL listed; 2) The face area of individual boxes does not exceed 16 SQ IN; 3) The aggregate area of openings does not exceed 100 SQ IN in any 100 SF of wall area; 4) Outlet boxes on same side of wall are separated by a distance equal to the depth of the wall and the wall cavity is filled with mineral wool, or other approved, non-combustible blocking; AND 4) Outlet boxes on opposing sides of the wall are separated by a distance of at least 24 IN.
  - 11 Openings accommodating non-combustible conduits, pipes and tubes through single membranes which are part of a fire-rated wall are permitted, provided the aggregate area of the membrane opening do not exceed 100 SQ IN in any 100 SF of wall area.
  - 12 This row also includes wires and cables with steel jackets.
- 

## 2.5 FIRE-RESISTIVE JOINT ASSEMBLIES – GENERAL

### A. General:

1. Where joint will be exposed to the elements, fire-resistive joint sealant must be approved by manufacturer for use in exterior applications and shall comply with ASTM-C920.

### B. Head-of-Wall Assemblies:

1. General:
  - a. Use at top of fire-rated and smoke-rated walls and partitions where they abut floor and roof structures above.
  - b. Select systems with "D" designation (rated for dynamic movement capability.)
  - c. Select systems that can accommodate deflection of structure above.
  - d. Maximum Leakage for Fire-resistive Joints in Smoke Barriers: 0.00775 M<sup>3</sup>/Sec per lineal meter @ 7.47 Pa 5 CFM per lineal FT @ 0.30 IN of water.
  - e. Sound-control walls and Smoke Partitions which are not stipulated to include fire-resistance rating. Seal with Acoustical Sealant, specified in Section 09 29 00.
2. Minimum F- and T-ratings:
  - a. The minimum Fire (F) Rating for Firestop assemblies in walls shall equal that of the wall, but not less than 1-HR.
  - b. The minimum Temperature (T) Rating of Firestop assemblies in walls may equal zero.
3. Acceptable Systems:
  - a. Metal Stud and Drywall Walls: Select system from UL HW-D-0000 Series.
  - b. Concrete and Masonry Walls: Select system from UL HW-D-1000 Series.

## **PART 3 - EXECUTION**

### **3.1 PREPARATION**

- A. Examination of Conditions: Examine areas and conditions under which work is to be performed and identify conditions detrimental to proper or timely completion.
- B. Surfaces to which firestop materials will be applied shall be free of dirt, grease, oil, scale, laitance, rust, release agents, water repellents, and any other substances that may inhibit optimum adhesion.
- C. Provide masking and temporary covering to prevent soiling of adjacent surfaces by firestopping materials.
- D. Do not proceed until unsatisfactory conditions have been corrected.

### **3.2 INSTALLATION**

- A. General:
  - 1. Install firestop systems in accordance with "PERFORMANCE REQUIREMENTS" Article and in accordance with the conditions of testing and classification as specified in the published design.
  - 2. Seal openings or voids made by penetrations to ensure an air and water resistant seal.
  - 3. Install in accordance with manufacturer's instructions, to maintain fire separations per UL listing.
  - 4. Comply with manufacturer's installation instructions.
  - 5. Apply a suitable bond-breaker to prevent three-sided adhesion in applications where this condition might occur such as the intersection of a gypsum wallboard/steel stud wall to floor or roof assembly where the joint is backed by a steel ceiling runner or track.
  - 6. Protect materials from damage on surfaces subjected to traffic.
- B. Identification Labels.
  - 1. General:
    - a. Identify each Firestop Assembly as defined in "Quality Assurance."
    - b. Do not locate ID labels/tags on finished surfaces or where they will be exposed to view by public occupants.
  - 2. Through Penetration Firestop Assemblies:
    - a. Where items penetrate walls above ceiling:
      - 1) Place one self-adhesive on each side of walls.
      - 2) Tie-on ID tags, tied small penetrants may be used also.
    - b. Where items penetrate floors/roofs:
      - 1) Place a tie-on ID tag to small penetrating items on underside of slab only.
      - 2) Large penetrants may be identified by self-adhering label.
  - 3. Fire-resistive Joint Assemblies:
    - a. Locate ID labels at terminal ends of joint and not more than 50 FT on center thereafter.
    - b. Utilize self-adhesive type labels on both sides of walls.

### **3.3 FIELD QUALITY CONTROL**

- A. Keep areas of work accessible until inspection by authorities having jurisdiction.
- B. Where deficiencies are found, repair or replace assemblies so they comply with requirements.

### **3.4 ADJUSTING AND CLEANING**

- A. Remove equipment, materials and debris, leaving area in undamaged, clean condition.
- B. Clean surfaces adjacent to sealed openings to be free of excess materials and soiling as work progresses.

C. Perform patching and repair of firestopping systems damaged by other trades.

**END OF SECTION**

**SECTION 07 92 13**  
**EXTERIOR JOINT SEALANTS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. Definition:
  - 1. Words “calk” and “caulking” mean sealant work.
- B. Seal joints which would otherwise permit penetration of moisture or air, unless sealant work is specifically required under other sections.
- C. Work included: Provide sealants as follows:
  - 1. Flashing reglets and retainers.
  - 2. Exterior wall joints.
  - 3. Masonry control joints, and between masonry and other materials.
  - 4. Isolation joints.
  - 5. Joints between paving or sidewalks and building.
  - 6. Joints at penetrations of walls, floors and decks by piping and other services and equipment not requiring firestopping.
  - 7. Perimeters door and window frames, louvers, grilles, etc.
  - 8. Joints between dissimilar materials, to provide visually acceptable closures.
  - 9. Solidly bed thresholds at exterior doors.
  - 10. Other joints where caulking, or sealant is indicated.
  - 11. Joints where Pre-molded Compressible Sealants is indicated.
- D. Related materials specified elsewhere:
  - 1. Interior Joint Sealants: See Section 07 92 16.
  - 2. Firestopping: Specified in Section 07 84 00.
  - 3. Acoustical Sealant: Specified in Section 09 29 00.

**1.2 QUALITY ASSURANCE**

- A. Sealant materials:
  - 1. Sealant specification: ASTM-C920 Type S or M, Grade-NS, minimum Class-25.
  - 2. Sealant testing: ASTM-C510; ASTM-C711; ASTM-C719 Class-25, Grade-N; ASTM-C792; ASTM-C793; ASTM-C910.
  - 3. Sealant use: ASTM-C1193.
  - 4. Pre-molded Compressible Sealants: ASTM-C509.
  - 5. Installer approved by manufacturer.
  - 6. Compressible sealants: ASTM-C509.
- B. Staining Potential (of adjacent materials caused by sealants):
  - 1. Pre-test proposed sealants where sealants are used with any of the following materials:
    - a. Architectural Precast.
    - b. Concrete Masonry.
  - 2. Test Method: ASTM-C1248.
  - 3. Historical testing using same materials and cataloged by sealant manufacturer will be considered acceptable.
  - 4. Where testing suggests that staining potential exists: Reselect sealant and retest.
  - 5. Certify that staining potential has been evaluated.
- C. Environmental Reference Standards:
  - 1. Bay Area Air Quality Management District (BAAQMD)
    - a. Regulation 8, Rule 51.

2. Code of Federal Regulations (CFR)
  - a. 40 CFR, Part 59, Subpart D-2001: National Volatile Organic Compound Emission Standards for Architectural Coatings.

### **1.3 SUBMITTALS**

- A. Shop Drawings:
  1. Sealant Schedule with the following information:
    - a. Generally describe locations requiring sealants (i.e. Brick to Alum Window).
    - b. List type of sealant to be used, and name of product proposed.
    - c. Include a blank column on schedule for colors.
    - d. Upon review, Architect to complete Color Column.
    - e. Submit color samples with Sealant Schedule.
- B. Samples:
  1. Cured sample of each color for color selection (submit with Sealant Schedule).
  2. Colors for Pre-molded Compressible Sealant.
- C. Project Information:
  1. Certificate that furnished sealants meet minimum VOC requirements as specified by the California South Coast Air Quality Management District Rule.
- D. Contract Closeout Information:
  1. Warranty.
  2. Certifications.
- A. LEED Information:
  1. LEED Credits MR 5.1 and 5.2, Regional Materials: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.

### **1.4 JOB CONDITIONS**

- A. Perform sealant work only when ambient temperature is 40 degF or higher.
- B. Cold Climates: Do not apply sealants late afternoons, late fall or early spring.
- C. Apply only to joints free of material which may inhibit bond.
- D. Apply to cementitious materials only when thoroughly cured and dry.

### **1.5 WARRANTY**

- A. Provide written warranty that sealant work will remain free of defects for a period of 2 years:
  1. Failure of watertightness or air tightness constitutes defect.
  2. Remove defective work and materials and replace with new work and materials.
  3. Repair other work damaged as a result of defective sealant work at no additional expense to BNL.
  4. Warranty signed by installer and Contractor.

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS**

- A. Acceptable manufacturers:
  1. Silicone sealants:
    - a. Base:
      - 1) Tremco.

- 2) Dow Corning.
- b. Optional:
  - 1) Pecora.
  - 2) GE Silicones.
  - 3) Sonneborn/ChemRex.
  - 4) Bondaflex Technologies.
- 2. Polyurethane sealants:
  - a. Base:
    - 1) Tremco.
  - b. Optional:
    - 1) Pecora.
    - 2) Sonneborn/ChemRex.
    - 3) Sika.
    - 4) Bondaflex Technologies.
- 3. Other Sealants:
  - a. Base: As indicated.
- 4. Pre-molded Compressible Sealant:
  - a. Base:
    - 1) Emseal.
  - b. Optional:
    - 1) Dayton Superior, Polytite.
    - 2) Construction Specialties, (C/S).
    - 3) MM Systems.

## 2.2 SEALANTS - GENERAL

- A. General:
  - 1. Provide colors matching materials being sealed.
  - 2. Where sealant is not exposed to view, use manufacturer's standard color which has best performance.
  - 3. Use non-sag sealant in vertical and horizontal joints.
  - 4. Use self-leveling in horizontal joints.
  - 5. Before use of sealant, investigate its compatibility with surfaces, fillers and other materials in joint system.
  - 6. Use only compatible materials.
  - 7. Obtain sealants from manufacturers who will provide manufacturers' field service representatives at project site for purpose of advising and instructing installers.
    - a. Provide such services, at no expense to BNL.
  - 8. VOC Content of Interior Sealants: Provide interior sealants and sealant primers that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
    - a. Sealants: 250 g/L.
    - b. Sealant Primers for Nonporous Substrates: 250 g/L.
    - c. Sealant Primers for Porous Substrates: 775 g/L.
  - 9. Not more than 250 g/L VOC in compliance with Bay Area Management Rules.
- B. Silicone Sealants:
  - 1. Refer to Sealant Selection Guide for types required.
  - 2. Zero g/L VOC in compliance with Bay Area Management Rules.
- C. Polyurethane Sealants:
  - 1. Refer to Sealant Selection Guide for types required.
  - 2. Comply with VOC limits as required by local laws.
- D. Other Sealant Types:
  - 1. Refer to Sealant Selection Guide for types required.
  - 2. Comply with VOC limits as required by local laws.

## **2.3 MISCELLANEOUS MATERIALS**

- A. Joint cleaner, primer, bond breaker:
  - 1. As recommended by sealant manufacturer.
  - 2. Not more than 250 g/L VOC in compliance with Bay Area Management Rules.
- B. Backer Rod:
  - 1. Rod stock of polyethylene, polyethylene jacketed polyurethane foam, or other flexible, non-absorbent, non-bituminous material recommended by sealant manufacturer to:
    - a. Control joint depth.
    - b. Break bond of sealant at bottom of joint.
    - c. Provide proper shape of sealant.

## **2.4 PRE-MOLDED COMPRESSIBLE SEALANT**

- A. Pre-molded Compressible Sealant (pre-finished):
  - 1. Description: Foam backing: Multiple layers of acrylic-impregnated, expanding foam sealant and closed-cell (EVA) foam.
  - 2. Weather Facing: Low-modulus silicone with bellows profile.
  - 3. Movement capability: +/-25% movement (50% total).
  - 4. Material to be sized appropriately for joint widths indicated.
  - 5. Base Product: "ColorSeal" by Emseal.
- B. Compressible Backer:
  - 1. Description: Foam backing with multiple layers of acrylic-impregnated, expanding foam sealant and closed-cell (EVA) foam.
  - 2. Provide behind conventional backer-rod and sealant where indicated.
  - 3. Provide behind directly-applied liquid sealant where indicated.
  - 4. Movement capability: +/-25% movement (50%).
  - 5. Material to be sized appropriately for joint widths indicated.
  - 6. Base Product: "Backerseal" by Emseal.
- C. Accessory Items:
  - 1. Installation Adhesive: As recommended by manufacturer of compressible sealants and backers.
  - 2. Not more than 250 g/L VOC in compliance with Bay Area Management Rules.

## PART 3 - EXECUTION

### 3.1 SEALANT USAGE GUIDELINES

| Guide to Sealant Types - EXTERIOR  |   |   |  |   |  |
|--|---|---|--|---|--|
| Location   | Materials   | Sealant Type  | Base Product   | Remarks / Exceptions  |  |
| Exterior (General)   | Cast in Place Concrete  | Multi-part Polyurethane, chemically curing, epoxidized  | Tremco "Dymeric 240"   | Exception: Use "Dymonic" where used as bedding sealant for frames, sills, thresholds etc.           |  |
|  | Brick and Concrete Masonry  |   |  |   |  |
|  | Portland Cement Plaster   |   |  |   |  |
|  | Hollow Metal Door and Window Perimeters                             |   |  |   |  |
|  | Aluminum Composite Panels (ACM) and Metal Column Covers             | Silicone  | Tremco "Spectrem 1" or "Spectrem 3"  | --  |  |
|  | Joints in materials with high coefficients of linear expansion      |   |  |   |  |
|  | Weatherseals of Aluminum Window Frames (including perimeter joints) |   |  |   |  |
|  | Precast Concrete Panels   | Silicone  | Tremco "Spectrem 1"  | --  |  |
|  | EIFS Systems  |   |  |   |  |
|  | Stone Work  | Silicone  | Tremco "Spectrem 3"  | Exception: Pre-test for staining potential per ASTM-C1248, prior to use, with stain-sensitive stone |  |
|  | General Exterior Glazing  | Silicone; Neutral-cure  | Tremco "Spectrem 2" or "Proglaze"  | Exception: Select alternate silicone sealant types as appropriate for specific glazing application. |  |
|  | Butt Glazing and Structural Silicone Joints                         | Silicone; 1-part, Neutral-cure  | Dow Corning "795"  | --  |  |
|  | Fabrication of Insulating Glass Units (IGU)                         | Primary Seal: Polyisobutylene   | Select high quality sealants, of basic type listed, as appropriate for specific application. |   |  |
|  |   | Secondary Seal: Silicone  | Dow Corning "982"  | --  |  |
| Zone dams, shear blocks and other internal component of Aluminum Window Systems  | Silicone  | Use type or silicone which offers optimal adhesion and performance for application.   |  |   |  |
| Sheet Metal Gutters, Downspouts, Scuppers, etc   | Synthetic Rubber / Resin, elastomeric                               | Tremco "Gutter Sealant"   | --   |   |  |
| Joints where Silicone was previously used  | Silicone  | Use type or silicone which offers optimal adhesion and performance for condition, and which offers suitable color choices for matching. |  |   |  |
| Exterior Flatwork  | Concrete Paving and Parking Structures                              | Multi-part Polyurethane   | Tremco "THC 900 / 901"   | Exception: Where subject to continual water emersion; use "Vulkem 45 or 245"                        |  |
|  | Concrete Sidewalks  |   |  |   |  |
|  | Brick Paving and Walks  |   |  |   |  |
|  | Stone and Precast Plazas  |   |  |   |  |
| <b>General Notes:</b>  |   |   |  |   |  |
| 1. The above shall be use as a "guide" to selection of appropriate sealant types.  |   |   |  |   |  |
| 2. Optional sealant products shall offer same number of color choices as the Base Product listed.  |   |   |  |   |  |
| 3. All of the conditions and materials listed may not necessarily apply to subject project.  |   |   |  |   |  |
| 4. The above is intended to be an overall guide. Additional conditions and materials may be required on subject project. Notify Architect if additional Guidance is required to select unlisted items. |   |   |  |   |  |

### 3.2 PREPARATION

- A. Clean joints.
- B. Where finish coating or covering is to be applied to surface (e.g., paint, wall covering, glazed coating), wait until such coating or covering has been applied before installing sealant.

### **3.3 INSTALLATION - GENERAL**

- A. Make joints water and air tight.
- B. As required by manufacturer, prime joint surfaces.
  - 1. Limit application to surfaces to receive sealants.
  - 2. Mask off adjacent surfaces.
- C. Make depth of sealant not more than one-half width of joint, but in no case less than 1/4 IN.
- D. Subcaulk joints without suitable backstop, to proper depth.
- E. Install correctly sized backer rods.
- F. Apply bond breaker as required or recommended by sealant manufacturer.
- G. Tool sealants using sufficient pressure to fill voids.
- H. Upon completion, leave caulking smooth and even.
- I. Install to completely fill voids.

### **3.4 INSTALLATION – PRE-MOLDED COMPRESSIBLE SEALANT**

- A. Install compressible sealant to position at indicated depth.
  - 1. Take care to avoid contamination of sides of joint.
  - 2. Protect side walls of joint to depth of caulking.
  - 3. Install with adhesive faces in contact with joint sides.
  - 4. Field apply silicone corner bead sealant at face each side of expansion joint in accordance with compressible sealant manufacturer recommendations.

**END OF SECTION**

**SECTION 07 92 16**  
**INTERIOR JOINT SEALANTS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. Definition:
  - 1. Words “calk” and “caulking” mean sealant work.
  - 2. “Interior wet areas” means toilets, showers, kitchens and similar areas where sealant is subject to moisture.
  - 3. “Clean Zone” means any area ventilated by the clean zone air management system. Refer to Section 13 60 13 for Clean Zone Boundaries.
- B. Seal joints which would otherwise permit penetration of moisture or air, unless sealant work is specifically required under other sections.
- C. Work included: Provide sealants as follows:
  - 1. Masonry control joints, and between masonry and other materials.
  - 2. Flooring joints.
  - 3. Isolation joints.
  - 4. Joints at penetrations of walls, floors and decks by piping and other services and equipment not requiring firestopping.
  - 5. Perimeters of door and window frames, louvers, grilles, etc.
  - 6. Between cabinets, casework, countertops and back splashes where adjacent to walls.
  - 7. Joints between dissimilar materials, to provide visually acceptable closures.
  - 8. Sealant joints in the Clean Zone where indicated.
  - 9. Other joints where caulking, or sealant is indicated.
- D. Related materials specified elsewhere:
  - 1. Exterior Joint Sealants: See Section 07 92 13.
  - 2. Firestopping: Specified in Section 07 84 00.
  - 3. Acoustical Sealant: Specified in Section 09 29 00.
  - 4. Cleanroom Partition System Specified in Section 13 61 16.

**1.2 QUALITY ASSURANCE**

- A. Sealant materials:
  - 1. Sealant specification: ASTM-C920 Type S or M, Grade-NS, minimum Class-25.
  - 2. Sealant testing: ASTM-C510; ASTM-C711; ASTM-C719 Class-25, Grade-N; ASTM-C792; ASTM-C793; ASTM-C910.
  - 3. Sealant use: ASTM-C1193.
  - 4. Sealant VOC specifications: South Coast Air Quality Management District (SCAQMD), Rule #1168. Installer approved by manufacturer.
  - 5. VOC Limits: SCAQMD Rule #1168. Installer approved by manufacturer.
- B. Cleanroom sealant materials: Comply with outgassing criteria requirements in Section 01 35 34.
- C. Staining Potential (of adjacent materials caused by sealants):
  - 1. Pre-test proposed sealants where sealants are used with any of the following materials:
    - a. Architectural Precast.
    - b. Concrete Masonry.
  - 2. Test Method: ASTM-C1248.
  - 3. Historical testing using same materials and cataloged by sealant manufacturer will be considered acceptable.
  - 4. Where testing suggests that staining potential exists: Reselect sealant and retest.

- D. Environmental Reference Standards:
  - a. South Coast Air Quality Management District (SCAQMD), Rule #1168.

### **1.3 SUBMITTALS**

- A. Shop Drawings:
  - 1. Sealant Schedule with the following information:
    - a. Generally describe locations requiring sealants (i.e. Brick to Alum Window).
    - b. List type of sealant to be used, and name of product proposed.
    - c. Include a blank column on schedule for colors.
    - d. Upon review, Architect to complete Color Column.
    - e. Submit color samples with Sealant Schedule.
- B. Samples:
  - 1. Cured sample of each color for color selection (submit with Sealant Schedule).
- C. Project Information:
  - 1. Certificate that furnished sealants meet minimum VOC requirements as specified by the California South Coast Air Quality Management District Rule.
- D. Contract Closeout Information:
  - 1. Warranty.
  - 2. Certifications.
- A. LEED Information:
  - 1. LEED Credits MR 5.1 and 5.2, Regional Materials: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.
  - 2. LEED Credit EQ 4.1 – Low Emitting Materials, Adhesives and Sealants: Manufacturer’s data on VOC content for adhesives and sealants applies under this section.

### **1.4 JOB CONDITIONS**

- A. Perform sealant work only when ambient temperature is 40 degF or higher.
- B. Cold Climates: Do not apply sealants late afternoons, late fall or early spring.
- C. Apply only to joints free of material which may inhibit bond.
- D. Apply to cementitious materials only when thoroughly cured and dry.

### **1.5 WARRANTY**

- A. Provide written warranty that sealant work will remain free of defects for a period of 2 years:
  - 1. Failure of watertightness or air tightness constitutes defect.
  - 2. Remove defective work and materials and replace with new work and materials.
  - 3. Repair other work damaged as a result of defective sealant work at no additional expense to BNL.
  - 4. Warranty signed by installer and Contractor.

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS**

- A. Acceptable manufacturers:
  - 1. Polyurethane sealants:
    - a. Base:

- 1) Tremco.
- b. Optional:
  - 1) Pecora.
  - 2) Sonneborn/ChemRex.
  - 3) Sika.
  - 4) Bondaflex Technologies.
- 2. Silicone sealants:
  - a. Base:
    - 1) Tremco.
    - 2) Dow Corning.
  - b. Optional:
    - 1) Pecora.
    - 2) GE Silicones.
    - 3) Sonneborn/ChemRex.
    - 4) Bondaflex Technologies.
- 3. Cleanroom Sealants:
  - a. Base:
    - 1) Sika Corp.
  - b. Optional:
    - 1) Dow Corning.
- 4. Large Opening Acoustical Sealant:
  - a. Base:
    - 1) J.M. Clipper.

## 2.2 SEALANTS - GENERAL

- A. General:
  - 1. Provide colors matching materials being sealed.
  - 2. Where sealant is not exposed to view, use manufacturer's standard color which has best performance.
  - 3. Use non-sag sealant in vertical and horizontal joints.
  - 4. Use self-leveling in horizontal joints.
  - 5. Before use of sealant, investigate its compatibility with surfaces, fillers and other materials in joint system.
  - 6. Use only compatible materials.
  - 7. Obtain sealants from manufacturers who will provide manufacturers' field service representatives at project site for purpose of advising and instructing installers.
    - a. Provide such services, at no expense to BNL.
  - 8. VOC Content of Interior Sealants: Provide interior sealants and sealant primers that comply with the following limits for VOC content in accord with SCAQMD Rule #1168:
    - a. Sealants: 250 g/L.
    - b. Sealant Primers for Nonporous Substrates: 250 g/L.
    - c. Sealant Primers for Porous Substrates: 775 g/L.
- B. Polyurethane Sealants:
  - 1. Refer to Sealant Selection Guide for types required.
  - 2. Comply with VOC limits as required by local laws.
  - 3. VOC content no greater than 250 g/L in compliance with SCAQMD Rule #1168.
- C. Silicone Sealants:
  - 1. Refer to Sealant Selection Guide for types required.
  - 2. Comply with VOC limits as required by local laws.
  - 3. VOC content no greater than 250 g/L in compliance with SCAQMD Rule #1168.
- D. Cleanroom Sealants:
  - 1. Base Product: Sikaflex-1a by Sika Corp.
  - 2. Optional Product: 6-1125 by Dow Corning.

- E. Large Opening Acoustical Sealant:
1. Re-usable caulking sealant, compounded from inert fiber and non-dry synthetic oil base and premium waxes for a heavy putty-like consistency that will adhere to surfaces indicated and retain installed shape.
    - a. Provide reinforcing recommended by sealant manufacturer if required to maintain installed shape.
  2. Sealant shall be unaffected by moisture, gases and condensates and shall seal out dust, dirt, water, acids, air, fumes and gases.
  3. Sealant shall be provided in quantity and thickness to reduce sound transmission by minimum 40 dB at location indicated.
  4. Base Product: Duxseal by J.M. Clipper.
- F. Other Sealant Types:
1. Refer to Sealant Selection Guide for types required.
  2. Comply with VOC limits as required by local laws.
  3. VOC content no greater than 250 g/L in compliance with SCAQMD Rule #1168.

### 2.3 MISCELLANEOUS MATERIALS

- A. Joint cleaner, primer, bond breaker:
1. As recommended by sealant manufacturer.
  2. VOC content no greater than 250 g/L for nonporous materials and 775 g/L for porous materials in compliance with SCAQMD Rule #1168.
- B. Backer Rod:
1. Rod stock of polyethylene, polyethylene jacketed polyurethane foam, or other flexible, non-absorbent, non-bituminous material recommended by sealant manufacturer to:
    - a. Control joint depth.
    - b. Break bond of sealant at bottom of joint.
    - c. Provide proper shape of sealant.
  2. Rod material for the Clean Zone shall comply with outgassing requirements in Section 01 35 34.

## PART 3 - EXECUTION

### 3.1 SEALANT USAGE GUIDELINES

| Guide to Sealant Types - INTERIOR  |  |  |                       |   |
|--|--|--|-----------------------|---|
| Location   | Materials  | Sealant Type   | Base Product          | Remarks / Exceptions  |
| Interior<br>(General)  | Window Sills / Stools  | Product specified in Section 12 34 00<br>(100% silicone by Color Rite) |                       |   |
|  | Cabinets and Casework to wall  |  |                       |   |
|  | Countertops and Backsplashes   |  |                       |   |
|  | Sinks in Countertops   |  |                       |   |
|  | Interior Alum Doors and Window Frame Perimeters                          | Multi-part Polyurethane, chemically curing, epoxidized                 | Tremco "Dymeric 240"  | --  |
|  | Hollow Metal Door and Window Frames                                      | Siliconized Acrylic Latex (paintable)                                  | Tremco "Tremflex 834" | Exception: Where sealant will not be subsequently painted, and white color will not be visually compatible with adjacent finishes: Use "Dymeric 240" of matching color. |
| Acoustical Sealant Joints at top and bottom terminations of Interior Walls | Specified In Section 09 29 00 (and in Section 07 84 00 where fire-rated) |  |                       |   |

|                        |  |                                       |                        |  |
|------------------------|--|---------------------------------------|------------------------|--|
| Interior Flatwork      | Control Joints in Concrete Floors in Mechanical Rooms and other "un-finished" spaces | Multi-part Polyurethane               | Tremco "THC 900 / 901" | Exception: Where subject to continual water emersion; use "Vulkem 45 or 245" |
|                        | Stone and Precast Flooring   |                                       |                        |  |
| Interior Wet Areas     | Porcelain, Ceramic Tile, Metals, and surfaces with Epoxy Paints                      | Silicone; Air cure                    | Tremco "Tremsil 200"   | --   |
| Clean Zone, Clean Room | All  | One-part Polyurethane or One-part RTV | Sikaflex-la            | Any use exposed to cleanroom air systems exposure.                           |

**General Notes:**

1. The above shall be use as a "guide" to selection of appropriate sealant types.
2. Optional sealant products shall offer same number of color choices as the Base Product listed.
3. All of the conditions and materials listed may not necessarily apply to subject project.
4. Not all project conditions may be addressed on above table; Refer also to other specification sections and install sealants where called for by other sections.
5. The above is intended to be an overall guide. Additional conditions and materials may be required on subject project. Notify Architect if additional Guidance is required to select unlisted items.
6. Materials and Conditions "conventionally" occur on Exterior but used on Interior of this project may not be listed on this Table. Refer to Exterior Guide (Section 07 92 13) for appropriate sealant type. i.e. If project calls for Brick Masonry on interior: Refer to Section 07 92 13 for type of Sealant to be used.

### 3.2 PREPARATION

- A. Clean joints.
- B. Where finish coating or covering is to be applied to surface (e.g., paint, wall covering, glazed coating), wait until such coating or covering has been applied before installing sealant.

### 3.3 INSTALLATION -GENERAL

- A. General:
  1. Make joints water and air tight.
  2. Make depth of sealant not more than one-half width of joint, but in no case less than 1/4 IN.
  3. Install correctly sized backer rods.
  4. Apply bond breaker as required or recommended by sealant manufacturer.
- B. Prime joint surfaces as recommended by sealant manufacturer for conditions:
  1. Limit application to surfaces to receive sealants.
  2. Mask off adjacent surfaces.
- C. Sub-caulk joints without suitable backstop, to proper depth.
- D. Tool sealants using sufficient pressure to fill voids.
- E. Upon completion, leave caulking smooth and even.
- F. Hollow Metal Door Frames:
  1. Seal frames to wall.
  2. Seal frames to floor substrates and hard floor finishes (do not seal to previously installed carpet and similar finishes.)
  3. Seal hairline gaps where stops and rabbets of frame members intersect.

**END OF SECTION**



**HDR**

**D I V I S I O N    0 8**  

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**OPENINGS**

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**SECTION 08 11 13**  
**HOLLOW METAL (HM) DOORS AND FRAMES**

**PART 1 - GENERAL**

**1.1 QUALITY ASSURANCE**

- A. Hollow Door and Frame Standards:
  - 1. ANSI/SDI-A250.4 for Physical Performance.
  - 2. ANSI/SDI-A250.8 for Level, Model, and overall requirements.
- B. Standards for Oversize Openings:
  - 1. ANSI/NAAMM-HMMA 861 for door leaves in excess of 48 IN wide or 96 IN high.
- C. Fire rated doors and frames:
  - 1. Provide doors which are identical in materials and construction to units in door and frame assemblies tested in accordance NFPA 252, NFPA 80, and UL10C (Positive Pressure).
  - 2. Provide doors which are labeled and listed for ratings indicated by ITS – Warnock Hersey, UL or other testing and inspection agency acceptable to authorities having jurisdiction.
  - 3. Physical label or approved marking shall be affixed to fire door or fire door frame, at an authorized facility as evidence of compliance with procedures of labeling agency.
  - 4. Positive Pressure:
    - a. Comply with Positive Pressure Requirements UL 10C, Category A.
    - b. Provide "S" labels where required.
- D. Installation Quality Control:
  - 1. Completion of work in this section requires purchase of a tool called "PLS Frame Set", which shall be used to insure frames are kept plumb, level and square through out course of construction.
  - 2. At end of construction "PLS Frame Set" device shall become property of BNL.
  - 3. Refer to Part 3 this specification for entire protocol.

**1.2 SUBMITTALS**

- A. Shop Drawings:
  - 1. Door and frame schedule.
- B. Project Information:
  - 1. Manufacturer's Certificate of UL construction for oversized fire rated doors and frames.
- C. LEED Information:
  - 1. LEED Credits MR 4.1 and 4.2, Recycled Content: Product data indicating percentages by weight of post-consumer and post-industrial recycled content for products having recycled content; include statement indicating costs for each product having recycled content.
  - 2. LEED Credits MR 5.1 and 5.2, Regional Materials: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.
  - 3. LEED Credit EQ 4.2, Low Emitting Materials – Paints and Coatings: Manufacturers data indicating VOC content of products specified.

**1.3 PRODUCT DELIVERY, STORAGE AND HANDLING**

- A. General:
  - 1. Deliver materials cartoned or crated.
  - 2. Inspect upon delivery for damage.

3. Store units in upright position under cover.
  4. Place units on wood sills at least 4 IN off floors, and in manner that will prevent rust and damage.
  5. Cover only with “breathable” sheet good.
  6. Provide a 1/4 IN air space between the doors to promote air circulation.
- B. Storage of Doors:
1. If the cardboard wrapper on door becomes wet, or moisture appears, remove wrapper immediately.
- C. Storage of Frames:
1. Assembled frames shall be stored in vertical position and no more than five units per stack.
- D. Repair minor damage provided finish is acceptable to Architect; otherwise, remove and replace.

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS**

- A. Acceptable manufacturers:
1. Hollow Metal Doors and Frames:
    - a. Base:
      - 1) Steelcraft Manufacturing (Ingersoll-Rand).
    - b. Optional:
      - 1) Curries (ASSA ABLOY).
      - 2) Ceco Door Products (ASSA ABLOY).
      - 3) Republic Doors and Frames.
  2. Hollow Metal Doors for Recessed CVR Exit Devices.
    - a. Base:
      - 1) Steelcraft Manufacturing (Ingersoll-Rand).
    - b. Optional:
      - 1) Other manufactures, listed as Optional in previous paragraph which can comply with label requirements.
  3. Oversize Hollow Metal Doors and Frames:
    - a. Base:
      - 1) Fleming Steel Doors and Frames.

### **2.2 GENERAL MATERIALS**

- A. Steel sheet and strip:
1. Typical: ASTM-A568.
- B. Corrosion-resistant coating:
1. Standard:
    - a. Hot-dip Galvannealed: A60 per ASTM-A653.
    - b. Minimum zinc-iron alloy coating: 0.6 OZ/FT<sup>2</sup>.
  2. Application: Provide above corrosion-resistant coating at all door and frame components where used at exterior and interior wet and humid locations as defined by following:
    - a. Exterior openings:
      - 1) Openings located in an exterior wall.
      - 2) Openings that are exposed to weather even if protected by overhead canopy.
      - 3) Openings used to form either side of an entrance vestibule (a.k.a. air lock vestibule) between exterior and conditioned spaces.
      - 4) Openings used for roof access.
      - 5) Openings to and from loading docks, trash collection and compacting areas.
    - b. Interior openings in “wet and humid” areas:
      - 1) Openings to and from loading docks, trash collection and compacting areas.

- C. Primer:
1. Doors and frames shall be cleaned, phosphatized and finished as standard with one coat of baked-on rust inhibiting primer paint in accordance with ANSI A250.10.
  2. Primer shall be suitable and compatible as base for specified finish paints.
- D. Zinc-rich primer for repair of galvanized/galvannealed items: “Galvilite” by ZRC Worldwide.

### 2.3 GENERAL REQUIREMENTS – HOLLOW METAL (HM) DOORS

- A. General:
1. Comply with ANSI/SDI A250.8.
- B. Determination of performance level for each door:
1. In accordance with following schedule, use indicated level of HM door indicated for its location, size and other listed criteria.
    - a. Note: Not all items below may apply to subject project.

| Schedule of HM Door Levels                      |  |                               |   |
|---|--|-------------------------------|---|
| Location  | Additional Criteria                                    | Use ANSI Level:               | Miscellaneous   |
| Exterior Doors <sup>1</sup><br>(flush)          | Openings where each leaf is less than 47 IN            | Level 3<br>(Extra Heavy-duty) | Galvanized / galvannealed, Thermally Insulated                                    |
|   | Openings where one or more of the leaves exceeds 47 IN | Level 4<br>(Maximum-duty)     |   |
| Exterior Doors <sup>1</sup><br>(stile and rail) | All  | Level 3<br>(Extra Heavy-duty) | Galvanized / galvannealed, Thermally Insulated                                    |
| Interior Doors                                  | Non-fire rated   | Level 3<br>(Extra Heavy-duty) | --  |
|   | Fire rated   | Level 3<br>(Extra Heavy-duty) | Labeled as indicated<br>(w/out astragal wherever possible)                        |
|   | Wet / Humid Areas <sup>2</sup>                         | Level 3<br>(Extra Heavy-duty) | Galvanized / galvannealed; Moisture-resistant core - Fire-resistant were required |

#### General Notes:

Refer to Door Schedule for indication of the Door Type (i.e. Width, Fire Rating, Flush vs. Stile & Rail, etc)  
 Refer to Plans for door location (Exterior vs. Interior)  
 Where Hurricane or Tornado-resistant openings are specified: Refer “ADDITIONAL REQUIREMENTS” for appropriate door/frame construction.

#### Footnotes:

1. Refer to Part 2.2 for definition of “Exterior” locations.
2. Refer to Part 2.2 for definition of “Wet/Humid” locations.

- C. Construction - Hollow Metal (HM) Doors:
1. Door Thickness:
    - a. 1-3/4 IN.
  2. HM Door Level, per ANSI-A250.8:
    - a. Level 2, Heavy-duty, physical performance Level B.
      - 1) Face Sheet Thickness: 18 GA (0.042 IN).
    - b. Level 3, Extra Heavy-duty, physical performance Level A.
      - 1) Face Sheet Thickness: 16 GA (0.053 IN).
    - c. Level 4, Maximum-duty, physical performance Level A.
      - 1) Face Sheet Thickness: 14 GA (0.067 IN).
  3. Typical Model, per ANSI-A250.8:
    - a. Model 2, Seamless.
  4. End channels at top and bottom of door:
    - a. Minimum Sheet thickness of channels: 16 GA (0.053 IN).
    - b. Bottom channel: “Flush”.
    - c. Top channel:
      - 1) “Flush”.

7. Reinforce all corners and hardware cutouts per ANSI/DHI A115.
8. Reinforce frames where closers and overhead stops are scheduled with 3/16 IN thick x 12 IN-long strapping.
9. Steel boxes at back of hardware cut-outs, minimum 0.45mm 0.018 IN welded to frame
10. Base Product: "F-, DW-, or A-Series Frames" (as applicable for conditions) by Fleming Steel Doors and Frames.

## 2.6 FABRICATION

### A. General:

1. Fabricate rigid, neat in appearance and free from defects.
2. Form to indicated sizes and profiles.
3. Fit and assemble in shop, wherever practical.
4. Mark work that cannot be fully assembled in shop, to assure proper assembly at site.
5. Door to Frame Clearances:

| Door To Frame Clearances          |                                 |                                   |  |  |              |
|-----------------------------------|---------------------------------|-----------------------------------|--|--|--------------|
| Rated / Non-rated                 | Location                        |                                   | Wood Doors                                     | Hollow Metal Doors                             |              |
| Rated Openings                    | Top Rail to Frame               |                                   | 3/32 to 1/8 IN                                 | 3/32 to 5/32 IN                                |              |
|                                   | Lock Stile to Jamb              |                                   |  |  |              |
|                                   | Hinge Stile to Jamb             |                                   |  |  |              |
|                                   | Meeting Stiles at Pair Doors    |                                   | 1/16 to 1/8 IN                                 | 1/16 to 1/8 IN                                 |              |
|                                   | Face of door to face of Stop    |                                   |  |  |              |
|                                   | Door Bottom to Floor / Flooring | Typical; all floor covering types |  | Up to 1/2 IN                                   | Up to 1/2 IN |
|                                   |                                 | At Non-combustible Sills          |  | Up to 3/8 IN                                   | Up to 3/8 IN |
| Bare floors; No flooring or sills |                                 | Up to 3/4 IN                      | Up to 3/4 IN                                   |  |              |
| Non-rated Openings                | All Conditions                  |                                   | Comply with criteria listed for rated openings | Comply with criteria listed for rated openings |              |

- a. Comply also with additional requirements of the following where more stringent:
  - 1) ANSI A250.8.
  - 2) Fire-rated doors: NFPA 80.
  - 3) Smoke-Control Doors: NFPA 105.
  - 4) Locally adopted Building Code.

### B. Hardware Preparation:

1. Factory prepare hollow metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to Door Hardware Schedule and templates furnished as specified in Section 08 71 00.
2. Locate hardware indicated, or if not indicated, according to ANSI/SDI A250.8.
3. Reinforce doors and frames to receive non-templated, mortised and surface-mounted door hardware.
4. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.
5. Coordinate locations of conduit and wiring boxes for electrical connections with Division 16 Sections.

### C. Clean off mill scale and foreign materials, touch-up damaged galvanized or galvanized surfaces.

### D. Prime:

1. Shop prime.

- E. Fire Labels:
  1. Affix permanent labels to fire rated units in accordance with testing agency requirements.
  2. At openings where continuous hinges, or other items when scheduled and installed would conceal fire label, locate labels on alternative locations as allowed by listing agency and local authorities.
- F. Prepare frames for Door Position Switches (DPS):
  1. Coordinate locations with Security System provider.
  2. Locate DPS frame head approximately 4 IN from latching door edge.

## **PART 3 - EXECUTION**

### **3.1 INSPECTION**

- A. Examine structure, substrates, and conditions under which work is to be installed for conditions detrimental to correct and timely completion.
- B. Installation constitutes acceptance of responsibility for performance.

### **3.2 INSTALLATION QUALITY CONTROL**

- A. Initially set frames plumb, level & square within allowable tolerances using "PLS Frame Set" device or approved equal.
- B. Re-check plumb, level and square after walls are set and make adjustments where required.
- C. Re-check plumb, level and square again just prior to hanging doors, making adjustments as required. Insure that door-to-frame clearances are also within specified tolerances.
- D. Punch List:
  1. Make "PLS Frame Set" device available to General Contractor or Construction Manager for preparation of Punch List.
  2. General Contractor or Construction Manager to utilize "PLS Frame Set" device in preparing Punch List.
  3. Re-check plumb, level and square after deficiencies identified in Punch List are corrected.
  4. Make "PLS Frame Set" device available to Architect for purpose of checking completion of Punch List items.
  5. Closeout: Turn "PLS Frame Set" device over to BNL.

### **3.3 INSTALLATION**

- A. General:
  1. Install steel doors, frames, and accessories in accordance with approved shop drawings, manufacturer's data, and as specified.
  2. Place frames prior to construction of enclosing walls and ceilings.
  3. Coordinate building in of anchors, and frame grouting with other trades.
- B. Placing Frames:
  1. General:
    - a. Comply with provisions in ANSI A250.11/ SDI 105, unless otherwise indicated.
    - b. Install fire-rated frames according to NFPA 80.
  2. Place frames before construction of adjacent walls.
    - a. Exception: Where adjacent walls are cast-in-place concrete: Set frames 'after' wall is constructed.
  3. Set frames accurately in position, plumbed, aligned, and braced securely.
  4. Adjust hollow metal door frames for squareness, alignment, twist, and plumb to the following tolerances:
    - a. Plumbness: Plus or minus 1/16 IN, measured at jambs at floor.
    - b. Levelness: Plus or minus 1/16 IN per leaf, measured across width of header.

- c. Squareness: Plus or minus 1/16 IN, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
  - d. Alignment: Plus or minus 1/16 IN, measured at jambs on horizontal line parallel to plane of wall.
  - e. Twist: Plus or minus 1/16 IN, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
5. Do not remove spreaders until surrounding wall construction is complete.
  6. After surrounding walls have been constructed, verify that frames are still in proper alignment.
    - a. Re-check for level, plumb, square, twist and other problems that will prevent proper fitting of doors.
    - b. Correct deficiencies before surrounding construction is allowed to proceed.
    - c. Work with wallboard installer, if necessary, to correct misalignment problems.
  7. After wall construction is completed, remove temporary braces and spreaders, leaving surfaces smooth and undamaged.
  8. Prior to hanging doors: Verify all aspects of frame alignment, and correct deficiencies.
- C. Frame-to-Wall Anchors:
1. Utilize anchor type specified for wall condition.
  2. Align anchors at hinge centers on hinge jamb and at corresponding heights on strike jamb.
  3. Secure frame to wall per manufacturer's instructions.
- D. Grout all frames set into Cast-in-Place Concrete, CMU, and other masonry walls.
1. Do not grout frames set into metal stud-framed wall types.
- E. Grout all double egress frames, frames in masonry walls, and frames of doors swinging singly or in pairs 4 FT and wider.
1. Grout frames full at head and jambs.
- F. Door Installation:
1. Comply with ANSI A250.8.
  2. Fit hollow-metal doors accurately in frames, within clearances specified.
  3. Shim as necessary to comply with SDI 122 and ANSI/DHI A115.1G.
- G. Prime-Coat Touchup:
1. Immediately after erection, sand smooth rusted or damaged areas of primer coat.
  2. Touch up primer coat with compatible air-drying primer.
  3. Leave surfaces smooth for finish painting.
  4. VOC content of prime coat for touch up shall not exceed 250 g/L.
- H. Field Painting of HM Frames and Doors:
1. Painting of Exterior openings: Specified in Section 09 91 13.
  2. Painting of Interior openings: Specified in Section 09 91 23.
  3. Do not paint factory pre-finished doors such as stained faux wood (embossed steel) doors.
- I. Install Sealants:
1. Sealant (specified elsewhere):
    - a. Exterior Sealants: Specified in Section 07 92 13.
    - b. Interior Sealants: Specified in Section 07 92 16.
  2. Seal frames to walls.
  3. Seal frames to floor slabs and hard floor finishes.
  4. Hairline gap at intersections of head and jamb frames (intersections of rabbets and stops):
    - a. Fill exposed seam with painter's caulk.
- J. Install silencers.

### **3.4 ADJUSTING AND CLEANING**

- A. Alignment:

1. After surrounding walls have been constructed, verify frames are remain in proper alignment.
  2. Check for level, plumb, square, twist and other problems that will prevent proper fitting of doors.
  3. Correct deficiencies before surrounding construction is allowed to proceed.
- B. Protection Removal:
1. Immediately before final inspection, remove protective wrappings from doors and frames.
- C. Leave work complete and in proper operating condition.
- D. Remove and replace defective work.
- E. Ensure that all fire labels are intact, and readily visible.

**END OF SECTION**



**SECTION 08 14 16**  
**FLUSH WOOD DOORS**

**PART 1 - GENERAL**

**1.1 QUALITY ASSURANCE**

- A. Quality Standards - General:
  - 1. Source limitations: Obtain flush wood doors through one source from a single manufacturer.
  - 2. Quality standard: Comply with WDMA I.S.1-A 04
  - 3. ANSI A115. W Series, Wood Door Hardware Standards.
- B. Manufacturing Standards:
  - 1. WDMA (Window and Door Manufacturer's Association) Industry Standard I.S. 1A-04
  - 2. Forestry Stewardship Council, (FSC).
  - 3. Sustainable Forest Initiative as indicated for Alternate No. 7.
- C. Fire Rated Door Standards:
  - 1. Provide items which are identical in materials and construction to units tested in door and frame assemblies in accordance NFPA 252, NFPA 80, and UL10C (Positive Pressure).
  - 2. Provide items which are labeled and listed for ratings indicated by ITS – Warnock Hersey, UL or other testing and inspection agency acceptable to authorities having jurisdiction.
  - 3. A physical label or approved marking shall be affixed to the fire door or fire door frame, at an authorized facility as evidence of compliance with procedures of the labeling agency.
  - 4. Positive Pressure:
    - a. Comply with Positive Pressure Requirements UL 10C, Category A (concealed intumescent).
      - 1) The use of surface-applied intumescent is not an acceptable alternative unless written approval is given by Architect prior to bidding.
    - b. Comply with ASTM-E2074.
  - 5. Provide "S" labels where required.

**1.2 SUBMITTALS**

- A. Shop Drawings:
  - 1. Indicate location, size, and hand of each door; elevation of each kind of door; location and extent of hardware blocking; and other pertinent data.
  - 2. Indicate dimensions and locations of cutouts.
  - 3. Indicate requirements for veneer matching.
  - 4. Indicate doors to be factory finished and finish requirements.
  - 5. Indicate fire ratings for fire doors.
- B. Product Data:
  - 1. Include details of construction for each type of door.
  - 2. Include factory finishing specifications.
  - 3. Provide manufacturer's technical data for each type of door including details of core and edge construction, trim for openings and factory-finishing specifications.
- C. Samples:
  - 1. Samples for Verification: Factory finishes applied to actual door face materials for each material and finish.
    - a. For each wood species and finish, provide one piece of the expected finished work.
    - b. Minimum Size: 8 x 10 IN indicating finish.
- D. Contract Closeout Information:
  - 1. Warranty.

2. Certification by Sustainable Forest Initiative as indicated for Alternate No. 7.

E. LEED Information:

1. MR 4.1 & 4.2 – Recycled Content: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content; include statement indicating costs for each product having recycled content.
2. LEED credit MR 5.1 & 5.2 –Local Regional Materials: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.
3. LEED credit MR 7.0, Certified Wood: Chain-of-custody certificates certifying that products specified to be made from certified wood comply with forest certification requirements. Include evidence that mill is certified for chain of custody by an FSC-accredited certification body; include statement indicating costs for each certified wood product.
4. LEED Credit EQ 4.4, Low-Emitting Materials, Composite Wood & Agrifiber Products: For composite-wood and agrifiber products used, documentation indicating that the bonding agent contains no urea formaldehyde. For each adhesive used, documentation indicating that the adhesive contains no urea formaldehyde.

F. Environmental Information:

1. Manufacturers data indicating wood products comply with standards of Sustainable Forest Initiative as indicated for Alternate No. 7.

### 1.3 PRODUCT DELIVERY, STORAGE AND HANDLING

A. General:

1. Comply with manufacturer's instructions and with WDMA I.S.1-A.
2. Protect doors during transit, storage and handling to prevent damage, soiling, and deterioration.
3. Do not walk on or stack other materials on top of stacked doors.
4. Do not drag doors across one another.
5. Do not subject wood doors to heat or humidity extremes.
  - a. Prior to delivery, verify that HVAC system is continuously operational, balanced, and capable of maintaining the following conditions thereafter:
    - 1) Allowable Temperature Range: 50 to 90 DegF.
    - 2) Allowable Relative Humidity Range: 30 to 50% R.H.

B. Protect doors from exposure to natural and artificial light after delivery.

C. Provide manufacturer's identifying mark on each door.

1. Identify items as to type and location.

### 1.4 WARRANTY

A. Warrant doors in writing for life of original installation against defects including:

1. De-lamination, warp, twist, bow, telegraphing, and other defects that may impair or affect performance of door for purpose intended.
  - a. Allowable values as prescribed by Performance Standard specified.
2. Remove and replace defective doors; include cost of removal of defective units, re-hanging and refinishing of replacement units.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

A. Acceptable manufacturers:

1. Wood Doors:
  - a. Base:
    - 1) Marshfield Door Systems.
  - b. Optional:
    - 1) Algoma Hardwoods.
    - 2) Eggers Industries.
    - 3) VT Industries.
    - 4) Mohawk Flush Doors, Inc.
    - 5) Oshkosh.

## **2.2 DOOR CONSTRUCTION – GENERAL**

- A. General:
  1. Door Construction Method: 5-Ply, Hot press glued, solid core.
  2. Factory finished.
  3. Performance Standards (per WDMA I.S. 1A-04):
    - a. “Extra Heavy Duty”.
  4. Adhesives:
    - a. Type(s) as required by WDMA Performance Standard specified.
    - b. Utilize waterproof adhesives for doors indicated near potentially wet conditions.
    - c. Conform to EPA VOC regulations.
  5. Workmanship: Comply with WDMA I.S. 1A-04.
  6. Thickness: 1-3/4 IN unless noted otherwise.
  7. Width and Height as scheduled for each opening.

## **2.3 CORE CONSTRUCTION**

- A. General:
  1. Manufacture in compliance with WDMA Standards.
  2. Select specific core types which comply with label for scheduled ratings, sizes and hardware devices.
  3. Bond cores to stiles and rails; “Drop-in” (un-bonded) cores are NOT acceptable.
- B. Non-Fire Rated Doors:
  1. SLC-5, Stave Lumber Core.
    - a. FSC certified.
    - b. Sustainable Forest Initiative certified as indicated for Alternate No. 7.
- C. 20-minute Fire Rated doors:
  1. Core type indicated above for non-rated doors.
- D. Fire Rated Doors greater than 20 minutes (45, 60 & 90):
  1. Manufacturer’s standard mineral-core construction as required by label and hardware scheduled.
  2. Provide manufacturers standard laminated-edge construction with improved screw-holding capability and split resistance that are labeled and listed to provide fire rating indicated.
  3. Include composite inner blocking.
- E. Stiles:
  1. Provide manufacturers standard laminated-edge construction with improved screw-holding capability and split resistance.
  2. Fire-rated doors: Fabricate stiles from fire-retardant material as allowed by label.
  3. Meeting Stiles where CVR Exit Devices are scheduled: Avoid the use of applied metal channels where label allows fire-retardant material as an alternative.
- F. Rails:
  1. Solid Hardwood or Structural Composite Lumber (SCL).
- G. Cross-banding: Engineered wood or wood-based composite, securely bonded to core.

- H. Composite Inner Blocking:
1. Material: Composite engineered wood product approved for use in fire ratings indicated.
  2. Provide inner blocking in the following locations:

| <b>Inner-Blocking - Locations Required &amp; Minimum Sizes</b> |   |                         |                     |
|--|---|-------------------------|---------------------|
| <b>Location</b>  | <b>Usage</b>                            | <b>WDMA Designation</b> | <b>Minimum Size</b> |
| Top Rail   | All doors                               | HB-1                    | 5 IN                |
| Mid Rail   | Doors w/ Exit Devices                   | HB-6                    | 5 IN                |
| Lock Block   | All doors (except those w/Exit Devices) | HB-4                    | 5 x 18 IN           |
| Stile Block  | Doors w/ Flushbolts or Pivots           | HB-7                    | 5 IN                |
| Bottom Rail  | All doors                               | HB-2                    | 5 IN                |

**General Notes:**

Other Locations and Sizes: Provide additional Inner Blocking as required for Hardware devices Scheduled

3. Provide inner blocking at both surface-applied hardware AND thru-bolted hardware.

**2.4 DOORS WITH TRANSPARENT FINISH – PREMIUM GRADE**

- A. General:
1. Utilize WDMA “Premium Grade” criteria except as modified below.
  2. Veneer Thickness: 1/50 IN at 12% moisture content.
  3. Veneer Grade: HPVA Grade “A”.
- B. Veneer Species (both faces unless otherwise noted):
1. Red Oak.
- C. Veneer Cut:
1. Plain Sliced.
- D. Veneer Leaf Match:
1. Book match.
- E. Face Assembly Match:
1. Running.
- F. Door-to door Match: Match Pairs and sets.
- G. Door Vertical Edges: Same species as face, no joints.
- H. Transoms (where applicable):
1. Matching:
    - a. Continuous Match.
  2. Bottom edge: Solid hardwood or veneer, same species as face.

**2.5 MISCELLANEOUS ITEMS**

- A. Metal Stile Channels:
1. Description: Nominal 5 IN metal edge channels at fire-rated pairs equipped scheduled to receive Concealed Vertical Rod (CVR) Exit Devices.
  2. Usage: Use only where fire-retardant wood stiles alone are insufficient to satisfy label.
  3. When Metal Stile channels are necessary:
    - a. Material / Finish: Stainless Steel / #4 Satin Brushed.
    - b. Concealed Intumescent Seals: Include where required by fire label.
    - c. Include overlapping metal astragal lip where opening is part of a Smoke Barrier.

- B. Overlapping Astragals:
1. Provide approved overlapping astragals where required by label but not provided in Section 08 71 00 / Hardware.

## 2.6 FABRICATION

- A. Factory-fit doors to suit frame openings, with the following uniform clearances (comply with most stringent criteria):
1. NFPA 80 for fire rated doors.
  2. Locally adopted Building Code.
  3. WDMA prefit clearances for factory-fit doors.
  4. Manufacturers hardware templates.
  5. ANSI A250.8.
  6. Door to Frame Clearances Table:

| Door To Frame Clearances Table    |                                 |                                   |  |
|-----------------------------------|---------------------------------|-----------------------------------|--|
| Rated / Non-rated                 | Location                        |                                   | Wood Doors                                     |
| Rated Openings                    | Top Rail to Frame               |                                   | 3/32 to 1/8 IN                                 |
|                                   | Lock Stile to Jamb              |                                   |  |
|                                   | Hinge Stile to Jamb             |                                   |  |
|                                   | Meeting Stiles at Pair Doors    |                                   | 1/16 to 1/8 IN                                 |
|                                   | Face of door to face of Stop    |                                   |  |
|                                   | Door Bottom to Floor / Flooring | Typical; all floor covering types |  |
| At Non-combustible Sills          |                                 | Up to 3/8 IN                      |  |
| Bare floors; No flooring or sills |                                 | Up to 3/4 IN                      |  |
| Non-rated Openings                | All Conditions                  |                                   | Comply with criteria listed for rated openings |

- B. Factory-machine doors for hardware that is not surface-applied.
1. Comply with final Hardware Schedules, Frame Shop Drawings, and hardware templates.
  2. Coordinate measurements of hardware mortises in metal frames to verify dimensions and alignment before factory machining.
  3. Factory pre-drill pilot holes for surface-applied items.
- C. Openings and Cut-outs:
1. Make cutouts accurately and neatly.
  2. Provide two sets of glazing stop moldings for openings to completely cover cut edges.
    - a. Neatly miter stops at corners.
  3. Cut and trim openings through doors to comply with applicable requirements of referenced standard for kinds of doors required.
  4. Fill nail holds in wood stops.
- D. Top and Bottom Edges:
1. Render top and bottom edges smooth, non-absorptive and readily cleanable.
  2. SCL rails: Apply veneer tape, plastic laminate or otherwise finish rough or porous edges.
  3. Apply clear sealer to aid cleaning ability and decrease porosity.
- E. Fire Labels:
1. Affix permanent labels to fire rated units in accordance with agency requirements.
  2. On openings where continuous hinges, or other items which would conceal label, are scheduled: Locate labels on alternative locations as allowed by listing agency and local authorities.

- F. Vertical Door Edges:
  - 1. Lock Stile Edges: Beveled 1/8 IN per 2 IN.
    - a. Exception for Inactive Leaves: Fabricate “inactive leaves” with a square edge at the lock stile edge. (Active leaves to be beveled per above.)
  - 2. Hinge Stiles Edge: Beveled 1/8 IN per 2 IN.
  - 3. Exceptions for Double-Acting Doors: Provide convex, radiused edges at lock stiles and hinge stiles.

## 2.7 FACTORY FINISH

- A. General:
  - 1. Comply with WDMA finish requirements.
  - 2. Completely pre-finish doors at factory.
- B. Transparent Finish Systems:
  - 1. Stain (STN):
    - a. Type: Manufacturer’s standard type.
    - b. Stain Color:
      - 1) To be selected by Architect from Manufacturer’s standard line.
  - 2. Transparent Finish Coat:
    - a. System WDMA TR-6 Catalyzed Polyurethane.
    - b. Sheen: 30 to 40.

## 2.8 ACCESSORIES

- A. Glazing Stops:
  - 1. General:
    - a. Select assemblies which are certified for fire ratings indicated.
    - b. Select assemblies which are physically compatible with glazing type indicated.
  - 2. Stop Material (Rated and non-rated Doors):
    - a. Flush, wood veneer-clad extrusions.
    - b. Core Material: Extruded PVC or approved composite material.
    - c. Species, grain and finish of Wood Veneer Cladding: Match face veneer of doors.
    - d. Profile: Flush with face of door; no projecting lip.
    - e. Match profile of “W-6” by “Marshfield.
    - f. Exception: Matching solid hardwood stops may be substituted at non-fire-rated openings. Same species or compatible species with door facing.
- B. Field Glazing:
  - 1. Glass: Specified in Section 08 81 04.

## PART 3 - EXECUTION

### 3.1 INSPECTION

- A. Examine doors and installed frames before hanging doors.
  - 1. Verify suitability of openings to accept installation.
  - 2. Verify that frames comply with indicated requirements for type, size, location and swing characteristics and have been installed with level heads and plumb jambs.
  - 3. Do not hang doors in frames which are set out of plumb, out of square, or out of parallel until condition is rectified.
  - 4. Work with frame installer and wall installer to correct misalignment issues.
- B. Verify that Wood Doors have been properly conditioned to ambient conditions, and with in temperature and humidity levels recommended by manufacturer.
- C. Verify that door warp shall not exceed values prescribed by “Performance Standard” specified above.

1. Refer to WDMA I.S.1-A - 2004.
- D. Reject doors with defects prior to hanging.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.
- F. Installation constitutes acceptance of responsibility for performance.

### **3.2 INSTALLATION**

- A. Installation of wood doors to comply with WDMA IS 1A, door manufacturer's specific instructions, NFPA 80, Building Code as locally adopted.
  1. Manufacturer's written instructions: Install doors to comply with manufacturer's written instructions, referenced quality standard, and as indicated.
  2. Install fire-rated doors in corresponding fire-rated frames according to NFPA 80.
- B. Factory-finished doors to be installed just prior to substantial completion.
- C. Do not hang damaged, warped, stained, defective or otherwise damaged doors.
- D. Pilot holes to be drilled for screws attaching hinges, closers, lock hardware and all other devices to the stile or face of door.
  1. Pilot hole diameter shall not exceed 90% of the root diameter of the screw.
- E. Fit doors to frames and machine for hardware, to extent not previously worked at factory.
- F. Install doors in accordance with manufacturer's instructions.
- G. Glazing Stops:
  1. Finish as appropriate for material and type:
    - a. Veneer-wrapped Stops: Finish to match face veneer on doors.
    - b. Solid Wood Stops: Finish to match face veneer on doors.
    - c. Metal Stops: Paint in color to be selected by Architect.
  2. Fill nail holds in wood and wood clad stops.
- H. Paint ferrous metal astragals and lock stile plates in color to be selected by Architect.
  1. Do not Paint Stainless Steel Items.
- I. Hardware: For installation, see Section 08 71 00 / Door Hardware.

### **3.3 ADJUSTING**

- A. Adjust for proper fit and uniform clearance.
  1. Operation: Adjust all doors to swing and operate freely.
- B. Align all doors for uniform clearance at each edge.
- C. Adjust and check each door to insure proper operating and function.
- D. Ensure that all fire labels are intact, and readily visible.

### **3.4 PROTECTION**

- A. Protect installed items from dirt, moisture and physical abuse by subsequent trades.

### **3.5 REPAIRS**

- A. Prior to Final Occupancy: Repair or replace damaged items at discretion of Architect.
  1. Restore finish before installation if fitting or machining is required at Project site.
  2. Replace or re-hang doors which are warped, twisted, or which are not in true planes.
  3. Replace or re-hang doors which are hinge bound and to not swing or operate freely.
  4. Replace doors which are damaged prior to occupancy.

## **END OF SECTION**



**SECTION 08 31 16**  
**ACCESS PANELS AND DOORS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. Provide where indicated:
  - 1. Architectural: See architectural drawings.
  - 2. Mechanical: See mechanical drawings.
  - 3. Electrical: Provided by electrical, See Section 26 00 10.

**1.2 SUBMITTALS**

- A. Product data:
  - 1. Technical data on each type of access panel and/or door.
- B. LEED Information:
  - 1. LEED Credits MR 4.1 and 4.2, Recycled Content: Product data indicating percentages by weight of post-consumer and post-industrial recycled content for products having recycled content; include statement indicating costs for each product having recycled content.
  - 2. LEED Credits MR 5.1 and 5.2, Regional Materials: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.

**PART 2 - PRODUCTS**

**2.1 MATERIALS**

- A. Acceptable manufacturers:
  - 1. Access panels:
    - a. Base:
      - 1) Milcor.
    - b. Optional:
      - 1) JL Industries.
      - 2) Nystrom.
      - 3) Karp Associates.
      - 4) Williams Brothers.
      - 5) Acudor Products, Inc.
      - 6) Ventfabrics.
  - 2. All panels for project by same manufacturer.

**2.2 ACCESS DOORS PANELS AND FRAMES – GENERAL REQUIREMENTS**

- A. General:
  - 1. Size:
    - a. As required to allow access, inspection, service, and removal of items served.
    - b. Minimum 18 x 18 IN.
  - 2. Non-fire rated:
    - a. Door panels: Minimum 14 GA steel
    - b. Frame: Minimum 16 GA steel.
  - 3. Fire rated construction:
    - a. Provide in fire rated walls, floors and ceilings.

- b. UL listed.
  - c. Minimum 20 GA steel door, factory primed.
  - d. Sandwich type door filled with insulation.
  - e. 1-1/2 HR (B) fire rating.
  - f. Automatic door closing system.
4. Latching Mechanism:
- a. Cylinder-operated steel cam lock with 2 keys; all units keyed alike.
    - 1) Exception: Standard screwdriver slotted cam locks may be used at units that are installed 90 IN or higher more above floor or walking surface (measured to the centerline of latching mechanism).
5. Finish:
- a. Factory-primed
  - b. Paint in field: Specified in Section 09 91 13 (exterior units) and 09 91 23 (interior units).
6. Access doors, panels, and frames in ductwork: See additional requirements in Section 23 31 13.
7. Lighting fixtures shall not be used in lieu of access panels.

### **2.3 SCHEDULE OF ACCESS DOOR TYPES**

- A. Style and type as required for wall or ceiling materials in which installed.
- B. Flush Access Doors installed in gypsum wallboard walls and ceilings:
  - 1. Provide units with galvanized wallboard taping flange to be embedded in wallboard construction. Units to have a trimless final appearance when installation is complete.
- C. Flush Access Doors installed in concrete, masonry and tile walls and ceilings:
  - 1. Provide units with exposed trim flange having a nominal face width of 3/4 IN or less, Paint trim to match door.
  - 2. Install with adjustable metal masonry anchors.

### **2.4 FABRICATION**

- A. General:
  - 1. Provide access door and frame assemblies manufactured as integral units ready for installation.
- B. Metal Surfaces:
  - 1. For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes.
  - 2. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.
- C. Doors and Frames:
  - 1. Grind exposed welds smooth and flush with adjacent surfaces.
  - 2. Furnish attachment devices and fasteners of type required to secure access panels to types of supports indicated.
- D. Latching Mechanisms:
  - 1. Furnish number required to hold doors in flush, smooth plane when closed.
- E. Extruded Aluminum: After fabrication, apply manufacturer's standard protective coating on aluminum that will come in contact with concrete.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- A. Comply with manufacturer's written instructions for installing access doors and frames.

- B. Set frames accurately in position and attach securely to supports with plane of face panels aligned with adjacent finish surfaces.
- C. Install doors flush with adjacent finish surfaces or recessed to receive finish material.

### **3.2 ADJUSTING AND CLEANING**

- A. Adjust doors and hardware after installation for proper operation.
- B. Remove and replace doors and frames that are warped, bowed, or otherwise damaged.

**END OF SECTION**



**SECTION 08 33 23**  
**OVERHEAD COILING DOORS (CD)**

**PART 1 - GENERAL**

**1.1 DEFINITIONS**

- A. Coiling Doors (CD-IS):
  - 1. Exterior openings: Coiling doors with insulating slats motorized operation.

**1.2 SUBMITTALS**

- A. Shop Drawings.
- B. Samples:
  - 1. Finish colors for selection by Architect.
- C. Project Information:
  - 1. Certificate of UL construction.
- D. Contract Closeout Information:
  - 1. Operating and maintenance data.
  - 2. BNL instruction report.
- E. LEED Information:
  - 1. LEED Credits MR 4.1 and 4.2, Recycled Content: Product data indicating percentages by weight of post-consumer and post-industrial recycled content for products having recycled content; include statement indicating costs for each product having recycled content.
  - 2. LEED Credits MR 5.1 and 5.2, Regional Materials: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.

**1.3 JOB CONDITIONS**

- A. Coordinate electrical hookups with Electrical Specification Divisions.
- B. Verify structural door framing for acceptability.
- C. Correct deficiencies.

**PART 2 - PRODUCTS**

**2.1 MATERIALS**

- A. Acceptable manufacturers:
  - 1. Overhead doors:
    - a. Base:
      - 1) Cornell.
    - b. Optional:
      - 1) Cookson.
      - 2) McKeon.
      - 3) North American Rolling Door, Wayne Dalton.
      - 4) Overhead Door.
      - 5) Raynor.

## 2.2 COILING DOORS – GENERAL CRITERIA

- A. See Door Schedule Drawing for the following:
  - 1. Door height(s) and width(s).
  - 2. Coiling Door Type.
  - 3. Rating requirements.
  - 4. Other information unique to each opening.
- B. Curtain:
  - 1. 2 – 3 IN tall slats, interlocked to form an upward coiling curtain.
  - 2. Nominal Thickness: 3/4 IN.
  - 3. Gauge as determined by application, wind load, door width, and materials.
  - 4. Type of material and finish as indicated for each door.
  - 5. Typical Slat Style(s):
    - a. Insulated doors (CD-IS):
      - 1) Double wall slats injected with polyurethane foam.
      - 2) Thickness: 15/16 IN.
      - 3) Thermal Value: R=6.25 minimum.
      - 4) Slat Type: Cornell 6F.
  - 6. Fenestrated Slats:
    - a. Provide on doors where indicated.
    - b. Size of individual lites: 5 x 3/4 IN acrylic lites.
    - c. Typical lite arrangement:
      - 1) Place in sets of 15, 5 lites high x 3 wide.
      - 2) Provide 2 sets per door.
      - 3) Exception: Where other configurations are specifically indicated.
    - d. Provide double pane lites where lites are indicated for doors which have insulated slats.
    - e. Do not provide lites in Fire Rated doors where they would compromise fire label.
  - 7. Endlocks:
    - a. Minimum requirement: Provide malleable iron endlocks at each end of alternating slats to act as a wearing surface and to maintain slat alignment.
    - b. Enhanced endlock types; upgrade to these types as appropriate.
      - 1) Motorized Doors: Upgrade to continuous endlocks, (every slat).
    - c. Provide roller endlocks where roller windlocks are required: Exterior Doors where door width exceeds 12 FT- 4 IN.
- C. Bottom Bar:
  - 1. Curtain to be reinforced with bottom bar consisting of 2 back-to-back angles.
  - 2. Material and Finishes: As indicated for each door type, generally matching the curtain material and finish.
  - 3. Neoprene bottom seal to protect floor surface at sill.
    - a. Except where Safety Edge is indicated.
  - 4. Where floor surface slopes across width of opening: Fabricate bottom bar to match floor slope.
  - 5. Notch for obstructions where indicated or as required.
- D. Bracket plates:
  - 1. Minimum thickness: 1/4 IN.
  - 2. Fitted with sealed ball bearing on drive end.
  - 3. Material and Finishes as indicated for each door type.
- E. Spring counterbalance:
  - 1. Housed in a steel pipe of diameter and wall thickness to limit maximum deflection to 0.03 IN/FT.
  - 2. Springs: Helical torsion type designed to include an overload factor of 25% and for optimal ease of operation.
    - a. Motorized Doors: Utilize High Cycle springs rated at 100,000 cycles.
  - 3. Springs to be grease-packed and mounted on a cold-rolled steel inner shaft.

4. Spring Tension: adjustable from end of bracket plate.
  5. Include safety device that prevents free fall of curtain in any position, in the event of failure of an operating mechanism.
  6. Sealed ball bearings to minimize wear of pipe shaft rotation around inner shaft.
- F. Mounting:
1. Typical configuration:
    - a. Face of wall (inside).
    - b. Unless otherwise indicated for each door type.
- G. Guide angles and wall angle assemblies:
1. Minimum thickness: 3/16 IN.
  2. Provide adequate overlap of guide flanges over curtain to satisfy design windload.
  3. Material and Finishes: As indicated for each door type.
  4. Include removable section on coil side for installation and service.
    - a. Exception: Omit requirement where Stainless Steel or Aluminum guides are specified.
- H. Hood:
1. Typical profile:
    - a. Round.
    - b. Except where noted otherwise.
  2. Reinforce to prevent sag.
  3. Include intermediate hood supports where door width exceeds 16 FT.
  4. Material and Finishes: As indicated for each door type.
  5. Include neoprene hood baffle at doors used on the exterior.
  6. Include Flame Baffle at Fire Rated openings.

### **2.3 EXTERIOR DOORS – SPECIFIC CRITERIA**

- A. Design Exterior doors to meet Design Wind Load.
1. Design wind load pressure: 30 PSF minimum.
- B. Weather Seals:
1. Bottom Bar Seal:
    - a. Motorized doors with safety edge: Combination electric safety edge device and weatherseal.
    - b. Non-motorized doors: Manufacturer's standard neoprene astragal seal at bottom bar.
  2. Guide weatherstripping which seals against the exterior face of slats.
  3. Neoprene hood baffle.
  4. Air infiltration: Maximum 1 CFM/FT of perimeter.
- C. Windlocks:
1. Provide windlocks on all doors used in an Exterior wall, regardless of width.
  2. Provide roller windlocks (and roller endlocks) where door width exceeds 12 FT- 4 IN.

## 2.4 MATERIALS & FINISHES – GALVANIZED/STEEL (G/S) UNITS

| <b>Materials and Finishes for Galv/Steel (G/S) Coiling Units</b>                          |                              |                            |                |
|---|------------------------------|----------------------------|----------------|
| <b>Component Item</b>   | <b>Material <sup>2</sup></b> | <b>Primer <sup>2</sup></b> | <b>Finish</b>  |
| <b>Curtain Slats</b>  | Galv Steel                   | Baked-on Primer            | Powder Coat    |
| <b>Bottom Bar</b>   | Galv Steel                   | Baked-on Primer            | Powder Coat    |
| <b>Wall/Guide Angles</b>  | Ferrous Steel                | Shop Coat Primer           | Paint in Field |
| <b>Hood</b>   | Ferrous Steel                | Shop Coat Primer           | Paint in Field |
| <b>End Bracket Plates</b>   | Ferrous Steel                | Shop Coat Primer           | Paint in Field |
| <b>Fascia <sup>1</sup></b>  | Ferrous Steel                | Shop Coat Primer           | Paint in Field |
| <b>Footnotes:</b>   |                              |                            |                |
| 1. Where Fascias are required.  |                              |                            |                |
| 2. Upgrade components which are exposed to weather to "Galv Steel" and "Baked-on Primer". |                              |                            |                |

- A. Definition of items indicated in above Table:
1. Material:
    - a. Galvanized Steel, ASTM-A653 G90.
  2. Primer:
    - a. Baked-on Primer: Epoxy-modified polyester, applied at factory.
      - 1) Use on galvanized components.
    - b. Shop coat primer: Rust-inhibiting primer, applied at factory.
      - 1) Use on non-galvanized components.
    - c. Primer Color(s): Gray and/or Tan to be selected by Architect for each door.
  3. Factory Finishes:
    - a. Powder Coat: Factory-applied Powder Coat.
      - 1) Color(s) to be selected by Architect.
  4. Field-painted items:
    - 1) Specified in Section 09 91 23 (for interior doors).

## 2.5 OPERATION – MOTORIZED UNITS

- A. Refer to Door Schedule for appropriate operation type for each opening
- B. Motorized doors, (typical operation type unless noted otherwise):
1. Comply with UL 325.
  2. High starting torque Motor rated for continuous duty:
    - a. Minimum 3/4 HP, 460 VAC, 3 Phase.
  3. Opening rate: Between 8 and 9 IN/SEC.
  4. Gear reduction.
  5. Solenoid braking.
  6. Limit switches for upper and lower limits of door travel.
  7. Magnetic relay contactor.
  8. Overload protection.
  9. Pre-wiring to terminal block.
  10. Motor to be removable for repair without affecting hand chain operation.
  11. Safety System(s):
    - a. Wireless Electric Safety Edge:
      - 1) Causes curtain to stop and reverse when an obstruction is encountered when closing.
      - 2) Self-monitoring, wireless.
      - 3) Doors which are both motorized and used on exterior: Use Combination electric safety edge device and weatherseal.
  12. Panic Release Device (PRD):

- a. ADA compliant control located on wall adjacent to door to enable momentary opening of motorized doors for egress.
  - b. After door has been opened for exiting, the motor shall self close the curtain and secure the door.
  - c. Provide on doors where indicated.
13. Back-up operation:
- a. Hand Chain (HC) with electrical interlock to break motor circuit when hand chain is engaged.
    - 1) Force required: Not to exceed 35 LBS.
14. Controls:
- a. Key activated, flush mounted, 3 pushbutton control.
  - b. Operation:
    - 1) OPEN button to fully open door when button is depressed (momentary contact).
    - 2) CLOSE button to close door when button is depressed (momentary contact).
    - 3) STOP button stops door in either direction (momentary contact).
  - c. Interlock motor so that CLOSE button will be deactivated when door is in full down position and OPEN button will be de-energized when door is in full open position.
  - d. Electronic interlock, which discontinues the motor operator when it senses that the curtain has been secured by mechanical locking device.
  - e. Control devices:
    - 1) NEMA-1 at interior mounting locations.
    - 2) NEMA-4X at exterior, and interior wet locations.
    - 3) Install 1 per door opening where directed by Architect.
15. Locking at motorized units:
- a. Primary:
    - 1) Locking by motor operator's brake and gear drive.
  - b. Secondary:
    - 1) Electric interlock with locking device to prevent operation of motor when manual lock device is engaged.

## **PART 3 - EXECUTION**

### **3.1 INSPECTION**

- A. Verify that dimensions are correct.
  - 1. Resolve any discrepancies between "design" dimensions and "actual" dimensions.
- B. Verify suitability of substrate and opening to accept installation.
- C. Installation constitutes acceptance of substrate and responsibility for performance.

### **3.2 INSTALLATION**

- A. By manufacturer or authorized representative.
- B. Prior to occupancy, adjust door for smooth operation.

**END OF SECTION**



**SECTION 08 34 73**  
**SOUND CONTROL DOOR ASSEMBLIES**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Furnish all labor, materials, tools, equipment, and services for all Sound Control Door Assemblies, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

**1.2 QUALITY ASSURANCE**

- A. Sound control door assembly standards:
  - 1. Identical to assemblies whose STC ratings are determined according to ASTM-E90 and ASTM-E413:
    - a. Tested by independent acoustical agency accredited by the National Voluntary Laboratory Association Program of NIST.
    - b. STC rating: 46.
  - 2. Manufacturer qualifications: Firm experienced in manufacturing sound control door assemblies similar to those indicated for the Project and with a record of successful in-service performance:
    - a. Manufacturer shall provide doors, frames, gasketing, thresholds, hinges when integral with design, and other appurtenances required for sound control.
    - b. Single manufacturer shall provide sound control door assemblies.

**1.3 SUBMITTALS**

- A. Shop drawings:
  - 1. Door and frame schedule.
  - 2. Show fabrication, installation, anchorage and interface of frames with adjacent construction.
  - 3. Include details for each frame type, cam-lift hinge if used, sound seals, door bottom, threshold and door.
- B. Project information:
  - 1. Manufacturer's certification that each sound control door assembly complies with requirements.
- C. Field test reports indicating and interpreting test results for compliance with performance requirements of installed sound control doors.

**PART 2 - PRODUCTS**

**2.1 ACCEPTABLE MANUFACTURERS**

- A. Sound control door assemblies:
  - 1. Base:
    - a. Overly Manufacturing.
  - 2. Optional:
    - a. Industrial Acoustics.
    - b. Krieger Steel Products.
    - c. Pioneer Industries.
    - d. Jamison Door.
- B. Other manufacturers desiring approval comply with Section 00 26 00.

## 2.2 MATERIALS

- A. Cold-rolled steel sheets: ASTM-A1008.
- B. Hot-rolled steel sheets and strip: ASTM-A1011.
- C. Galvanized steel sheets: ASTM-A653 with ZF180 or Z180 A90 or G90 zinc coating.
- D. Support and anchors:
  - 1. Not less than 1.3mm 0.053 IN thick sheet steel.
  - 2. Galvanize items to be built into exterior walls, complying with ASTM-A153 Class B.
- E. Inserts, bolts and fasteners:
  - 1. Manufacturer's standard units.
  - 2. Galvanize items to be built into exterior walls, complying with ASTM-A153 Class B.
- F. Primer:
  - 1. Rust inhibitive enamel or paint, air-drying or baking.
  - 2. Suitable as base for specified finish paints.
- G. Doors:
  - 1. Flush design, minimum 1-3/4 IN thick, constructed with welds and without seams to produce sound ratings indicated:
    - a. Join faces at vertical edges by welding, ground and dressed smooth for invisible welds and smooth, flush surfaces on exposed faces or stile edges.
    - b. Bevel both vertical edges 1/8 IN in 2 IN.
    - c. Reinforce top and bottom with continuous steel channels of same material and thickness as face sheets, and spot weld channels to both face sheets.
    - d. Close top and bottom edges to provide flush construction with additional steel channels.
  - 2. Interior doors: Fabricate from two cold-rolled stretcher-leveled steel sheets, minimum 0.042 IN thick.
- H. Frames:
  - 1. Formed from steel sheets, full-welded unit construction with corners mitered, reinforced and continuously welded full depth and width:
    - a. Interior frames: Cold-rolled or hot-rolled steel, minimum 0.067 IN thick.
  - 2. Sound seals: Gasketing system to provide sound rating indicated:
    - a. Compression or magnetic one-piece head and jamb seals.
    - b. Automatic door bottom or compression seal with cam-lift hinges at sill.
    - c. Smooth threshold.
  - 3. Jamb anchors: Formed galvanized steel units for securing frames to adjacent construction:
    - a. Provide 4 anchors per jamb, plus one additional anchor for each 18 IN or fraction more than 90 IN in height.
    - b. Minimum 3/8 IN diameter concealed bolts into expansion shields or inserts, with manufacturer's recommended anchors and frame reinforcing at anchor locations, for in-place concrete.
  - 4. Floor anchors: Minimum 0.070 IN thick formed galvanized steel sheet anchors for each jamb:
    - a. Clip-type with two holes to receive fasteners, welded to bottom of jambs, for monolithic concrete slabs.
    - b. Adjustable type with extension clips, allowing not less than 2 IN height adjustment, for separate concrete topping slabs where bottom of frames are at finish floor surface.
  - 5. Spreader bars: Removable spreader bars across bottom of frames, tack welded to jambs.
  - 6. Plaster guards: Minimum 0.016 IN thick steel guards or boxes welded to frame at back of hardware cutouts to close interior of openings for protection of hardware operation.
- I. Hardware reinforcement:
  - 1. Provide steel reinforcement plates indoors and frames for hardware in accordance with hardware schedule and templates furnished:
    - a. Drilled and tapped for fully templated hardware.

- b. As required for field drilling and tapping for field applied hardware.
2. Reinforcement for hinges: Minimum 0.167 IN thick by 1-1/2 IN wide by 6 IN longer than the hinge, secured by not less than 6 spot welds.
3. Other frame reinforcement: Minimum 0.093 IN thick for strikes, closers, and surface-mounted hold-open arms.
4. Other door reinforcement: Minimum 0.093 IN thick for locks faces, and closers; and minimum 0.067 IN thick for other surface-mounted hardware.

## **2.3 FABRICATION**

- A. Fabricate doors and frames to be rigid and free from defects, warp and buckle:
  1. Form metal to accurate sizes and profiles.
  2. Fit and assemble units in manufacturer's plant to maximum extent practical; prefit and identify work to be assembled at the Project site.
  3. Weld exposed joints continuously; grind, fill, dress and make welds smooth, flush and invisible.
- B. Exposed fasteners: Provide zinc-coated countersunk, flat or oval headed screws and bolts.
- C. Hardware preparation: Factory mortise, reinforce, drill and tap doors and frames for hardware in accord with hardware schedule and templates:
  1. Comply with HMMA-830.
  2. Locate hardware according to DHI recommendations unless otherwise indicated or approved by submittal.
- D. Shop painting: Clean, pre-treat and paint exposed surfaces of doors and frames:
  1. Remove mill scale, rust, oil, grease, dirt and other foreign materials before pretreatment and painting.
  2. Apply cold or hot phosphate solution pretreatment to cleaned metal surfaces.
  3. Within time limits recommended for pretreatment used, apply smooth even shop coat of fast-drying lead-free rust-inhibitive primer:
    - a. Application shall be compatible with substrate and field-applied finish paint system specified:
      - 1) Interior Painting: Section 09 91 23.
    - b. Application shall be capable of providing protection for prolonged exposure until topcoat is applied.

## **PART 3 - EXECUTION**

### **3.1 PREPARATION**

- A. After wet construction is complete and dry, prepare wall openings to receive door and frame assemblies according to manufacturers written instructions.
- B. Verify frames are of correct size and swing, and that squareness, alignment, twist and plumbness tolerances comply with HMMA-865.
- C. Installation constitutes acceptance of responsibility for performance.

### **3.2 INSTALLATION**

- A. Install items in accordance with manufacturer's written instructions, and coordinate sequence of installation with other work to avoid delays:
  1. Install appropriate anchors and devices for securing frames to adjacent construction.
  2. Set frames accurately in position, plumbed, aligned and securely braced until permanent anchors are set.
- B. Fit doors accurately in their frames with the following clearances:
  1. Jambs: 1/8 IN.

2. Head with butt hinges: 1/8 IN.
  3. Head with cam-lift hinges: 3/8 IN.
  4. Bottom: Manufacturer's standard.
- C. Install and adjust sound seals that are not permanently factory-installed, in accordance with the manufacturer's written instructions.
- D. Install and adjust hardware according to hardware manufacturer's written instructions.
- E. Immediately after erection, sand smooth any rusted or damaged areas of prime coat and touch-up with compatible air-drying primer.

### **3.3 FIELD QUALITY CONTROL**

- A. Engage a qualified independent testing agency to perform sound control field testing.
- B. Independent testing agency services shall include the following:
1. Field tests conducted according to ASTM-E336 with results calculated according to ASTM-E413 to confirm that operating field STC values are within 5 dB of laboratory STC values.
  2. Test results reported promptly in writing by testing agency to Owner, Contractor and Architect.
- C. Repair or replace components of sound control doors where test results indicate STC rating does not meet requirements:
1. Testing agency repeat field test at Contractor's expense, and Contractor correct defects until tests show satisfactory results.

### **3.4 ADJUST AND CLEAN**

- A. Check and adjust operating hardware items, and leave work in complete and proper operating condition.
- B. Ensure that fire labels are intact, and readily visible.
- C. Remove and replace defective work, including but not limited to the following:
1. Damaged or ineffective seals.
  2. Doors or frames that is warped, bowed or otherwise unacceptable.

**END OF SECTION**

**SECTION 08 42 30**  
**AUTOMATIC CLEANROOM SLIDING DOORS**

**PART 1 - GENERAL**

**1.1 WORK INCLUDED**

- A. Provide Automatic sliding doors with operator for Cleanroom applications:
1. Cleanroom ISO Class 4 (Class 10) certified compatible.

**1.2 QUALITY ASSURANCE**

- A. Manufacturer Qualifications:
1. Manufacturer
  2. Minimum 5 years successful experience in the fabrication of automatic doors of the type required for this project.
  3. Manufacturer capable of providing field service representation during installation, approving acceptable installer and approving application method.
- B. Installer Qualifications:
1. Experienced to perform work of this section and specializing in the installation of work similar to that required for this project.
  2. Installer shall be acceptable to product manufacturer.
- C. References:
1. American Architectural Manufacturer's Association:
    - a. AAMA 101: Appendix Dissimilar Materials.
    - b. AAMA 607.1: Clear Anodic Finishes for Architectural Aluminum.
    - c. AAMA 611: Voluntary Specification for Anodized Architectural Aluminum.
    - d. AAMA 701: Voluntary Specification for Pile Weatherstripping and Replaceable Fenestration Weatherseals.
  2. American Association of Automatic Door Manufacturer's (AAADM).
  3. American National Standards Institute:
    - a. ANSI Z97.1: Safety Glazing Materials Used in Buildings - Methods of Test.
    - b. ANSI A156.10: For Power Operated Pedestrian Doors; Sliding Doors section.
  4. American Society for Testing and Materials:
    - a. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
    - b. ASTM B221: Aluminum-Alloy Extruded Bars, Rods, Shapes and Tubes.
    - c. ASTM C1036.90: Flat Glass.
    - d. ASTM C1048: Heat Treated Flat Glass, Kind HS, Kind FT Coated and Uncoated Glass.
  5. National Fire Protection Association:
    - a. NFPA-101: Code for Safety to Life from Fire in Buildings & Structures.
    - b. NFPA 70: National Electric Code.
  6. The Aluminum Association:
    - a. AA Aluminum Finishes Manual.
  7. Institute of Environmental Sciences and Technology (IEST): Test methods used for characterizing the performance of cleanroom sliding doors shall be in accordance with ISO 14644.
  8. Underwriters Laboratory, Inc.:
    - a. UL-325: Electrical Door, Drapery, Gate, Louver, and Window Operators and Systems.

**1.3 SUBMITTALS**

- A. Product Data: Submit manufacturer's product data, including description of materials, components, fabrication, finishes, and installation.

- B. Shop Drawings:
  - 1. Submit drawings showing layout, profiles, product components including anchorage, accessories, finish and glazing details (where required).
  - 2. Interface drawings if in storefront/curtain wall.
- C. Samples:
  - 1. Provide samples of materials with specified finishes.
- D. Contract Closeout Information:
  - 1. BNL Manual.
  - 2. AAADM inspection compliance form completed and signed by certified AAADM inspector prior to doors being placed in operation as proof of compliance with ANSI A156.10.
  - 3. BNL instruction report.
  - 4. Warranty: Manufacturer's standard warranty for one year from date of installation.
- E. Test Reports: Certification Certificate and Particle Test Report from the door manufacturer certifying that the doors comply with the cleanliness class performance requirements.
- F. LEED Information:
  - 1. LEED Credits MR 4.1 and 4.2, Recycled Content: Product data indicating percentages by weight of post-consumer and post-industrial recycled content for products having recycled content; include statement indicating costs for each product having recycled content.
  - 2. LEED Credits MR 5.1 and 5.2, Regional Materials: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.

#### **1.4 JOB CONDITIONS**

- A. Coordinate installation and connection with work required under Electrical Specification Divisions.
- B. Power supplied to automatic sliding door package:
  - 1. 120 VAC, Single Phase, 20 AMP.
  - 2. Specified in Electrical Specification Divisions, and shown on Electrical Drawings.
- C. Coordinate the installation of automatic cleanroom sliding doors with the Cleanroom Partition System, Section 13 61 16.

### **PART 2 - PRODUCTS**

#### **2.1 MATERIALS**

- A. Acceptable manufacturers:
  - 1. Automatic Cleanroom Sliding Doors:
    - a. Base:
      - 1) Horton Automatics.
    - b. Optional:
      - 1) Besam.
      - 2) Stanley Access Technologies.

#### **2.2 BASIS**

- A. Base Product:
  - 1. "110 Series" by Horton Automatics.
- B. Optional Products:
  - 1. "Unislide, Overhead Concealed Series" by Besam.
  - 2. "Duraglide 3000" by Stanley Access Technologies.

## 2.3 COMPONENT MATERIALS

- A. Automatic Cleanroom Sliding Doors:
  - 1. Comply with ANSI/BHMA 156.10.
  - 2. Slide sliding entrances, consisting of sliding aluminum doors, carrier frame, track and hanger assembly, door jambs, trim, guides, roller assembly, activation and safety devices, and hardware.
  - 3. Aluminum parts: 6063-T5 alloy.
  - 4. Steel components: Per manufacturer's requirements.
  - 5. Fabrication:
    - a. Weld or mechanically reinforce corners to resist motion forces.
    - b. Make joints tight.
  - 6. Glass:
    - a. Comply with ANSI standard Z 97.1.
    - b. Clear Glazing: Laminated Glass; 1/4 IN clear.
    - c. UV Glazing: Provide for wall system and doors of Lithography Bay.
      - 1) 1/4 IN thick, Capable of eliminating 99.995% of UV light, between 250 nm-450 nm wavelengths (yellow) or 250 nm-550 nm wavelengths (amber).
      - 2) Glazing Manufacturers:
        - a) Base: StatiCon Technologies; StatiCon AC-300, amber.
        - b) Optional: Other manufacturers are acceptable if matching manufacturer properties of the Base Products.
- B. Operator:
  - 1. Electro-mechanical by means of self-contained unit, microprocessor controller, and complete with pressure regulators.
  - 2. Provide adjustments for speed, power and delay.
  - 3. Recycle operation to return door instantly to full open from any point in closing cycle.
  - 4. Remote power units not acceptable.
- C. Emergency Break-away function:
  - 1. Interlocking breakaway assembly permitting door to swing 90 degrees from closed position.
  - 2. Emergency feature to comply with requirements of applicable codes, ordinances, and NFPA.
  - 3. Header of carrier frame to interlock with door top by means of spring loaded catch releases.
  - 4. Emergency operation deactivates automatic circuits.
  - 5. Closing of door automatically resets controls.
  - 6. Emergency breakaway shall not require a force greater than 50 LBS for emergency operation.
  - 7. Break-away: Provide option for both SX and SO panel break-aways allowing both panels to be opened for equipment move-in/out..

## 2.4 FINISH

- A. Anodic Coatings:
  - 1. Clear Anodized:
    - a. AAMA 611 Architectural Class I:
      - 1) Type AA-M10 C22 A41.
      - 2) Color: Clear.

## 2.5 CONTROLS AND SENSORS

- A. On/Off Switch:
  - 1. Key switch:
    - a. Locate on operator housing.
    - b. Include status indicator LED's.

- B. Actuation and Safety Devices:
  - 1. General:
    - a. Anti-vandalism design and concealed adjustments for zone size and sensitivity.
    - b. Finish to match door frame.
  - 2. Touchless Jamb-Mounted Activation Sensor:
    - a. Diffused scanning technology with adjustable range up to 15 IN; junction box included.
    - b. Locate a sensor on each side of the door.
    - c. Conventional infrared technology which is sensitive to Fire Alarm Strobes will NOT be allowed.
  - 3. Presence (safety) Sensors:
    - a. Hold-open beams: Two pulsed infrared photoelectric beams to be mounted within opening of door unit at 24" and 48" above finish floor.
    - b. Sender/receiver arrangement parallels door opening and recycles door when closing (does not activate door when unit is fully closed).

## **2.6 OPTIONAL INTERLOCK CONTROLLER**

- A. Multiple doors entering a clean room and/or vestibule area shall include a microprocessor based interlock control to prevent two doors from being open at the same time:
  - 1. The control shall keep track of the order of request from the activation switch.
  - 2. Design shall have a memory capable of remembering order of open requests.
  - 3. Reference the Door Schedule for doors to receive interlocking option.

## **2.7 WARNINGS**

- A. Warning decals: Provide at both sides of doors.

# **PART 3 - EXECUTION**

## **3.1 INSPECTION**

- A. Verify suitability of substrates and openings to accept installation.
- B. Installation constitutes acceptance of responsibility for performance.
- C. Dissimilar Materials: Comply with AAMA 101, Appendix Dissimilar Materials by separating aluminum materials and other corrodible surfaces from sources of corrosion or electrolytic action contact points.

## **3.2 INSTALLATION**

- A. Perform complete installation of automatic door control equipment.
- B. Include electrical connections between components.
- C. Cooperate with electrician on control wiring.
- D. Leave work ready to operate.
- E. Turn over to BNL, adjusted and correctly operating.

## **3.3 CLEANING, ADJUSTMENT AND PROTECTION**

- A. Cleaning: After installation, installer to take following steps:
  - 1. Remove temporary coverings and protection of adjacent work areas.
  - 2. Remove construction debris from construction site and legally dispose of debris.
  - 3. Repair or replace damaged installed products.
  - 4. Clean product surfaces as recommended by the door manufacturer's printed instructions.
- B. Adjustment: An AAADM certified technician shall inspect and adjust installation to assure compliance with ANSI A156.10.

- C. Protection: Advise the Contractor of manufacturer's written precautions required through the remainder of the construction period, to ensure that doors will be without damage at the time of acceptance.

**END OF SECTION**



**SECTION 08 44 13**  
**CURTAIN WALL SYSTEMS (CWS)**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section includes: an outside-glazed, aluminum Curtain Wall Systems (CWS), including perimeter trims, stools, accessories, shims and anchors, and perimeter sealing of curtain wall framing.
- B. Work installed but not furnished:
  - 1. Exterior Glass and glazing: Section 08 81 02.
  - 2. Finish Hardware (items not listed herein): Specified in Section 08 71 00.
- C. Section includes: an outside-glazed, aluminum framed Skylights and Sloped curtain wall areas , including perimeter trims, curb receivers, flashings, accessories, shims and anchors, and sealants.

**1.2 QUALITY ASSURANCE**

- A. Qualifications:
  - 1. Installer Qualifications:
    - a. Experienced in the installation of curtainwall systems similar in size and scope indicated for this project.
    - b. Installer who is trained by, and approved of by curtainwall manufacturer.
  - 2. Manufacturer Qualifications:
    - a. Manufacturer capable of providing field service representation during construction, approving acceptable installer and approving installation methods.
- B. Pre-installation meeting:
  - 1. Conduct Pre-installation meeting to verify project requirements, substrate conditions, manufacturer's installation instructions, and manufacturer's warranty requirements.
- C. Fabrication, erection and finishing standards: Applicable standards of AA, AAMA and AWS.
- D. Welding and welders:
  - 1. Utilize skilled and qualified welders, licensed where required in accordance with local building regulations.
  - 2. Perform welding in conformance with AWS structural welding code.

**1.3 DESIGN CRITERIA**

- A. Provide engineering design performed and sealed by registered Engineer, licensed to practice Structural Engineering in the State of New York.
  - 1. Design curtainwall system to satisfy requirements of applicable building codes.
- B. Design framing and anchorage systems to allow for:
  - 1. Expansion and contraction, caused by changes in surface temperature equal to DT (delta T).
    - a. DT for this project: 200 DegF.
    - b. Thermal contraction/expansion in this range shall not cause buckling, stresses on glass, failure of joint seals, undue stress on structural elements, damaging loads on fasteners, reduction of performance, or other detrimental effects over this temperature range.
    - c. Operating windows and doors shall function normally over this temperature range.
  - 2. Structural movements of building structure:
    - a. Inter-story drift caused by wind or earthquake forces.
      - 1)  $h/400$  max.

- b. Live load deflection of the supporting members.
      - 1)  $L/360$ .
- C. Primary Seal at Perimeter:
  - 1. Locate inboard of back plane of glazing pocket.
- D. Drainage:
  - 1. Design Curtainwall System to intercept, collect, contain, and drain water (which may infiltrate system) harmlessly to exterior.

#### **1.4 MOCK-UP WALL**

- A. Erect a Mock-up Wall 2 bays wide and 2 stories high.
  - 1. Install complete with glass, glazing, insulation, spandrels, anchors and other components required to create entire assembly.
- B. Perform Field Testing on Mock-up Wall.
  - 1. Evaluate appearance, anchorage, and weathertightness.
  - 2. If unit is not acceptable, modify and/or remove and re-construct new Mockup Wall and retest, until assembly is accepted.
- C. Finally accepted Mock-up serves as standard of quality for remainder of curtain wall construction.
- D. Mock-up Wall may be retained in place as a permanent part of the building.
  - 1. If constructed separate from the building, Mock-up Wall shall remain intact during balance of curtainwall installation, and used for comparative purposes.

#### **1.5 DESIGN LOADS**

- A. Design Curtainwall systems and anchorage to meet Design Load.
  - 1. Use the greater of the following:
    - a. Wind Pressures listed on Design Requirements on Structural Drawings.
    - b. Wind Pressures defined by Building Code as locally adopted and amended.
  - 2. Limit deflection to values specified for "Uniform Load Test".
    - a. Comply with local Building Code where more restrictive.
- B. Design Skylights and/or Sloped Curtainwall Systems and anchorage to meet Design Load.
  - 1. Wind Load: Use the greater of the following:
    - a. Wind Pressures listed on Design Requirements on Structural Drawings.
    - b. Wind Pressures defined by Building Code as locally adopted and amended.
    - c. 195 kPa 40 PSF.
  - 2. Snow Load: Use the greater of the following:
    - a. Wind Pressures listed on Design Requirements on Structural Drawings.
    - b. Wind Pressures defined by Building Code as locally adopted and amended.
  - 3. Limit deflection to  $L/175$  and allowable stress with a safety factor of 1.65
    - a. Comply with local Building Code where more restrictive.

#### **1.6 LABORATORY TESTS**

- A. General:
  - 1. Systems proposed for use on this project shall tested to ensure that they meet performance criteria listed in this Article.
    - a. Utilize independent testing laboratories specifically qualified to conduct performance tests required.
    - b. Laboratory tests may be conducted in manufacturer's laboratories provided they are witnessed and certified by qualified independent testing laboratory personnel.
  - 2. Perform tests on full sized unit for project or a minimum 2-story high, 20 FT-wide, unit.
    - a. Mount specimen in test chamber in exact accordance with job conditions including anchorage system, caulking, sealing, etc.

- b. Unit for test to be completely assembled glazed unit.
  - c. Thermal tests may be conducted on a 4x6 FT unit.
  - d. Test air infiltration first, water resistance second.
  - e. Other tests may be in any order.
3. Pre-construction Laboratory Testing from certified lab will be acceptable (in lieu of “job-specific testing”).
- a. Lab Test Reports, indicating compliance with specified criteria must be based on a test unit that accurately represents the product currently being produced for use on subject project.
    - 1) Base and Optional Manufacturers: Test reports may be up to 10 years old.
    - 2) Manufacturers not listed as Base or Optional: Test reports may be up to 5 years old.
- B. Air Infiltration Test:
- 1. Test specimens in accordance with ASTM-E283.
  - 2. Maximum Air Infiltration:
    - a. Fixed wall areas: 0.06 CFM/FT<sup>2</sup> when tested at 6.24 PSF.
    - b. Swinging Doors:
      - 1) Single: 0.50 CFM/FT<sup>2</sup> when tested at when tested at 6.24 PSF.
      - 2) Pairs: 1.0 CFM/FT<sup>2</sup> of perimeter crack, when tested at when tested at 1.56 PSF.
- C. Water Resistance Tests:
- 1. Static:
    - a. Test specimen in accordance with ASTM-E331.
    - b. No water leakage (as defined in AAMA 501) allowed with a when tested at static air pressure differential of 12 PSF.
  - 2. Dynamic:
    - a. Test specimen in accordance with AAMA 505.1.
    - b. No water leakage (as defined in AAMA 501) allowed with a when tested at an air pressure differential of 12 PSF.
- D. Uniform Load Tests:
- 1. Test specimen in accordance with ASTM-E330.
    - a. Apply 40 PSF static air pressure load to the specimen in the positive and negative direction.
      - 1) Spans less than 13 FT– 6 IN: There shall be no deflection in excess of L/175 of the span of any framing member.
      - 2) Spans greater than 13 FT– 6 IN: and less than 40 FT: There shall be no deflection in excess of L/240 plus 1/4 IN of the span of any framing member.
    - b. Increase test load pressure to 60 PSF: No glass breakage or permanent set in the framing members in excess of 0.2% of their clear spans shall occur.
- E. Thermal Transmittance (U-Value):
- 1. When tested to AAMA Specification 1503, the thermal transmittance (U-value) shall not exceed the following as defined by AAMA 507:

| <b>Thermal Transmittance</b>                             |   |                    |
|--|---|--------------------|
| ( Base Products: "1600 Wall - Systems 1 & 2" by Kawneer) |   |                    |
| <b>System Type</b>                                       | <b>Maximum U-Value</b><br>(BTUH / FT <sup>2</sup> / DegF) |                    |
|  | <b>Clear Glass</b>  | <b>Low-E Glass</b> |
| Units with pressure plate and caps<br>(Captured)         | 0.66  | 0.45               |
| Units with structural silicone glazing<br>(SSG)          | 0.58  | 0.45               |

**General Notes:**

1. U-Values indicated are based on 1 IN insulating glass units made with 2 layers of 6mm glass and 1/2 IN air space.
2. Values for Low-E column: Based on E=0.20, Argon-filled space, and warm-edge spacer.

## F. Condensation Resistance (CRF):

1. When tested to AAMA Specification 1503, the condensation resistance factor (CRF) shall not be less than the following:

| <b>Thermal Performance</b>                               |             |             |             |
|--|-------------|-------------|-------------|
| ( Base Products: "1600 Wall - Systems 1 & 2" by Kawneer) |             |             |             |
| System Type  | Minimum CRF |             |             |
|  | Component   | Clear Glass | Low-E Glass |
| Units with pressure plate and caps (Captured)            | Glass       | 61          | 68          |
|  | Frame       | 71          | 73          |
| Units with structural silicone glazing (SSG)             | Glass       | 59          | 67          |
|  | Frame       | 76          | 75          |

**General Notes:**

1. CRF values indicated are based on 1 IN insulating glass units made with 2 layers of 6mm glass and 1/2 IN air space.
2. Values for Low-E column: Based on E=0.20, Argon-filled space, and warm-edge spacer.

## G. Seismic:

1. When tested to AAMA 501.4, system must meet design displacement of 0.10 x the story height and ultimate displacement of 1.5 x the design displacement.

## H. Sound Transmission Loss:

1. Test in accordance with ASTM-E90.
2. Minimum Sound Transmission Class (STC): Not less than 34.

## I. Test of anodic seal:

1. Perform acid dissolution test on sealed anodized finish.
2. Perform in accordance with ASTM-B680.
3. Maximum permissible loss: 2.6 mg/IN<sup>2</sup>.
4. Furnish certified test report indicating that test was performed on aluminum for this project.
5. Furnish 1 test for each 50,000 FT<sup>2</sup> of material.

**1.7 SUBMITTALS**

## A. Shop Drawings.

1. Elevations, Sections & Details:
  - a. Show the locations of connections to building superstructure.
  - b. Key Shop Drawing Elevations to Structural Calculations and/or list the loads which will be imposed on the building superstructure by the curtain wall system.
  - c. Include depiction of glazing units showing locations and types for review and approval.

## B. Samples.

1. Range of anodic finishes.
2. Manufacturer's standard line of PVF finishes for color selection by Architect.

3. Finish hardware and fastening items.
- C. Project information:
1. Structural calculations prepared by a registered Engineer (licensed to practice Structural Engineering in the state where project is located) made by or for curtainwall manufacturer for review of interface between curtainwall support system and building structural frame.
    - a. Employ loads specified in "Design Loads" article in PART 1.
    - b. Submit concurrently with Shop Drawings.
  2. Laboratory Test Reports:
    - a. Reports conducted by certified independent laboratory that demonstrate compliance with performance values listed in "Laboratory Tests" article in PART 1.
  3. Field Test Reports.
- D. Contract Closeout Information:
1. Warranty.
  2. Maintenance Data.
- E. LEED Information:
1. LEED Credits MR 4.1 and 4.2, Recycled Content: Product data indicating percentages by weight of post-consumer and post-industrial recycled content for products having recycled content; include statement indicating costs for each product having recycled content.
  2. LEED Credit MR 5.1 and 5.2, Regional Materials: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.

## **1.8 WARRANTY**

- A. Weathertightness Warranty:
1. Written warranty signed jointly by fabricator, installer and Contractor, agreeing to repair or replace work performed under this section which fails.
  2. Failure includes defects in materials, workmanship, water tightness of assembly, caulking, glazing or other defects in system which affects its ability to perform as weathertight envelope.
  3. Warranty period: 5 years.
- B. Warranty on color integrity of 70% Kynar PVDF finishes:
1. PVDF Warranty period: 20 years.

## **1.9 DELIVERY, STORAGE, AND HANDLING**

- A. Ordering: Comply with manufacturer's ordering instructions and lead time requirements to avoid construction delays.
- B. Packing, Shipping, Handling, and Unloading: Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.
- C. Storage and Protection:
1. Store materials protected from exposure to harmful weather conditions.
  2. Handle material and components to avoid damage.
  3. Protect curtainwall material against damage from elements, construction activities, and other hazards before, during and after curtainwall installation.

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS**

- A. Acceptable manufacturers:

1. Curtainwall System (CWS):
  - a. Base:
    - 1) Kawneer.
  - b. Optional:
    - 1) Oldcastle Glass, Vistawall.
    - 2) Wausau Window and Wall Systems.
2. Skylights and/or Sloped Curtainwall Systems:
  - a. Base:
    - 1) Kawneer.
  - b. Optional:
    - 1) Wausau Window and Wall Systems.
    - 2) Vistawall Architectural Products..

## 2.2 FRAMING SYSTEM - GENERAL

- A. Materials - Aluminum Framing and Components:
  1. Material Standard: Extruded Aluminum, ASTM-B221, 6063-T5 alloy and temper.
  2. Member Wall Thickness: Each framing member shall provide structural strength to meet specified performance requirements.
  3. Member Depth and internal reinforcing:
    - a. Comply with frame depths indicated wherever possible.
    - b. Increase depth as required to structural strength necessary to resist Design Loads.
  4. Tolerances: Reference to tolerances for wall thickness and other cross-sectional dimensions of curtain wall members are nominal and in compliance with AA Aluminum Standards and Data.
  5. Provide strike boxes at all openings in framing system.
- B. Base Product:
  1. Curtainwall:
    - a. 1600 Unit Wall System 1 by Kawneer Company, Inc.

## 2.3 ACCESSORIES

- A. Fasteners:
  1. Where exposed, shall be Stainless Steel.
  2. Where not exposed: Select material at manufacturer's option, subject to galvanic compatibility with materials being joined.
- B. Gaskets: Glazing gaskets shall comply with ASTM-C864 and be extruded of a silicone-compatible EPDM rubber that provides for silicone adhesion.
- C. Perimeter Anchors: Aluminum.
  1. When steel anchors are used, provide insulation between steel material and aluminum material to prevent galvanic action.
- D. Thermal Barrier: Thermal separator shall be extruded of a silicone-compatible elastomer that provides for silicone adhesion.
- E. Interior Stools (aluminum):
  1. Aluminum extrusions and associated clips and fasteners.
- F. Doors:
  1. Fabricate of extruded sections assembled with tension rods, or welded corners.
  2. Dimensions:
    - a. Member Wall Thickness: 0.125 IN (minimum).
    - b. Member Depth: 1-3/4 IN.
    - c. Stiles and Top Rail:
      - 1) Medium:
        - a) 3-1/2 IN.
        - b) Base Product: "350 Swing Door, Medium Stile" by Kawneer.

- d. Bottom Rail: 12 IN.
  - 3. Include wear shield on bottom rail.
  - 4. Offset Pivots: Specified in Section 08 71 00.
  - 5. Provide manufacturer's standard weatherstripping at edges and door bottom.
  - 6. Prepare and reinforce doors to receive additional hardware specified in Section 08 71 00.
- G. Sun shades:
- 1. Inclusive of aluminum outriggers, louvers and fascia.
    - a. Wedge shaped outriggers supported from mullions, projecting approximately 30 IN from face of glass, unless otherwise indicated.
    - b. Minimum 4 evenly spaced circular louvers between outriggers.
    - c. Angular fascia.
  - 2. Mounted as indicated.
  - 3. Base product: Kawneer 1600 Sun Shade, Wedge Outrigger, Circular Louver, Angular Fascia.

## **2.4 RELATED MATERIALS**

- A. Perimeter Sealants: Specified in Section 07 92 13.
- B. Glass and glazing:
  - 1. Specified in Section 08 81 02.

## **2.5 FABRICATION - GENERAL**

- A. General:
  - 1. Fabricate components per manufacturer's installation instructions and with minimum clearances and shim spacing around perimeter of assembly, yet enabling installation and dynamic movement of perimeter seal.
  - 2. Accurately fit and secure joints and corners.
  - 3. Make joints flush, hairline and weatherproof.
  - 4. Prepare components to receive anchor devices.
  - 5. Fabricate anchors.
  - 6. Arrange fasteners and attachments to conceal from view.
- B. Weld by methods recommended by manufacturer and AWS to avoid discoloration.
  - 1. Grind exposed welds smooth and restore finish.
- C. Maintain true continuity of line and accurate relation of planes and angles.
- D. Separate dissimilar metals with bituminous paint or preformed separators to prevent corrosion.
- E. Separate metal surfaces at moving joints with plastic inserts or other non-abrasive concealed inserts to permanently prevent freeze-up of joint.
- F. Provide tubular and solid extruded aluminum mullions and horizontal rail shapes with sharp well defined corners and flush sight lines.
- G. Provide means to intercept, collect, contain and weep moisture accumulation harmlessly to exterior.
- H. Reinforce work as necessary for performance requirements, and for support to structure.
- I. Provide continuous solid or semi-rigid vinyl or cast urethane insulating materials to fully separate exterior exposed portions of aluminum from interior portions.
- J. Use no bolts, screws or other hardware components, metallic fastenings, etc. that will impair independent frame movement or thermal barrier effectiveness.
- K. Reinforce doors and frames and hardware.

## 2.6 FABRICATION SKYLIGHTS AND/OR SLOPED CURTAINWALL

- A. Major framing shall be factory prepared for job site assembly and sealed according to manufacturers recommended procedures.
- B. Rafters and Purlin Members:
  - 1. Integral drainage gutters in both the glazing pocket and inside the glass plane to drain moisture to the exterior.
  - 2. Flexible thermal break material at exterior side of the glass plane.
  - 3. Joints between Rafter and Intermediate Purlins:
    - a. Made without the use of clips.
    - b. Do not locate joint fasteners within the interior drainage gutter.
- C. Structural Silicone Glazed Purlin (where indicated):
  - 1. Minimum width of weather seal joint of silicone: 3/4 IN.
  - 2. Design interior structural joint design to withstand the maximum anticipated combined loads (with 6:1 safety factor).
  - 3. Apply silicone in accordance with sealant manufacturer's recommendations.
  - 4. Insulating glass units shall be of a construction suitable for structural silicone glazing.
  - 5. Completed joint will result in no through-metal or projecting fins exposed to the exterior.
- D. Sill Members:
  - 1. Run continuously past the Rafter Members creating a drainage gutter.
  - 2. Design with weep holes and silicone exterior glazing seal not less than 3/16 IN wide.
  - 3. Fasten aluminum pressure plates to the main grid members.
- E. Interior Glazing Seals:
  - 1. Resilient elastomers installed in the main framing members.

## 2.7 70% PVDF COATINGS

- A. General:
  - 1. Superior-performing, complying with AAMA 2605, and containing at least 70% PVDF (Hylar 500™ or Kynar 500®) resin.
  - 2. Pre-treatment process: Manufacturer's standard.
  - 3. Factory-applied, oven-baked.
  - 4. Specular Gloss (ASTM-D523): 30 +/-5 measured at 60 degree meter setting.
- B. Primer:
  - 1. DFT: 0.2 to 0.4 mils.
  - 2. Base Product: "Fluorprime" by Valspar.
- C. Topcoat:
  - 1. DFT: 1.0 to 1.3 mils.
  - 2. Base Product: "Fluorpon" as formulated by Valspar for Kawneer.
  - 3. Base Product: "Fluorpon" by Valspar.
  - 4. Base Product: "Duramar" by PPG.
  - 5. Base Product: "Sunstorm" by PPG.
  - 6. Base Product: "Trinar" by Akzo.
  - 7. Base Product: "Fluoroceram" by BASF.:
  - 8. Color:
    - a. Standard colors:
      - 1) To be selected from manufacturers stock colors.

## 2.8 SOURCE QUALITY CONTROL

- A. Source Quality:
  - 1. Provide Curtainwall systems and components specified herein from a single source.
  - 2. Curtainwall system (specified herein) and the following items shall be provided by the same manufacturer:

- a. Aluminum Storefront.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Site Verification of Conditions:
  - 1. Verify that substrate conditions, previously installed under other sections, are acceptable for Curtainwall installation in accordance with manufacturer's instructions.
  - 2. Verify openings are sized to receive Curtainwall System and sill plates are level in accordance with manufacturer's acceptable tolerances.
  - 3. Field Measurements:
    - a. Verify actual measurements/openings by field measurements before fabrication.
    - b. Show recorded measurements on Shop Drawings.
    - c. Coordinate field measurements, fabrication schedule with construction progress to avoid construction delays.

### **3.2 INSTALLATION**

- A. General:
  - 1. Install Curtainwall Systems plumb, level, and true to line, without warp or rack of frames with manufacturer's prescribed tolerances and installation instructions.
    - a. Provide adequate supports and anchor in place.
  - 2. Dissimilar Materials: Provide separation of aluminum materials from sources of corrosion or electrolytic action contact points.
  - 3. Comply fully with manufacturer's shop drawings, erection drawings, and recommendations for installation.
  - 4. Anchor securely in place.
  - 5. Separate metal surfaces from sources of corrosion or electrolytic action.
  - 6. Set sill and base members in a bed of sealant.
  - 7. Provide joint fillers or gaskets for weathertight construction.
    - a. Calk joints within and at perimeter of system.
- B. Glazing:
  - 1. General:
    - a. Glass shall be outside-glazed.
    - b. Secure glass to mullions using one or more of the following, as indicated.
  - 2. Captured Lites: Mechanically secured in place with extruded aluminum pressure plates anchored to the mullion using stainless steel fasteners spaced no greater than 9 IN on center.
  - 3. SSG Lites: Glass bonded in place with silicone bonded to aluminum mullions.
- C. Water Drainage:
  - 1. Each light of glass shall be compartmentalized using joint plugs and silicone sealant to divert water to the horizontal weep locations.
  - 2. Weep holes shall be located in the horizontal pressure plates and covers to divert water to the exterior of the building.

### **3.3 FIELD QUALITY CONTROL**

- A. Field Tests - General:
  - 1. Architect shall select Curtainwall units to be tested as soon as a representative portion of each Curtainwall type used on the project has been installed, glazed, perimeter caulked and cured.
  - 2. Where test results do not meet specified performance requirements: Correct deficiencies, and implement improved installation procedures for completing the balance of Curtainwall system.
- B. Hose Test (AAMA 501.2):

1. Test for water penetration in accordance with AAMA Standard 501.2, "Specifications for Field Check of Metal Curtain walls for Water Leakage".
- C. Manufacturer's Field Services:
1. Provide manufacturer's field service consisting of product use recommendations and periodic site visit for inspection of product installation.

### **3.4 PROTECTION AND CLEANING**

- A. Protection:
1. Protect installed product's finish surfaces from damage during construction.
  2. Protect Curtainwall System from damage from grinding and polishing compounds, plaster, lime, acid, cement, or other harmful contaminants.
- B. Cleaning:
1. Repair or replace damaged installed products.
  2. Clean installed products in accordance with manufacturer's instructions prior to BNL's acceptance.
  3. Remove construction debris from project site and legally dispose of debris.

**END OF SECTION**

**SECTION 08 71 00**  
**DOOR HARDWARE**

**PART 1 - GENERAL**

**1.1 SECTION INCLUDES**

- A. Finish door hardware.
- B. Thresholds.
- C. Gaskets.
- D. Key Cabinet.

**1.2 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION**

- A. Furnish cylinders to Section 08 11 13, 08 14 16, 08 31 16, 08 33 23, 08 42 30, 08 44 13 for installation.
- B. Furnish electromagnet portion of magnetic door holders specified under this section to Section 28 31 00 for installation.
- C. Furnish power supplies and door controllers specified under this section to Section 28 31 00 for installation.

**1.3 RELATED SECTIONS**

- A. Section 08 11 13 - Hollow Metal (HM) Doors and Frames.
- B. Section 08 14 16 - Flush Wood Doors (WD).
- C. Section 08 31 16 - Access Panels and Doors.
- D. Section 08 33 23 - Overhead Coiling Doors.
- E. Section 08 42 30 - Automatic Cleanroom Sliding Doors.
- F. Section 08 44 13 - Curtain Wall Systems.
- G. Section 13 61 16 - Cleanrooms.
- H. Section 28 31 00 - Fire Alarm System.

**1.4 QUALITY ASSURANCE**

- A. Finish designations and standards: Builders Hardware Manufacturers Association (BHMA) Standard 1301.
- B. Positive Pressure:
  - 1. Comply with Positive Pressure Requirements UL 10C, Category A.

**1.5 REGULATORY REQUIREMENTS**

- A. Unless scheduled otherwise, hardware shall comply with barrier free design requirements of the State of New York and Americans with Disabilities Act (ADA).
- B. Hardware and associated products shall be UL listed, except as otherwise specified under this section.

## 1.6 QUALIFICATIONS

- A. Installer qualifications: Supervised or inspected by certified Architectural Hardware Consultant (AHC).
- B. Hardware Supplier:
  - 1. Recognized architectural door hardware supplier, with warehousing facilities, who has been furnishing hardware in the project's vicinity for a period of not less than 2 years.
  - 2. On-staff, experienced Architectural Hardware Consultant (AHC) who is available, during the course of the Work, for consultation about project's hardware requirements.
- C. Electrified Hardware Supplier:
  - 1. Experienced door hardware supplier which has completed projects with electrified door hardware similar in material, design and extent to that indicated for this project, which has a record of successful in-service performance and is acceptable to manufacturer of materials.
  - 2. Shall prepare data for electrified door hardware based on testing and engineering analysis of manufacturer's assemblies similar to those in this project.

## 1.7 SUBMITTALS

- A. Shop Drawings:
  - 1. Complete Hardware Schedule by door.
    - a. Complete list of products including model numbers and cut sheets.
    - b. Hardware Schedule shall utilize Heading Numbers which are logically derived from Architect's Hardware Set numbers.
    - c. Hardware Sets shall follow the guidelines established in Door & Hardware Institute Handbook (DHI) Sequence and Format for the Hardware Schedule with index of doors and headings, indicating complete designations of every item required for each door or opening.
    - d. Electrical Wiring Diagrams: Provide detailed wiring diagrams showing terminal or pigtail connections for signaling, control and locking functions and any notes pertinent to programming, operation, etc. that are necessary to integrate the proposed hardware into electrical systems. In addition, when door hardware sets include automatic operators and locking or latching hardware on the same doors, provide detailed wiring diagrams showing the interconnection of these components to achieve coordinated operation with access control system specified in Section 28 31 00.
- B. Project Information:
  - 1. Certification that items bear UL label where required.
- C. Contract Closeout Information:
  - 1. Operating and maintenance data.
    - a. Parts catalog for each product furnished.
    - b. Keying records.
  - 2. Furnish as-built/as-installed schedule.
  - 3. BNL instruction report.
  - 4. Letter stating extra material has been delivered.
  - 5. Meeting minutes from Pre-Installation Conference.
- D. LEED Information:
  - 1. LEED Credit MR 4.1 & 4.2, Recycled Content: Product data indicating percentages by weight of post-consumer and post-industrial recycled content for products having recycled content; include statement indicating costs for each product having recycled content.
  - 2. LEED credit MR 5.1 & 5.2 –Local Regional Materials: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional..

## **1.8 PRODUCT DELIVERY, STORAGE AND HANDLING**

- A. Tag or package each item identified to hardware schedule.
- B. Include installation instructions.
- C. Deliver hardware items at times and to locations as directed.
- D. Check hardware against schedule, reorder missing items.
- E. Control items before and after installation so completion will not be delayed by hardware losses.
- F. Protect finishes by temporary coverings as required.
- G. Deliver extra hardware to BNL, boxed and identified.
- H. Deliver master and sub master keys to BNL, boxed and identified.

## **1.9 WARRANTY**

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fails in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Structural failures including excessive deflection, cracking or breakage.
    - b. Faulty operation of operators and door hardware.
    - c. Deterioration of metals, metal finishes, and others beyond normal weathering and use.
  - 2. Warranty Period: Three years from date of Substantial Completion, except as follows:
    - a. Electrified exit devices: 12 months from the date of placing the product in operation.
    - b. Manual Closers: 10 years from date of placing the product in operation.

## **1.10 PRE-INSTALLATION CONFERENCE**

- A. Prior to installation of hardware, Contractor shall conduct an on-site meeting to instruct hardware installer personnel in the proper installation of hardware and related electronics.
  - 1. Manufacturer's Representatives for Locksets, Closers, Exit Devices and other major hardware devices shall be present and direct instruction of installers.
  - 2. Require attendance of affected parties, not limited to: Contractor, Hardware installer, Electrical installer, door and frame installers, and security system installer (where applicable).
  - 3. Discuss installation sequence of components, Point-to-Point wiring diagrams, and address questions raised by installers.

## **1.11 JOB CONDITIONS**

- A. Coordinate installation with finishing operations.
- B. Where exact types of hardware specified are not adaptable to finished shape or size of members requiring hardware, provide suitable types having as nearly as practical as the same operation and quality as type specified, subject to Architect's approval.

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS**

- A. Acceptable manufacturers:
  - 1. Locks, Latches, and Electric Mortise Locks:
    - a. Base:
      - 1) Best Access Systems.
    - b. Optional:
      - 1) Corbin Russwin.

- 2) Sargent.
- 2. Cylinders:
  - a. Base:
    - 1) Best Access Systems.
    - 2) No substitutions.
- 3. Door Closers:
  - a. Base:
    - 1) LCN Closers.
  - b. Optional:
    - 1) Rixson.
    - 2) Corbin Russwin.
- 4. Hinges:
  - a. Base:
    - 1) Stanley Hardware.
  - b. Optional:
    - 1) Hager Hinge.
    - 2) McKinney.
- 5. Continuous Geared Hinges:
  - a. Base:
    - 1) Markar.
  - b. Optional:
    - 1) Hager Roton.
    - 2) Select.
- 6. Access Control Devices:
  - a. Base:
    - 1) Schlage Electronic Security (Locknetics).
  - b. Optional:
    - 1) Sargent, Assa-Abloy.
- 7. Mortar Shield (a.k.a. mud box):
  - a. Base:
    - 1) Stanley Hardware.
  - b. Optional:
    - 1) Hager.
- 8. Door Stops:
  - a. Base:
    - 1) Ives.
  - b. Optional:
    - 1) Hager.
    - 2) Trimco.
- 9. Overhead Door Holders and Stops:
  - a. Base:
    - 1) Glynn-Johnson.
  - b. Optional:
    - 1) Hager.
    - 2) Corbin Russwin.
- 10. Door Pulls, Pushplates, and Pushbars:
  - a. Base:
    - 1) Rockwood.
  - b. Optional:
    - 1) Hager.
    - 2) Ives.
- 11. Kickplates, Armorplates, and Door Edging:
  - a. Base:
    - 1) Rockwood.
  - b. Optional:
    - 1) Hager.

- 2) Ives.
- 12. Flushbolts and Coordinators:
  - a. Base:
    - 1) Ives.
  - b. Optional:
    - 1) Trimco.
    - 2) Hager.
    - 3) Rockwood.
- 13. Thresholds, Head Drips, Weatherstripping, and Smoke Gaskets:
  - a. Base:
    - 1) National Guard Products.
  - b. Optional:
    - 1) Zero.
    - 2) Pemko Manufacturing.
- 14. Exit Devices:
  - a. Base:
    - 1) Von Duprin.
  - b. Optional:
    - 1) Corbin Russwin.
    - 2) Precision.
- 15. Key Cabinet:
  - a. Base:
    - 1) Lund Equipment.
  - b. Optional:
    - 1) Telkee.
- 16. Other materials:
  - a. Base: As indicated.
- 17. Other manufacturers .

## 2.2 HARDWARE – GENERAL

- A. General:
  - 1. Provide hardware for fire rated openings in compliance with UL, NFPA-80 and CFR Part 36 (ADA) guidelines.
    - a. This requirement takes precedence over other requirements for such hardware.
    - b. Provide only hardware which has been tested and listed by UL for types and sizes of doors.
  - 2. Use products and sizes appropriate for door size, material, weight and configuration in accordance with manufacturer's recommendations.
  - 3. Furnish items of hardware for proper door swing.
  - 4. Provide strikes with curved lips.
  - 5. Provide extended lips when necessary.
  - 6. Provide strike boxes.
  - 7. Tactile Warning:
    - a. Definition: Etched, milled or knurled surface treatment used on Levers to warn occupants, especially vision impaired occupants, of a potentially dangerous room or condition beyond door.
    - b. Provide on corridor-side levers of doors to loading platforms, boiler and mechanical rooms, stages, utility stairs, roof access, communications and electrical closets and similar rooms.
  - 8. Provide dustproof strikes for doors with Flushbolts or other bolts to floor.
  - 9. Plate, Shoe Support Spacer, Shoe Adapter: As required by manufacturer for mounting and operation of door holders and closers. Finish matching holder or closer.
    - a. Protection Plates (Stainless Steel): 16 gauge, beveled three sides. Finish shall be #4 (630). Fasteners; No. 6 oval head, Phillips, undercut, stainless steel, sheet metal screws. Width of plates as follows:

- b. Mop Plates:
    - 1) Single Doors: Opening width less 1 inch.
    - 2) Pair Doors: Each plate, 1 inch less than width of leaf.
  - c. Kick Plates and Armor Plates:
    - 1) Single Doors: Opening width less 2 inches.
    - 2) Pair Doors: Each plate, 1 inch less than width of leaf.
    - 3) Single Door (Stop Mounted Gaskets): Opening width less 3 inches or as required.
  - 10. Code Required Door Sign: At means of egress doors, with special locking arrangements (delayed egress), provide a sign having block letters 1 inch in height, on the door within 12 inches of the release device stating "PUSH UNTIL ALARM SOUNDS. DOOR CAN BE OPENED IN 15 SECONDS." Sign shall be on a contrasting background.
  - 11. Closers: Provide brackets and mounting plates as required to allow for proper installation with door and frame conditions and coordination with other hardware items. Provide fastener types required for proper installation.
  - 12. Exit Devices: Provide glass bead kits as necessary for proper installation on doors with glass lites or similar raised materials. Provide vertical rod guards and latch guards as required to meet handicapped requirements.
  - 13. Thresholds: At interior locations, thresholds to be full width of jambs. At exterior locations, thresholds to be full width of jambs or full depth to leading edge of adjacent horizontal surface material as required to achieve gradual transition between levels and surfaces. An abrasive, non-slip coating shall be provided for all thresholds at exterior locations. Thresholds shall be neat fitted around jambs of frames and anchored in place in an approved manner.
  - 14. Jamb Guards: Provide two for each opening where called for in hardware sets.
  - 15. Bid and submit manufacturer's updated/improved item if scheduled item is discontinued.
- B. Templates:
- 1. Provide templates to door and frame suppliers.
  - 2. List template numbers on Hardware Schedule submittal for use by fabricators.
  - 3. Provide copies of approved Hardware Schedule to related suppliers, fabricators, and installers.
  - 4. Include numbered templates.
  - 5. Advise Architect of items which will not operate properly, attain the required fire label, and where components are physically/functionally incompatible.
- C. Manufacturer's Name Plate:
- 1. Do not use products that have manufacturer's name or trade name displayed in a visible location, except in conjunction with required fire-rated labels and as otherwise acceptable to the architect.
  - 2. Manufacturer identification is permitted on the rim of lock cylinders.
- D. Fasteners:
- 1. Manufacture hardware to conform to templates.
  - 2. Generally prepare for Phillips oval head machine screw installation.
  - 3. Exposed screws to match hardware finish or, if exposed in surfaces of other work, to match finish of other work as closely as possible.
  - 4. Mineral core doors:
    - a. Attachment of hinges:
      - 1) Use screws, which are fully threaded (from tip to head).
    - b. Attachment of Closers:
      - 1) Utilize thru-bolts at mineral core doors.
  - 5. Provide concealed fasteners (unless thru bolted).
  - 6. Provide non-corrosive fasteners.

## 2.3 HARDWARE DESCRIPTIONS

- A. Cylinders:
- 1. Comply with BHMA A156.5 Grade 1.

2. Material: Brass or bronze, stainless steel, or nickel silver.
  3. Finish(es): Match lock mechanism(s) to which cylinders are installed.
  4. Cylinder Type:
    - a. Full-sized Interchangeable Cores (IC).
  5. Determine type required to suit locking mechanisms to which they will be installed. Include appropriate trim rings, cams, tail pieces, and adaptors.
  6. Patented cylinders and keys to protect against from unauthorized manufacture.
  7. Provide cylinders for all locking mechanisms scheduled.
- B. Keys:
1. Material: Nickel-silver.
  2. Stamping: Permanently inscribe each key with applicable change key room number as directed by Facilities Management and.” Do Not Duplicate.”
  3. Quantity: In addition to one extra blank key for each lock, provide the following:
    - a. Cylinder Change Keys: 3.
    - b. Master Keys: Existing, quantity as directed by Facilities Management.
- C. Delivery:
1. All orders for cylinders are to be placed through Best Lock Corporation, North Salem, New York. Specify that material is for Brookhaven National Laboratory and that all packages, shipping tickets and correspondence have the following identification information clearly included on these:  
 “For installation in Bldg. \_\_\_\_, Job No. \_\_\_\_.”
  2. Upon receipt of uncombined cores, exchange same for “Contractor Cores” and keys from PE, and install “Contractor Cores” in all locks. At job completion, return all keys properly tagged to PE. PE will then remove “Contractor Cores” and replace with final cores.

## **2.4 EXTRA MATERIAL AND TOOLS**

- A. Provide extra hardware materials to BNL for maintenance purposes:
1. Types of items required:
    - a. Latchsets and Locksets: Quantity 2 each function.
    - b. Closers: Quantity 2 each type.
    - c. Exit Devices: Quantity 1 each type.
  2. Provide 1 of each function and type per 100 units; with minimum of 1 of each required.
- B. Provide 6 sets of lock tools.

## **2.5 OPERATION - KEYING**

- A. Establish keying system with BNL: A representative of the cylinder manufacture, the BNL and the building users shall work directly to formulate a keying system and delivery requirements.
- B. Key Schedule: Obtain a key schedule from the BNL. After reviewing the key schedule with the vendor, submit a project key schedule along with key bitting to the Facilities Management for approval.
- C. Lock cylinders and keys shall be furnished by the hardware vendor and cylinders installed by the General Contractor. Deliver all permanent keys to the BNL.
- D. Provide and set up complete visible card indexed system with key tags and control slips.
- E. Tag and identify keys and install in key cabinet.
- F. Construction Keying:
1. Provide cylinders with feature that permits voiding of construction keys without cylinder removal.
    - a. Provide 10 construction master keys.
  2. Provide construction keying for exterior doors and primary entrances to construction areas.

## **2.6 KEY CABINET**

- A. Sheet steel construction, piano hinged door with cylinder type lock master keyed to building system.
- B. Size cabinet for 1.75 times number of door locks.
- C. Horizontal metal strips for key hook labeling with plastic strip cover over paper labels.
- D. Dual Tag System: One set for permanent attachment of file key. One set with snaphook holding at least four keys.
- E. Alphabetical indexing of lock information.
- F. Arrange keys alphabetically and numerically.
- G. Finish: Baked enamel, color as selected from manufacturer's standards.

## **PART 3 - EXECUTION**

### **3.1 INSPECTION**

- A. Verify suitability of substrate to accept installation.
- B. Verify that power supply is available to electrically operated devices.
- C. Installation constitutes responsibility for performance.

### **3.2 INSTALLATION**

- A. Install in accordance with manufacturer's installation instructions, supervised or inspected by an AHC.
- B. Fit hardware before final door finishing.
- C. Permanently install hardware after finishing operations are complete.
- D. Mounting Heights: Mount hardware at heights indicated in DHI "Recommended Locations for Builders Hardware Custom Steel Doors and Frames", unless shown or specified otherwise, or to comply with requirements of governing regulations or ADA.

| Mounting Heights of Hardware |  |
|------------------------------|--|
| Item                         | Height 1,2<br>(to Item Centerline)   |
| Mortise Locksets             | 1024mm 40-5/16 IN AFF to Centerline of Strike 3                                      |
| Cylindrical Locksets         |  |
| Exit Devices                 |  |
| Door Pulls                   | 1067mm 42 IN AFF to Centerline of Pull   |
| Pushplates                   | 1143mm 45 IN AFF to Centerline of Plate  |
| Auxiliary Deadbolts          | 1219mm 48 IN AFF to Centerline of Strike   |
| Butt Hinges (and Pivots)     | Top Hinge: Not more than 298mm 11-3/4 IN down from frame                             |
|                              | Bottom Hinge: Not more than 330mm 13 IN above floor                                  |
|                              | Equally spaced between Top and Bottom Hinges. Refer to Part 2 for quantity required. |
| Other Items                  | Comply with SDI and DHI Recommendations  |

Footnotes/Additional Requirements:

1. Mounting Heights shall also comply with ADA and ICC/ANSI 117.1
2. Mounting Heights shall also comply with prevailing Building Code and Fire Codes.
3. Deviation of from listed height will be allowed up to + 38mm 1-1/2 IN provided this does not cause a conflict of between the lock and lite cutouts.

- E. Install hardware with fasteners concealed where not required by code to be exposed.
- F. Follow ANSI A205.6 for drilling and tapping procedures. Securely fasten parts and fit faces snug and flush. Use only fasteners furnished with each device. Ensure operating parts move freely and smoothly without binding or excessive clearance. Where through bolting is required or recommended, use spacers or sex bolts.
- G. When hardware is to be installed on surfaces to be field finished, install hardware only after finishes are completely dry.
- H. When field cutting or fitting is required on surfaces to be field finished, cut, fit, and install hardware, and then remove prior to finishing. Reinstall only after finishes are completely dry.
- I. At exterior doors and elsewhere as indicated, set thresholds in a bed of sealant, and neatly caulk around perimeter to prevent water from entering under threshold. Use sealant as specified in Section 07 92 13. Do not block weep holes. Follow ANSI/BHMA A156.21 for threshold installation requirements. Use stainless steel fasteners at exterior thresholds.
- J. Install key cabinet where directed. Provide anchors designed for mounting surface encountered.
- K. Coordinate installation of electric access control hardware.
  1. Hardware installer to be responsible for coordination with electrical installer for low voltage installations.
- L. Door Position Switches (DPS):
  1. Coordinate door and frame preparations with door and frame suppliers, and Security System installer as appropriate.

2. Locate in frame head approximately 100mm 4 IN from latching door edge, unless otherwise instructed.

### 3.3 ADJUST AND CLEAN

- A. Adjust and check each operating item of hardware to ensure proper operation or function.
  1. Lubricate moving parts with lubricant recommended by manufacturer.
  2. Replace units which cannot be adjusted and lubricated to operate smoothly.
  3. Conversion of Construction Keying to Permanent (by BNL):
    - a. Demonstrate conversion method to BNL's facility personnel, making certain BNL's team understands methodology required to convert cylinders from "construction" to "permanent" configuration.
    - b. Ensure that BNL has proper instruction and all necessary tools needed to convert keying to final configuration.
- B. Approximately six months after substantial completion, check and readjust to assure proper function of doors and hardware.
  1. Clean and lubricate operational items.
  2. Replace items which have deteriorated or failed.
  3. Prepare a written report of current and predictable problems in operation of hardware.
  4. Report visit and furnish copy of report to BNL with copy to Architect.
- C. When hardware is installed more than one month prior to final acceptance or occupancy, during week prior to acceptance or occupancy, make a final check and adjustment of hardware items.
  1. Clean and lubricate as necessary to assure proper function and finish.
  2. Adjust door control devices to compensate for operation of heating and ventilating equipment.
- D. Instruct BNL's personnel:
  1. Operating and maintenance procedures.
  2. Key control system.
  3. Methodology used to re-key cylinders from "construction" to "permanent" configuration.
- E. Prior to substantial completion instruct BNL's personnel in systems operation.
  1. Standard system operation and maintenance.
  2. Modification of codes.
  3. Acquisition, monitoring and scheduling of ID cards.
  4. Instruction in software applications.

### 3.4 HARDWARE SETS:

#### HDW 01

|   |                |
|---|----------------|
| 2 ea Continuous Hinges FM-300 x CTP x 32D                           | Markar         |
| 2 ea Electric Power Transfers EPT-10 x SP28                         | Von Duprin     |
| 1 ea Electric Exit Device RX EL3547A-NL-OP x 26D                    | Von Duprin     |
| 1 ea Electric Exit Device RX EL3547A-EO x 26D                       | Von Duprin     |
| 1 ea Rim Cylinder x 26D   | Best           |
| 1 ea Power Supply PS873K-2 AO                                       | Von Duprin     |
| 2 ea Pulls BF157 x 32D  | Rockwood       |
| 1 ea Automatic Door Operator 9550 x 689, push side                  | LCN            |
| 1 ea Jamb Mounted Actuator 8310-818T x 32D, interior                | LCN            |
| 1 ea Pedestal Mounted Actuator 8310-853T x 32D, exterior            | LCN            |
| 1 ea Threshold 425E x SIA, provide width to coordinate with opening | National Guard |
| 2 ea Door Position Switches 1078C                                   | GE/Sentrol     |

Note: All weatherstrip and other hardware by aluminum door supplier.

HDW 02

|   |                |
|---|----------------|
| 2 ea Continuous Hinges FM-300 x CTP x 32D                           | Markar         |
| 2 ea Electric Power Transfers EPT-10 x SP28                         | Von Duprin     |
| 2 ea Electric Exit Device RX E3547A-L (NL) x 03 x 26D               | Von Duprin     |
| 2 ea Mortise Cylinder x 26D   | Best           |
| 2 ea Closer 4111 x 689, top jamb                                    | LCN            |
| 2 ea Overhead Stop 90S x 32D  | Glynn Johnson  |
| 1 ea Threshold 425E x SIA, provide width to coordinate with opening | National Guard |
| 2 ea Door Position Switches 1078C                                   | GE/Sentrol     |

Note: Access Control. Coordinate with Security Vendor. All weatherstrip and other hardware by aluminum door supplier.

HDW 03

|   |                |
|---|----------------|
| 1 ea Continuous Hinges FM-300 x CTP x 32D                       | Markar         |
| 1 ea Continuous Hinges FM-300 x 32D                             | Markar         |
| 1 ea Electric Power Transfer EPT-10 x SP28                      | Von Duprin     |
| 1 ea Electric Lockset 45HW7DEU 3J x 630 x RQE, request to exit  | Best           |
| 1 ea Closer 4111 x 689, top jamb, active leaf                   | LCN            |
| 1 ea Closer 4130 x ST2309 x 689, top jamb, inactive leaf        | LCN            |
| 1 ea Overhead Stop 90S x 32D, active leaf                       | Glynn Johnson  |
| 1 set Constant Latch Flush Bolts FB51P x 32D                    | Ives           |
| 1 ea Dust Proof Strike DPI x 26D                                | Ives           |
| 1 ea Coordinator COR x FL x US28, furnish brackets as needed    | Ives           |
| 2 ea Armor Plates 34 inch x 32D                                 | Rockwood       |
| 1 ea Threshold 425E Alum, furnish width as required for opening | National Guard |
| 1 set Gasketing 700EN, head & jamb                              | National Guard |
| 2 ea Automatic Door Bottoms 229SSS x end caps                   | National Guard |
| 2 ea Sweeps 600A  | National Guard |
| 1 ea Astragal 148N  | National Guard |
| 2 ea Door Position Switches 1078C                               | GE/Sentrol     |

Note: Access Control. Coordinate with Security Vendor.

HDW 04

|   |                |
|---|----------------|
| 2 ea Continuous Hinges FM-300 x 32D                                 | Markar         |
| 2 ea Exit Device 9847EO x 26D                                       | Von Duprin     |
| 2 ea Closer 4111 CUSH x 689   | LCN            |
| 2 ea Armor Plates 34 inch x 32D                                     | Rockwood       |
| 1 ea Threshold 425E x SIA, provide width to coordinate with opening | National Guard |
| 1 set Gasketing 700EN, head & jamb                                  | National Guard |
| 2 ea Automatic Door Bottoms 229SSS x end caps                       | National Guard |
| 2 ea Sweeps 600A  | National Guard |
| 1 set Astragals 115NA   | National Guard |
| 2 ea Door Position Switches 1078C                                   | GE/Sentrol     |

HDW 05

|   |                |
|---|----------------|
| 1 ea Continuous Hinge FM-300 x 32D                                  | Markar         |
| 1 ea Exit Device 98EO x 26D   | Von Duprin     |
| 1 ea Closer 4111 CUSH x 689   | LCN            |
| 1 ea Armor Plate 34 inch x 32D                                      | Rockwood       |
| 1 ea Threshold 425E x SIA, provide width to coordinate with opening | National Guard |
| 1 set Gasketing 700EN, head & jamb                                  | National Guard |
| 1 ea Automatic Door Bottom 229SSS x end caps                        | National Guard |
| 1 ea Sweep 600A   | National Guard |
| 1 ea Door Position Switch 1078C                                     | GE/Sentrol     |

HDW 05A

|  |                |
|--|----------------|
| 1 ea Continuous Hinge FM-300 x 32D               | Markar         |
| 1 ea Exit Device 98EO x 26D                      | Von Duprin     |
| 1 ea Closer 4111 x 689, top jamb push side mount | LCN            |
| 1 ea Kick Plate 8 inch x 32D                     | Rockwood       |
| 1 ea Threshold 950S x SIA                        | National Guard |
| 1 set Gasketing 107SA, head & jamb               | National Guard |
| 1 ea Automatic Door Bottom 229SSS x end caps     | National Guard |
| 1 ea Door Position Switch 1078C                  | GE/Sentrol     |

HDW 06

|   |                |
|---|----------------|
| 1 ea Continuous Hinge FM-300 x CTP x 32D                            | Markar         |
| 1 ea Electric Power Transfers EPT-10 x SP28                         | Von Duprin     |
| 1 ea Electric Exit Device RX E98L (NL) x 03 x 26D                   | Von Duprin     |
| 1 ea Mortise Cylinder x 26D   | Best           |
| 1 ea Closer 4111 x 689, top jamb                                    | LCN            |
| 1 ea Overhead Stop 90S x 32D  | Glynn Johnson  |
| 1 ea Threshold 425E x SIA, provide width to coordinate with opening | National Guard |
| 1 set Gasketing 700EN, head & jamb                                  | National Guard |
| 1 ea Automatic Door Bottom 229SSS x end caps                        | National Guard |
| 1 ea Sweep 600A   | National Guard |
| 1 ea Door Position Switch 1078C                                     | GE/Sentrol     |

Note: Access Control. Coordinate with Security Vendor.

HDW 07

|   |                |
|---|----------------|
| 1 ea Continuous Hinge FM-300 x 32D                                  | Markar         |
| 1 ea Exit Device 35EO x 26D   | Von Duprin     |
| 1 ea Closer 4111 x 689, top jamb                                    | LCN            |
| 1 ea Overhead Stop 90S x 32D  | Glynn Johnson  |
| 1 ea Threshold 425E x SIA, provide width to coordinate with opening | National Guard |
| 1 ea Door Position Switch 1078C                                     | GE/Sentrol     |

Note: All weatherstrip and other hardware by aluminum door supplier.

#### HDW 08

|   |                |
|---|----------------|
| 1 ea Continuous Hinge FM-300 x 32D                              | Markar         |
| 1 ea Storeroom Lockset 45H7D 3J x 630                           | Best           |
| 1 ea Closer 4111 x 689, top jamb                                | LCN            |
| 1 ea Overhead Stop 90S x 32D, active leaf                       | Glynn Johnson  |
| 1 ea Threshold 425E Alum, furnish width as required for opening | National Guard |
| 1 set Gasketing 700EN, head & jamb                              | National Guard |
| 1 ea Automatic Door Bottom 229SSS x end caps                    | National Guard |
| 1 ea Sweep 600A   | National Guard |
| 1 ea Door Position Switch 1078C                                 | GE/Sentrol     |

#### HDW 09

|  |                |
|--|----------------|
| 1 ea Continuous Hinge FM-300 x 32D                                 | Markar         |
| 1 ea Deadbolt MS1850S x 628, backset to center on lock stile       | Adams Rite     |
| 2 ea Mortise Cylinders x 26D                                       | Best           |
| 2 ea Pulls BF160 – BTB x 32D                                       | Rockwood       |
| 1 ea Closer 4041 x 689, push side mount x brackets/plate as needed | LCN            |
| 1 ea Overhead Stop 100S x 32D                                      | Glynn Johnson  |
| 1 ea Threshold 425E x Alum   | National Guard |
| 1 ea Door Position Switch 1078CH                                   | GE/Sentrol     |

Note: All weatherstrip and other hardware by aluminum door supplier.

#### HDW 10

|   |                |
|---|----------------|
| 2 ea Continuous Hinges FM-300 x CTP x 32D                           | Markar         |
| 2 ea Electric Power Transfers EPT-10 x SP28                         | Von Duprin     |
| 1 ea Electric Exit Device RX EL3547A-NL-OP x 26D                    | Von Duprin     |
| 1 ea Electric Exit Device RX EL3547A-EO x 26D                       | Von Duprin     |
| 1 ea Rim Cylinder x 26D   | Corbin Russwin |
| 1 ea Power Supply PS873K-2 AO                                       | Von Duprin     |
| 2 ea Pulls BF157 x 32D  | Rockwood       |
| 1 ea Automatic Door Operator 9550 x 689, push side                  | LCN            |
| 1 ea Jamb Mounted Actuator 8310-818 x 32D, interior                 | LCN            |
| 1 ea Pedestal Mounted Actuator 8310-853T x 32D, exterior            | LCN            |
| 1 ea Threshold 425E x SIA, provide width to coordinate with opening | National Guard |
| 2 ea Door Position Switches 1078C                                   | GE/Sentrol     |

Note: Access Control. Coordinate with Security Vendor. All weatherstrip and other hardware by aluminum door supplier.

#### HDW 11

|  |            |
|--|------------|
| 6 ea Hinges CB168 5 x 4.5 x 26D NRP (8ea. At 8'-0" doors, 10 ea. at 9'-6") | Stanley    |
| 1 ea Electric Power Transfer EPT-10 x SP28                                 | Von Duprin |
| 1 ea Electric Lockset 45HW7DEU 3J x 630 x RQE, request to exit             | Best       |
| 1 ea Closer 4041 x 689, active leaf, parallel arm mount                    | LCN        |
| 1 ea Closer 4041 x ST2338 x 689, inactive leaf, parallel arm mount         | LCN        |
| 1 set Automatic Flush Bolts FB41P x 32D                                    | Ives       |
| 1 ea Dust Proof Strike DP2 x 26D   | Ives       |
| 1 ea Coordinator COR x FL x US28, furnish brackets as needed               | Ives       |
| 2 ea Kick Plates 16 inch x 32D   | Rockwood   |
| 2 ea Silencers SR64  | Ives       |
| 2 ea Door Position Switches 1078C  | GE/Sentrol |

Note: Access Control. Coordinate with Security Vendor.

#### HDW 12

|  |            |
|--|------------|
| 6 ea Hinges CB168 4.5 x 4.5 x 26D                              | Stanley    |
| 1 ea Electric Power Transfer EPT-10 x SP28, active leaf        | Von Duprin |
| 1 ea Electric Lockset 45HW7DEU 3J x 630 x RQE, request to exit | Best       |
| 2 ea Closer 4041 x 689, parallel arm, active leaf              | LCN        |
| 1 ea Wall Stop WS407 x 32D, inactive leaf                      | Ives       |
| 1 set Constant Latch Flush Bolts FB61P x 32D, inactive leaf    | Ives       |
| 1 ea Dust Proof Strike DP2 x 26D                               | Ives       |
| 1 ea Coordinator COR x FL x US28, furnish brackets as needed   | Ives       |
| 2 ea Kick Plates 16 inch x 32D                                 | Ives       |
| 2 ea Silencers SR64  | Ives       |
| 2 ea Door Position Switch 1078C                                | GE/Sentrol |

Note: Access Control. Coordinate with Security Vendor.

#### HDW 13

|  |                |
|--|----------------|
| 6 ea Hinges CB168 4.5 x 4.5 x 26D NRP (8ea. at 8'-0" doors)    | Stanley        |
| 1 ea Electric Power Transfer EPT-10 x SP28                     | Von Duprin     |
| 1 ea Electric Lockset 45HW7DEU 3J x 630 x RQE, request to exit | Best           |
| 2 ea Closer 4041 x 689, parallel arm mount                     | LCN            |
| 1 set Automatic Flush Bolts FB41P x 32D                        | Ives           |
| 1 ea Dust Proof Strike DP2 x 26D                               | Ives           |
| 1 ea Coordinator COR x FL x US28, furnish brackets as needed   | Ives           |
| 2 ea Armor Plates 32 inch x 32D                                | Rockwood       |
| 1 set Gasketting 700ES, head and jambs                         | National Guard |
| 1 set Astragals 137SA  | National Guard |
| 2 ea Automatic Door Bottoms 229SSS x end caps                  | National Guard |
| 2 ea Door Position Switches 1078C                              | GE/Sentrol     |

Note: Access Control. Coordinate with Security Vendor.

HDW 13A

|   |                |
|---|----------------|
| 6 ea Hinges CB168 4.5 x 4.5 x 26D NRP         | Stanley        |
| 2 ea Electric Power Transfer EPT-10 x SP28    | Von Duprin     |
| 2 ea Electric Exit Device RX-E9847L-F x 626   | Von Duprin     |
| 2 ea Closer 4041 x 689, parallel arm mount    | LCN            |
| 2 ea Armor Plates 32 inch x 32D               | Rockwood       |
| 1 set Gasketting 700ES, head and jambs        | National Guard |
| 1 set Astragals 137SA                         | National Guard |
| 2 ea Automatic Door Bottoms 229SSS x end caps | National Guard |
| 2 ea Door Position Switches 1078C             | GE/Sentrol     |

Note: Access Control. Coordinate with Security Vendor.

HDW 14

|  |                |
|--|----------------|
| 8 ea Hinges CB168 4.5 x 4.5 x 26D NRP                          | Stanley        |
| 1 ea Electric Power Transfer EPT-10 x SP28                     | Von Duprin     |
| 1 ea Electric Lockset 45HW7DEU 3J x 630 x RQE, request to exit | Best           |
| 2 ea Closer 4041 x 689, parallel arm mount                     | LCN            |
| 1 set Automatic Flush Bolts FB41P x 32D                        | Ives           |
| 1 ea Dust Proof Strike DP2 x 26D                               | Ives           |
| 1 ea Coordinator COR x FL x US28, furnish brackets as needed   | Ives           |
| 2 ea Kick Plates 8 inch x 32D                                  | Rockwood       |
| 1 set Gasketting 700ES, head and jambs                         | National Guard |
| 1 set Astragals 137SA  | National Guard |
| 2 ea Automatic Door Bottoms 229SSS x end caps                  | National Guard |
| 2 ea Door Position Switches 1078C                              | GE/Sentrol     |

Note: Access Control. Coordinate with Security Vendor.

HDW 15

|   |                |
|---|----------------|
| 2 ea Continuous Hinges FM-300 x 32D                     | Markar         |
| 2 ea Push Plates 70C x 32D                              | Rockwood       |
| 2 ea Pull Plates BF107 x 70C x 32D                      | Rockwood       |
| 2 ea Closer 4041-Spring CUSH x DEL x 689, 90Degree Stop | LCN            |
| 2 ea Armor Plates 34 inch x 32D                         | Rockwood       |
| 2 ea Mop Plates 6 inch x 32D                            | Rockwood       |
| 1 set Gasketting 700ES, head & jamb                     | National Guard |
| 2 ea Automatic Door Bottoms 229WHSS x end caps          | National Guard |
| 1 set Astragals 9600A                                   | National Guard |

HDW 16

|  |          |
|--|----------|
| 8 ea Hinges CB168 .5 x 4.5 x 26D               | Stanley  |
| 1 ea Classroom Lockset 45HW7R 3J x 630         | Best     |
| 1 ea Closer 4011 x 689, active leaf, pull side | LCN      |
| 1 set Manual Flush Bolts FB458 x 26D           | Ives     |
| 1 ea Dust Proof Strike DP2 x 26D               | Ives     |
| 2 ea Kick Plates 8 inch x 32D                  | Rockwood |
| 2 ea Silencers SR64                            | Ives     |

#### HDW 17

|  |                |
|--|----------------|
| 8 ea Hinges CB168 4.5 x 4.5 x 26D  | Stanley        |
| 2 ea Exit Device 9847WDC-EO-BE-F x LBR x 26D   | Von Duprin     |
| 1 ea Electronic Closer/Holder 4410ME x 689, top jamb push side   | LCN            |
| 1 ea Electronic Closer/Holder 4410ME x 689, top jamb push side x long arm<br>for 170 degree hold open where required | LCN            |
| 4 ea Kick Plates 8 inch x 32D  | Rockwood       |
| 1 set Gasketting 5050B, head & jamb  | National Guard |
| 1 set Astragals 137SA  | National Guard |

Note: Do not use overlapping astragal.

#### HDW 18

|  |                |
|--|----------------|
| 8 ea Hinges CB168 4.5 x 4.5 x 26D        | Stanley        |
| 2 ea Push Plates 70C x 32D               | Rockwood       |
| 2 ea Pull Plates BF107 x 70C x 32D       | Rockwood       |
| 2 ea Closer 4041CUSH x 689, parallel arm | LCN            |
| 2 ea Kick Plates 8 inch x 32D            | Rockwood       |
| 1 set Gasketting 5050B, head & jamb      | National Guard |
| 1 set Astragals 137SA                    | National Guard |

#### HDW 19

|   |                |
|---|----------------|
| 2 ea Continuous Hinges FM-300 x CTP x 32D               | Markar         |
| 2 ea Electric Power Transfer EPT-10 x SP28              | Von Duprin     |
| 2 ea Electric Exit Device RX-EL9847L-F x LBR x 03 x 26D | Von Duprin     |
| 2 ea Rim Cylinder x 26D                                 | Schlage        |
| 1 Power Supply PS873-2                                  | Von Duprin     |
| 2 ea Closer 4041 x 689, push side                       | LCN            |
| 2 ea Overhead Stop 90S x 32D                            | Glynn Johnson  |
| 2 ea Armor Plates 34 inch x 32D                         | Rockwood       |
| 1 set Gasketting 5050B, head & jamb                     | National Guard |
| 2 ea Sweeps 600A  | National Guard |
| 1 set Astragals 137SA                                   | National Guard |
| 2 ea Door Position Switches 1078C                       | GE/Sentrol     |

Note: Access Control. Coordinate with Security Vendor.

#### HDW 20

|   |                |
|---|----------------|
| 2 ea Continuous Hinges FM-300 x CTP x 32D             | Markar         |
| 2 ea Electric Power Transfer EPT-10 x SP28            | Von Duprin     |
| 2 ea Electric Exit Device RX-EL9847L x LBR x 03 x 26D | Von Duprin     |
| 2 ea Rim Cylinder x 26D                               | Schlage        |
| 1 Power Supply PS873-2                                | Von Duprin     |
| 2 ea Closer 4041 x 689, push side                     | LCN            |
| 2 ea Overhead Stop 90S x 32D                          | Glynn Johnson  |
| 2 ea Armor Plates 34 inch x 32D                       | Rockwood       |
| 1 set Gasketting 5050B, head & jamb                   | National Guard |
| 2 ea Sweeps 600A                                      | National Guard |
| 1 set Astragals 137SA                                 | National Guard |
| 2 ea Door Position Switches 1078C                     | GE/Sentrol     |

Note: Access Control. Coordinate with Security Vendor.

HDW 21

|  |                |
|--|----------------|
| 8 ea Hinges CB168 4.5 x 4.5 x 26D                | Stanley        |
| 2 ea Exit Device 9847WDC-L-BE-F x LBR x 03 x 26D | Von Duprin     |
| 2 ea Closer 4041 x 689, push side mount          | LCN            |
| 2 ea Wall Stop WS407 x 32D                       | Ives           |
| 2 ea Kick Plates 8 inch x 32D                    | Rockwood       |
| 1 set Gasketing 700EN, head & jamb               | National Guard |
| 2 ea Automatic Door Bottoms 229SSS x end caps    | National Guard |
| 1 set Astragals 9115A                            | National Guard |

Note: Do not use overlapping astragal.

HDW 22

|  |                |
|--|----------------|
| 8 ea Hinges CB168 4.5 x 4.5 x 26D NRP                          | Stanley        |
| 1 ea Electric Power Transfer EPT-10 x SP28                     | Von Duprin     |
| 1 ea Electric Lockset 45HW7DEU 3J x 630 x RQE, request to exit | Best           |
| 2 ea Closer 4041 x 689, parallel arm mount                     | LCN            |
| 1 set Automatic Flush Bolts FB41P x 32D                        | Ives           |
| 1 ea Dust Proof Strike DP2 x 26D                               | Ives           |
| 1 ea Coordinator COR x FL x US28, furnish brackets as needed   | Ives           |
| 2 ea Kick Plates 16 inch x 32D                                 | Rockwood       |
| 1 set Gasketing 700EN, head & jamb                             | National Guard |
| 2 ea Automatic Door Bottoms 229SSS x end caps                  | National Guard |
| 1 ea Astragal 148N   | National Guard |
| 2 ea Door Position Switch 1078C                                | GE/Sentrol     |

Note: Access Control. Coordinate with Security Vendor.

HDW 23

|   |                |
|---|----------------|
| 8 ea Hinges CB168 4.5 x 4.5 x 26D (6 ea at 7'0" door) | Stanley        |
| 2 ea Exit Device 9847EO-F x LBR x 26D                 | Von Duprin     |
| 2 ea Closer 4041 x 689, push side mount               | LCN            |
| 1 ea Wall Stop WS407 x 32D                            | Ives           |
| 4 ea Kick Plates 8 inch x 32D                         | Rockwood       |
| 1 set Gasketing 5050, head & jamb                     | National Guard |
| 1 set Astragals 115A                                  | National Guard |

HDW 24

|                                    |                |
|------------------------------------|----------------|
| 4 ea Hinges CB179 4.5 x 4.5 x 26D  | Stanley        |
| 1 ea Office Lockset 45H7A 3J x 630 | Best           |
| 1 ea Wall Stop WS407 x 32D         | Ives           |
| 1 ea Coat Hook 946P x 26D          | Hager          |
| 1 set Gasketing 5050B, head & jamb | National Guard |

HDW 25

|  |                |
|--|----------------|
| 3 ea Hinges CB179 4.5 x 4.5 x 26D (4 ea at 8'-0" doors)                | Stanley        |
| 1 ea Electric Power Transfer EPT-10 x SP28                             | Von Duprin     |
| 1 ea Electric Lockset 45HW7DEU 3J x 630 x RQE, request to exit         | Best           |
| 1 ea Closer 4041 x 689, parallel arm (180 degree where shown on dwgs.) | LCN            |
| 1 ea Kick Plate 8 inch x 32D   | Rockwood       |
| 1 set Gasketing 5050B, head & jamb                                     | National Guard |
| 1 ea Door Position Switch 1078C  | GE/Sentrol     |

Note: Access Control. Coordinate with Security Vendor.

HDW 26

|  |                |
|--|----------------|
| 3 ea Hinges CB168 5 x 4.5 x 26D (4 ea at 8'-0" door) (4.5 x 4.5 at 3'-0" door) | Stanley        |
| 1 ea Electric Power Transfer EPT-10 x SP28                                     | Von Duprin     |
| 1 ea Electric Lockset 45HW7DEU 3J x 630 x RQE, request to exit                 | Best           |
| 1 ea Closer 4041 x 689, parallel arm (180 degree where shown on dwgs.)         | LCN            |
| 1 ea Kick Plate 16 inch x 32D  | Rockwood       |
| 1 set Gasketing 5050B, head & jamb   | National Guard |
| 1 ea Door Position Switch 1078C  | GE/Sentrol     |

Note: Access Control. Coordinate with Security Vendor.

HDW 27

|  |                |
|--|----------------|
| 3 ea Hinges CB168 4.5 x 4.5 x 26D (4 ea at 8'-0" doors)        | Stanley        |
| 1 ea Electric Power Transfer EPT-10 x SP28                     | Von Duprin     |
| 1 ea Electric Lockset 45HW7DEU 3J x 630 x RQE, request to exit | Best           |
| 1 ea Closer 4041 x 689, pull side                              | LCN            |
| 1 ea Wall Stop WS407 x 32D                                     | Ives           |
| 1 ea Kick Plate 8 inch x 32D                                   | Rockwood       |
| 1 set Gasketing 5050B, head & jamb                             | National Guard |
| 1 ea Door Position Switch 1078C                                | GE/Sentrol     |

Note: Access Control. Coordinate with Security Vendor.

HDW 28

|  |                |
|--|----------------|
| 3 ea Hinges CB168 5 x 4.5 x 26D          | Stanley        |
| 1 ea Exit Device 98L-BE x 26D            | Von Duprin     |
| 1 ea Closer 4041 x 689, push side        | LCN            |
| 1 ea Wall Stop WS407 x 32D, where needed | Ives           |
| 1 ea Kick Plate 8 inch x 32D             | Rockwood       |
| 1 set Gasketing 5050B, head & jamb       | National Guard |

HDW 29

|  |          |
|--|----------|
| 3 ea Hinges CB179 4.5 x 4.5 x 26D        | Stanley  |
| 1 ea Privacy Latchset 45H0L x 3J x 630   | Best     |
| 1 ea Closer 4041 x 689, pull side mount  | LCN      |
| 1 ea Wall Stop WS407 x 32D, where needed | Ives     |
| 1 ea Kick Plate 8 inch x 32D             | Rockwood |
| 1 ea Mop Plate 6 inch x 32D              | Rockwood |
| 3 ea Silencers SR64                      | Ives     |

HDW 30

|   |                |
|---|----------------|
| 3 ea Hinges CB168 5 x 4.5 x 26D (4.5 x 4.5 at 3'-0" door) | Stanley        |
| 1 ea Exit Device 98L-F-BE x 26D                           | Von Duprin     |
| 1 ea Closer 4041 x 689, pull side                         | LCN            |
| 1 ea Wall Stop WS407 x 32D                                | Ives           |
| 1 ea Kick Plate 8 inch x 32D                              | Rockwood       |
| 1 set Gasketing 5050B, head & jamb                        | National Guard |

HDW 31

|   |               |
|---|---------------|
| 4 ea Hinges CB179 5 x 4.5 x 26D (4.5 x 4.5 at 3'-0" door) | Stanley       |
| 1 ea Classroom Lockset 45H7R 3J x 630                     | Best          |
| 1 ea Overhead Stop 450S x 32D                             | Glynn Johnson |
| 1 ea Kick Plate 8 inch x 32D                              | Rockwood      |
| 3 ea Silencers SR64                                       | Ives          |

HDW 32

|   |          |
|---|----------|
| 3 ea Hinges CB168 4.5 x 4.5 x 26D                                 | Stanley  |
| 1 ea Passage Latchset 45H0N x 3J x 630                            | Best     |
| 1 ea Closer 4041 x 689, pull side (parallel arm at outswing door) | LCN      |
| 1 ea Wall Stop WS407 x 32D, where needed                          | Ives     |
| 1 ea Kick Plate 8 inch x 32D                                      | Rockwood |
| 1 ea Mop Plate 6 inch x 32D (at inswing door only)                | Rockwood |
| 3 ea Silencers SR64   | Ives     |

HDW 33

|   |               |
|---|---------------|
| 4 ea Hinges CB179 5 x 4.5 x 26D (4.5 x 4.5 at 3'-0" door) | Stanley       |
| 1 ea Classroom Lockset 45H7R 3J x 630                     | Best          |
| 1 ea Closer 4041 x 689, pull side                         | LCN           |
| 1 ea Overhead Stop 450S x 32D                             | Glynn Johnson |
| 1 ea Kick Plate 8 inch x 32D                              | Rockwood      |
| 3 ea Silencers SR64                                       | Ives          |

HDW 34

|                                       |               |
|---------------------------------------|---------------|
| 4 ea Hinges CB179 4.5 x 4.5 x 26D     | Stanley       |
| 1 ea Storeroom Lockset 45H7D 3J x 630 | Best          |
| 1 ea Closer 4041 x 689, pull side     | LCN           |
| 1 ea Overhead Stop 450S x 32D         | Glynn Johnson |
| 1 ea Kick Plate 8 inch x 32D          | Rockwood      |
| 3 ea Silencers SR64                   | Ives          |

HDW 35

|  |          |
|--|----------|
| 4 ea Hinges CB179 4.5 x 4.5 x 26D        | Stanley  |
| 1 ea Storeroom Lockset 45H7D 3J x 630    | Best     |
| 1 ea Closer 4041 x 689, parallel arm     | LCN      |
| 1 ea Wall Stop WS407 x 32D, where needed | Ives     |
| 1 ea Kick Plate 8 inch x 32D             | Rockwood |
| 3 ea Silencers SR64                      | Ives     |

HDW 36

|  |                |
|--|----------------|
| 3 ea Hinges CB168 5 x 4.5 x 26D                            | Stanley        |
| 1 ea Electric Power Transfer EPT-10 x SP28                 | Von Duprin     |
| 1 ea Electric Exit Device RX-E98L-F x 26D, FSE fail secure | Von Duprin     |
| 1 ea Closer 4041CUSH x 689                                 | LCN            |
| 1 ea Wall Stop WS407 x 32D                                 | Ives           |
| 1 ea Kick Plate 8 inch x 32D                               | Rockwood       |
| 1 set Gasketing 5050B, head & jamb                         | National Guard |
| 1 ea Door Position Switch 1078C                            | GE/Sentrol     |

Note: Access Control. Coordinate with Security Vendor.

HDW 37

|                             |            |
|-----------------------------|------------|
| 1 ea Mortise Cylinder x 26D | Best       |
| 1 ea Door Position Switch   | GE/Sentrol |

Note: All other hardware by Overhead Door supplier.

HDW 38

|   |                |
|---|----------------|
| 4 ea Hinges CB179 4.5 x 4.5 x 26D                                 | Stanley        |
| 1 ea Classroom Lockset 45H7R 3J x 630                             | Best           |
| 1 ea Closer 4041 x 689, pull side (parallel arm at outswing door) | LCN            |
| 1 ea Overhead Stop 410S x 32D, concealed                          | Glynn Johnson  |
| 1 ea Kick Plate 8 inch x 32D                                      | Rockwood       |
| 2 sets Gasketing 5050B, head & jamb, mount back to back           | National Guard |
| 1 ea Automatic Door Bottom 423N, concealed                        | National Guard |

HDW 39

4 ea Hinges CB179 4.5 x 4.5 x 26D  
1 ea Storeroom Lockset 45H7D 3J x 630  
1 ea Overhead Stop 450S x 32D  
1 ea Kick Plate 8 inch x 32D  
1 ea Mop Plate 6 inch x 32D  
3 ea Silencers SR64

Stanley  
Best  
Glynn Johnson  
Rockwood  
Rockwood  
Ives

HDW 40

3 ea Hinges CB179 4.5 x 4.5 x 26D NRP  
1 ea Electric Power Transfer EPT-10 x SP28  
1 ea Electric Exit Device RX-E98L-F x 26D, FS fail safe  
1 ea Closer 4041CUSH x 689  
1 ea Wall Stop WS407 x 32D  
1 ea Kick Plate 8 inch x 32D  
1 set Gasketing 5050B, head & jamb  
1 ea Door Position Switch 1078C

Stanley  
Von Duprin  
Von Duprin  
LCN  
Ives  
Rockwood  
National Guard  
GE/Sentrol

Note: Access Control. Coordinate with Security Vendor.

HDW 41

3 ea Hinges CB168 4.5 x 4.5 x 26D NRP  
1 ea Electric Power Transfer EPT-10 x SP28  
1 ea Electric Lockset 45HW7DEU 3J x 630 x RQE, request to exit  
1 ea Closer 4041 x 689, parallel arm (180 degree where shown on dwgs.)  
1 ea Armor Plates 34 inch x 32D  
1 ea Mop Plate 6 inch x 32D  
1 set Gasketing 700ES, head and jambs  
2 ea Automatic Door Bottoms 229SSS x end caps  
1 ea Door Position Switch 1078C

Stanley  
Von Duprin  
Best  
LCN  
Rockwood  
Rockwood  
National Guard  
National Guard  
GE/Sentrol

Note: Access Control. Coordinate with Security Vendor.

END OF SETS

**END OF SECTION**



**SECTION 08 81 02**  
**EXTERIOR GLASS AND GLAZING**

**PART 1 - GENERAL**

**1.1 QUALITY ASSURANCE**

- A. Glass standards:
1. Flat glass ASTM-C1036.
    - a. Float glass: Type I, Quality q3; and Class 1 unless otherwise indicated.
    - b. Figured glass: Type II, Quality q7, Form 3; and Class 1, Finish f1 and Pattern p2 unless otherwise indicated.
  2. Flat glass, heat treated (coated/uncoated) ASTM-C1048.
    - a. Heat strengthened glass: Kind HS, Type I, Quality q3; and Class 1 and Condition A unless otherwise indicated.
    - b. Tempered glass: Kind FT, Type I, Quality q3; and Class 1 and Condition A unless otherwise indicated.
  3. F.S.DD-M-00411B(1).
  4. NFPA-80 Standard for Fire Doors and Windows.
  5. Insulating Glass Units:
    - a. Insulating Glass Certification Council (IGCC), Class CBA.
    - b. ASTM-E2190: Standard Specification for Insulating Glass Unit Performance and Evaluation.
    - c. ASTM-E2188: Standard Test Method for Insulating Glass Unit Performance.
    - d. ASTM-E2189: Standard Test Method for Testing Resistance to Fogging in Insulating Glass Units.
  6. ANSI Z97.1.
  7. CPSC 16 CFR 1201.
  8. GANA Glazing Manual.
- B. Glazing standards:
1. "Glazing Manual", by the Glass Association of North America (GANA) .
  2. "Glazing Guidelines for Sealed Insulating Glass Units", by the Insulating Glass Manufacturers Alliance (IGMA).

**1.2 SUBMITTALS**

- A. Samples:
1. 12 IN x 12 IN, of each specified type of glass.
  2. Ceramic frit pattern.
- B. Contract closeout information:
1. Warranty.
- C. LEED Information:
1. LEED Credits MR 4.1 and 4.2, Recycled Content: Product data indicating percentages by weight of post-consumer and post-industrial recycled content for products having recycled content; include statement indicating costs for each product having recycled content.
  2. LEED Credits MR 5.1 and 5.2, Regional Materials: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.

### 1.3 JOB CONDITIONS

- A. Do not proceed with installation under adverse weather conditions, or when temperatures are below or above manufacturer's recommended limitations.

### 1.4 WARRANTY

- A. Written 5 year warranty signed by installer to cover weather tightness of installation including air and water integrity.
- B. Written warranty signed by manufacturer or fabricator of glass units against failure.
  - 1. Failure: Deterioration due to normal conditions, thermal failure of insulating units, or obscured vision.
    - a. Coated glass: 10 year.
    - b. Laminated glass: 5 year.
    - c. Insulating glass (vertical): 10 year.
    - d. Insulating glass (sloped): 5 year.
    - e. Reflective spandrel: 5 year.
    - f. Tempered glass: Heat soaked warranty.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Acceptable manufacturers:
  - 1. Insulating glass and insulating spandrel glass fabricators:
    - a. Base:
      - 1) Viracon.
    - b. Optional:
      - 1) Guardian.
      - 2) PPG.
  - 2. Fire-rated Glass Ceramic:
    - a. Base:
      - 1) Technical Glass Products.
    - b. Optional:
      - 1) Safti.
- B. Glass materials:
  - 1. Comply with indicated standards.
  - 2. See Glass Types Schedule for listing of types.
  - 3. Materials specified in Glass Types Schedules are minimum acceptable products.
  - 4. Single manufacturer produce individual glass types used in fabrication of insulating units.
  - 5. Manufacturer or fabricator determine if materials should be heat strengthened or fully tempered at non-hazardous locations that do not require safety glazing and provide accordingly.
  - 6. Low-E coating:
    - a. Soft-coat.
- C. Glazing compounds:
  - 1. Nonsag, nonstain type.
  - 2. Pigmented to match frame units not requiring painting.
  - 3. Compatible with adjacent surfaces.
  - 4. For use in setting glass: Neutral-cure Silicone sealant.
  - 5. Sealant tape: Butyl rubber sealant tape or ribbon having a continuous neoprene shim.
  - 6. Gaskets:
    - a. Polyvinyl chloride or neoprene.

- b. Extruded, flexible, of profile and hardness required to receive glass and provide a watertight installation.
- D. Installation setting blocks and spacers:
  - 1. Neoprene, compatible with sealants used.
  - 2. Setting blocks: 80-90 durometer.
  - 3. Spacers: 40-50 durometer.
  - 4. Compressible filler stock: Closed cell jacketed rod stock of synthetic rubber or plastic foam.
- E. Insulating glass spacers:
  - 1. Aluminum, desiccant filled.
    - a. Finish: Mill.
- F. Shims, clips, springs, angles, beads, attachment screws and other miscellaneous items: As indicated or required.

## 2.2 GLASS TYPES SCHEDULE

- A. Glass Type EX-1:
  - 1. Clear float, 6mm thick.
- B. Glass Type EX-2, Tempered:
  - 1. Clear, tempered tongless float, 6 mm thick, heat soaked.
- C. Glass Type EX-3:
  - 1. Clear, float, 6mm thick.
  - 2. Low Emissivity coating on second face.
- D. Glass Type EX-4:
  - 1. Clear, tempered float, 6 mm thick, heat soaked.
  - 2. Low Emissivity coating on second face.
- E. Glass Type EX-8, Fire-rated Glass Ceramic:
  - 1. Monolithic wireless, UL labeled for assembly indicated.
  - 2. Thickness: 5mm.
  - 3. Surface: Polished.
  - 4. Base Product: "FireLite" by Technical Glass Products.
- F. Glass Type EX-9, Fire-rated, Safety-rated Glass Ceramic:
  - 1. Laminated, wireless, UL labeled for assembly indicated.
  - 2. Impact-Safety Rated per ANSI Z93.1 and CPSC 16CFR1201.
  - 3. Thickness: 8mm, laminated.
  - 4. Surface: Polished.
  - 5. Base Product: "FireLite Plus" by Technical Glass Products.
- G. Glass Type EX-11:
  - 1. Insulating Glass: 2 sheets of 6 mm thick glass, hermetically sealed together at edges with spacers and sealant, with 1/2 IN dehydrated and argon filled air space.
  - 2. Outside glass: Type EX3.
  - 3. Inside glass: Type EX1.
- H. Glass Type EX-12, Laminated Skylight Glazing:
  - 1. Insulated Glass: 2 sheets of glass hermetically sealed together at edges with spacers and sealant, with 13 mm 1/2 IN dehydrated air space.
  - 2. Outside glass: 6 mm thick, clear heat strengthened.
  - 3. Inside glass: Two pieces of 6 mm thick, clear, heat strengthened glass laminated together.
    - a. Interlayer: 60 mil.

- I. Glass Type EX-13:
  - 1. Insulated Spandrel Glass: 2 sheets of 6 mm thick heat strengthened float glass hermetically sealed together at edges with spacers and sealant, with 13 mm 1/2 IN dehydrated and argon filled air space.
  - 2. Outside glass: EX-4.
  - 3. Inside glass: EX-1, third face with ceramic frit.
    - a. Frit pattern: 1/8 IN diameter dots spaced 1/4 IN on center.
      - 1) Color: White dots.
- J. Glass Type EX-14:
  - 1. Insulated Spandrel Glass: 2 sheets of 6 mm thick heat strengthened float glass hermetically sealed together at edges with spacers and sealant, with 13 mm 1/2 IN dehydrated and argon filled air space.
  - 2. Outside glass: EX-4.
  - 3. Inside glass: EX-2, third face with ceramic frit.
    - a. Frit pattern: 1/8 IN diameter dots spaced 1/4 IN on center.
      - 1) Color: White dots.
- K. Glass Type EX-18:
  - 1. Insulated Tempered Glass: 2 sheets of 6 mm thick tempered glass hermetically sealed together at edges with spacers and sealant, with 1/2 IN dehydrated and argon filled air space.
  - 2. Outside glass: EX-4.
  - 3. Inside glass: EX-2.
- L. Glass Type EX-19:
  - 1. Triple Paine Insulated Glass: 3 sheets of 6 mm thick glass hermetically sealed together at edges with spacers and sealant, with 1/2 IN dehydrated and argon filled air spaces.
  - 2. Outside glass: EX-3.
  - 3. Middle glass: EX-1.
  - 4. Inside glass: EX-1.
- M. Glass Type EX-21:
  - 1. Fire Rated Insulated Glass: 2 sheets of glass hermetically sealed together at edges with spacers and sealant, with 1/2 IN dehydrated and argon filled air space.
  - 2. Outside glass: EX-8.
  - 3. Inside glass: EX-2.

## **PART 3 - EXECUTION**

### **3.1 INSPECTION**

- A. Examine framing or glazing channel surfaces, backing, stop design, and conditions under which glazing is to be installed.

### **3.2 INSTALLATION**

- A. Do not install glass with edge damage.
- B. Contractor is responsible for correct glass size for each opening, within tolerances and dimensions established.
- C. Comply with recommendations of manufacturers, except where more stringent requirements are indicated.
- D. As a minimum, comply with GANA Glazing Manual and IGMA Glazing Guidelines for Sealed Insulating Glass Units.
- E. Install sealants as recommended by sealant manufacturer.

- F. Install setting blocks in adhesive or sealant.
- G. Provide spacers inside and out, of proper size and spacing, for glass size, except where gaskets are used for glazing.
- H. Minimum Bite:
  - 1. Monolithic, 1/4 IN, Glass: 3/8 IN.
  - 2. 1 IN Insulating units: 1/2 IN.
  - 3. For other sizes: Refer to Table C of AAMA's Aluminum Curtain Wall Design Manual, Volume 6, Glass & Glazing.
- I. Sealant Depth: Equal to sealant width.
- J. Prevent sealant exudation from glazing channels.
  - 1. Leave void at heel (or install filler) at jambs and head.
  - 2. Do not leave void (or install filler) at sill.
- K. Miter cut and bond gasket ends together at corners.
- L. Immediately after installation, attach crossed streamers to framing held away from glass.
- M. Do not apply anything to surfaces of glass.
- N. Install spandrel units from exterior of building.
- O. Remove and replace damaged glass.

### **3.3 CLEANING AND PROTECTION**

- A. Maintain glass reasonably clean during construction, so that it will not be damaged by corrosive action and will not contribute to deterioration of other materials.
- B. Ensure that weep system in frames is not blocked by sealant.
- C. Wash and polish glass on both faces not more than 7 days prior to final completion of work in each area.
- D. Comply with glass manufacturer's recommendations and "GANA 01-0300".

### **END OF SECTION**



**SECTION 08 81 04**  
**INTERIOR GLASS AND GLAZING**

**PART 1 - GENERAL**

**1.1 QUALITY ASSURANCE**

- A. Glass standards:
1. Flat glass ASTM-C1036:
    - a. Float glass: Type I, Quality q3; and Class 1 unless otherwise indicated.
    - b. Figured glass: Type II, Quality q7, Form 3; and Class 1, Finish f1 and Pattern p2 unless otherwise indicated.
    - c. Mirror glass and one-way vision glass: Type I, Quality q1 or q2, Class 1, and coated for purpose.
  2. Flat glass, heat treated (coated/uncoated) ASTM-C1048:
    - a. Heat strengthened glass: Kind HS, Type I, Quality q3; and Class 1 and Condition A unless otherwise indicated.
    - b. Tempered glass: Kind FT, Type I, Quality q3; and Class 1 and Condition A unless otherwise indicated.
  3. Mirror Glass: ASTM-C1503:
    - a. Grade: Mirror cut size.
    - b. Quality: Mirror select.
    - c. Color: Clear.
    - d. Thickness: 1/4 IN.
    - e. Length and width: As indicated on drawings.
  4. F.S.DD-M-00411B(1).
  5. NFPA-80 Standard for Fire Doors and Windows.
  6. ANSI Z97.1.
  7. CPSC 16 CFR 1201.
  8. GANA Glazing Manual.
- B. Glazing standards:
1. "Glazing Manual", by the Glass Association of North America (GANA) .

**1.2 SUBMITTALS**

- A. Samples:
1. 12 IN x 12 IN, of each specified type of glass.
- B. LEED Information:
1. LEED Credits MR 4.1 and 4.2, Recycled Content: Product data indicating percentages by weight of post-consumer and post-industrial recycled content for products having recycled content; include statement indicating costs for each product having recycled content.
  2. LEED Credits MR 5.1 and 5.2, Regional Materials: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.

**1.3 JOB CONDITIONS**

- A. Do not proceed with installation under adverse weather conditions, or when temperatures are below or above manufacturer's recommended limitations.

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS**

- A. Acceptable manufacturers:
  - 1. Tempered Amber Tinted Glass:
    - a. PPG.
  - 2. Fire-rated Glass Ceramic:
    - a. Base:
      - 1) Technical Glass Products.
    - b. Optional:
      - 1) Safti.
  - 3. Decorative glass:
    - a. Base:
      - 1) Ruby Glass.
- B. Glass materials:
  - 1. Comply with indicated standards.
  - 2. See Glass Types Schedule for listing of types.
  - 3. Materials specified in Glass Types Schedules are minimum acceptable products.
  - 4. Single manufacturer produce individual glass types used in fabrication of insulating units.
  - 5. Manufacturer or fabricator determine if materials should be heat strengthened or fully tempered at non-hazardous locations that do not require safety glazing and provide accordingly.
- C. Glazing compounds:
  - 1. Nonsag, nonstain type.
  - 2. Pigmented to match frame units not requiring painting.
  - 3. Compatible with adjacent surfaces.
  - 4. For use in setting glass: Neutral-cure Silicone sealant.
  - 5. Sealant tape: Butyl rubber sealant tape or ribbon having a continuous neoprene shim.
  - 6. Gaskets:
    - a. Polyvinyl chloride or neoprene.
    - b. Extruded, flexible, of profile and hardness required to receive glass and provide a watertight installation.
- D. Installation setting blocks and spacers:
  - 1. Neoprene, compatible with sealants used.
  - 2. Setting blocks: 80-90 durometer.
  - 3. Spacers: 40-50 durometer.
  - 4. Compressible filler stock: Closed cell jacketed rod stock of synthetic rubber or plastic foam.
- E. Shims, clips, springs, angles, beads, attachment screws and other miscellaneous items: As indicated or required.
- F. Decorative glass: Color and pattern as selected.

### **2.2 GLASS TYPES SCHEDULE**

- A. Glass Type 1, Clear Float:
  - 1. Clear float, 6mm thick.
- B. Glass Type 2, Clear Tempered:
  - 1. Clear, tempered tongless float, 6 mm thick.
- C. Glass Type 2A, Tempered Amber Tinted:
  - 1. Clear, tempered tongless float, 6 mm thick.
  - 2. Surface: Polished.
  - 3. Provide amber tinted film:
    - a. Transmittance: No measurable transmittance below 500 mm wave length.

- D. Glass Type 9, Laminated Ceramic Glass (Fire-rated and Safety-rated):
  - 1. Laminated, wireless, UL labeled for assembly indicated.
  - 2. Impact-Safety Rated per ANSI Z93.1 and CPSC 16CFR1201.
  - 3. Thickness: 8mm, laminated.
  - 4. Surface: Polished.
  - 5. Surface: Unpolished.
  - 6. Base Product: "FireLite Plus" by Technical Glass Products.
- E. Glass Type GL1:
  - 1. Tempered glass.
  - 2. Sheet Width: 65 IN.
  - 3. Sheet Height: 97 IN.
  - 4. Minimum Thickness: 5/16 IN.
  - 5. Pattern Direction: Horizontal.
  - 6. Base Product: "CT08022" by Corporate Clear Texture, Ruby Glass.

## **PART 3 - EXECUTION**

### **3.1 INSPECTION**

- A. Examine framing or glazing channel surfaces, backing, stop design, and conditions under which glazing is to be installed.

### **3.2 INSTALLATION**

- A. Do not install glass with edge damage.
- B. Contractor is responsible for correct glass size for each opening, within tolerances and dimensions established.
- C. Comply with recommendations of manufacturers, except where more stringent requirements are indicated.
- D. As a minimum, comply with GANA Glazing Manual and IGMA Glazing Guidelines for Sealed Insulating Glass Units.
- E. Install sealants as recommended by sealant manufacturer.
- F. Install setting blocks in adhesive or sealant.
- G. Provide spacers inside and out, of proper size and spacing, for glass size, except where gaskets are used for glazing.
- H. Minimum Bite:
  - 1. Monolithic, 1/4 IN, Glass: 3/8 IN.
  - 2. 1 IN Insulating units: 1/2 IN.
  - 3. For other sizes: Refer to Table C of AAMA's Aluminum Curtain Wall Design Manual, Volume 6, Glass & Glazing.
- I. Sealant Depth: Equal to sealant width.
- J. Prevent sealant exudation from glazing channels:
  - 1. Leave void at heel (or install filler) at jambs and head.
  - 2. Do not leave void (or install filler) at sill.
- K. Miter cut and bond gasket ends together at corners.
- L. Immediately after installation, attach crossed streamers to framing held away from glass.
- M. Do not apply anything to surfaces of glass.
- N. Install spandrel units from exterior of building.

- O. Remove and replace damaged glass.
- P. Installation of Mirrors:
  - 1. Mastic Attachment: Install mirrors with mirror adhesive applied to back of mirror and pressed against substrate as recommended by mirror supplier.

### **3.3 CLEANING AND PROTECTION**

- A. Maintain glass reasonably clean during construction, so that it will not be damaged by corrosive action and will not contribute to deterioration of other materials.
- B. Ensure that weep system in frames is not blocked by sealant.
- C. Wash and polish glass on both faces not more than 7 days prior to final completion of work in each area.
- D. Comply with glass manufacturer's recommendations and "GANA 01-0300".

**END OF SECTION**

**SECTION 08 91 00**  
**ARCHITECTURAL LOUVERS**

**PART 1 - GENERAL**

**1.1 QUALITY ASSURANCE**

- A. Air Movement and Control Association (AMCA) certification.

**1.2 STRUCTURAL PERFORMANCE CRITERIA**

- A. Design Criteria: Provide units which are capable of withstanding the effects of loads and stresses from wind and normal thermal movement without permanent deformation of members or fasteners.
- B. Structural Design Criteria:
  - 1. Design to meet 2006 International Building Code, as locally adopted and amended, and the following:
    - a. Wind Velocity (3-sec gust, measured at 33 FT above ground): 120 MPH
    - b. Importance Factor:
      - 1) 1.15, Category IV.
    - c. Exposure Category:
      - 1) Exposure B.
- C. Thermal Movements:
  - 1. Ambient Temperature Change: 120 degF.
  - 2. Material Surface Temperature Change: 180 degF.

**1.3 SUBMITTALS**

- A. Shop drawings.
- B. Product Data:
  - 1. Performance data bearing AMCA certified ratings for air flow, water penetration, free area, and other listed criteria specified.
- C. Samples:
  - 1. Finishes.
- D. Contract Closeout Information:
  - 1. Warranty.
- E. LEED Information:
  - 1. LEED Credits MR 4.1 and 4.2, Recycled Content: Product data indicating percentages by weight of post-consumer and post-industrial recycled content for products having recycled content; include statement indicating costs for each product having recycled content.
  - 2. LEED Credits MR 5.1 and 5.2, Regional Materials: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.

**1.4 JOB CONDITIONS**

- A. Coordinate with mechanical ductwork as required.

**1.5 WARRANTY**

- A. 20-year Warranty on PVDF finish.

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS**

- A. Acceptable manufacturers:
  - 1. Architectural Louvers:
    - a. Base:
      - 1) Airolite.
    - b. Optional:
      - 1) Airline Products.
      - 2) Industrial Louvers.
      - 3) Reliable Products.
      - 4) Ruskin Manufacturing.
      - 5) C/S Group.
  - 2. Combination Louver/Dampers:
    - a. Base:
      - 1) Airolite.
    - b. Optional:
      - 1) Airline Products.
      - 2) C/S Group.
      - 3) Industrial Louvers.
      - 4) Reliable Products.
      - 5) Ruskin Manufacturing.

### **2.2 MATERIALS - GENERAL**

- A. General:
  - 1. Frame and Blade Material:
    - a. 6063-T5, Extruded aluminum.
  - 2. Bird screen:
    - a. 1/2 IN square mesh, 16 GA aluminum.
    - b. Install in manufacturer's standard folded frame.
    - c. Include at all units unless noted otherwise.
  - 3. Painted Finish:
    - a. Factory primed and painted with coats of Kynar 500 (70% PVDF).
      - 1) Oven-cured.
      - 2) 3-coat system complying with AAMA 2605.
      - 3) Color:
        - a) To be selected from manufacturer's standard line.
      - 4) 20-year warranty on PVDF finish.
  - 4. Gang louver units together, where necessary or where indicated to makeup the overall sizes required.
- B. Sealant: See Section 07 92 13 for materials.
- C. Accessories: Fabricate anchors, reinforcing, and required ancillary items of compatible material.

### **2.3 ARCHITECTURAL LOUVERS**

- A. 6 IN Deep Architectural Louvers (Drainable Blade-type):
  - 1. Fixed, storm resistant, drainable with horizontal and vertical gutter system.
    - a. Horizontal continuous blade appearance, Concealed intermediate verticals.
  - 2. Performance (per AMCA 500-L-99):
    - a. Maximum pressure drop: 0.10 IN at 900 FPM.
    - b. Minimum free area: 57 percent.
    - c. Beginning point of water penetration (0.01 OZ/SF): 1,250 FT/MIN, 11,375 CFM, 0.20 IN.
  - 3. Louver Blade Angle: 35 Degrees.

4. Frame Depth: 6 IN thick.
  5. Minimum Wall Thicknesses (Frames and Blades): 0.081 IN thick.
  6. Unit Size(s): As indicated.
  7. Base Product (Concealed Blade): "CB6776" by Airolite.
- B. Blank-off Panels:
1. General:
    - a. Paint panels prior to installation.
      - 1) Color: Flat Black.
    - b. Attach blank-off panels with stainless steel screws.
  2. Insulated type:
    - a. Insulated blank off panels:
      - 1) 2 sheets of 0.050 aluminum with isocyanurate or phenolic foam 1 IN thick core, with edges sealed.
      - 2) Edge treatment: Trim perimeter of blank-off panels with louver manufacturer's standard, extruded aluminum, channel frames.
        - a) Minimum nominal wall thickness of channels: 0.080 IN.
        - b) Mitered corners.

## **PART 3 - EXECUTION**

### **3.1 INSPECTION**

- A. Verify suitability of openings to accept units.
- B. Correct unsatisfactory conditions.
- C. Installation constitutes acceptance of responsibility for performance.

### **3.2 INSTALLATION**

- A. Install in accordance with manufacturer's recommendations.
- B. Install anchoring and bracing accessories as required.
- C. Install blank off panels at unused portions of louvers.
- D. Install bird screens.
- E. Seal perimeter joints watertight.

**END OF SECTION**



**HDR**

**D I V I S I O N    0 9**

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**FINISHES**

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**SECTION 09 06 10**  
**ROOM FINISH AND COLOR SCHEDULE**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. Room Finish Schedule will not be issued:
1. See Reflected Ceiling Plans for ceiling heights and finishes and colors.
  2. See Interior Finish Plans for floor and wall finishes and colors.
  3. See Furniture Plans for type and location of furniture.
  4. See Casework Plans for location of casework.
  5. See specifications for product information.

**END OF SECTION**



**SECTION 09 21 27**  
**EXTERIOR STUD WALL SYSTEM**

**PART 1 - GENERAL**

**1.1 DESIGN RESPONSIBILITY**

- A. Provide engineering design performed and sealed by registered Engineer, licensed to practice Structural Engineering in the State of New York. Engineer shall have a minimum of 10 years experience with projects of similar scope.
- B. Design Criteria:
  - 1. AISC Specifications for Design of Cold-Formed Steel Structural Members.
  - 2. Design Exterior Stud Wall System to satisfy requirements of applicable building codes as locally amended, but not less than the loads shown on the contract documents:
    - a. Design Exterior Soffits similarly.
    - b. Include all superimposed loads.
  - 3. Limit lateral deflection of stud wall system due to wind or earthquake as follows:

| <b>MAXIMUM ALLOWABLE DEFLECTION</b>                           |                               |
|---|-------------------------------|
| <b>Exterior Finish Material</b>                               | <b>Deflection Limit</b>       |
| Stone Cladding  | Smaller of<br>L/600 or 0.3 IN |
| Metal Panels, Curtainwalls, and other flexible wall finishes. | L/360                         |
| Studs abutting windows or louvers.                            | 1/4 IN                        |

- 4. Select stud gauge and spacing as required to limit deflection due to applied loads:
  - a. Utilize strength properties of metal stud only.
  - b. Disregard contribution of facings such as Gypsum Wall Board and Gypsum Sheathing, which lose strength when wet.
- 5. Size and define headers reinforcing members around openings.
- 6. Develop details defining method of fastening throughout system.
- 7. Review and professionally seal submittals and calculations. Provide Engineer's stamp for the State of New York.
- 8. Connections:
  - a. Screws for steel-to-steel connections shall be self-drilling tapping in compliance with SAE J78 of the type, size, and location as shown on the drawings.
  - b. Electroplated screws shall have a Type II coating in accordance with ASTM B 633. Screws, bolts, and anchors shall be hot-dipped galvanized in accordance with ASTM A 123/A 123M or ASTM A 153/A 153M as appropriate.
  - c. Screws bolts, and anchors shall be hot dipped galvanized in accordance with ASTM A 123/A 123M or ASTM A 153/A 153M as appropriate.
- C. Additional Criteria for Framing System for Exterior Soffits:
  - 1. In addition to gravity loads, design framing system to resist wind uplift.

**1.2 SUBMITTALS**

- A. Shop Drawings:
  - 1. Complete drawings prepared by manufacturer defining framing member sizes, locations, and connection details. Include plans, sections, elevations, layouts, profiles and product component locations, including anchorage, bracing, fasteners, accessories and finishes:

- a. Show connection details with screw types and locations, weld lengths and locations, and other fastener requirements.
  - b. Coordinate size of openings and support requirements for items installed in openings, with Contractor.
  - c. Show openings, edges and support conditions that have been field verified with respect to location.
  - d. Show openings, edges and support conditions that have coordinated with respect to physical requirements of items to be installed in or on exterior wall system.
2. Details and isometrics at windows showing layouts of Air Barrier Flashings and sequence of installation.
- B. Project information:
1. Catalog data indicating cross sectional properties.
  2. Structural calculations.
  3. Certification Exterior Stud Wall System has been designed, to satisfy specified design criteria, sealed by registered Engineer, licensed to practice Structural Engineering in the State of New York.
  4. Manufacturer and product name of sheathing.
- C. LEED Information:
1. LEED Credits MR 4.1 and 4.2, Recycled Content: Product data indicating percentages by weight of post-consumer and post-industrial recycled content for products having recycled content; include statement indicating costs for each product having recycled content.
  2. LEED Credits MR 5.1 and 5.2, Regional Materials: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.

### **1.3 QUALITY ASSURANCE**

- A. Product Tests: Mill certificates or data from a qualified independent testing agency, or in-house testing with calibrated test equipment indicating steel sheet complies with requirements, including base-metal thickness, yield strength, tensile strength, total elongation, chemical requirements, ductility, and metallic-coating thickness.
- B. Welding Qualifications:
1. Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code-Steel," and AWS D1.3, "Structural Welding Code-Sheet Steel."
- C. Fire-Test-Response Characteristics:
1. Where indicated, provide cold-formed metal framing identical to that of assemblies tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.

### **1.4 PRODUCT DELIVERY, STORAGE, AND HANDLING**

- A. See Section 01 65 00.

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS**

- A. Acceptable manufacturers:
1. Exterior metal studs:
    - a. Base:
      - 1) Dietrich Industries (Worthington Industries).
    - b. Optional:

- 1) Clarkwestern Building Systems.
  - 2) California Expanded Metal Products Co. (CEMCO).
  - 3) Allied Studco.
  - 4) Custom Stud Inc.
  - 5) Marino\WARE.
  - 6) The Steel Network.
2. Sheathing:
    - a. Base:
      - 1) Georgia Pacific.
    - b. Optional:
      - 1) National Gypsum Company.
      - 2) USG.
      - 3) CertainTeed.
      - 4) Temple-Inland.
  3. Seam Sealant, for sheathing:
    - a. Base:
      - 1) Dow Corning.
    - b. Optional:
      - 1) Pecora.
      - 2) Tremco.
      - 3) Other manufacturers as recommended by maker of Sheathing.
  4. Galvanizing repair coating:
    - a. Base:
      - 1) Tnemec.
    - b. Optional:
      - 1) ZRC Worldwide.
- B. Metal Studs and Tracks:
1. Steel Quality:
    - a. Framing components shall conform to ASTM C955.
    - b. Steel: ASTM-A1003.
  2. Minimum Yield Strength: 33,000 PSI.
  3. Finish:
    - a. Prime with rust inhibitive, red oxide paint.
    - b. ASTM A653, Type SS, Grade 50, G-60 galvanized.
  4. Stud sizes:
    - a. Depth: As indicated.
    - b. Thickness: As determined by Structural calculations.
  5. Track Thickness: Not less than thickness required for studs.
    - a. Exception: Thinner track gauges may be used where demonstrated by structural calculations to be acceptable.
  6. Markings:
    - a. Studs and track shall have product markings stamped on the web of the section.
    - b. Markings shall be repeated throughout length of the member at a maximum spacing of 4 FT o.c. and shall be legible and easily read.
    - c. Product marking shall include the following:
      - 1) An ICBO number.
      - 2) Manufacturer's identification.
      - 3) Minimum delivered uncoated steel thickness.
      - 4) Protective coating designator.
      - 5) Minimum yield strength.
- C. Metal stud system accessories:
1. Including:
    - a. Deflection clips and connectors.
    - b. Head-of-Wall deflection systems.

- c. Rigid connectors.
  - d. Floor joist framing connectors.
  - e. Bridging, bracing, and backing systems.
  - f. Truss framing.
  - g. Fire-Rated connectors.
  - h. Specialty clips, connectors, and fasteners.
2. As recommended by manufacturer.
  3. Provide horizontal bracing at not more than 4 FT o.c. or at mid span of 10 FT or less high walls.
  4. Provide lateral strap bracing and shear wall framing as indicated.

## 2.2 EXTERIOR METAL STUDS

- A. Exterior Studs:
1. Galvanized steel studs, runner channels and track, bracing, and accessories, ASTM-A924 minimum G60 galvanized.
  2. Select members in accordance with Design Criteria.
  3. Stud depth(s): As indicated on Drawings.
  4. Span(s): As indicated on Drawings.
  5. Stud spacing: Maximum 16 IN OC; use closer spacing, 12 IN OC minimum, as needed to satisfy load deflection criteria.
  6. Stud Gauge: As determined for loads and deflection criteria.
    - a. Minimum thickness for Studs, Runners and Tracks: 43 mils (18 GA); use heavier thickness as needed to satisfy loading and deflection criteria.
  7. Minimum flange on Deep-Leg runners: 2 IN.
  8. Runner fasteners: Power driven fasteners to withstand minimum 190 LB shear and bearing.
  9. Headers: C-shapes used to form header beams, of web depths required and with stiffened flanges.
    - a. Gauges: As determined by engineering calculations for specific openings.

## 2.3 EXTERIOR GYPSUM SHEATHING

- A. General Description: Water-resistant, mold-resistant suitable for long term weather-exposure during construction.
1. Comply with ASTM-C1177.
  2. Minimum Mold Resistance: 10 rating per ASTM-D3273.
  3. Minimum Thickness: 1/2 IN.
    - a. Provide 5/8 IN thick Type X product version where fire rated Exterior walls are indicated.
    - b. Soffit boards: Provide appropriate non-sag product where sheathing is used horizontally as in soffits.
  4. Base Products:
    - a. Description: Water-resistant treated gypsum core sheathing board with glass mat facers.
    - b. Approved products meeting this criteria:
      - 1) "Dens-Glass Gold Exterior Sheathing" by Georgia Pacific.
      - 2) "e<sup>2</sup>XP Extended Exposure Sheathing" by National Gypsum.
      - 3) "Securock Glass-Mat Sheathing" by USG.
  5. Optional Products:
    - a. Description: Facer-less, water-resistant treated gypsum core sheathing board with embossed drainage pattern on back.
    - b. Approved products meeting this criteria:
      - 1) "Fiberock Brand Sheathing, Aqua-Tough" by USG;
      - 2) "GlasRoc Sheathing" by Certainteed.
- B. Seam Sealant/Fastener Head Sealant:
1. Coordinate sealant for compatibility with selected air or vapor barrier systems and sheathing.

6. Where stud design is outside edge of floor slab, provide galvanized connectors that satisfy loading requirements and allow individual floor movement to occur without affecting stud system integrity.
  7. Shop weld assemblies as required to meet design requirements.
    - a. Retouch burned off or abraded galvanizing with galvanizing repair coating.
  8. Cut studs square and set with firm bearing against webs of top and bottom tracks.
  9. Position studs vertically in tracks and space as indicated in design.
  10. Do not splice studs.
- E. Metal Wall Backing: Specified in Section 09 22 16.
1. Coordinate installation of metal wall backing used to support wall-supported items with installation of exterior stud wall system.
  2. See Section 09 22 16 for items requiring metal wall backing.
- F. Wood Wall Blocking: Specified in Section 06 10 53.
1. Coordinate installation of wood wall blocking used to support wall-supported items with installation of exterior stud wall system specified herein.
  2. See Section 06 10 53 for items requiring wood wall blocking.
- G. Exterior Sheathing:
1. Position sheathing so that edges of sheathing panels occur at stud centers.
  2. Screw to exterior of each stud as recommended by manufacturer.
  3. Butt sheathing boards together tightly:
    - a. Maximum gap between boards: 1/8 IN.
    - b. Seal seams and fastener heads with sealant per "Method 1" as described Georgia Pacific.
  4. Sheathing at Roof-side of parapet walls:
    - a. Apply sheathing on roof side of stud-framed parapet walls.
    - b. Sheathing is not required where parapet back-up walls are masonry.
- H. Exterior Ceilings and Soffits:
1. Control Joints;
    - a. Locate Control Joints in a manner that subdivides ceilings/soffits as indicated, and within the following limits: Subdivide so that no area exceeds 900 FT<sup>2</sup>, and no area has a length which exceeds 30 FT.
    - b. Locate Control Joints at transitions between areas of different shapes.
  2. Finish System:
    - a. Tape joints with glass mesh tape.
    - b. Fill screw heads.
    - c. Apply skim coat over entire surface.
  3. Paint: Specified in Section 09 91 13.

### 3.3 FASTENING

- A. Fasten framing members together by welding or by using self-drilling or self-tapping screws. Electrodes and screw connections shall comply as required and indicated in the design calculations.
1. Welding shall be performed in accordance with AWS D1.3/D1.3M, as modified by AISI SG02-1.
    - a. Welders, welding operations, and welding procedures shall be qualified according to AWS D1.3/D1.3M.
    - b. Welds shall be cleaned and coated with rust inhibitive galvanizing paint.
    - c. Do not field weld materials lighter than 18 GA.
  2. Screws shall be self-drilling self-tapping of the type, size, and location shown on the drawings.
    - a. Screw penetration through joined materials shall not be less than three exposed threads.

- b. Minimum spacings and edge distances for screws shall be as specified in AISI SG02-1.
- c. Screws covered by sheathing materials shall have low profile heads.
- 3. Anchors shall be of the type, size, and provided at locations shown on the drawings.

### **3.4 INSTALLATION OF AIR BARRIER**

- A. Section 07 27 16.

### **3.5 FIELD QUALITY CONTROL**

- A. Testing: BNL will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Field and shop welds will be subject to testing and inspecting.
- C. Testing agency will report test results promptly and in writing to Contractor and Architect.
- D. Remove and replace work where test results indicate that it does not comply with specified requirements.
- E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

### **3.6 PROTECTION**

- A. Protect erected wall and openings with temporary covers until finish, roofing, flashing, and windows are installed.

### **3.7 REPAIRS**

- A. Repair portions of sheathing that is damaged by rain, wind, or prolonged exposure.
- B. Repair portions of Air Barrier which are damaged by wind or prolonged exposure.
  - 1. Damage shall include rips, tears, loss of adhesion of seam tape, and elongation of membrane at fastener penetrations.
- C. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed metal framing with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

**END OF SECTION**



**SECTION 09 22 16**  
**NON-LOAD BEARING METAL STUD FRAMING**

**PART 1 - GENERAL**

**1.1 QUALITY ASSURANCE**

- A. General:
1. Where fire resistance classifications are indicated for walls or partitions: Provide studs and accessories of type tested and listed for construction indicated.
  2. Products proposed for use in fire-rated assemblies shall be approved by nationally recognized testing laboratory.
- B. ASTM Reference Standards:
1. ASTM-C645: Standard Specification for Nonstructural Steel Framing Members.
  2. ASTM-A653: Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
  3. ASTM-C754: Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products.

**1.2 PERFORMANCE REQUIREMENTS**

- A. Select steel studs in accordance with the manufacturer's standard load tables and following Design Pressures and Maximum Deflections:

| <b>PERFORMANCE CRITERIA</b>  |                           |                                       |
|--|---------------------------|---------------------------------------|
| <b>Use Condition <sup>2</sup></b>  | <b>Design Pressure</b>    | <b>Maximum Deflection<sup>1</sup></b> |
| Wall enclosing stairs, elevator hoistways, and other vertical shafts   | 10<br>LBS/FT <sup>2</sup> | L/120                                 |
| Wall enclosing vestibules, ground floor lobbies, and similar spaces subject to intermittent exposure to exterior wind conditions   | 15<br>LBS/FT <sup>2</sup> | L/240                                 |
| Walls scheduled with Cementitious Backer Board, Moisture-resistant, or Abuse-Resistant Gypsum Wallboard  | 15<br>LBS/FT <sup>2</sup> | L/360                                 |
| Walls scheduled to receive Tile, lath and plaster, or veneer plaster. <sup>2</sup>   |                           |                                       |
| Typical Interior Walls/Partitions (those not listed above)   | 5<br>LBS/FT <sup>2</sup>  | L/240                                 |
| Interior Ceilings, Soffits and Bulkheads   | 5<br>LBS/FT <sup>2</sup>  | L/360                                 |
| <p><b>Footnotes:</b></p> <ol style="list-style-type: none"> <li>1. Limit deflection to L/360 where wall cladding on either face is any of the following: Ceramic Tile, Stone Tile, Porcelain Tile, Thin Brick, Lath &amp; Plaster, Simulated Masonry, Adhered-stone, Veneer Plaster and similar brittle finishes which are prone to movement-induced cracking.</li> <li>2. Where elements meet multiple conditions; Use most stringent Deflection and Design Pressure values.</li> </ol> |                           |                                       |

**1.3 SUBMITTALS**

- A. Project Information:
1. Manufacturer of listed products.

- B. LEED Information:
1. LEED Credits MR 4.1 and 4.2, Recycled Content: Product data indicating percentages by weight of post-consumer and post-industrial recycled content for products having recycled content; include statement indicating costs for each product having recycled content.
  2. LEED Credits MR 5.1 and 5.2, Regional Materials: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS**

- A. Acceptable manufacturers:
1. Non-load Bearing Framing Components:
    - a. Base:
      - 1) Dietrich Industries (Worthington Industries).
    - b. Optional:
      - 1) ClarkWestern Building Systems.
      - 2) California Expanded Metal Products Co. (CEMCO).
      - 3) Allied Studco.
      - 4) Custom Stud Inc.
      - 5) Marino/WARE.
      - 6) The Steel Network.
  2. Framing for Gypsum Board Soffits and Ceilings:
    - a. Base:
      - 1) Dietrich Industries (Worthington Industries).
    - b. Optional:
      - 1) ClarkWestern Building Systems.
      - 2) California Expanded Metal Products Co. (CEMCO).
      - 3) Allied Studco.
      - 4) Custom Stud Inc.
      - 5) Marino/WARE.
      - 6) The Steel Network.
  3. Interlocking Grid Support Systems for Gypsum Board Ceilings:
    - a. Base:
      - 1) USG Corporation.
    - b. Optional:
      - 1) Chicago Metallic.
      - 2) Armstrong.

### **2.2 MATERIAL DESCRIPTION**

- A. General:
1. Products proposed for use in fire-rated assemblies shall be approved by nationally recognized testing laboratory.
  2. Provide metal framing members that have a minimum recycled content of 65 percent.
- B. Metal Studs (non-load-bearing type):
1. C-shaped studs and tracks roll-formed from corrosion-resistant galvanized steel that conforms to ASTM-C645.
  2. Galvanized: ASTM-A653, G40.
  3. Stud Depths: As indicated by Wall Types.
  4. Minimum Flanges Width: 1-1/4 IN.
  5. Minimum thickness: 18 mil (25 GA), except as follows:

- a. Provide heavier thickness as required to comply with PERFORMANCE REQUIREMENTS.
  - b. Upgrade framing members to minimum 30 mil (20 GA) studs at following conditions:
    - 1) At jambs of openings: Two 30 mil (20 GA) studs.
    - 2) One or both sides of partition will be faced with any of following:
      - a) Tile backing board.
      - b) Adhered stone.
      - c) Plaster.
      - d) Moisture-resistant.
      - e) Abuse-resistant wallboard.
      - f) Lead-backed gypsum wallboard.
    - 3) Where partitions are not extended to overhead structural deck, and are without supporting diagonal bracing, or horizontal stiffeners.
  - c. Provide heavier gauge thickness where specifically indicated.
6. Instead of heavier stud thickness, the design may employ diagonal braces (kickers) above the ceiling to reduce the overall span and thus stiffen the wall frame. Coordinate locations with building services items.
- a. Do not employ studs with stud thickness less than allowed by Fire Resistance-rated assemblies.
7. Base Products:
- a. Studs: "Ultrasteel" by Dietrich.
  - b. Tracks (runners): "TR-Series" by Dietrich.
- C. Head-of-Wall Accessories:
1. General Criteria:
    - a. Configure to permit deflection of overhead superstructure while maintaining structural integrity, fire and smoke-resistance, and sound control as required by each wall.
  2. Basis of Design - Slotted Top Track (a.k.a. deflection Track):
    - a. Deep leg, vertically slotted track for all walls which extend to structure.
    - b. Minimum Thickness: 30 mil (20 GA).
    - c. Width: As required for studs sizes indicated.
    - d. Depth: Minimum 2-1/2 IN down-standing legs with 1/4 IN wide by 1-1/2 IN high slots spaced 1 IN on center.
    - e. Material: Cold-formed sheet steel; galvanized; ASTM-A653, .
    - f. Base Product: "SLP-TRK" by Sliptrack Systems, Dietrick, ClarkWestern, etc.
    - g. Accessories:
      - 1) Include fasteners suitable for attachment to superstructure elements.
      - 2) Include Z-bars, cold-rolled channels, or similar clips to accommodate thickness of Spray-applied Fire-Resistive Materials (SFRM).
    - h. Additional components where walls are fire-rated:
      - 1) Include fasteners, clips and other items necessary to secure wall frame to building superstructure according to UL-listed designs.
      - 2) Select systems tested in accordance with UL-2079 for conditions.
    - i. Firestopping Sealants, Sprays and Forming Materials: Specified in Section 07 84 00.
  3. Alternative top track configurations may be considered by Architect for approval.
    - a. Proposed systems must be configured to accommodate deflection of superstructure without inducing axial loading on the partition wall.
    - b. Proposed systems must be tested for fire resistive requirements indicated.
    - c. Contractor is obligated to demonstrate to Architect that proposed system complies with project requirements.
- D. Shaftwall Framing: C-H shaped studs with U or J shaped tracks.
1. Material: Galvanized steel complying with ASTM-A653, G40.
  2. Minimum Thickness: 40 mil (20 GA).
  3. Minimum Size: 2-1/2, 4, and 6 IN as indicated.
  4. Stud Spacing: 24 IN.

5. Structural Design Criteria:
    - a. Select stud with properties necessary to limit deflection to L/240 deflection at load of 10 PSF.
    - b. Use larger size and gauge if required to satisfy span and deflection criteria.
  6. Shaftwall assembly with gypsum wallboard specified in Section 09 29 00:
    - a. Fire resistance rating: 2 hours in accordance with ASTM-E119.
    - b. Sound transmission class: Minimum STC 47 in accordance with ASTM-E90.
  7. Base Product: "CT Cavity Shaftwall Studs" by Dietrich.
- E. Z-Bar standoff clips:
- a. Galvanized steel, minimum 30 mil (20 GA) thickness, 2 IN x 2 IN x 2 IN size by length required, unless otherwise indicated to accommodate beam and deck fireproofing:
  2. Provide Z-bars for attachment of top track to superstructure elements which are to be protected with sprayed fireproofing.
  3. Length:
    - a. At structural steel member: Length equal to flange width of structural steel member.
    - b. At steel deck: Minimum length equal to partition width, or as required to span steel deck flutes.
    - c. Extend length of Z-bar to accommodate partition offset that will not clear fireproofed steel beam.
  4. Base Product: "Z Bar" by Dietrich.
- F. Furring Channels (hat-channels):
1. Hat-shaped sections.
  2. Galvanized: ASTM-A653, G40.
  3. Sizes: 7/8 and 1-1/2 IN, as indicated.
  4. Minimum Thickness: 30 mil (20 GA); Use heavier gauge as dictated by conditions.
  5. Base Product: "FC-Series" by Dietrich.
- G. Z-Furring:
1. Z-shaped sections, attached to structural parent wall.
  2. Galvanized: ASTM-A653, G40.
  3. Sizes: 1, 1-1/2, 2 and 2-1/2 IN, as indicated.
  4. Minimum Thickness: 18 mil (25 GA); Use heavier gauge as dictated by conditions.
  5. XPS Foam Insulation: Specified in Section 07 21 00.
  6. Base Product: "ZF-Series" by Dietrich.

### 2.3 ACCESSORY ITEMS

- A. Wire ties:
1. 43 mil (18 GA) soft annealed, galvanized.
- B. Fasteners for tracks:
1. Power driven type, to withstand minimum 190 LB shear when driven.
- C. Closure:
1. When continuous vapor retarder is required, provide continuous 30 mil (20 GA) galvanized closure angle to receive vapor retarder and vapor retarder tape.
- D. Isolation Strip Material:
1. Non-absorbent, foam padding as required to prevent direct contact between metal framing member and exterior concrete or masonry parent walls.
  2. Minimum thickness: 0.40 mil.
- E. Backing (modified track runners):
1. C-shaped track runners; roll-formed from corrosion-resistant galvanized steel that conforming to ASTM-C645.
  2. Galvanized: ASTM-A653, G40.
  3. Minimum Backing Height: 6 IN.

4. Minimum Flange Width: 1-1/4 IN.
5. Minimum Thickness: 30 mil (20 GA).
6. Base Product: "TR-Series Track Runner" by Dietrich.

## 2.4 SUPPORT SYSTEMS FOR GYPSUM CEILINGS

- A. Interlocking Grid Systems:
  1. Description: ASTM-C645, direct-hung system composed of T-Shaped framing members designed to carry load of screw-applied gypsum ceiling board.
  2. Tabs on Cross-Tees to interlock into slots in Main Runners where intersections occur.
  3. Base Product: "Drywall Suspension System" by USG Corporation.
  4. Optional Products: "Drywall Grid Systems" by Armstrong; "Drywall Furring System" by Chicago Metallic.
  5. Other items including suspension wire, tie wire, attachment devices: As specified and indicated.
- B. Track and Channel Systems:
  1. Material: ASTM-C645 roll-formed steel with G40 galvanized coating.
  2. Minimum Thickness: 30 mil (20 GA); Use heavier gauge as dictated by conditions.
  3. Carrying Channels:
    - a. Size: 1-1/2 IN.
  4. Furring Channels (hat-channels):
    - a. Sizes: 7/8 and 1-1/2 IN, as indicated.
  5. Other items including suspension wire, tie wire, attachment devices: As specified and indicated.
- C. Stud-Framed Ceiling/Soffit Systems:
  1. C-shaped studs or joists; roll-formed from corrosion-resistant galvanized steel that conforms to ASTM-C645.
  2. Galvanized Coating: ASTM-A653, G40.
  3. Minimum Frame Member Depth: 3-5/8 IN minimum, unless otherwise indicated.
    - a. Use wider stud sections if ceiling span and support requires.
  4. Minimum flange width: 1-1/4 IN.
  5. Minimum stud thickness: 20 gauge.
  6. Other items including suspension wire, tie wire, attachment devices: As specified and indicated.
- D. Tie Wire:
  1. Material: ASTM-A641, Class 1 zinc coating, soft temper.
  2. Minimum Diameter (single-strand): 0.0625 IN (14 GA).
  3. Minimum Diameter (single-strand): 0.0475 IN (18 GA).
- E. Wire Hangers:
  1. Material: ASTM-A641, Class 1 zinc coating, soft temper.
  2. Minimum Diameter: 0.162 IN (8 GA).
- F. Anchors in Concrete:
  1. Anchors of type and material indicated below, with holes or loops for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to 5 times that imposed by ceiling construction, as determined by testing per ASTM-E488 or ASTM-E1512 as applicable.
  2. Acceptable types: Cast-in-place, post-installed expansion anchors and post-installed bonded anchors.
  3. Material: Carbon-steel components zinc plated to comply with ASTM-B633, Class Fe/Zn 5 (0.005 mm) for Class SC 1 service condition.

- G. Power-Actuated Fasteners in Concrete:
  - 1. Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hangers of type indicated, and with capability to sustain, without failure, a load equal to 10 times that imposed by ceiling construction, as determined by testing per ASTM-E1190.
  - 2. Comply with seismic design requirements where applicable.

## **PART 3 - EXECUTION**

### **3.1 INSPECTION**

- A. Examine supporting structure and conditions under which system will be installed.
- B. Correct conditions detrimental to proper installation.
- C. Installation constitutes acceptance of responsibility for performance.

### **3.2 INSTALLATION - GENERAL**

- A. General:
  - 1. Installation Standard: ASTM-C754, except comply with framing sizes and spacing indicated.
    - a. Gypsum Board Assemblies: Comply with additional requirements in ASTM-C840 relative to framing installation.
  - 2. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.
  - 3. Install bracing at terminations in assemblies.
  - 4. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.
  - 5. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.
  - 6. Extend framing full height to structural supports. Exception: Where partitions are indicated to terminate at, or just above, suspended ceilings.
    - a. Continue framing around ducts and similar items which penetrate partitions.
  - 7. Utilize slip-type head track assemblies where framing extends to overhead structural supports.
    - a. Configure to resist lateral loads while accommodating deflection of overhead building superstructure without inducing axial loading on partition framing.
- B. Size floor tracks and head track assemblies to match studs.
  - 1. Align floor track and deflection track accurately.
  - 2. Secure floor track and deflection track to structure in accordance with manufacturer's instructions and referenced regulatory requirements.
  - 3. Secure at corners and at ends.
- C. Position studs vertically engaging floor track and head-of-wall deflection track.
  - 1. Space studs maximum 16 IN on center.
    - a. Provide additional studs at corners, partition intersections and terminations of partitions, and at each side of control joints.
    - b. Positively anchor studs to floor tracks with self-tapping pan head screws, or stud clinching tool on both flanges of each stud.
    - c. Positively anchor studs to deflection track with wafer-head screws on both flanges of each stud.
- D. Fire rated partitions: Anchor as required by fire resistance design, and Firestopping design.
- E. Align stud knockouts to facilitate running of wires and conduit.
- F. Where partitions abut vertical structural elements, provide perimeter relief.

1. Gypsum Association GA-600, Figure 9.

G. Head-of-Wall:

1. Provide slotted top track for all walls that go to structure.
2. Secure top track to superstructure with 0.145 IN x 1 IN powder actuated fasteners located 16 IN on center (max).
  - a. Pre-fit forming material that may be required as a part of a fire-resistive joint system.
3. Where partitions attach to structural elements that are scheduled to receive Spray-applied Fire Resistive Materials (SFRM):
  - a. Install Z-bar to underside of steel beams and steel deck before sprayed fireproofing is applied.
  - b. Locate Z-bars perpendicular to line of partition, spaced maximum 16 IN on center.
  - c. Attach each Z-bar with two 0.145 IN x 1 IN powder-actuated fasteners located minimum 1 IN from ends of Z-bar.
  - d. After fireproofing, secure top track to Z-bars with No. 8 x 9/16 IN waferhead framing screws spaced maximum 16 IN on center.
4. Where fire-rated partitions are offset and will not clear fireproofed steel beam, extend Z-bar outrigger horizontally from bottom of beam out to minimum 50mm 2 IN beyond width of head-of-wall.
  - a. Attach 3/4 IN expanded metal lath continuous, width of top of Z-bar outriggers prior to fireproofing steel beam to accommodate sprayed fireproofing.
5. Cut vertical studs 5/8 IN short to create a deflection gap when installed into top track.
  - a. Secure vertical studs to top track with No. 8 x 9/16 IN waferhead framing screw at each stud flange, screwing through track slots for positive stud connection.
6. Secure Gypsum Wallboard to vertical studs; do not secure Gypsum Wallboard to top track directly.
7. Prepare wall for installation of seals and/or firestopping:
  - a. Fire-rated Walls: Prepare for fire-resistive joint assemblies specified in Section 07 84 00.
  - b. Non-fire rated partitions (including Smoke Partitions): Prepare for Acoustical Sealant specified in Section 09 29 00.

H. Furring Channels:

1. Install furring channel systems, directly attached to parent walls, as indicated.
2. Install channels at maximum 16 IN OC.
3. Provide additional framing at openings, cutouts, corners, and control joints.
4. Fasten to masonry walls with cut nails.
5. Fasten to concrete with power driven fasteners.
6. Space fasteners not more than 24 IN OC, staggered on opposite flanges of hat channels.

### 3.3 FRAMING AT OPENINGS

A. General:

1. Control Joints (CJ): Provide for control joints at all openings.
  - a. Install additional stud, maximum 1/2 IN from jamb studs.
  - b. Do not fasten extra stud to track or jamb stud.
  - c. Refer to specification Section 09 29 00 for control joint locations.
2. Prefabricated headers, jambs, and sill framing systems (optional):
  - a. Proprietary opening framing systems may be considered as an alternative to conventionally fabricated framing.
  - b. Pre-approved Products: "HDS Framing System" by Dietrich.
  - c. Submit propose alternative systems to Architect for review.

B. Door Openings:

1. Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.
2. Unless indicated otherwise, extend jamb studs through suspended ceilings and secure laterally to overhead structure.

3. Jamb Studs:
    - a. Install two studs, toe-to-toe, at each jamb, unless otherwise indicated.
    - b. Minimum thickness of jamb studs: 30 mil (20 GA) at all openings.
    - c. Securely attach jamb studs to door frames.
  4. Headers:
    - a. Openings less than 4 FT wide:
      - 1) Cut-to-length section of floor runner above and below wall openings.
      - 2) Split flanges and bend webs at ends.
      - 3) Overlap and screw attach jamb studs to frames.
    - b. Openings over 4 FT wide:
      - 1) Cut-to-length, horizontal box beam studs above and below wall openings.
      - 2) Design for actual span and loading.
    - c. Incorporate Miscellaneous Steel members (Specified in Section 05 50 10) and Wood Blocking (Specified in Section 06 10 53) where indicated.
  5. Control Joints at head of Jamb:
    - a. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2 IN clearance from jamb stud to allow for installation of control joint in finished assembly.
- C. Other Framed Openings:
1. Frame openings other than door openings the same as required for door openings, unless otherwise indicated.
  2. Install framing below sills of openings to match framing required above door heads.
  3. Headers and Sills:
    - a. Openings less than 4 FT wide:
      - 1) Cut-to-length section of floor runner above and below wall openings.
      - 2) Split flanges and bend webs at ends.
      - 3) Overlap and screw attach jamb studs to frames.
    - b. Openings over 4 FT wide:
      - 1) Cut-to-length, horizontal box beam studs above and below wall openings.
      - 2) Design for actual span and loading.
    - c. Incorporate Miscellaneous Steel members (Specified in Section 05 50 10) and Wood Blocking (Specified in Section 06 10 53) where indicated.
  4. Cripple Studs:
    - a. Install cut-to-length intermediate (vertical) studs above and below openings.
    - b. Spacing: As indicated for typical (full-length) studs.

### **3.4 WALL BACKING AND BLOCKING**

- A. Metal Wall Backing: Provide in-wall metal wall backing reinforcement where following items are required to be wall-mounted to interior walls and interior of exterior walls:
  1. Crash rails, chair rails, wall bumpers, and similar wall protection devices.
  2. Contractor or BNL-furnished equipment indicated to be wall-mounted.
  3. Toilet accessories that do not include proprietary backing devices.
  4. Toilet Partitions and Lockers.
  5. Markerboards, Tackboards, and Chalkboards.
  6. Other wall-mounted items where backing is indicated by details or specification.
- B. Wood Wall Blocking: Specified in Section 06 10 53.
- C. Coordinate mounting height, location, and coverage with item to be supported.
- D. Determine material width according to item to be supported.
- E. Provide in-wall metal wall backing material to interior metal stud walls specified herein and "Exterior" stud walls specified in Section 09 21 27.
- F. Attachment: Minimum 2 - #10 sheet metal screws at each stud.

### **3.5 INSTALLATION - CEILING**

- A. Install in compliance with manufacturer's recommendations.
- B. Provide required items to support and trim out neatly, flush or recessed mechanical and electrical items.
- C. Frame openings in ceiling support system to accommodate access panels and similar openings and penetrations.
  - 1. Completely frame openings with closed channel side of stud facing opening for support of recessed mechanical and electrical items.

### **3.6 INSTALLING CEILING SUPPORT SYSTEMS**

- A. Install suspension system components in sizes and spacings indicated on Drawings, but not less than those required by referenced installation standards for assembly types and other assembly components indicated.
- B. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.
- C. Suspend hangers from building structure as follows:
  - 1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.
    - a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
  - 2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.
    - a. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards.
  - 3. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.
  - 4. Flat Hangers: Secure to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices and fasteners that are secure and appropriate for structure and hanger, and in a manner that will not cause hangers to deteriorate or otherwise fail.
  - 5. Do not attach hangers to steel roof deck.
  - 6. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
  - 7. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
  - 8. Do not connect or suspend steel framing from ducts, pipes, or conduit.
- D. Fire-Resistance-Rated Assemblies: Wire tie furring channels to supports.
- E. Grid Suspension Systems:
  - 1. Attach perimeter wall track or angle where grid suspension systems meet vertical surfaces.
  - 2. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.
- F. Installation Tolerances:
  - 1. Install suspension systems that are level to within 1/8 IN in 12 FT measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

### **END OF SECTION**



**SECTION 09 29 00**  
**GYP SUM WALLBOARD**

**PART 1 - GENERAL**

**1.1 QUALITY ASSURANCE**

- A. Chinese manufactured and imported gypsum wallboard shall not be permitted for use.
- B. ASTM Standards:
  - 1. ASTM-C1396: Standard Specification for Gypsum Board.
  - 2. ASTM-C475: Joint Treatment Materials for Gypsum Wallboard.
  - 3. ASTM-C557: Adhesives.
  - 4. ASTM-D3273: Mold-resistant Gypsum Board.
  - 5. ASTM-C840: Application and Finishing of Gypsum Board.
  - 6. ASTM-C841: Installation of Interior Lathing and Furring.
  - 7. ASTM-C1002: Steel Drill Screws for Application of Gypsum Board or Metal Plaster Bases.
  - 8. ASTM-E84: Surface-Burning Characteristics of Building Materials.
  - 9. ASTM-E90: Sound Transmission Testing.
  - 10. ASTM-E119: Fire Tests of Building Construction.
  - 11. ASTM-C1629: Abuse-Resistant Non-decorated Interior Gypsum Panel Products and Fiber-Reinforced Cement Panels.
  - 12. GA-216 Recommended Specifications.
  - 13. GA-238 Guidelines for Prevention of Mold Growth on Gypsum Board.
- C. Environmental Reference Standards:
  - 1. Bay Area Air Quality Management District (BAAQMD):
    - a. Regulation 8, Rule 51.
  - 2. Code of Federal Regulations (CFR):
    - a. 40 CFR, Part 59, Subpart D-2001: National Volatile Organic Compound Emission Standards for Architectural Coatings.
- D. Fire-Resistance-Rated Assemblies:
  - 1. For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM-E119 by an independent testing agency.
  - 2. Provide materials listed by UL, or other approved testing laboratory, for construction and rating type indicated.
- E. STC-Rated (sound-rated) Assemblies:
  - 1. Provide materials and construction identical to those tested in assembly indicated according to ASTM-E90 and classified according to ASTM-E413 by an independent testing agency.
- F. Environmental Criteria:
  - 1. Sealants:
    - a. Bay Area Air Quality Management District (BAAQMD); Regulation 8, Rule 51.
      - 1) Code of Federal Regulations (CFR); 40 CFR, Part 59, Subpart D-2001: National Volatile Organic Compound Emission Standards for Architectural Coatings.
  - 2. Adhesives:
    - a. South Coast Air Quality Management District (AQMD): Comply with requirements of Rule 1168 – Adhesive Applications:
      - 1) Adhesive VOC Content: 40 CFR 59, Subpart D (EPA Method 24).
  - 3. Insulation: Environmental Protection Agency (EPA) Comprehensive Procurement Guidelines (CPG): Comply with recovered (recycled) content criteria of the CPG for insulation materials.

## 1.2 SUBMITTALS

- A. Project Information:
  - 1. Manufacturer exposure limitations for wallboard installation prior to building being weather-tight:
  - 2. Manufacturer name of listed products.
- B. LEED Information:
  - 1. LEED Credits MR 4.1 and 4.2, Recycled Content: Product data indicating percentages by weight of post-consumer and post-industrial recycled content for products having recycled content; include statement indicating costs for each product having recycled content.
  - 2. LEED Credits MR 5.1 and 5.2, Regional Materials: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.
  - 3. LEED Credit EQ 4.1, Low-Emitting Materials – Adhesives and Sealants: Manufacturer’s product data for construction sealants, including printed statement of VOC content.

## 1.3 STORAGE AND HANDLING

- A. Store materials inside under cover and keep them dry and protected against damage from weather, condensation, direct sunlight, construction traffic, and other causes:
  - 1. Stack panels flat to prevent sagging.

## 1.4 PROJECT CONDITIONS

- A. Environmental Limitations:
  - 1. Comply with ASTM-C840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.
- B. Avoid installation of interior wallboard products until installation areas are enclosed and conditioned.
  - 1. Temporarily protect un-enclosed spaces from effects of weather.
  - 2. Do not install panels that are wet, moisture-damaged, or contaminated by mold.
  - 3. Remove installed items that have been damaged by moisture or are contaminated by mold:
    - a. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
    - b. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.
- C. During gypsum wallboard installation and finishing: Maintain temperatures between 50 and 70 DegF.
- D. Coordinate installation with other trades to allow time for correct installation of their work.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Acceptable manufacturers:
  - 1. Gypsum Wallboard and accessories:
    - a. Base:
      - 1) Georgia Pacific (GP).
    - b. Optional:
      - 1) United States Gypsum (USG).
      - 2) National Gypsum Company (NGC).
      - 3) Certaineed.
      - 4) American Gypsum.

2. Specialty Drywall Trim:
  - a. Base:
    - 1) Pittcon Industries.
  - b. Optional:
    - 1) Fry Reglet Corp.
    - 2) Gordon, Inc.
3. Foam tape:
  - a. Base:
    - 1) Norton Performance Plastics.
4. Sound Attenuation Batts (SAB):
  - a. Base:
    - 1) Owens Corning.
  - b. Optional:
    - 1) Johns Manville.
    - 2) Knauf Insulation.
    - 3) Guardian.
    - 4) Certainteed.
    - 5) Thermafiber.
5. Acoustical sealants:
  - a. Base:
    - 1) USG.
  - b. Optional:
    - 1) Tremco.
    - 2) Pecora.
    - 3) Grabber.
    - 4) BOSS.
    - 5) STI.

## 2.2 GYPSUM WALLBOARD (GWB) SCHEDULE

- A. General:
  1. Utilize the following, in conjunction with Wall Types, Details, and Finish Schedule to determine types of wallboard appropriate to each condition.
  2. Furnish in maximum available lengths, consistent with installation requirements:
    - a. Long Edge: Tapered.
    - b. Short Ends: Square.
  3. Upgrade the listed types to fire-rated equivalent products when used in fire-rated assemblies.
  4. Upgrade the listed GWB products to mold-resistant types, where wallboard is installed in Electrical, Communication Rooms, Mechanical shafts, Stair Shafts and similar locations where wallboard is installed prior to building being weather-tight.
- B. Exterior Gypsum Sheathing (walls):
  1. Specified in Section 09 21 27.
- C. Exterior Gypsum Sheathing (ceilings and soffits):
  1. Specified in Section 09 21 27.
- D. Interior face of Exterior Walls:
  1. Mold-resistant (with facer):
    - a. Application: In-board face of exterior stud walls.
    - b. Thickness: 5/8 IN.
    - c. Mold-resistance score: 10 per ASTM-D3273.
    - d. Base Product: "DensArmor PLUS Interior Guard" and "DensArmor PLUS Interior Guard Fireguard" by Georgia Pacific.
    - e. Optional Products:
      - 1) "XP Wallboard" and "Fire-Shield XP Wallboard" by National Gypsum;
      - 2) "Mold Tough" and "Mold Tough Firecode" by USG.

- 3) "ProRoc Moisture & Mold Resistant Gypsum" and "ProRoc Moisture & Mold Resistant Gypsum Type X" by Certainteed.
  - f. Utilize approved fire-resistive products where MR wallboard is scheduled in Fire Rated Walls.
- E. Interior Partitions and Ceilings:
1. Regular board (conventional paper faced , with gypsum core):
    - a. Applications: Non-wet, non-fire rated interior walls and ceilings.
    - b. Thickness: 5/8 IN.
    - c. Base Product: "Toughrock Gypsum Wallboard" by Georgia Pacific.
  2. Fire-rated board (conventional, Type X core, with paper facers):
    - a. Applications: Use for fire rated walls, fire rated ceilings and joint backing at fire rated ceilings.
    - b. Thickness: 5/8 IN.
    - c. Base Product: "Toughrock Fireguard Type X and Toughrock Fireguard C Gypsum Wallboard" by Georgia Pacific.
    - d. Optional Product: "ProRoc Type X" by Certainteed.
  3. Moisture-resistant Gypsum Wallboard (MR GWB):
    - a. Applications: Use for non-tiled walls and casually-wet walls and where indicated. (Upgrade to Tile Backer Board for tiled walls and walls with frequent wetting such as like Showers, Decontam, and Cart Washing etc.).
    - b. Thickness: 5/8 IN.
    - c. Mold-resistance score: 10 per ASTM-D3273.
    - d. Base Product: "DensArmor PLUS Interior Guard" and "DensArmor PLUS Interior Guard Fireguard" by Georgia Pacific.
    - e. Optional Products:
      - 1) "XP Wallboard" and "Fire-Shield XP Wallboard" by National Gypsum;
      - 2) "Mold Tough" and "Mold Tough Firecode" by USG.
      - 3) "ProRoc Moisture & Mold Resistant Gypsum" and "ProRoc Moisture & Mold Resistant Gypsum Type X" by Certainteed.
    - f. "XP Wallboard" "Fire-Shield XP Wallboard" by National Gypsum; "Mold Tough" and "Mold Tough Firecode" by USG.
    - g. Utilize approved fire-resistive products where MR wallboard is scheduled in Fire Rated Walls.
  4. Tile Backer Board (TBB):
    - a. Applications:
      - 1) Provide TBB at walls of showers, tub rooms, toilet rooms, decontamination rooms, and similar walls where tile is scheduled.
      - 2) Provide TBB at non-tile walls that will be continuously wet.
    - b. Description: Moisture-resistant treated gypsum core, glass mats (both sides), and vinyl, water barrier coating on finished side:
      - 1) Conventional cement-board and "green-board" products are not acceptable.
    - c. Thickness: 5/8 IN.
    - d. Base Product: "DensShield Tile Backer" by Georgia Pacific.
      - 1) Include Level 5 finish at non-tiled portions.
    - e. Optional Product (uniform composition):
      - 1) "Fiberock Interior Panel, Aqua-Tough" by USG.
      - 2) "GlasRoc Tile Backer" by Certainteed.
    - f. Where TBB wallboard is scheduled in Fire Rated Walls. Upgrade to approved fire-resistive products with comparable moisture-resistance. Base Product: "DensShield Fireguard Tile Backer" by Georgia Pacific.
- F. Shaftwall Liner Panel (fire-rated):
1. Thickness: 1 IN x 24 IN wide.
  2. Fire-rated Type X core.
  3. Mold and moisture resistant:

- a. Tested in accordance with ASTM-E136.
- b. Fiberglass coated glass mats, both faces.
- c. Base Product: "DensGlass Ultra Shaftliner" by Georgia Pacific.

### **2.3 TRIM ACCESSORIES**

- A. General Interior Trim:
  - 1. General:
    - a. Comply with ASTM-C1047.
    - b. Material for general, interior uses: Galvanized or aluminum-coated steel sheet, rolled zinc, or paper-faced galvanized steel sheet
    - c. Material for wet and exterior areas: Zinc.
  - 2. Shapes:
    - a. Corner bead.
    - b. LC-Bead: J-shaped; exposed long flange receives joint compound.
    - c. L-Bead: L-shaped; exposed long flange receives joint compound.
    - d. U-Bead: J-shaped; exposed short flange does not receive joint compound.
    - e. Expansion (control) joint.
    - f. Curved-Edge Corner bead: With notched or flexible flanges.
    - g. Other items as indicated.
- B. Specialty Trim (where specifically indicated):
  - 1. General:
    - a. Profiles and dimensions indicated.
    - b. Material: 6063-T5 Aluminum.
    - c. Finish: Factory primed for paint-in-field.
    - d. Flanges to be embedded: Corrosion-resistant primer compatible with joint compound and finish materials specified.
  - 2. Base Products:
    - a. Wall Reveals: "SRW Series" by Pittcon.
    - b. Trim Reveals: "STR Series" by Pittcon.

### **2.4 JOINT TREATMENT MATERIALS**

- A. General:
  - 1. Comply with ASTM-C475.
- B. Joint Tape:
  - 1. Interior Gypsum Wallboard: Paper.
  - 2. Tile-backing Panels: As recommended by panel manufacturer.
- C. Joint Compounds for Interior Gypsum Wallboard:
  - 1. Ensure products are compatible with other compounds applied previously or on successive coats.

| Required Compound Types  |   |   |
|--------------------------|---|---|
| Purpose                  | Additional Description  | Compound Type Required  |
| Pre-filling              | For filling open joints and voids   | Setting-type, Taping Compound   |
| Embedding and First Coat | For embedding tapes & first coat over joints, fasteners, and trim flanges | Setting-type, Taping Compound   |
| Fill Coat                | For second coat   | Setting-type, Sand-able Topping Compound<br>OR<br>Drying-type, All-purpose Compound.  |
| Finish Coat              | For third coat  | Drying-type, All-purpose Compound.  |
| Skim Coat                | For final coat of Level 5 finish, where a Level 5 finish is specified     | Setting-type, Sand-able Topping Compound<br>OR<br>Drying-type, All-purpose Compound.<br>OR<br>High-build, spray-applied coating product designed to produce Level 5 finish (without traditional, trowel-applied skim coat.) |

**Notes:**

1. Above table applies to conventional, paper-faced, interior wallboard. For paperless wallboard panels: Use compounds recommended by panel manufacturer.
2. Cementitious Backer Units: As recommended by backer unit manufacturer. Use compounds recommended by panel manufacturer.
3. Water-Resistant Gypsum Backing Board: Use setting-type taping compound and setting-type, sandable topping compound.
4. Glass-Mat, Water-Resistant Backing Panel: Use compounds recommended by panel manufacturer.
5. Provide dust control products in occupied areas or adjacent to occupied areas. Base Product: "Sheetrock Brand Dust Control Joint Compound" by USG.

D. Laminating Adhesive:

1. Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.
2. Manufacturer's recommended type for use with selected materials, mildew resistant, non-staining type, and with a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

**2.5 ACOUSTICAL MATERIALS**

A. General:

1. Provide where indicated.
2. Minimum Nominal Thickness: As required to achieve STC indicated for wall systems.
3. Density: As required to achieve STC indicated for wall systems.

B. Sound Attenuation Batts (SAB):

1. Material: Glass or Mineral Fiber.
2. Commercial sound blanket, ASTM-C665, Type I (un-faced) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.
3. Surface burning characteristics (per ASTM-E84):
  - a. Minimum Flame Spread: 10.
  - b. Maximum Smoke developed: 10.
4. Fire-Resistance-Rated Assemblies: Select SAB materials and thicknesses that that are approved for use in assemblies listed.
5. Acoustically rated Assemblies: Select SAB materials and thicknesses that that are approved for use in assemblies listed.
6. Base Product: "QuietZone Sound Attenuation Batts" by Owens-Corning;
7. Optional: "Sound Attenuation Fire Blankets" by Thermafiber.

C. Acoustical Sealants:

1. Flexible, non-hardening.

2. Base Product: "Acoustical Sealant" by USG:
  - a. Optional: "Acoustical Sealant" by Tremco; "Dynatrol II" by Pecora; "Acoustical Sealant GSC" by Grabber; "SpecSeal Smoke N Sound Caulk" by STI; "824 Acoustical Sound Sealant" by BOSS.
3. Spray-applied, expanding foam sealants will not be allowed.

## **2.6 MISCELLANEOUS ITEMS**

- A. Firestopping Sealants and Forming Materials:
  1. Specified in Section 07 84 00.
- B. Thermal Insulation:
  1. Specified in Section 07 21 00 and other Division 07 sections.
- C. Screws:
  1. ASTM-C1002, unless otherwise indicated.
  2. Self-tapping, bugle head, length to penetrate framing member minimum 5/8 IN.
  3. Type S for gypsum wallboard to metal; Type G for gypsum wallboard to gypsum wallboard.
  4. Screws used to secure wallboard panels to Metal Studs: Comply with ASTM-C954.
  5. Screws used with cementitious backer boards: As recommended by panel manufacturer.
- D. Sealants:
  1. Other than acoustical sealant below, see Section 07 92 16.
- E. Foam tape:
  1. PVC 1/2 x 1/4 IN: With pressure sensitive adhesive; Norseal.
  2. EPDM 1/2 x 1/4 IN: With pressure sensitive adhesive; Cellular rubber by Gasket Dynamics.
- F. Backing for control and expansion joints:
  1. Fire rated board.
- G. Sealer for moisture-resistant gypsum wallboard.
  1. Manufacturer's standard compound.
  2. Use at joints, cut edges and screw penetrations.
- H. Framing and suspension systems for Gypsum Board Ceilings:
  1. Specified in Section 09 22 16.

## **PART 3 - EXECUTION**

### **3.1 INSPECTION AND PREPARATION**

- A. Examine supporting structure and conditions prior to wallboard installation.
- B. Correct unsatisfactory conditions.
- C. Start of installation assumes responsibility for shielding integrity of system.
- D. Verify areas scheduled to receive radiation shielding are suitable for installation.

### **3.2 INSTALLATION – GENERAL**

- A. General Requirements:
  1. Comply with ASTM-C840.
  2. Install products per manufacturer's specific installation instructions.
  3. Remove loose materials and vacuum cavity of gypsum dust prior to enclosing stud space.
  4. Install wallboard vertically with edges over metal stud framing members and similar framing support members.
  5. Secure to each support or framing member with screws.
  6. Bring boards into contact but do not force into place.

7. Fit neatly and carefully.
  8. Stagger edge joints on opposite side of partition so they occur on different framing members.
  9. Proceed with attachment from board center toward ends and edges.
  10. Make cuts neatly.
  11. Install with 1/4 IN gap between gypsum board and floor.
  12. Seal ends, cutouts and screw penetrations of moisture resistant boards with sealer.
  13. Install wallboard over metal framing studs and similar framing support members at interior face of exterior walls full height from floor to structure above.
- B. Wallboard installation prior to building being weather-tight:
1. This is intended to allow early installation of wallboard in critical path areas such as: Electrical, Communication Rooms, Mechanical shafts, Stair Shafts and similar locations:
    - a. Notify Architect and BNL where such early installation is proposed.
  2. Where wallboard is installed prior to building being weathertight: Upgrade the scheduled GWB products to their mold-resistant counterparts:
    - a. Products proposed are subject to Architect approval.
  3. Exposure time shall be limited by manufacturer requirements.
- C. Sound Insulation:
1. Install sound insulation in walls from floor to structure above, where sound rated walls are indicated.
  2. Install in thicknesses and densities necessary to achieve sound rating.
  3. Pack spaces around electric boxes and other penetrations to maintain full sound rating:
    - a. Utilize Acoustical Sealants to fill small voids that remain
- D. Acoustical Sealant:
1. General:
    - a. Apply Acoustical Sealant at joints, voids, and penetrations through wallboard to maximize sound control:
      - 1) Seal wallboard edges to adjacent construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant.
      - 2) Install acoustical sealant at both faces of partitions at perimeters and through penetrations.
      - 3) Comply with ASTM-C919 and with manufacturer's written recommendations for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.
    - b. Upgrade to proper firestopping where required in Fire-rated. Refer to Section 07 84 00 for Firestopping of Thru-wall Penetrations.
  2. Base-of-Walls:
    - a. Provide a continuous bead of Acoustical Sealant to bottom edge of Gypsum Wallboard where it meets the floor. Do so at "all" walls regardless of fire rating.
  3. Head-of-Walls:
    - a. Apply Acoustical Sealant to top edge of wallboard where meets the superstructure:
      - 1) Exception: Use Firestopping (Specified in Section 07 84 00) at head condition of "fire-rated walls".
- E. Curved Partitions:
1. Space studs or furring to prevent flat areas between framing at curved surfaces.
- F. Wall Reveals:
1. Install reveal wall channels and/or aluminum framing as recommended by manufacturer.
- G. Changes in Material:
1. Install corner bead where partition or ceiling abuts structural element or dissimilar wall or ceiling.

- H. Installation Wallboard around Metal Door and Window Frames:
1. Contract Documents call for hollow metal frames to be rigorously aligned at time of their original installation:
    - a. Notify frame installer of specific frames that are noticeably out of alignment before wallboard work commences.
    - b. Take care not to unduly disturb their original alignment when installing adjacent wall board.
    - c. Notify frame installer of specific frames that become misaligned during the installation of wallboard.
  2. Upon completion of wallboard work, notify frame installer to return to site and check openings to for proper alignment.
  3. Work with frame installer to correct misalignment issues before proceeding.

### **3.3 INSTALLATION - SINGLE LAYER SYSTEM**

- A. Set screws between 3/8 to 1/2 IN from edges:
1. Space maximum 8 IN OC at edges and, 12 IN OC in field of board.
  2. Where wallboard butts at wall/ceiling juncture, hold screws back 6 IN from edges.
  3. Use closer screw spacing if required by UL.
- B. Drive screws so head rests in slight dimple without cutting face paper or fracturing core.

### **3.4 INSTALLATION - TWO LAYER SYSTEM**

- A. Space screws in base layer maximum 8 IN OC at edges, and 12 IN OC in field of board.
- B. Screw apply finish layer.
- C. Stagger joints not less than one support from first layer.

### **3.5 INSTALLING TRIM ACCESSORIES**

- A. General:
1. For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.
- B. Control Joints:
1. Install control joints according to ASTM-C840 and in specific locations approved by Architect for visual effect.
- C. Interior Trim: Install in the following locations:
1. Cornerbead: Use at outside corners.
  2. Bullnose Bead: Use at outside corners.
  3. Bullnose Bead: Use at outside corners where indicated.
  4. LC-Bead: Use at exposed panel edges.
  5. L-Bead: Use where indicated.
  6. U-Bead: Use at exposed panel edges where indicated.
  7. Curved-Edge Cornerbead: Use at curved openings.
- D. Specialty Trim: Install in locations indicated.

### **3.6 INSTALLATION - SHAFTWALL**

- A. Install shaft walls in compliance with UL and Gypsum Association description.
- B. Provide shaft wall systems permitting entire erection procedure from outside shaft.
- C. Provide special metal runner angles and channels, and studs or splines spaced per manufacturers requirements.
- D. Provide number, type and thickness of wallboard layers including air spaces and insulation to achieve indicated ratings for fire resistance and sound reduction.

- E. Comply with requirements for thickness of metal and thickness of wall, for heights of wall indicated.
- F. Use maximum practical board lengths.
- G. Bring boards into contact but do not force into place.
- H. Fit neatly and carefully.
- I. Seal perimeter and openings with firestopping.

### **3.7 PROJECTIONS IN ELEVATOR HOISTWAYS**

- A. Inspect elevator shafts to determine if projections greater than 4 IN exist.
- B. Where such projections exist:
  - 1. Install GWB bevels sloping at 75 degrees from horizontal.
  - 2. Utilize metal studs of strength necessary.

### **3.8 INSTALLATION – CEILING**

- A. Install in compliance with manufacturer's recommendations.
- B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.
- C. Install fire rated ceiling assemblies as indicated:
  - 1. Fasten minimum 3 IN wide fire rated board continuous over joints or use firestopping.
- D. Install sound insulation so coverage required for sound rating is achieved; maximum 2.2 PSF.
- E. Access Panels and Doors: Locate where required by Sections 08 31 16 and 26 00 10, or where indicated. See Section 08 31 16 for product description.

### **3.9 CONTROL JOINTS**

- A. General:
  - 1. Install Control Joints in location indicated and as described in this article.
  - 2. Comply with additional requirements of ASTM-C840, GA-216, and GA-234.
  - 3. Install suitable backing material to maintain required rating where Control Joints occur in fire or sound rated assemblies.
- B. Partitions:
  - 1. Provide vertical Control Joints (on both wall faces) which align with door frames, window frames, and similar opening as follows:
    - a. Single Doors and Cased Opening:
      - 1) Locate CJ's at both jambs, from head of opening to top of partition.
    - b. Pair doors:
      - 1) Locate CJ's at both jambs, from head of opening to top of partition.
      - 2) Exception: Control Joints are not required where partition forms a "cross-corridor" condition.
    - c. Doors with adjacent sidelights:
      - 1) Locate CJ's at both jambs from head of opening to top of partition, and, from sill to floor at sidelight jambs.
    - d. Sliding Doors:
      - 1) Locate CJ's at both jambs, from head of opening to top of partition.
    - e. Punched Windows (less than 30 FT in width):
      - 1) Both jambs from head of opening to top of partition, and from sill edge to floor.
    - f. Ribbon Windows (more than 30 FT in width):
      - 1) Both jambs from head of opening to top of partition, and from sill edge to floor.

- 2) Locate additional intermediate CJ's (constructed similarly) so that maximum distance between CJ's does not exceed 30 FT apart.
  2. Provide additional vertical Control Joints, spaced no more than 30 FT apart from each other, from opening-related CJ's (listed above), or from corners.
  3. Provide horizontal Control Joints at partitions which are more than one story in height:
    - a. Locate horizontal Control Joints where partitions bypass each intermediate floor.
    - b. Align control joint with floor line, unless otherwise indicated.
- C. Ceilings:
1. Use Control Joints to subdivide ceilings/soffits as indicated, and within the following limits:
    - a. Ceilings with perimeter relief:
      - 1) Subdivide so that no area exceeds 2500 FT<sup>2</sup>, and no area has a length which exceeds 50 FT:
        - a) Exception where Ceiling occurs at Exterior: Subdivide so that no area exceeds 900 FT<sup>2</sup>, and no area has a length which exceeds 30 FT.
    - b. Ceilings without perimeter relief:
      - 1) Subdivide so that no area exceeds 900 FT<sup>2</sup>, and no area has a length which exceeds 30 FT.
    - c. Locate Control Joints at transitions between areas of different shapes.
- D. Soffits:
1. Use Control Joints to subdivide ceilings/soffits as indicated, and within the following limits:
    - a. Exterior Subdivide so that no area exceeds 900 FT<sup>2</sup>, and no area has a length which exceeds 30 FT.
    - b. Locate Control Joints at transitions between areas of different shapes.
    - c. Continue lines of soffit Control Joints vertically to top of fascia.

### 3.10 WALLBOARD FINISHING

- A. General:
1. Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration.
  2. Promptly remove residual joint compound from adjacent surfaces.
- B. Pre-fill open joints and voids, rounded or beveled edges, and damaged surface areas.
- C. Apply joint tape over gypsum board joints, except those with trim having flanges not intended for tape.
- D. Where wallboard abuts dissimilar surfaces: Securely attach continuous trim beads in accordance with manufacturers directions.
- E. Where bead abuts exterior metal window frames or other metal components, separate from other material by use of foam tape.
- F. Apply Joint Compound and Tape in accordance with fire-rated design:
1. Apply joint treatment compound in accordance with manufacturer's directions.
  2. Fill joints, screw heads, and internal corners with compound.
  3. Extend joint system vertically from floor to extent described as follows:
    - a. Fire Walls, Barriers, and Partitions: Extend to full height of wall.
    - b. Smoke Barriers and Partitions: Extend to full height of wall.
    - c. Interior face of exterior wall (non-rated): Extend to full height of wall.
  4. Refer to Drawings for indication of partition heights.
- G. Level 4 Finish:
1. Comply with ASTM-C840.
  2. After drying, sand or otherwise smooth final coat of compound as needed to eliminate high spots or excess compound to leave smooth, even, and level surface.
  3. Draw down final coat of compound to a smooth even plane.

4. Locations:
    - a. Wallboard scheduled to be finished with Gloss Level 1 (flat), Level 2 (velvet), or Level 3 (eggshell) paint, glazed coating, textured coating, or wall covering.
    - b. All other locations, unless noted otherwise.
- H. Level 5 Finish:
1. Comply with ASTM-C840.
  2. After irregularities have been eliminated, a thin skim coat of joint compound or material manufactured specifically for this purpose shall be trowel applied to the entire surface of the board and joints, and excess compound removed leaving a thin film covering the surface.
  3. Avoid ridges or tool marks that might show through finishes.
  4. Lightly sand or sponge where required to assure a smooth, even, and level surface.
  5. Locations:
    - a. Exposed ceiling, soffit, or wall areas abutting window mullions, skylights, or receiving direct indoor lighting.
    - b. Long hallways or corridors.
    - c. Atriums, Lobbies, Auditoriums and similar large spaces.
    - d. Multi-story spaces.
    - e. Wallboard scheduled to be finished with Gloss Level 4 (satin), Level 5 (semi-gloss), Level 6 (gloss), Level 7 (high gloss), paint, glazed coating, textured coating, or wall covering.
    - f. Surfaces using MRB or other wallboard types with a glass mat facer on finished side.
    - g. Exceptions: Revert to Level 4 where above listed surfaces are to be finished with textured decorative treatments, wall covering, paneling, or wall guard.
- I. Repairs:
1. After painter has applied primer to wallboard surfaces, repair and refinish defective areas.
  2. If wallboard is damaged, or surfaces are roughened, repair, or remove and replace, to satisfaction of Architect, at no additional cost to BNL.

### **3.11 PARTITION IDENTIFICATION**

- A. Identify partitions indicated on Drawings as having a required fire or smoke rating.
1. Identification: Same as indicated on drawing legend.
  2. Location: 10 FT on center but not less than once per wall segment, both sides of partition, above ceiling line:
    - a. Above access panels in hard ceiling.
  3. Lettering: 2 IN Helvetica, painted with aid of stencils.
  4. Color: Red.

### **3.12 PROTECTION**

- A. Protect installed wallboard from water damage during construction.
- B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
- C. Remove and replace panels that are wet, moisture damaged, and mold damaged:
1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
  2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.
- D. Prior to finishing, walls shall be inspected for visible mold growth:
1. Replace affected portions.

## **END OF SECTION**

## SECTION 09 30 00

### TILE

#### PART 1 - GENERAL

##### 1.1 SUBMITTALS

- A. Shop Drawings:
  - 1. Indicate tile layout, patterns, color arrangement, perimeter conditions, junctions with dissimilar materials, movement joints, thresholds, ceramic accessories, and setting methods and details.
- B. Samples:
  - 1. Three full size samples of each tile specified Room Finish and Color Schedule as shown on drawings.
- C. Project Information:
  - 1. Installation methods.
  - 2. Manufacturer's Certificate: For each shipment, type and composition of tile provide a Master Grade Certificate signed by the manufacturer and the installer certifying that products meet or exceed the specified requirements of ANSI A137.1.
- D. Contract Closeout Information:
  - 1. Maintenance Data: Include recommended cleaning methods, cleaning materials, stain removal methods, and polishes and waxes.
  - 2. Letter stating extra material has been delivered.
- E. LEED Information:
  - 1. LEED Credits MR 4.1 and 4.2, Recycled Content: Product data indicating percentages by weight of post-consumer and post-industrial recycled content for products having recycled content; include statement indicating costs for each product having recycled content.
  - 2. LEED Credits MR 5.1 and 5.2, Regional Materials: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.
  - 3. LEED Credit EQ 4.1, Low-Emitting Materials – Adhesives and Sealants: Manufacturer's product data for construction sealants, including printed statement of VOC content.

##### 1.2 QUALITY ASSURANCE

- A. ANSI A137.1, 1988 - Specifications for Ceramic Tile.
- B. TCNA (HB) - Handbook for Ceramic Tile Installation; Tile Council of North America, Inc.
- C. ANSI A108, A118, and A136 Specifications for Installation of Ceramic Tile.
- D. Maintain one copy each of applicable reference standards and specifications on site.
- E. Installer Qualifications: Company specializing in performing the work of this section with minimum 5 years experience.
- F. Single Source Responsibility:
  - 1. Obtain each type and color of tile from a single source.
  - 2. Obtain each type and color of mortar, adhesive and grout from the same source.

### **1.3 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver and store products in manufacturer's unopened packaging until ready for installation.
- B. Protect adhesives and liquid additives from freezing or overheating in accordance with manufacturer's instructions.
- C. Store tile and setting materials on elevated platforms, under cover and in a dry location and protect from contamination, dampness, freezing or overheating.

### **1.4 ENVIRONMENTAL REQUIREMENTS**

- A. Do not install adhesives in an unventilated environment.
- B. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.
  - 1. Maintain ambient and substrate temperature of 50 DegF during installation of mortar materials.

### **1.5 EXTRA MATERIALS**

- A. Provide 10 sq ft of each size, color, and surface finish of tile specified.

## **PART 2 - PRODUCTS**

### **2.1 MANUFACTURERS**

- A. Acceptable manufacturers:
  - 1. Tile:
    - a. Base:
      - 1) Caesar.
      - 2) As noted in Room Finish and Color Schedule shown on drawings.
    - b. Optional:
      - 1) Daltile.
      - 2) American Olean.
  - 2. Accessories:
    - a. Base:
      - 1) As scheduled.

### **2.2 TILE**

- A. General: Provide tile that complies with ANSI A137.1 for types, compositions and other characteristics indicated. Provide tile in the locations and of the types colors and pattern indicated on the Drawings and identified in the Schedule and the end of this Section. Tile shall also be provided in accordance with the following:
  - 1. Factory Blending: For tile exhibiting color variations within the ranges selected under Submittal of samples, blend tile in the factory and package so tile taken from one package shows the same range of colors as those taken from other packages.
  - 2. Mounting: For factory mounted tile, provide back or edge mounted tile assemblies as standard with the manufacturer, unless otherwise specified.
  - 3. Factory Applied Temporary Protective Coatings: Where indicated under tile type, protect exposed surfaces of tile against adherence of mortar and grout by precoating with a continuous film of petroleum paraffin wax applied hot. Do not coat unexposed tile surfaces.
  - 4. Trim Units: Matching bead, bull-nose, cove, and base shapes in sizes coordinated with field tile.
  - 5. Static Coefficient of Friction: Tile on walkway surfaces shall be provided with the following values as determined by testing in conformance with ASTM C 1028.
    - a. Level Surfaces: Minimum of 0.6 (Wet).

- b. Step Treads: Minimum of 0.6 (Wet).
- c. Ramp Surfaces: Minimum of 0.8 (Wet).
- 6. Sizes:
  - a. PCT-1 is 11-13/16 IN x 23-5/8 IN x nominal .12 mm.
  - b. PCT-2 is 11-13/16 IN x 11-13/16 IN x nominal .12 mm.
  - c. Base: 2-6/8 IN x 11-13/16 IN.
- 7. Edges: Square.
- 8. Grout joint: 2/3 mm.

### 2.3 SETTING MATERIALS

- A. Setting materials: As required by installation Method, See Part 3.
- B. VOC content of adhesives shall have a VOC content no greater than 65g/L in accord with SCAQMD Rule #1168.
- C. Tile backer board: See Section 09 29 00.
- D. Shower liner:
  - 1. Listed in International Plumbing Code, 417.
  - 2. Approved by Authority Having Jurisdiction.
    - a. Listed in International Association of Plumbing and Mechanical Officials Directory:

### 2.4 TRIM AND ACCESSORIES

- A. Non-Ceramic Trim: Material and finish, style and dimensions to suit application, for setting using tile mortar or adhesive; use in the following locations:
  - 1. Transition between floor finishes of different heights.
  - 2. Thresholds at door openings.
- B. Transition Joint Strips: Profile and height as indicated; with integral perforated anchoring leg for setting the strip into the setting material:
  - 1. Transition strip profile:
    - a. Sloped, variable height: If adjacent flooring level is different than tile.
      - 1) Schluter-RENO-V.
    - b. Flat, smooth profile. If adjacent flooring level is same as tile.
      - 1) Schluter-RENO-T.
  - 2. Height:
    - a. As required to suit application.
    - b. Maximum change in level: 0-1/2 IN.
    - c. Maximum slope: 1:2.
  - 3. Material: Stainless Steel.
    - a. Finish: As selected by Architect from manufacturer's standard finishes.
- C. Joint Sealant: Two component polyurethane sealant, ASTM-C920, Type M (self-leveling) for horizontal joints, Type II (non-sag) for vertical joints as specified in Section 07 92 16.
  - 1. Color: Match grout.
  - 2. Ensure sealant is chemically compatible with tile, mortar, and grout.
  - 3. Ensure sealant can physically and chemically withstand environmental conditions normally expected at installation areas.
  - 4. Joint Backing: Closed cell foam polyethylene.
  - 5. Sealants shall have a VOC content no more than 70 g/L in accord with SCAQMD Rule #1168.
- D. Setting Buttons: Plastic buttons of thickness required for joint size indicated to maintain uniform joint width.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Verify that wall surfaces are free of substances which would impair bonding of setting materials, smooth and flat within tolerances specified in ANSI A137.1, and are ready to receive tile.
- B. Verify that sub-floor surfaces are dust-free, and free of substances which would impair bonding of setting materials to sub-floor surfaces, and are smooth and flat within tolerances specified in ANSI A137.1.
- C. Verify that concrete sub-floor surfaces are ready for tile installation by testing for moisture emission rate and alkalinity; obtain instructions if test results are not within limits recommended by tile manufacturer and setting materials manufacturer.
- D. Verify that required floor-mounted utilities are in correct location.

### **3.2 PREPARATION**

- A. Protect surrounding work from damage.
- B. Remove any curing compounds or other contaminates.
- C. Vacuum clean surfaces and damp clean.
- D. Seal substrate surface cracks with filler. Level existing substrate surfaces to acceptable flatness tolerances.
- E. Install backer board in accordance with ANSI A108.11 and board manufacturer's instructions. Tape joints and corners, cover with skim coat of dry-set mortar to a feather edge.
- F. Prepare substrate surfaces for adhesive installation in accordance with adhesive manufacturer's instructions.

### **3.3 INSTALLATION - GENERAL**

- A. Install tile and setting materials in accordance with applicable requirements of ANSI A108.1 through A108.13, manufacturer's instructions, and TCNA Handbook recommendations.
- B. Install shower liner:
  - 1. Coordinate with shower drain, See Section 22 42 00.
- C. Exterior: Provide waterproofing method over interior space.
- D. Interior: Provide waterproofing method TCNA "wet" area:
  - 1. "Tile surfaces that are either soaked, saturated, or regularly and frequently subjected to moisture or liquids (usually water), such as gang showers, tub enclosures, showers, laundries, saunas, steam rooms, swimming pools, hot tubs, and exterior areas."
- E. Lay tile to pattern indicated. Arrange pattern so that a full tile or joint is centered on each wall and that no tile less than 1/2 width is used. Do not interrupt tile pattern through openings.
- F. Cut and fit tile to penetrations through tile, leaving sealant joint space. Form corners and bases neatly. Align floor joints.
- G. Place tile joints uniform in width, subject to variance in tolerance allowed in tile size. Make joints watertight, without voids, cracks, excess mortar, or excess grout.
- H. Form internal angles square and external angles bullnosed.
- I. Install ceramic accessories rigidly in prepared openings.
- J. Install non-ceramic trim in accordance with manufacturer's instructions.

- K. Where accent tiles (such as glass tiles) are of a lesser thickness than surrounding field tiles: Increase bedding thickness as required to achieve relatively flush alignment between finished faces of accent tiles and adjacent field tiles.
- L. Install thresholds where indicated.
- M. Sound tile after setting. Replace hollow sounding units.
- N. Allow tile to set for a minimum of 48 hours prior to grouting.
- O. Grout tile joints. Use standard grout unless otherwise indicated.
- P. Movement Joints and Other Sealant Usage:
  - 1. Comply with TCNA EJ171.
  - 2. Locate movement joints where indicated.
  - 3. Where not indicated: Locate movement joints directly over the following substrate conditions:
    - a. Changes in substrate material.
    - b. Over control joints, expansion joints and seismic joints in substrate.
    - c. Over construction joints in substrate (cold joints).
    - d. At junctures of floors meet and walls and other restraining elements such as curbs, columns, bases, and wall corners.
    - e. At other locations recommended by TCNA EJ171 Movement Joint requirements.
  - 4. Furthermore, locate additional Movement Joints in accordance with maximum spacing allowed by following table:

| <b>Maximum Spacing of Movement Joints</b>              |                        |
|--|------------------------|
| <b>Condition</b>                                       | <b>Maximum Spacing</b> |
| Interior   | 25 FT                  |
| Interior where exposed to direct sunlight or moisture. | 12 FT                  |
| Exterior   |                        |

- 5. Joint Width: In accordance with TCNA EJ171.
- 6. Rake or cut control joints through setting bed to supporting slab or structure. Keep joints free of mortar.
- 7. Fill joints with self-leveling polyurethane sealant and backing material specified in Section 07 92 16.
- 8. Provide sealant material at items penetrating tile work, unless otherwise indicated.
- 9. Apply sealant to junction of tile and dissimilar materials and junction of dissimilar planes.
- 10. Fill joints around toilet fixtures with white silicone sanitary sealant. Refer to Section 07 92 16.
- 11. Use manufacturer's expansion joint flashing when covering expansion joints with waterproof or crack isolation membranes.
- 12. Provide sealants and related materials in accordance with cited ANSI and TCNA requirements.
- Q. Penetrating Sealer:
  - 1. General:
    - a. Apply Penetrating Sealer to all tiled surfaces (unless otherwise noted):
      - 1) Exception: Application of Penetrating Sealer is not necessary where Epoxy Grouts are used.
    - b. Apply in accordance with Manufacturer's instructions.
  - 2. Surface Preparation:
    - a. Ensure that surface is dry, clean and free of waxes, sealers or finishes.
    - b. Utilize recommended cleaner/stripper as necessary.
    - c. Ensure that tile and grout have been in place and are fully cured (48 - 72 hours depending on conditions).

- d. Test product in obscure area to ensure desirable results.
- 3. Application:
  - a. Apply Penetrating Sealer using a clean new mop, lambswool applicator, sponge or brush.
  - b. Allow it to penetrate for 10 - 15 minutes.
  - c. Wipe off any excess.
  - d. Apply a second coat (using same procedure) to ensure that Grout and porous tiles are well sealed.
  - e. Test after 2 hours by applying drops of water on the surface.
    - 1) If it penetrates immediately, apply an additional coat.
- 4. Cleaning:
  - a. If a residue is visible on the surface after drying, remove it with a sponge or white polishing pad 60 minutes after application.

**3.4 CLEANING**

- A. Clean tile and grout surfaces.

**3.5 PROTECTION OF FINISHED WORK**

- A. Do not permit traffic over finished floor surface for 72 hours after installation.
- B. Cover floors with kraft paper and protect from dirt and residue from other trades.
- C. Where floor will be exposed for prolonged periods cover with plywood or other similar type walkways.

**3.6 INSTALLATION METHODS**

| <b>INSTALLATION - FLOORS - THIN-SET METHODS</b>     |             |   |                  |
|---|-------------|---|------------------|
| <b>Application/Substrate</b>                        | <b>TCNA</b> | <b>Bond/mortar</b>                                    | <b>Grout</b>     |
| Exterior Concrete                                   | F102        | Dry set or latex Portland cement                      | Standard grout   |
| Exterior Concrete/waterproof (above interior space) | F102        | Waterproof membrane/ Dry set or latex Portland cement | Standard grout   |
| Interior concrete                                   | F113        | Dry set or latex Portland cement                      | Standard grout   |
| Interior concrete/waterproof (wet areas)            | F122        | Waterproof membrane/ Latex-Portland cement            | Polymer modified |
| Interior epoxy                                      | F131        | Epoxy   | Epoxy            |

| <b>INSTALLATION - SHOWERS AND BATHTUB WALLS</b>                                  |                     |                       |                           |
|--|---------------------|-----------------------|---------------------------|
| <b>Application/Substrate</b>   | <b>TCNA</b>         | <b>Bond/mortar</b>    | <b>Grout</b>              |
| Shower receptor (mortar set with liner)  | B420, Use with W245 | Latex-Portland cement | Standard/polymer modified |
| Wall backer  | W245                | Latex-Portland cement | Standard/polymer modified |
| Shower receptor (mortar set with liner)  | B431, Use with W247 | Latex-Portland cement | Epoxy                     |
| Wall backer  | W247                | Latex-Portland cement | Epoxy                     |
| Seal joints between tile work and other work with sealant, see Section 07 92 16. |                     |                       |                           |

| <b>INSTALLATION - WALL TILE</b> |                        |                                  |                           |
|---------------------------------|------------------------|----------------------------------|---------------------------|
| <b>Application/Substrate</b>    | <b>TCNA</b>            | <b>Bond/mortar</b>               | <b>Grout</b>              |
| Backer /membrane (toilets)      | W245/247               | Latex-Portland cement            | Standard/polymer modified |
| Backer                          | W223                   | Organic                          | Standard/polymer modified |
| Concrete or masonry             | W202                   | Dry set or latex Portland cement | Standard/polymer modified |
| Interior epoxy                  | W245, W247, W244 E,C,F | Latex-Portland cement            | Epoxy                     |
| Glass Tile                      |                        |                                  |                           |

**END OF SECTION**



**SECTION 09 51 00**  
**ACOUSTICAL & CEILING TILE MATERIALS (AM)**

**PART 1 - GENERAL**

**1.1 QUALITY ASSURANCE**

- A. Standard for suspension systems: ASTM-C635.
- B. Standard for installation: ASTM-C636.
- C. Ceilings and Interior Systems Construction Association (CISCA):
  - 1. Seismic Zones as 0 through 2.

**1.2 DESIGN PARAMETERS**

- A. Suspension System Design Parameters:
  - 1. Comply with:
    - a. 2003 International Building Code (Section 1621) and 2002 ASCE-7 (Section 9.6.2.6).
    - b. CISCA Standards: Current latest edition unless other editions are specifically by above building code or ASCE-7.
  - 2. IBC Seismic Category: Category B.

**1.3 SUBMITTALS**

- A. Samples:
    - 1. Three samples of each material selected for verification.
  - B. Contract Closeout Information:
    - 1. Maintenance data.
    - 2. Letter stating extra material has been delivered.
    - 3. Interior finish fire performance data:
      - a. Provide for each finish material and type specified:
        - 1) Manufacturer's printed information including:
          - a) Fire class.
          - b) NFPA test number.
          - c) Photograph.
        - 2) Proof of purchase.
- C. LEED Information:
  - 1. LEED Credits MR 4.1 and 4.2, Recycled Content: Product data indicating percentages by weight of post-consumer and post-industrial recycled content for products having recycled content; include statement indicating costs for each product having recycled content.
  - 2. LEED Credits MR 5.1 and 5.2, Regional Materials: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.
  - 3. LEED Credit EQ 4.1, Low-Emitting Materials – Adhesives and Sealants: Manufacturer's product data for construction sealants, including printed statement of VOC content.

**1.4 JOB CONDITIONS**

- A. Carefully coordinate ceiling layout with other work that penetrates acoustical ceiling systems.
- B. Specifically coordinate with sprinkler head spacing.
- C. Install acoustical material after floor and wall finishes.

## PART 2 - PRODUCTS

### 2.1 MATERIALS - ACOUSTICAL SUSPENSION SYSTEMS

- A. Suspension systems - General:
  - 1. Heavy duty systems, ASTM-C635.
  - 2. Main runner jointing by spliced, interlocking ends, tab locks, pin locks, or other suitable connections.
  - 3. Cross runners interlocking with main runners.
  - 4. Provide types indicated.
- B. Acceptable manufacturers (Suspension Systems):
  - 1. Steel Suspension Systems:
    - a. Base:
      - 1) As noted for individual types in Room Finish and Color Schedule, as shown on Drawings.
- C. Hanger Wire:
  - 1. General:
    - a. Pre-stretched, with a yield stress load of at least 5 times design load, but not less than 0.080 IN (12 GA).
    - b. Utilize continuous lengths, without kinks and splices.
  - 2. Galvanized Steel (general use):
    - a. Galvanized, soft annealed steel wire, conforming to ASTM-A641.
- D. Trim: Provide moldings wherever ceiling meets walls, partitions, other vertical elements, and other types of ceilings or ceiling fixtures; where ceiling mounted fixtures have integral flange trim, no additional trim is required.
- E. Attachment Devices:
  - 1. Size for 5 times the design load indicated in ASTM-C635, Table 1, "Direct Hung," unless otherwise indicated:
    - a. Comply with seismic design requirements where applicable.
  - 2. Anchors in Concrete:
    - a. Anchors of type and material indicated below, with holes or loops for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to 5 times that imposed by ceiling construction, as determined by testing per ASTM-E488 or ASTM-E1512 as applicable.
    - b. Acceptable types: Cast-in-place, post-installed expansion anchors and post-installed bonded anchors.
    - c. Material: Carbon-steel components zinc plated to comply with ASTM-B633, Class Fe/Zn 5 (0.005 mm) for Class SC 1 service condition.
  - 3. Power-Actuated Fasteners in Concrete:
    - a. Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hangers of type indicated, and with capability to sustain, without failure, a load equal to 10 times that imposed by ceiling construction, as determined by testing per ASTM-E1190.
- F. Suspension systems - types:
  - 1. **CG-1:** Exposed grid, non-rated:
    - a. Description: Galvanized, double web steel, main and cross runners.
    - b. Face width: 9/16 IN.
    - c. Base Product:
      - 1) "Suprafine XL", by Armstrong
    - d. Finish on exposed surfaces: Smooth, flat white.
  - 2. **CG-2:** Perimeter trim, non-rated:
    - a. Description: Extruded aluminum trim channel with cross-tee and main beam interface.
    - b. Trim Channel: 4 IN high, #AX4 STR.

- c. Corners: Factory cut.
  - d. Base Product:
    - 1) Armstrong Axiom Classic.
  - e. Finish on exposed surfaces: Smooth, flat, white.
  - f. Provide all manufacture-recommended posts, corners, and accessories.
- G. Framing and suspension systems for Gypsum Board Ceilings:
- 1. Specified in Section 09 22 16.

## 2.2 MATERIALS - CEILING TILES

- A. Acceptable manufacturers (Ceiling Tiles):
- 1. Ceiling tile - Wet formed mineral fiber:
    - a. Base:
      - 1) Armstrong Ceiling Products.
      - 2) As noted for individual types in Room Finish and Color Schedule as shown on drawings.
    - b. General performance description:
      - 1) Scheduled finishes to be factory applied.
      - 2) Class A incombustible units. Flame spread 125 or less. Smoke development: 50 or less.
      - 3) Fire rated units (when used): UL labeled.
      - 4) Edges uniformly fabricated, true, square.
      - 5) Sizes as required to fit scheduled suspension system.
- B. Acoustical Material Products:
- 1. AM-1:
    - a. Ultima Tegular Fine Texture #1912.
    - b. Size: 24" x 24" x 3/4".
    - c. Light Reflectance: 0.90.
    - d. Edge: Beveled.
    - e. Noise Reduction Co-efficient: 0.70.
    - f. Sag Resistance: Humiguard Plus.
    - g. Anti-Microbial: Bio Block.
  - 2. AM-2:
    - a. Health Zone Ultima #1936.
    - b. Size: 24" x 24" x 3/4".
    - c. Light Reflectance: 0.86.
    - d. Edge: Beveled, tegular.
    - e. Noise Reduction Co-efficient: 0.70.
    - f. Sag Resistance: Humiguard Plus.
    - g. Anti-Microbial: Bio Block.
    - h. Durability: Scrubbable.
  - 3. AM-3:
    - a. Optima Tegular Plank #3262.
    - b. Size: 24" x 96" x 1".
    - c. AC: 190.
    - d. Edge: Square.
    - e. Noise Reduction Co-efficient: 0.95.
    - f. Sag Resistance: Humiguard Plus.
    - g. Anti-Microbial: Inherent.
    - h. Accessories: Provide Clip #435, installed at 1/3 points along each long edge.
  - 4. AM-4 – Alternate Only:
    - a. Ultima Tegular Fine Texture #1915.
    - b. Size: 24" x 48" x 3/4".
    - c. Light Reflectance: 0.90.
    - d. Edge: Beveled.

- e. Noise Reduction Co-efficient: 0.70.
- f. Sag Resistance: Humiguard Plus.
- g. Anti-Microbial: Bio Block.

### **2.3 EXTRA MATERIAL**

- A. Provide BNL with one carton of each type and pattern of material for maintenance purposes.
- B. Provide in sealed labeled boxes to facilitate identification.

### **2.4 RELATED MATERIALS (SPECIFIED ELSEWHERE)**

- A. Diffusers and grilles: Specified in Section 23 31 13.
- B. Light Fixtures: Specified in Section 26 51 13.
- C. Sealants specified in Section 07 92 16.

### **2.5 FABRICATION**

- A. Intersections between Main Tees and Cross Tees: Butt cut and notch as required.
- B. Perimeter Wall Angles: Fabricate to match the system(s) specified.
- C. Include components and accessories necessary resist seismic loads and dead loads of items such as light fixtures and air diffusers.

## **PART 3 - EXECUTION**

### **3.1 INSPECTION**

- A. Verify suitability of substrate to accept installation.
- B. Examine installation site for unevenness or irregularities that would affect quality and execution of work.
- C. Installation constitutes acceptance of responsibility for performance.

### **3.2 PREPARATION**

- A. Consult other trades involved before start of ceiling work, to determine areas of potential interference.
- B. Do not start installation until interferences have been resolved.

### **3.3 INSTALLATION TOLERANCES**

- A. Comply with ASTM-C635.
- B. Maximum deviation from level plane: Not to exceed 1/8 IN in 10 FT (with no load applied).
- C. Maximum Bow: Not to exceed 1/32 IN in 2 FT.
- D. Maximum Camber: Not to exceed 1/32 IN in 2 FT.
- E. Maximum Twist: Not to exceed 1 Degree in 2 FT.

### **3.4 INSTALLATION - SUSPENSION SYSTEM - GENERAL**

- A. Design and install ceiling system per Cisca standards indicated in Part 1.
- B. Install suspension system in accordance with ASTM-C636 and manufacturers' instructions.
- C. Grid layout: See Reflected Ceiling Plans:
  - 1. Install grid square with room and with grid center lines or acoustical panel center lines coinciding with center lines of room, each direction:

- a. Acoustical panel dimension at perimeter walls: Not less than 6 IN.
  - b. In case of conflict with lighting plan contact Architect.
- D. Do not use defective or damaged materials.
- E. Install moldings where ceilings meet walls, partitions, other vertical elements, and other types of ceilings:
  - 1. Support runners and border units on moldings.
  - 2. Secure moldings to wall construction by fastening through holes drilled in web.
  - 3. Space holes not more than 3 IN from each end and at each stud.
  - 4. Draw up fasteners tight against vertical surfaces.
  - 5. Miter cut inside and outside corners.
  - 6. Level to a tolerance not more than 1 in 1000.
  - 7. Install with leg supporting bottom flange of runners.
- F. Leave suspension system ready to accept installation of acoustic materials.

### **3.5 INSTALLATION – WALL ANGLES**

- A. Install Wall Angles where ceilings meet walls, partitions, other vertical elements, and other types of ceilings:
  - 1. Secure Wall Angles to wall construction (coincident with stud spacing):
    - a. Maximum spacing from terminal ends: 3 IN.
    - b. Draw up fasteners tight against vertical surfaces.
  - 2. Level to a tolerance not more than 1 in 1000.
  - 3. Miter cut inside and outside corners.
  - 4. Install with leg supporting bottom flange of Main Tee's and Cross Tees.

### **3.6 INSTALLATION – HANGER WIRES**

- A. General:
  - 1. Provide in time to avoid delay in progress of work.
  - 2. Provide hangers and inserts necessary to support ceiling suspension systems and ceiling dead loads.
  - 3. Locate and align hangers and inserts correctly.
  - 4. Coordinate location and alignment with work of other trades.
  - 5. Do not suspend any part of suspension system from ducts, pipes, conduit, equipment, cable tray, etc.
  - 6. Provide supplementary rough suspension system and trapeezing where necessary to support ceilings beneath pipes, ducts, equipment, etc.
  - 7. Install hanger wires plumb to main tees and cross tees.
  - 8. Splay hangers no greater than 30 degrees from vertical to avoid obstructions or other conditions that prevent plumb, vertical installation.
  - 9. Install wires vertically in such a manner that they are not more than 1:6 out-of-plumb, unless counter-sloping wires are provided.
  - 10. Do not attach wires to, bent around, interfering material or equipment.
- B. Space hangers to prevent loads from items in or on ceiling from causing eccentric deflection and rotation:
  - 1. Provide additional hangers to support lighting fixtures.
  - 2. Provide additional hangers within 6 IN of end of main runners.
  - 3. Do not bear runners on walls or partitions.

### **3.7 INSTALLATION – MAIN RUNNERS**

- A. Utilize Wall Angles to align and receive terminal ends of Main Tees without transferring load to Wall Angle.
- B. Space Main Tees as indicated, and as required to receive lay-in panels and fixtures.

- C. Support terminal ends of Main Tees by wires located within 6 IN from boundary walls.
- D. Suspend Main Tees from building superstructure with hanger wires specified.
- E. Support Main Tees with hanger wire at intervals necessary to support applied load and to satisfy deflection criteria.

### **3.8 INSTALLATION – CROSS RUNNERS**

- A. Space Cross Tees as indicated, and as required to receive lay-in panels and fixtures:
  - 1. Install cross runners with a positive interlock.
- B. Utilize Wall Angles to align and receive terminal ends of Cross Tees without transferring load to Wall Angle.
- C. Support terminal ends of Cross Tees by wires located within 6 IN from boundary walls.
- D. Suspend Main Tees from building superstructure with hanger wires specified.
- E. Support Main Tees with hanger wire at intervals necessary to support applied load and to satisfy deflection criteria.

### **3.9 INSTALLATION – LAY-IN ITEMS**

- A. Install acoustic materials into suspension system in accordance with manufacturer's instructions.
- B. Install lay-in panels, fixtures, diffusers, grilles, and similar items in a manner that will not compromise performance of the suspension system:
  - 1. Provide supplemental hangers for fixtures which exceed manufacturer's published load data.
    - a. Supplemental hanger systems shall be approved by Building Official.
- C. Field cut as required to fit materials to grid:
  - 1. Tegular and similar tiles articulated edges:
    - a. Machine field-cut edges to match profile of factory edges.
- D. Make cuts square and true.
- E. Do not install damaged units.
- F. Install access splines in concealed systems as directed and as required to provide access to concealed items.
- G. Identify access tile with a white headed thumb tack.
- H. Do not provide access splines for tiles in security areas.
- I. Hold-down Clips:
  - 1. Provide Hold-down-clips where mylar-faced and/or foil-faced tiles are scheduled.
  - 2. Provide Hold-down-clips where scrubable tiles are scheduled.
  - 3. Provide hold down clips if UL rated ceiling requires.

### **3.10 CLEANING**

- A. Perform cleaning and replacement of defective units in time to avoid delay in progress of work and before final completion of work.
- B. Carefully clean soiled surfaces.
- C. Remove and replace irregular, discolored, defective or damaged components at no additional expense to BNL.

### **3.11 PROTECTION**

- A. Protect installed materials from damage.

**END OF SECTION**



**SECTION 09 54 24**  
**METAL PLANK CEILINGS**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general conditions of Contract, including General and Supplementary Conditions and Divisions-1 Specification sections apply to work of this section.

**1.2 SUMMARY**

- A. Section Includes:
  - 1. Metal ceiling panels.
  - 2. Suspension system.
  - 3. Wire hangers, clips, wall angle moldings and accessories.
- B. Related Sections:
  - 1. Section 09 51 00 – Acoustical Ceilings
  - 2. Division 23 Heating, Ventilating, and Air Conditioning
  - 3. Division 26 Electrical Work

**1.3 REFERENCES**

- A. American Society for Testing and Materials (ASTM):
  - 1. ASTM A 641 “Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire”
  - 2. ASTM C 423 “Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method”
  - 3. ASTM E 84 “Standard Test Method for Surface Burning Characteristics of Building Materials”
  - 4. ASTM E 1414 Standard Test Method for Airborne Sound Attenuation Between Rooms Sharing a Common Ceiling Plenum.
  - 5. ASTM E 1264 Classification for Acoustical Ceiling Products
  - 6. ASTM E1477 “Standard Test for Luminous Reflectance Factor of Acoustical Materials by use of Integrating-Sphere Reflectometers”
- B. International Code Council Evaluation Service
  - 1. AC156 - Acceptance Criteria for Seismic Qualification Testing of Non-structural Components

**1.4 SUBMITTALS**

- A. Product Data: Submit manufacturer’s technical data for each type of ceiling unit and suspension system required.
- B. Samples: Mimimum 12 inch x 12 inch samples of specified metal panel; 8 inch long samples of suspension system if applicable.
- C. Installation Instructions: Submit manufacturer’s installation instructions as referenced in Part 3, Installation.
- D. Shop Drawings: Submit manufacturer’s shop drawings as referenced in Part 3, Installation.
- E. Certifications: Manufacturer’s certifications that products comply with specified requirements, including laboratory reports showing compliance with specified tests and standards.

- F. LEED Information:
1. LEED Credits MR 4.1 and 4.2, Recycled Content: Product data indicating percentages by weight of post-consumer and post-industrial recycled content for products having recycled content; include statement indicating costs for each product having recycled content.
  2. LEED Credits MR 5.1 and 5.2, Regional Materials: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.
  3. LEED Credit EQ 4.1, Low-Emitting Materials – Adhesives and Sealants: Manufacturer’s product data for construction sealants, including printed statement of VOC content.

## **1.5 QUALITY ASSURANCE**

- A. Single-Source Responsibility: Provide metal ceiling and suspension components produced by a single manufacturer with resources adequate to deliver a product of consistent quality in terms of appearance and physical properties for all project scopes without risk of delay or interruption.
- B. Fire Performance Characteristics: Identify ceiling components with appropriate applicable, testing, including:
1. Surface Burning Characteristics: As follows, tested per ASTM E84:
    - a. Flame Spread: 25 or less
- C. Seismic Performance: System seismic performance verified through full-scale testing in accordance with ICC-ES – AC-156 Acceptance Criteria for Seismic Qualification Testing of Non-Structural components.
- D. Coordination of Work: Coordinate ceiling work with installers of related work including, but not limited to building insulation, gypsum board, light fixtures, mechanical systems, electrical systems, and sprinklers.

## **1.6 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver system components in manufacturer’s original, unopened packages clearly labeled with the following information: item number and quantity, manufacturer’s name and address, client name and address and site address.
- B. Store components in a fully enclosed dry space where they will be protected against damage from moisture, direct sunlight, surface contamination and other construction activities.
- C. Exercise care in handling components to prevent damage to the surfaces and edges and prevent distortion or other physical damage.

## **1.7 PROJECT CONDITIONS**

- A. Space Enclosure:
1. Building areas to receive ceilings shall be free of construction dust and debris. Products may be installed where temperatures are between 32 degF and 120 degF and in spaces before the building is enclosed, where HVAC systems are cycled or not operating. Such installations shall not be exposed to abnormal conditions, namely: chemical fumes, presence of standing water, or contact with moisture, as could result from condensations or building leaks. These products cannot be used in exterior applications unless the system has been specifically designed and approved for exterior application.

## **1.8 WARRANTY**

- A. Ceiling System: Submit a written warranty executed by the manufacturer, agreeing to repair or replace panels that fail within the warranty period. Failures include, but are not limited to:
1. Ceiling Panels and Suspension System: Rust and manufacturing defects.

- B. Warranty Period:
  - 1. One (1) year from date of substantial completion.
- C. The Warranty shall not deprive BNL of other rights BNL may have under other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the Contractor under the requirements of the Contract Documents.

## **1.9 MAINTENANCE**

- A. Extra Materials: Deliver extra materials to BNL. Furnish extra materials described below that match products installed. Packaged with protective covering for storage and identified with appropriate labels.
  - 1. Ceiling Units: Furnish quantity of full-size units equal to 2 percent of amount installed.
  - 2. Suspension System Components: Furnish quantity of each exposed suspension component equal to 1 percent of amount installed.
- B. Deliver extra stock to BNL's representative.

## **PART 2 - PRODUCTS**

### **2.1 MANUFACTURER**

- A. Suspension Systems:
  - 1. Armstrong World Industries, Inc.
- B. Ceiling Panels:
  - 1. Armstrong World Industries, Inc

### **2.2 SUSPENSION SYSTEM**

- A. Product: Armstrong MetalWorks (RH 200) Plank Grid System
- B. Components:
  - 1. U-Profile Carrying Channel.
  - 2. U-Profile Splice used to form continuous U-Profile carrying channel.
  - 3. Plug-in clip provided for attachment to U-Profile carrying channel.
  - 4. RH200 J-Bar components.
  - 5. RH200 J-Bar Security Clip.
  - 6. Wall Anchor
  - 7. Wall Molding/Perimeter Treatment: (To be determined based on panel size and design.)
- C. Finish: All steel parts shall be chemically cleansed electro galvanized steel.
  - 1. Wall Molding Color: To match the actual color of the ceiling panel unless otherwise specified.
- D. Hanger Wire: Hanger wire shall be galvanized carbon steel per ASTM A 641, soft temper, pre-stretched, with a yield stress load of at least three (3) times design load, but not less than 12 gauge (0.106") diameter.

### **2.3 METAL CEILING PANELS**

- A. Ceiling Panels Type AMP-1:
  - 1. Surface Texture: Smooth (Perforated with black acoustical fleece).
  - 2. Composition: 25 gauge minimum, electrogalvanized steel
  - 3. Perforations:
    - a. Pattern #: Rd 3506. Exact pattern to be verified by Designer – with submittal.
    - b. Hole size: 0.138 inch.
    - c. On center spacing: Refer to Architect's sample.
    - d. % Open area: 6%.
  - 4. Finish: Scrubbable, powder coat, post painted (applied after forming)

5. Color: As chosen by Architect' from manufacturer's available RAL colors.
  6. Size: As indicated on architectural drawings
  7. Edge Profile: Long edges return to form butt joints; short edges form hook-on return flanges
    - a. RH200 – Joints are gasketed with 1/8 IN gasket
  8. Noise Reduction Coefficient (NRC): ASTM C 423; 0.90.
  9. Ceiling Attenuation Class (CAC): ASTM C 1414; 35.
  10. Flame Spread: ASTM E 1264; Class A per IBC.
  11. Light Reflectance (LR): ASTM E 1477; White Panel: 0.61.
  12. Dimensional Stability:  $L/360 \leq 0.250$  inch
  13. Acceptable Product: MetalWorks RH200 Plank System, as manufactured by Armstrong World Industries
- B. Accessories:
1. Fiberglass infill panel: To achieve up to 0.90 NRC performance.
  2. Cutouts and apertures: For use with audio speakers, air diffusers, flexible head sprinklers and certain light fixtures. They are not intended for use with smoke detectors.
  3. Manufacturer's standard edge trim at perimeter walls.
  4. Sealants specified in Section 07 92 16.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Installer must inspect the area where the ceiling system is to be installed for conditions that may affect the work and notify the Contractor in writing of any unsatisfactory conditions before proceeding.
- B. All work above the ceiling system is to be satisfactorily completed prior to start of the ceiling installation.
- C. All unsatisfactory conditions potentially affecting the ceiling system are to be corrected prior to the start of ceiling installation.
- D. Do not proceed with installation until all wet work such as concrete, terrazzo, plastering and painting has been completed and thoroughly dried out.

### **3.2 PREPARATION**

- A. Examine construction and conditions under which system will be installed. Do not proceed with installation until unsatisfactory conditions have been corrected.

### **3.3 INSTALLATION**

- A. Install the suspended ceiling system in accordance with the manufacturer's shop drawings, installation instructions, applicable industry standards, and the governing code of jurisdiction.
  1. RH200 Installation Instructions: LA295804
  2. RH215 Installation Instructions: LA295805
- B. Installed panels should be free from damaged edges or other defects detrimental to appearance and function.
- C. Install partial panels as shown on manufacturer's shop drawings, but not less than one-half full size.

### **3.4 FIELD QUALITY CONTROL**

- A. Deflection of any grid components shall not exceed 1/360 of the span.

### **3.5 ADJUSTING AND CLEANING**

- A. Adjust ceiling components to provide a consistent finish and appearance in conformity with pre-established tolerances and requirements. All panels showing signs of damage, either in finish or in form are to be replaced. All exposed surfaces are to be cleaned of any dirt, grease, fingerprints and marks or other imperfections with cleaning materials recommended by the manufacturer.

**END OF SECTION**



## SECTION 09 60 05

### WATER VAPOR EMISSION CONTROL FOR CONCRETE WITH APPLIED FLOORING

#### PART 1 - GENERAL

##### 1.1 SUMMARY

- A. Delaminating, blistering, staining, mold growth, and other problems related to installation and performance of moisture-sensitive flooring materials on concrete slabs are possible.
  - 1. Chemistry of flooring and installation products, concrete installation, and weather conditions during construction period are some factors contributing to possible problems.
  - 2. Moisture resistant adhesives and moisture mitigation systems may be applied to concrete surface to produce moisture state allowing flooring to bond to concrete surface.
  - 3. Tests are not long term predictors of moisture conditions. They only indicate conditions at time of test, but can be useful benchmarks if conditions do change.
  - 4. For most meaningful results, it is imperative tests are executed under environment conditions required by testing standards.
  - 5. Objective of this section is to reduce potential for moisture related problems in slabs-on-grade and suspended slabs.
  - 6. This specification requires a pre-determined level of resistance to help neutralize future problems.
  - 7. In the rare case that testing exceeds minimum design criteria indicated, each individual condition will need further evaluation.

##### 1.2 DESCRIPTION

- A. Test concrete floors, on grade or suspended, before finish flooring installed; to determine moisture, humidity, and alkalinity conditions. See Section 01 45 23.
  - 1. Provide additional testing required by flooring manufacturers.
  - 2. Test data may serve as benchmark for future testing.
  - 3. Test data may discover problematic areas that may need remediation prior to proceeding.
- B. Provide flooring manufacturer's recommended vapor resistive products on concrete floors, on grade or suspended, to resist current and future excessive moisture, humidity, and alkalinity conditions and; reduce mold, mildew, and micro-organism growth:
  - 1. Adhesive applied and fluid-applied flooring:
    - a. Resist humidity levels of at least 80%, ASTM-F2170.
    - b. Resist pH levels of at least 9, ASTM-F710.
    - c. Contractor option: Provide flooring manufacturer's recommended water vapor emission control system, compatible with flooring installation.
    - d. Floors testing above proposed system's maximum level of effectiveness; bring to attention of Architect.
- C. Provide materials of this section in areas to receive applied flooring products:
  - 1. See Room Finish Schedule.
- D. If different systems are used on differing adjacent flooring areas, verify compatibility of systems.
  - 1. One system that satisfies criteria for all flooring types may be used.

##### 1.3 QUALITY ASSURANCE

- A. References:
  - 1. ASTM-F710: Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring.
  - 2. ACI-302.2R: Guide for Concrete Slabs that Receive Moisture-Sensitive Flooring Materials.

- B. Installation Contractor:
  - 1. Firm with not less than 5 years of successful flooring experience similar to work of this section and flooring systems specified; and accepted by flooring manufacturer, including:
    - a. Testing procedures.
    - b. Moisture resistive adhesives.
    - c. Moisture mitigation systems.
  - 2. Upon request, submit letter from flooring manufacturer stating acceptance.

#### **1.4 PRE-INSTALLATION MEETING**

- A. Pre-installation meeting, directed by Contractor, prior to beginning of flooring work to discuss following:
  - 1. Contract Document requirements.
  - 2. Floor plan.
  - 3. Flooring manufacturer's recommendations and details.
  - 4. Leveling compound manufacturer's recommendations.
  - 5. Adhesive manufacturer's recommendations.
  - 6. Moisture resistant adhesive manufacturer's recommendations.
  - 7. Moisture mitigation system manufacturer's recommendations.
  - 8. UL requirements.
  - 9. Available on site storage.
  - 10. Floor protection from damage by other trades.
- B. Attendance is recommended for:
  - 1. Contractor.
  - 2. Flooring installer's superintendent.
  - 3. Flooring manufacturer's representative.
  - 4. Concrete installer.
  - 5. Other trades whose work may affect flooring system.
- C. Minimum two weeks prior to meeting, flooring installers shall forward pertinent information to Contractor for review.
  - 1. Installation drawings.
  - 2. Manufacturer product data.
  - 3. Samples of proposed materials.
  - 4. Sample warranty.
  - 5. Other information deemed pertinent for sound and secure application.
- D. Include review of specifications, details, application requirements and preliminary work.
- E. Objectives of pre-installation meeting to include:
  - 1. Review foreseeable methods and procedures related to flooring work.
  - 2. Tour representative areas of flooring substrates (decks); inspect and discuss condition of substrate, joints, drains, curbs, penetrations and other preparatory work performed by others.
  - 3. Review normal-weight and light-weight concrete locations.
  - 4. Review metal deck, vented or non-vented.
  - 5. Review water/cement ratios.
  - 6. Review curing process.
  - 7. Review under-slab vapor barrier and soil conditions.
  - 8. Review deck for loss of flatness/levelness.
  - 9. Review leveling compound.
  - 10. Review weather history from time of concrete pour to until meeting.
  - 11. Review mechanical system requirements for testing and flooring installation.
  - 12. Review testing and installation temperature and humidity requirements.
  - 13. Review flooring system requirements, (drawings, specifications and other contract documents).
  - 14. Review required submittals both completed and yet to be completed.

15. Review and finalize construction schedule related to flooring work and verify availability of materials, installer's personnel, equipment and facilities needed to make progress and avoid delays.
  16. Review conditions at adjacent flooring types.
  17. Review required inspection, testing, certifying and material usage accounting procedures.
  18. Record discussion of meeting including decisions and agreements (or disagreements) reached.
    - a. If substantial disagreements exist at conclusion of meeting, determine how disagreements will be resolved and set date for reconvening conference.
- F. Furnish copy of record to each party who may be affected by flooring work, whether or not they were in attendance, and to BNL and Architect.

## **1.5 SUBMITTALS**

- A. Project Information:
1. Test reports:
    - a. Each flooring area of each flooring type.
  2. Manufacturer and product for each flooring type.
- B. LEED Information:
1. LEED Credits MR 5.1 and 5.2, Regional Materials: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.

## **PART 2 - PRODUCTS**

### **2.1 WATER VAPOR EMISSION CONTROL**

- A. Acceptable manufacturers:
1. Water vapor resistive adhesive, or water vapor emission control system:
    - a. Base:
      - 1) Flooring manufacturer's approved products.
- B. Products capable of meeting design criteria:
1. Compatible floor covering, mitigation system, adhesive, and leveling system products.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Examine substrate and conditions under which flooring is to be installed.
- B. Verify substrates are clean, free from moisture, or materials that may affect adhesion.
- C. Verify concrete cured a minimum of 28 days.
- D. Verify concrete surfaces are free of defects and irregularities.
- E. Verify concrete type and water/cement ratio, see Section 03 31 00.
- F. Verify installation of under-slab retarder, see Section 03 31 10.
- G. Verify curing procedure used, see Section 03 31 10.
- H. Verify floors are level or meet indicated slope, see Section 03 35 00.
- I. Do not proceed with installation until unsatisfactory conditions have been corrected.

- J. Installation indicates acceptance of substrates and responsibility for performance.
- K. Verify flooring manufacturer's installation criteria for each type of flooring.

### **3.2 TESTING**

- A. Test concrete for each area of each flooring type as required by flooring manufacturer.
- B. Conditioning: Minimum 48 hours prior to testing:
  - 1. Concrete floor slabs: Service temperature.
  - 2. Occupied air space above the floor slab: Service temperature.
  - 3. Occupied air space relative humidity above the floor slab: Service humidity.
  - 4. Continue conditioning required until, during, floor installation.
  - 5. Continue conditioning after flooring installation as required by applicable manufacturers.
  - 6. See Construction Schedules.
  - 7. See Temporary Heating, Ventilation, and Cooling, Section 01 50 00.
  - 8. Tests:
    - a. Alkalinity: ASTM-F710.
    - b. Humidity within concrete: ASTM-F2170.
    - c. Other tests as required by flooring manufacturer.

### **3.3 PREPARATION**

- A. Moisture Resistant Adhesive: As recommended by flooring and adhesive manufacturers.
- B. Emission control system: As recommended by mitigation system manufacturer.
  - 1. Mask and protect walls, equipment from installation process.
  - 2. Shot blast or grind concrete surfaces, grind near walls and clean joints.
  - 3. Broom-sweep and vacuum slab surfaces to remove dust and debris.

### **3.4 INSTALLATION**

- A. Install system components with manufacturer employed or approved personnel.
- B. Apply control system as recommended by manufacturer.
  - 1. Fill cracks, joints, and surface irregularities as recommended by manufacturer.

### **3.5 FIELD QUALITY CONTROL**

- A. Allow materials to acclimate for a minimum of 72 hours at a temperature of 70 DegF and relative humidity of 50%.
- B. Protect floor.

**END OF SECTION**

**SECTION 09 65 18**  
**SHEET RUBBER FLOORING (SR)**

**PART 1 - GENERAL**

**1.1 QUALITY ASSURANCE**

- A. ASTM-F1859, Standard Specification for Rubber Sheet Floor Covering Without Backing.
- B. ASTM-F1860, Standard Specification for Rubber Sheet Floor Covering With Backing.
- C. South Coast Air Quality Management District, Rule 1168.

**1.2 SUBMITTALS**

- A. Project Information:
  - 1. Seaming Diagram.
- B. Contract Closeout Information:
  - 1. Maintenance data.
  - 2. Warranty.
  - 3. Letter stating extra material has been delivered.

**1.3 PRODUCT DELIVERY, STORAGE AND HANDLING.**

- A. Store at minimum 70 degF for 72 hours prior to use.

**1.4 JOB CONDITIONS**

- A. Remove incompatible residual materials (such as curing compounds, paint, varnish, oils, release agents, sealers, waxes and other incompatible materials) using mechanical means approved by manufacturer.
  - 1. Determine compatibility by a bond test or by the adhesive/flooring manufacturer's recommendations.
  - 2. Avoid organic solvents.
- B. Maintain work spaces at 65-85 degF with maximum 75% relative humidity 72 hours prior to installation, during, and after installation.
  - 1. Provide artificial heating or cooling as required.
  - 2. Verify equipment will not leave contaminants on concrete.
- C. Install after wall finishes.
- D. Install prior to carpet and acoustical material.
- E. Schedule installation to minimize accumulation of air contaminants that cannot be removed prior to occupancy.
- F. Air out construction with 100% outside air.
  - 1. Do not recirculate prior to occupancy.
  - 2. Ventilate during installation. Seal return air ducts and use direct exhaust to outdoors.

**1.5 WARRANTY**

- A. Manufacturer: Excessive Wear Warranty.

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS**

- A. Acceptable manufacturers:
  - 1. Sheet Rubber (SR) flooring:
    - a. Base:
      - 1) Nora Rubber.
- B. Sheet Rubber (SR) Material:
  - 1. Description: Not less than 30% synthetic rubber with natural fillers and environmentally compatible color pigments.
  - 2. Minimum Thickness: 0.12 IN.
  - 3. Minimum Sheet Width: 4 FT.
  - 4. Slip Resistance: Static coefficient of friction equal to or greater than 0.5 per ASTM-D2047.
  - 5. Capable of being bent over a 3/4 IN mandrel without breaking or crazing.
  - 6. Base Product: Noraplan, Environcare, Article 1463.
- C. Fire and Smoke Rating:
  - 1. Critical Radiant Flux, per ASTM-E648 / NFPA 253:
    - a. Class I, not less than 0.45 W/cm<sup>2</sup>.
    - b. Smoke Density: >450 per ASTM-E662, NFPA 258.
- D. Stain Resistance Properties:
  - 1. Ammonia 28%: 1 Hour; No Change/24 Hour; No Change.
  - 2. Chloroform: 1 Hour; No Change/24 Hour; Very slight surface attack.
  - 3. Ethyl Alcohol 90 Vol: 1 Hour; No Change/24 Hour; Slight dulling.
  - 4. Iodine: 1 Hour; No Change/24 Hour; No Change.
  - 5. Sulfuric Acid 3%: 1 Hour; No Change/24 Hour; No Change.
  - 6. Sulfuric Acid 30%: 1 Hour; Slight Swelling/24 Hour; Slight Swelling
  - 7. Trichloroethane: 1 Hour; Slight Swelling/24 Hour; Slight Swelling.
- E. Adhesive and seaming cement: As recommended by manufacturer.
- F. Water vapor emission control system: Comply with Section 09 60 05.

### **2.2 EXTRA MATERIAL**

- A. Provide BNL with 50 SF of each color and type for maintenance.

## **PART 3 - EXECUTION**

### **3.1 INSPECTION**

- A. Examine substrate and conditions under which flooring is to be installed.
- B. Concrete preparation for floor finishes: See Section 09 60 05.
- C. Assure that substrate is clean, dry and level prior to installation.
- D. In event moisture is present, take action to dry out substrate as required.

### **3.2 INSTALLATION**

- A. General:
  - 1. Install sheet flooring in maximum possible sizes.
  - 2. Refer to seaming diagram for special patterns and shapes.
  - 3. Install by double cutting seams for tight fit.
  - 4. Form seams by lapping edges and double cutting with power seam cutter if available; otherwise, overlap and double cut using sharp flooring or utility knife.

5. Furnish sheets in one room or area from same production run.
- B. Install sheets in manufacturer's standard adhesive.
  1. Provide applicable adhesive in rooms that will potentially be wet on a frequent basis.
- C. Heat-Welded Seams:
  1. Rout seams and heat weld together with coordinated colored heat welding rod in accordance with Rubber Flooring manufacturer's recommendations.
- D. Transitions:
  1. Where flooring abuts adjacent rooms with different flooring colors, thickness, or material (ie. Sheet Vinyl or Sheer Rubber): Refer to drawing details:
    - a. Install accenting Transition Strips.
    - b. Where seam occurs in door openings: Locate Transition Strip directly under door when in closed position.
    - c. Where abutting materials are Carpet, Ceramic Tile, Quarry Tile, Stone Tile: Utilize the Transition Strip specified in those respective sections.
    - d. Install tapered edge Transition Strips where tile edge is exposed or where flooring terminates.

### **3.3 CLEAN UP**

- A. Before final completion, thoroughly strip clean and buff flooring.
- B. Do not wax.
- C. Remove damaged and delaminated flooring and replace with new flooring at no additional expense to BNL.

### **END OF SECTION**



**SECTION 09 65 19**  
**RESILIENT TILE FLOORING (VCT), BASE (RB)**

**PART 1 - GENERAL**

**1.1 QUALITY ASSURANCE**

- A. ASTM:
1. ASTM-F1700, "Standard Specification for Solid Vinyl Tile.
  2. ASTM-D2047: "Measuring Static Coefficient of Friction of Flooring Finishes".

**1.2 SUBMITTALS**

- A. Samples:
1. Resilient Tile: 3 samples of each material and colors in Room Finish and Color Schedule, Section 09 06 10 for verification.
  2. Resilient Base:
    - a. 3 samples of each material and colors in Room Finish and Color Schedule, Section 09 06 10 for verification.
    - b. Field-fabricated corners: Construct sample base inside and outside corner:
      - 1) Include minimum 4 FT straight base each direction from corner.
      - 2) If not acceptable construct additional corners.
        - a) Stress whitening and cracking will not be acceptable.
        - b) Color and height variation will not be acceptable.
      - 3) Sample corners constitute standard of quality for actual construction.
      - 4) Maintain sample corners during construction.
      - 5) Remove when directed.
      - 6) Sample corners may be built into permanent construction provided sample area is readily identifiable during construction.
      - 7) Do not proceed with base installation until sample corners are approved by Architect.
- B. Contract Closeout Information:
1. Maintenance data.
  2. Letter stating extra material has been delivered.
  3. Warranty.
  4. Interior finish fire performance data:
    - a. Provide for each finish material and type specified:
      - 1) Manufacturer's printed information including:
        - a) Fire class.
        - b) NFPA test number.
        - c) Photograph.
      - 2) Proof of purchase.
- C. LEED Information:
1. LEED Credits MR 4.1 and 4.2, Recycled Content: Product data indicating percentages by weight of post-consumer and post-industrial recycled content for products having recycled content; include statement indicating costs for each product having recycled content.
  2. LEED Credits MR 5.1 and 5.2, Regional Materials: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.
  3. LEED Credit EQ 4.1, Low-Emitting Materials, Sealants and Adhesives: Manufacturers' product data for construction adhesive, including printed statement of VOC content.

4. LEED Credit MR 6.0, Rapidly Renewable Materials: Manufacturers' product data for products manufactured from rapidly renewable material; indicate type of rapidly renewable material.
- D. LEED 2009 Tracking Information:
1. LEED Credit EQ 4.3, Low-Emitting Materials – Flooring Systems: Manufacturer's Product data indicating that flooring products comply with the following standards:
    - a. Manufacturers' product data that resilient floor tile and base adhesives comply with the VOC requirements of IEQ Credit 4.1.
    - b. Manufacturers' product data that resilient floor tile is certified as compliant with the Scientific Certification System FloorScore standard.

### **1.3 PRODUCT DELIVERY, STORAGE AND HANDLING**

- A. Deliver materials in good condition to the jobsite in the manufacturer's original unopened containers that bear the name and brand of the manufacturer, project identification, and shipping and handling instructions.
- B. Store materials in a clean, dry, enclosed space off the ground, and protected from the weather and from extremes of heat and cold:
  1. Protect adhesives from freezing.
  2. Store flooring, adhesives and accessories in the spaces where they will be installed for at least 48 hours before beginning installation.
- C. Store at minimum 70 DegF for 72 hours before installation.

### **1.4 JOB CONDITIONS**

- A. Maintain site installation conditions in the following range: 65 to 85 DegF with maximum 75% relative humidity for at least 48 hours before, during, and for not less than 48 hours after installation:
  1. Thereafter, maintain a minimum temperature of 55 DegF in areas where work is completed.
  2. Protect all materials from the direct flow of heat from hot-air registers, radiators, or other heating fixtures and appliances.
  3. Provide artificial heating or cooling as required.
  4. Verify equipment will not leave contaminants on concrete.
- B. Install flooring and accessories after the other finishing operations, including painting, have been completed:
  1. Close spaces to traffic during the installation of the flooring.
  2. Do not install flooring over concrete slabs until they are sufficiently dry to achieve a bond with the adhesive, in accordance with the manufacturer's recommended bond and moisture tests.
- C. Install flooring after wall finishes.
- D. Install tile flooring prior to carpet and acoustical ceiling material.
- E. Schedule installation to minimize accumulation of air contaminants that cannot be removed prior to occupancy.
- F. Air out construction with 100% outside air:
  1. Do not recirculate prior to occupancy.
  2. Ventilate during installation. Seal return air ducts and use direct exhaust to outdoors.

### **1.5 WARRANTY**

- A. Remove and replace defective areas to satisfaction of Architect at no additional expense to BNL.
- B. Written warranty that material will be free from manufacturing defects:
  1. From date of purchase: Material, 5 years.
  2. Labor, 2 years.

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS**

- A. Acceptable manufacturers:
  - 1. Vinyl Composition Tile (VCT); Alternate Only:
    - a. Base:
      - 1) Armstrong World Industries.
      - 2) As noted for individual type in Room Finish and Color Schedule, as shown on drawings.
  - 2. Resilient Base (RB-1):
    - a. Base:
      - 1) Roppe.
    - b. Optional:
      - 1) BurkeMercer.
      - 2) Johnsonite.
      - 3) Armstrong World Industries.
      - 4) VPI Floor Products.

### **2.2 RESILIENT TILE PRODUCTS**

- A. Vinyl Composition Tile; Alternate Only:
  - 1. Non -asbestos composition.
  - 2. Reference Standard: ASTM-F1066:
    - a. Class 2, Through pattern tile.
  - 3. Minimum Static Load Limit: 75 PSI per ASTM-F970.
  - 4. Critical Radiant Flux, per ASTM-E648 / NFPA 253:
    - a. Class I, not less than 0.45 W/cm<sup>2</sup>.
  - 5. Smoke Developed: 450 or less per ASTM-E662 / NFPA 258.
  - 6. Nominal Total Thickness: 0.125 IN gauge.
  - 7. Nominal Tile Size: 12 x 12 IN square; 1/8 IN thick.
  - 8. Static coefficient of friction: 0.6:
    - a. Ramp static coefficient of friction: 0.8.
  - 9. FloorScore certified by the Resilient Floor Covering Institute.

### **2.3 RESILIENT BASE PRODUCTS**

- A. Resilient Base (RB-1):
  - 1. Material: Thermoplastic Rubber, Type TP per ASTM-F1861.
  - 2. Critical Radiant Flux, per ASTM-E648 / NFPA 253:
    - a. Class I, not less than 0.45 W/cm<sup>2</sup>.
  - 3. Smoke Developed: 450 or less per ASTM-E662 / NFPA 258.
  - 4. Field formed external and internal corners.
  - 5. Provide continuous rolls, minimum 95 FT long.
  - 6. Typical Profile:
    - a. Type: Top set, coved type.
    - b. Nominal Size: 1/8 x 4 IN, 1/4 IN wide at bottom.

### **2.4 MISCELLANEOUS PRODUCTS**

- A. Leveling Compound:
  - 1. As recommended by manufacturer:
    - a. Compatible with adhesives.
    - b. Moisture resistant.
    - c. Non-crumbling.
- B. Primers and Adhesive (general-use):

1. As recommended by flooring manufacturer with VOC content no greater than 50 g/L in accord with SCAQMD Rule #1168.
- C. Transition Strip:
1. Nominal Size: 1/8 x 1 IN plain color homogeneous vinyl with backing.
  2. Use tapered profiles where abutting material is of different thickness.
- D. Water Vapor Emission Control System: See Section 09 60 05.

## **2.5 EXTRA MATERIAL**

- A. General:
1. Provide materials in clearly labeled containers.
- B. Quantities of Extra Material Required:
1. Resilient Tiles: One full carton of each type, color and pattern of material for maintenance.
  2. Resilient Base; 15 LF of each color and type of base for maintenance.

## **PART 3 - EXECUTION**

### **3.1 INSPECTION**

- A. Examine substrate and conditions under which flooring is to be installed:
1. Verify that surfaces are smooth and free from cracks, holes, ridges, and other defects that might prevent adhesive bond or impair durability or appearance of the flooring material.
  2. Verify surfaces are free from curing, sealing, parting and hardening compounds; residual adhesives; adhesive removers; and other foreign materials that might prevent adhesive bond. Visually inspect for evidence of moisture, alkaline salts, carbonation, dusting, mold, or mildew.
  3. Verify substrates are clean, free from moisture, or materials which may affect adhesion.
  4. Verify floors are level or meet indicated slope.
- B. Report conditions contrary to contract requirements that would prevent a proper installation:
1. Do not proceed with the installation until unsatisfactory conditions have been corrected.
- C. Failure to call attention to defects or imperfections will be construed as acceptance and approval of the subfloor:
1. Installation indicates acceptance of substrates with regard to conditions existing at the time of installation.

### **3.2 PREPARATION**

- A. Smooth concrete surfaces, removing rough areas, projections, ridges, and bumps, and filling low spots, control or construction joints, and other defects as recommended by the flooring manufacturer.
- B. Remove paint, varnish, oils, release agents, sealers, and waxes:
1. Remove residual adhesives as recommended by the flooring manufacturer.
  2. Remove curing and hardening compounds not compatible with the adhesives used, as indicated by a bond test or by the compound manufacturer's recommendations for flooring.
  3. Avoid organic solvents.
- C. Perform subfloor moisture and alkalinity testing per manufacturer's recommendations to determine if surfaces are dry; free of curing and hardening compounds, old adhesive, and other coatings; and ready to receive flooring:
1. Concrete preparation for floor finishes: Further specified in Section 09 60 05.
- D. Determine compatibility by a bond test or by the adhesive/flooring manufacturer's recommendations.

- E. Vacuum or broom-clean surfaces to be covered immediately before the application of flooring. Make subfloor free from dust, dirt, grease, and all foreign materials.
- F. Protect adjacent work from damage.
- G. Fill cracks, joints, holes, depressions etc., in floors with leveling compound:
  - 1. Provide level surface or meet indicated slope.
- H. Where resilient flooring abuts other finish flooring materials and finished surfaces do not align, feather leveling compound for approximately 12 IN so finished surfaces will align.
- I. Coordinate leveling with water vapor emission control system specified in Section 09 60 05.

### **3.3 INSTALLATION - GENERAL**

- A. Do not start until work of other trades is complete:
  - 1. Coordinate with other floor, wall and ceiling work.
- B. Apply primers and adhesives as recommended by manufacturer.

### **3.4 INSTALLATION – FLOORING; ALTERNATE ONLY**

- A. Install flooring in accordance with manufacturer’s recommendations.
- B. Install flooring wall to wall before the installation of floor-set cabinets, casework, furniture, equipment, movable partitions, etc:
  - 1. Extend flooring into toe spaces, door recesses, closets, and similar openings as shown on the drawings.
- C. If required, install flooring on pan-type floor access covers:
  - 1. Maintain continuity of color and pattern within pieces of flooring installed on these covers.
  - 2. Adhere flooring to the subfloor around covers and to covers.
- D. Scribe, cut, and fit to permanent fixtures, columns, walls, partitions, pipes, outlets, and built-in furniture and cabinets.
- E. Install flooring with adhesives, tools, and procedures in strict accordance with the manufacturer's written instructions:
  - 1. Observe the recommended adhesive trowel notching, open times, and working times.
- F. Lay in patterns selected by Architect:
  - 1. Alternate tile 90 degrees if pattern is directional.
  - 2. Bond tile to floor, flush, tight, and in true alignment with adjacent tiles and with finished surface.
  - 3. Fit neatly into breaks and recesses, against walls, around pipes, and other obstructions.
  - 4. Install tapered edge Transition Strips where tile edge is exposed or where flooring terminates.
  - 5. Lay out tile to avoid less than 1/2 tile at permanent walls.
  - 6. Perform cutting or drilling of tile as required.
- G. Where tile color changes or floor finish material changes to sheet vinyl or sheet rubber:
  - 1. Install accenting Transition Strips.
  - 2. Where seam occurs in door openings: Locate Transition Strip directly under door when in closed position.
  - 3. Where abutting materials are Carpet, Ceramic Tile, Quarry Tile, Stone Tile etc: Utilize the Transition Strip specified in respective section.
- H. Roll entire floor.

### **3.5 INSTALLATION – WALL BASE**

- A. General:
  - 1. Install base after wall material has dried thoroughly.

2. Provide base at intersections of floor and vertical surfaces in areas scheduled to receive base and where intersection is exposed to view, unless otherwise noted.
  3. Set base straight and true.
  4. Fit into breaks and recesses.
  5. Scribe to trim at doors and door frame.
  6. Make joints tight.
  7. Install with top and bottom edge in firm contact with wall and floor.
  8. Install corners as recommended by manufacturer.
- B. Apply top set wall base to walls, columns, casework, and other permanent fixtures in areas where top set base is required:
1. Install base in lengths as long as practical with inside corners fabricated from base materials that are mitered or coped.
  2. Tightly bond base to vertical substrate with continuous contact at horizontal and vertical surfaces.
- C. Where control joints pass behind rubber, resilient vinyl, wood or other wall base types:
1. Caulk control joint using a color which matches color of base prior to installing Base.
- D. Fill voids with plastic filler along top edge of resilient wall base or integral cove cap on masonry surfaces or other similar irregular substrates.
- E. Place resilient edge strips tightly butted to flooring, and secure with adhesive recommended by edge strip manufacturer:
1. Install edge strips at edges of flooring that would otherwise be exposed.

### **3.6 ADJUST AND CLEAN**

- A. Immediately after application and rolling, remove surplus adhesive.
- B. Damp mop entire floor.
- C. Clean floors in accordance with manufacturer's recommendations.
- D. Leave floors smooth and clean.
- E. Protect with non-staining building paper as may be necessary to prevent dirt and damage.
- F. Protect traffic areas with fiberboard or plywood.
- G. Prohibit traffic on floors for 24 hours after installation.
- H. Prior to final walk through:
1. Wash, wax and buff floors and base.
  2. After thorough cleaning, apply two coats of wax recommended by flooring manufacturer.
  3. Buff after each coat.

**END OF SECTION**

**SECTION 09 65 35**  
**STATIC DISSIPATIVE SHEET RUBBER FLOORING (SDSR)**

**PART 1 - GENERAL**

**1.1 QUALITY ASSURANCE**

- A. Comply with International Institute of Synthetic Rubber Producers, standards.
- B. Fire and smoke ratings:
  - 1. Critical radiant flux: Class I, not less than 0.45 W/cm<sup>2</sup>, in accordance with ASTM-E648 and NFPA 253.
  - 2. Smoke developed: 450 or less, in accordance with ASTM-E662 and NFPA 258.
  - 3. Flame spread: Maximum 75 in accordance with ASTM-E84.
  - 4. Usage:
    - a. NFPA 101.
    - b. NFPA 99.
- C. Static load limit: 75 psi in accordance with ASTM-F970.
- D. Electrical resistance: 1,000,000 to 100,000,000 ohms in accordance with ESD-S.7 and ASTM-F150.
- E. Static generation: Less than 100 volts at 12 percent relative humidity and less than 10 volts at 40 percent relative humidity, with ESD footwear, in accordance with ESD-STM 97.2.
- F. Static decay: 5000 volts to zero in less than 0.5 seconds, with ESD footwear, in accordance with Federal Test 101C, Method 4046.
- G. Static coefficient of friction: Minimum 0.6 in accordance with ASTM-D2047.
- H. Installer qualifications: Installer shall be approved by product manufacturer to meet the requirements of this project.
- I. Comply with Fed Spec SS-T-312B.
- J. Provide static dissipative flooring, adhesive, copper grounding strips, and maintenance finish supplied by one manufacturer.

**1.2 SUBMITTALS**

- A. Shop drawings:
  - 1. Submit shop drawings, seaming plans, and details.
- B. Samples:
  - 1. Color as specified in Finish Key.
  - 2. Accessories for color selection.
  - 3. Extra material as specified.
- C. Product data.
- D. Contract closeout information:
  - 1. Maintenance data.
  - 2. Warranty.
  - 3. Letter stating extra material has been delivered.
- E. LEED Information:
  - 1. LEED Credit EQ 4.1, Low-Emitting Materials, Adhesives: Product data indicating that volatile organic compound (VOC) levels of adhesives are in compliance with South Coast Air Quality Management District (SCAQMD) regulations.

2. LEED Credit MR 5.1, Local/Regional Materials: Manufacturer's certification indicating final point of assembly for products and materials located within 500 miles of Project site. Include manufacturer's name, address and phone number.

### **1.3 PRODUCT DELIVERY, STORAGE AND HANDLING**

- A. Store at minimum 70 degF and 40 percent relative humidity for 72 hours prior to use and 72 hours after installation.

### **1.4 JOB CONDITIONS**

- A. Remove incompatible residual materials (such as curing compounds, paint, varnish, oils, release agents, sealers, waxes and other incompatible materials) using mechanical means approved by manufacturer.
  1. Determine compatibility by a bond test or by the adhesive/flooring manufacturer's recommendations.
  2. Avoid organic solvents.
- B. Maintain work spaces at 65-85 degF with maximum 75% relative humidity 72 hours prior to installation, during, and after installation.
  1. Provide artificial heating or cooling as required.
  2. Verify equipment will not leave contaminants on concrete.
- C. Install after wall finishes.
- D. Install prior to carpet and acoustical material.
- E. Schedule installation to minimize accumulation of air contaminants that cannot be removed prior to occupancy.
- F. Air out construction with 100% outside air.
  1. Do not recirculate prior to occupancy.
  2. Ventilate during installation. Seal return air ducts and use direct exhaust to outdoors.

### **1.5 WARRANTY**

- A. Manufacturer: Warrant product against wear exceeding 10 percent for a period of 5 years.
- B. Installer: Warrant installation against loss of bond to substrate and seam separation for a period of 5 years.

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS**

- A. Acceptable manufacturers:
  1. Static Dissipative Sheet Rubber (SDSR) flooring:
    - a. Base:
      - 1) Freudenberg Building Systems, Inc.
- B. Static Dissipative Sheet Rubber Flooring:
  1. Base Product: noraplan Environcare ed, Article 1390, ESD control, static dissipative, oil and grease resistant.
  2. Material: nora rubber Compound 948 with abundant natural fillers and environmentally compatible color pigments.
  3. Roll Size: 0.08 IN thickness, 48.2 FT x 48 IN
  4. Back of Tile: Smooth, sanded back.
  5. Limited Wear/Conductivity Warranty: 5 year wear; 10 year conductivity.
  6. Standard: ASTM F 1344, for solid color homogeneous tiles and through-mottled tiles as applicable.

7. Abrasion Resistance: Taber abrasion test, ASTM D 3389, H-18 wheel, 500 gram load, 1000 cycles, gram weight loss not greater than 0.70.
  8. Hardness: ASTM D 2240, Shore A, not less than 85.
  9. Slip Resistance: Static coefficient of friction (James Test): ASTM D 2047, equal to or greater than 0.5.
  10. Asbestos-Free: Products shall contain no asbestos.
  11. Flammability: ASTM E 648; NFPA 253; NBSIR 75 950 result to be not less than 0.45 watts per square centimeter, Class 1.
  12. Smoke Density: ASTM E 662, NFPA 258, NBS smoke density, less than 450.
  13. Bacteria Resistance: Products shall be resistant to bacteria, fungi, and micro-organism activity, according to ASTM E 2180 and ASTM G 21.
  14. Burn Resistance: Cigarette and solder burn resistance.
  15. Halogen-Free: Products shall contain no halogens.
  16. PVC-Free: Products shall contain no poly-vinyl-chloride.
  17. IAQ: Products shall meet GreenGuard requirements.
  18. Conductivity:  $10^6$  – less than or equal to  $10^9$  resistance to ground for when tested according to ASTM F 150 and ESD.S7.1 under >30 percent relative humidity at room temperature.
  19. Decay Time: < 0.25 seconds when tested according to FTM 4046.101.
  20. Static Generation: < 20 volts when tested according to ESD STM 97.2.
  21. ISO 14001: Manufacturer shall be ISO 14001 Environmental Management System Certified.
    - a. LEED requirements: Maximum VOC content of 50 g/L.
  22. Color: As selected.
  23. Static Load: Per ASTM F-970 Standard Test Method for Static Load Limit, residual compression, when tested with 800 LBS results shall be  $\leq 0.005$ ".
- C. Adhesive and seaming cement: As recommended by manufacturer.
- D. Cove: Manufacturer's standard, to form 3/4 IN radius.
- E. Cap: Extruded aluminum, rubber or PVC to finish of top of base.
- F. Grounding strips: Copper size and extent recommended by manufacturer.

## **2.2 EXTRA MATERIAL**

- A. Provide BNL with 50 SF of each color and type for maintenance.

## **PART 3 - EXECUTION**

### **3.1 INSPECTION**

- A. Examine substrate and conditions under which flooring is to be installed.
- B. Concrete preparation for floor finishes: See Section 09 60 05.
- C. Assure that substrate is clean, dry and level prior to installation.
- D. In event moisture is present, take action to dry out substrate as required.

### **3.2 INSTALLATION**

- A. Install sheet flooring in maximum possible sizes.
  1. Install by double cutting seams for tight fit.
  2. Provide transition strips as required where flooring abuts other flooring materials.
  3. Install 7/8 IN coved rubber fillet fillers at bases.
  4. Provide cap strip at top of base.
- B. Install sheets in adhesive.

- C. Form seams by lapping edges and double cutting with power seam cutter if available; otherwise, overlap and double cut using sharp flooring or utility knife.
- D. Reverse alternate sheets.
- E. Furnish sheets in one room or area from same production run.
- F. Areas of the flooring that are subject to direct sunlight through doors or windows shall have the doors or windows covered using blinds, curtains, cardboard or similar for the time of the installation and 72 hours after the installation to allow the adhesive to cure.
- G. If required, protect completed work from damage and construction operations using Masonite hardwood/plywood or similar (refer to nora Tech 156, available upon request) and inspect immediately before final acceptance of project. Clean flooring surfaces only after adhesive has fully cured, no sooner than 72 hours after installation, unless agreed with nora representative. Clean surfaces using non-abrasive materials and methods recommended by manufacturer's maintenance guide.
- H. The flooring contractor shall provide the following:
  - 1. Installer shall be approved by nora systems, Inc., for the requirements of the project or INSTALL (International Standards & Training Alliance) resilient, approved or certified for the requirements of the project.
  - 2. An effective project manager, to manage the installers, and ensure that all of the required procedures are followed, documented and that the installation guides are followed.
  - 3. Acclimate the flooring in the provided secure storage area that is maintained permanently or temporarily at service temperate and humidity or 68 degF  $\pm$  5 degF and 50 percent relative humidity  $\pm$  10 percent for at least 48 hours prior to and during the application of the flooring.
  - 4. Perform adhesive bond test in each major area (1 per 1,000 SQ FT), a detailed method statement (nora Tech 103) is available from nora systems, Inc., upon request. Examine after 72 hours to determine whether the bond is good to the substrate, if the preparation is sufficient or to look for signs of moisture. Do not proceed with the installation until all the results of the bond test are acceptable.
  - 5. Clean out and fill or repair any saw cuts and cracks following the written instructions from the manufacturer of the surface Moisture Suppression System (if used) or the smoothing compound manufacturer. Note: Do not install over any expansion joint, these shall be mirrored through to the surface using a suitable expansion joint cover.
  - 6. When required, use a suitable surface moisture suppression system that is fully warranted by the suppression system manufacturer to perform under the given conditions (moisture content, presence of vapor retarder, surface profile and presence of any known contaminates within the concrete) for the same warranty time period as the flooring supplied. The suppression system manufacturer shall provide written confirmation that the subfloor was prepared correctly prior to the installation of their product.
  - 7. Provide written confirmation that any surface moisture suppression system used, has been applied as instructed by the suppression system manufacturer including the required mils thickness, or confirm the amount of gallons used per square footage, and that the workmanship is fully warranted. Perform and confirm results of any testing required by the suppression mitigation system's manufacturer.
  - 8. If required, use a suitable fully warranted smoothing compound that shall have a minimum compressive strength of 3000 psi (per ASTM F 710 Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring) at the time the flooring will be used (heavy traffic), follow the manufacturer's written installation instructions including removal of old adhesives (do not use chemical adhesive removers, use the RFCI wet scraping method), during compounds, or any potential bond breakers and confirm any necessary surface profile, also to follow any requirement to prime the subfloor prior to smoothing, the recommended minimum and maximum thickness shall be followed.

9. If smoothing compound is used, provide written confirmation that the smoothing compound has been mixed and applied to the required smoothness and or levelness of the general contractor/end user, or ASTM F 710 Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring, following the manufacturer's written instructions and that the workmanship is fully warranted.
  10. Vacuum floors immediately prior to installing the flooring to remove all loose particles. If required, use only water based sweeping compounds, do not use wax or oil based compounds that leave behind a residue that may interfere with the adhesive bond.
- I. Install resilient flooring in accordance with manufacturer's installation guides.
  - J. Rout seams and heat weld together with coordinated colored heat welding rod or cold weld with coordinated colored cold weld compound in accordance with flooring manufacturer's installation guide.

### **3.3 CLEAN UP**

- A. Before final completion, thoroughly strip clean and buff flooring.
- B. Do not wax.
- C. Remove damaged and delaminated flooring and replace with new flooring at no additional expense to BNL.

**END OF SECTION**



**SECTION 09 66 16**  
**PRECAST TERRAZZO**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. Provide precast epoxy resin terrazzo treads with abrasive inserts and base where noted.
  - 1. Install terrazzo treads in steel stairs.
  - 2. Install terrazzo base where shown on drawings.
- B. Provide precast terrazzo units where indicated on the drawings and as required to complete the terrazzo work.

**1.2 QUALITY ASSURANCE**

- A. Comply with recommendations of National Terrazzo and Mosaic Association (NTMA) Standards.
- B. Employ installer who is experienced and skilled in installation of precast terrazzo and approved by manufacturer.

**1.3 SUBMITTALS**

- A. Shop drawings:
  - 1. Plan showing layout.
  - 2. Details showing abrasive inserts, edge conditions and setting coordination with steel stair stringers.
- B. Samples:
  - 1. 12 x 12 IN square samples of pattern and color of terrazzo for review of color, pattern and texture only.
  - 2. Grout color.
- C. Project information:
  - 1. Written certification of compliance with NTMA requirements.
  - 2. Manufacturer's installation instructions and certificate indicating that materials are in compliance with specifications.
  - 3. Manufacturer's written approval of installer.
- D. Contract closeout information:
  - 1. Maintenance data.
  - 2. Interior finish fire performance data:
    - a. Provide for each finish material and type specified:
      - 1) Manufacturer's printed information including:
        - a) Fire class.
        - b) NFPA test number.
        - c) Photograph.
      - 2) Proof of purchase.
- E. LEED Information:
  - 1. LEED Credits MR 4.1 and 4.2, Recycled Content: Product data indicating percentages by weight of post-consumer and post-industrial recycled content for products having recycled content; include statement indicating costs for each product having recycled content.

2. LEED Credits MR 5.1 and 5.2, Regional Materials: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.
3. LEED Credit EQ 4.1, Low-Emitting Materials – Adhesives and Sealants: Manufacturer's product data for construction sealants, including printed statement of VOC content.

#### **1.4 JOB CONDITIONS**

- A. Complete terrazzo installation before application of other items which might be damaged by this work.
- B. Remove and replace defective work and other work that does not comply with requirements.

### **PART 2 - PRODUCTS**

#### **2.1 MATERIALS**

- A. Acceptable Manufacturers:
  1. Precast Terrazzo:
    - a. Base:
      - 1) Terroxy Marble and Supply, Terry Resin Systems.
    - b. Optional:
      - 1) Precast & Building Supply Corp.
      - 2) Roberson Precast Limited.
      - 3) Romoco Precast Terrazzo Products.
      - 4) Angelozi Precast.

#### **2.2 MATERIAL DESCRIPTIONS**

- A. Precast Terrazzo:
  1. Matrix: Thermosetting amine-cured epoxy resin and hardener, mineral filler and color pigment complying with NTMA requirements.
  2. Aggregate: Natural, sound, crushed marble chips; color and grading to match specified color and pattern.
  3. Reinforcing, abrasive inserts and other components of the precast units shall comply with manufacturer's and NTMA Standards.
  4. Fabrication: Comply with NTMA Specifications and recommendations.
    - a. Treads shall be reinforced.
    - b. Exposed edges shall be rounded to 1/8 IN radius.
    - c. Abrasive inserts shall be uniformly set in channels and shall project 1/16 IN above terrazzo top surface.
  5. Terrazzo color(s) and pattern(s): As scheduled or indicated.
  6. Terrazzo composition: TM 09-1808:
    - a. Epoxy: Midnight #10079.
    - b. Chips:
      - 1) Cardiff Green #2s – 70 percent.
      - 2) Plate Glass #1s – 30 percent.
- B. Setting material: Manufacturer's recommended mortar mix for setting precast terrazzo on indicated substrate, consisting of the following components:
  1. Portland cement: ASTM-C150, Type 1.
  2. Sand: ASTM-C33, fine aggregate.
  3. Water: Clean and potable.
- C. Grout: Manufacturer's recommended grout mix for filling and sealing joints.
  1. Color shall closely match the principle color of the terrazzo units.

2. Comply with TCA Standards.
- D. Adhesives and Sealants:
1. Sealants shall have a VOC content of no greater than 250 g/L in accord wit SCAQMD Rule #1168.
  2. Adhesives shall have a VOC content no greater than 65 g/L in accord wit SCAQMD Rule #1168.

## **PART 3 - EXECUTION**

### **3.1 INSPECTION**

- A. Examine substrate and conditions under which terrazzo is to be installed to determine unsatisfactory conditions.
- B. Proceed with work when unsatisfactory conditions have been corrected and surfaces are accepted.
- C. Start of work constitutes acceptance of surface, and waiver of claim that surfaces are unsuitable.

### **3.2 INSTALLATION**

- A. Clean and prepare substrate, including application of primer if required for secure bond with mortar bed.
- B. Set precast terrazzo units accurately in mortar setting bed.
- C. Fill joints with grout and clean off excess grout.
- D. Install precast stair treads using concealed fasteners or field welded connections, ground smooth. Exposed metal reinforcement, clips and fasteners shall be painted color as selected by Architect.

### **3.3 PROTECTION AND FINAL CLEANING**

- A. Provide protection for finished work until building is ready for occupancy.
- B. Clean as recommended by terrazzo manufacturer when building is ready for occupancy.

**END OF SECTION**



**SECTION 09 67 26**  
**SEAMLESS EPOXY FLOORING (SEF)**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
1. Section specifies a highly decorative, seamless epoxy flooring system utilizing multi-colored ceramic granular aggregate quartz to provide an aesthetic, chemical resistant and durable wearing surface.

**1.2 QUALITY ASSURANCE**

- A. Minimum Performance Characteristics:
1. Impact Resistance, Gardner Impact Test: At greater than 160 IN-LB, no cracking, chipping or delamination.
  2. Abrasion Resistance: ASTM-D4060, 0.105 gm.
  3. Toxicity: US Department of Agriculture Research Service Meat Inspection Division, Non-Toxic.
  4. Flammability: ASTM-E84 Tunnel Test; Flame Spread Classification (FSC) not to exceed 35.
  5. Tensile Strength: ASTM-D638; 7250 PSI.
  6. Compressive Strength: ASTM-C579; 10,400 psi.
  7. Coefficient of Friction: ASTM-D2047.
  8. Chemical Resistance:
    - a. Unaffected by the following: 20 percent Hydrochloric Acid, Mercurochrome, Betadyne, Urine, Coffee, Ethyl Alcohol, Iodine, 10 percent Lactic Acid, Tea, and Mustard.
- B. Materials shall be recommended and manufactured by single supplier to insure compatibility and proper chemical and mechanical bond.
- C. Applicator Qualifications:
1. Applicator experienced in application of specified materials for a minimum of 7 years on projects of similar size and complexity and as approved by Architect.
  2. Provide list of completed projects including project name and location, name of Architect, name of material manufacturer, and approximate quantity of materials applied.
  3. Applicator Personnel: Employ persons trained for application of specified materials.

**1.3 SUBMITTALS**

- A. Product Data:
- B. Certificate that furnished adhesives and sealants meet minimum VOC requirements as specified by the California South Coast Air Quality Management District Rule.
- C. Samples:
1. Two 12 x 12 IN samples for color selection and grit consistency.
- D. Contract Closeout Information:
1. Maintenance data.
  2. Warranty.

**1.4 WARRANTY**

- A. Provide written 5-year warranty.
- B. Warranty flooring against:

1. Delamination from substrate.
2. Popping of aggregate.
3. Degradation of finish.
4. Cracking and spalling.
5. Water penetration.

## **1.5 PRODUCT SITE AND ENVIRONMENTAL REQUIREMENTS**

- A. Coordinate ventilation in compliance with Section 01 81 21.
- B. Material temperatures shall be minimum of 55 degF before use.
- C. Before commencing work, ensure environmental and site conditions are suitable for application and curing.
- D. Surfaces shall be acceptable in accordance with flooring manufacturer's recommendations.
- E. Correct unsuitable surfaces and conditions.
  1. Commencement of work constitutes acceptance of surfaces and working conditions.

## **1.6 PROTECTION**

- A. Protect adjacent surfaces from damage resulting from work of this trade.
  1. If necessary, mask or cover adjacent surfaces or both, including fixtures, cabinetwork, equipment, and similar items by suitable means.

## **PART 2 - PRODUCTS**

### **2.1 MANUFACTURERS**

- A. Acceptable manufacturers:
  1. Seamless Epoxy Flooring (SEF):
    - a. Base:
      - 1) Sika Industrial Flooring.
    - b. Optional:
      - 1) Crossfield Products, Dex-O-Tex.
      - 2) Dudick.
      - 3) Northern Industries.
      - 4) Sherwin-Williams, General Polymers.
      - 5) Stonhard.
      - 6) Tnemec.
      - 7) Tennant.
      - 8) Clifford W. Estes.

### **2.2 MATERIALS**

- A. Seamless Epoxy Flooring System:
  1. Concealed flooring system consisting of 100 percent solid epoxy.
  2. Components: Primer coat, body coat and topcoat.
  3. Locations to be used:
    - a. Apply in all locations scheduled to receive EC-1.
- B. Primer:
  1. Two component high solids, low modulus, low viscosity epoxy primer, or primer as recommended by manufacturer.
- C. Body Coat:
  1. Medium build epoxy binder/coating consisting of two component, high solids epoxy.
    - a. Color: To be selected by Architect.

- D. Topcoat:
  - 1. Clear Epoxy Topcoat consisting of two component high solids, low viscosity epoxy coating.
    - a. Coverage: 10 to 15 mils.
    - b. Color: Clear.
- E. Accessory strips:
  - 1. Depth and style as required.
- F. Water vapor emission control system: Comply with Section 09 60 05.

## **PART 3 - EXECUTION**

### **3.1 INSPECTION AND PREPARATION**

- A. Work shall not commence until building can be maintained at minimum temperature of 55 degF for 48 hours before, during, and 48 hours after application.
  - 1. Areas shall also be broom clean and dust free and shall have adequately controlled ventilation with bright, uniform lighting.
- B. Examine substrate and conditions under which flooring is to be installed.
  - 1. Surface must be clean, sound and dry.
- C. Concrete preparation for floor finishes: Provide water vapor control system testing and measures.
- D. Prepare substrate in accordance with manufacturer's instructions.
  - 1. Effectively remove concrete laitance from floor surfaces by mechanical shot blasting.
    - a. Acid etching is not acceptable.
  - 2. Grind existing concrete surfaces as required to produce a smooth, level surface, and remove contaminants.
- E. Prepare cracks and joints.
  - 1. Fill construction joints and other non-moving joints with elastomeric sealant approved by maker of epoxy flooring system.
- F. Start of work constitutes acceptance of surfaces and waiver of claim that surfaces are unsuitable.

### **3.2 INSTALLATION**

- A. General:
  - 1. Apply flooring in accordance with manufacturer's printed instruction, employing lead mechanic qualified under quality assurance portion of this specification, using equipment specifically designed for this purpose.
  - 2. Prepare cracks and joints per manufacturer's recommendations.
  - 3. Apply surfacing with uniform thicknesses for floors and for wall bases.
  - 4. Surfacing shall be tightly compacted.
  - 5. Finished work shall match approved samples; be uniform in thickness, sheen, color, pattern, and texture; and free from defects detrimental to performance.
  - 6. Match color of approved samples.
- B. Prime in accordance with manufacturer's instructions.
  - 1. Do not permit primer to collect in floor depressions.
  - 2. If necessary, apply second prime coat to porous areas.
  - 3. Install accessory strips at base and edge terminations in adhesive, or use concealed mechanical anchorages.
- C. Mix and place in accordance with manufacturer's instructions.
- D. Comply with time limitations and instructions for placing and curing.
- E. Install wall coving at perimeter walls.

1. Comply with manufacturer's procedures.
  2. Trowel apply vertical cove base.
  3. Hand sand cove base.
  4. Apply 3 coats of resin to assure a smooth surface and cove.
  5. Do not allow resin to puddle in cove.
  6. Install integral cove base to height of access floor with 1 IN radius cove.
- F. Apply seal coating uniformly over surfaces to satin finish.
- G. Grind down ridges and sharp projections.

### **3.3 PROTECTION**

- A. Provide non-staining protection for finished flooring until ready for installation of raised access floor.
- B. Repair, remove, or replace unacceptable flooring and base .

### **3.4 FINAL CLEANING**

- A. Clean floors as recommended by manufacturer prior to building occupancy.

**END OF SECTION**

**SECTION 09 67 81**  
**CONCRETE FLOOR SEALER (CFS-ND)**

**PART 1 - GENERAL**

**1.1 QUALITY ASSURANCE**

- A. Applicator must be a licensee of manufacturer, or approved in writing.

**1.2 SUBMITTALS**

- A. Project Information:
1. Maintenance data.
- B. LEED Information:
1. LEED Credits MR 5.1 and 5.2, Regional Materials: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.
  2. LEED Credit EQ 4.2, Low-Emitting Materials – Paints and Coatings: Manufacturer’s product data indicating VOC content.

**1.3 JOB CONDITIONS**

- A. Install only when surface and ambient temperatures are between 95 and 60 degF.
- B. Install prior to other finishes.
- C. Provide adequate ventilation during installation.
- D. Post and enforce No Smoking signs.

**PART 2 - PRODUCTS**

**2.1 MATERIALS**

- A. Acceptable manufacturers:
1. Concrete Floor Sealer – Normal Duty (CFS-ND):
    - a. Base:
      - 1) Symons.
    - b. Optional:
      - 1) Euclid Chemical Company.
      - 2) Nox-Crete.
- B. Concrete Floor Sealer – Normal Duty (CFS-ND):
1. Water-based, low VOC, acrylic copolymer solutions that cure, seal and dustproof concrete with minimal yellowing.
  2. Conform to ASTM-C309 and ASTM-C1315, Type I, Grade B, be VOC compliant, and meet all local air quality regulations.
  3. Federal Spec: TT-C-800A.
  4. Minimum Solids Content: 30% by volume.
  5. Primer: As recommended by manufacturer.
  6. Floor Sealer shall have a VOC content no more than 100 g/L in accord with SCAQMD Rule 1117.
  7. Base Product:
    - a. Symons Cure & Seal 30 EF.

## **PART 3 - EXECUTION**

### **3.1 INSPECTION**

- A. Verify suitability of substrate to accept installation.
- B. Installation constitutes acceptance of responsibility for performance.

### **3.2 PREPARATION**

- A. Verify that concrete was steel troweled and hair broomed and is free of fins, ridges or voids.
- B. Assure that curing agents used are compatible with coating system or completely removed.
- C. Concrete must be cured for minimum of 28 days, with moisture content not exceeding 8 percent.
- D. Remove surface contamination by cleaning or if necessary by sandblasting.
- E. Patch holes or voids.
- F. Rout out cracks exceeding 1/16 IN wide and calk.
- G. Calk non-moving joints up to 1 IN wide with suitable backer and sealant.
- H. Do not calk or overcoat joints where movement exceeds 25% or joints over 1 IN wide.
- I. These joints must receive other joint treatment to assure watertightness.
- J. Install test patch.
- K. If test patch indicates lack of adhesion, install primer.

### **3.3 INSTALLATION**

- A. DO NOT apply to surfaces scheduled to subsequently receive cementitious coatings or toppings, such as concrete, terrazzo, polyester or epoxy coatings.
- B. Apply by airless spray, long handled roller or brush.
- C. Apply in accordance with manufacturer's recommendations; minimum 2 coats.
- D. Apply first coat at not over 400 SF/GAL.
- E. Apply subsequent coat at a coverage rate not over 400 SF/GAL.
- F. Allow no traffic on sealed surface for 72 hours after application.

### **3.4 PATCHING AND CLEANING**

- A. Patch areas which fail to match adjacent work.
- B. Clean surface "broom clean" after completion of work.
- C. Remove debris resulting from these operations.

**END OF SECTION**

**SECTION 09 68 13**  
**CARPET TILE (CPTT)**

**PART 1 - GENERAL**

**1.1 QUALITY ASSURANCE**

- A. General requirements:
1. Manufacturer:
    - a. Carpet manufacturer shall have no less than 10 years of production experience with carpet similar to type specified in this document; and whose published product literature clearly indicate compliance of products with requirements of this section.
    - b. Single source responsibility: Provide product material by a single manufacturer for each carpet type specified.
  2. Trade Contractor: Firm with not less than five (5) years of successful carpeting experience similar to work of this section and recommended and approved by the carpet manufacturer. Upon request, submit letter from carpet manufacturer stating certification qualifications and acceptance.
  3. Substitutions: Where a selected manufacturer or product has been specified, an equal or superior product may be accepted only upon review and written acceptance by the Architect. It is mandatory that such review and approval be obtained prior to bidding, or the substitution will not be considered. All such proposed substitutions shall be submitted to the architect with all appropriate manufacturer's specifications and literature, and independent testing laboratory data. The architect's decision as to whether a product is equal or superior to the one specified shall be final. This section applies to any "or equal" noted in the specifications.
  4. Installer qualifications: Mill trained, skilled mechanics supervised by experienced superintendent with 50,000 yards experience.

**1.2 SUBMITTALS**

- A. Samples:
1. Three samples, minimum 12 IN x 12 IN of each material and color selected for verification.
- B. Contract Closeout Information:
1. Warranty/Guarantee.
  2. Letter stating extra material has been delivered.
  3. Maintenance data.
  4. Interior finish fire performance data:
    - a. Provide for each finish material and type specified:
      - 1) Manufacturer's printed information including:
        - a) Fire class.
        - b) NFPA test number.
        - c) Photograph.
      - 2) Proof of purchase.
- C. LEED Information:
1. LEED Credits MR 4.1 and 4.2, Recycled Content: Product data indicating percentages by weight of post-consumer and post-industrial recycled content for products having recycled content; include statement indicating costs for each product having recycled content.
  2. LEED Credits MR 5.1 and 5.2, Regional Materials: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.

3. LEED Credit MR EQ 4.1, Low-Emitting Materials, Adhesives & Sealants: Product data indicating that VOC levels of adhesives are in compliance with South Coast Air Quality Management District regulations.
  4. LEED Credit MR EQ 4.3, Low-Emitting Materials, Carpet Systems: Product data indicating that all carpet systems comply with Carpet and Rug Institute Green Label Plus program and carpet cushion complies with Carpet and Rug Institute Green Label program.
- D. LEED 2009 Tracking Information:
1. LEED Credit EQ 4.3, Low-Emitting Materials – Flooring Systems: Manufacturer’s Product data indicating that flooring products comply with the following standards:
    - a. Carpet and Rug Institute Green Label Plus program
    - b. Carpet and Rug Institute Green Label program
    - c. South Coast Air Quality Management District Rule #1168
- E. Sustainable Design Information:
1. Provide product data for carpet that is listed in the USDA’s BioPreferred Database or any other biobased component of carpet furnished.

### **1.3 PRODUCT DELIVERY, STORAGE AND HANDLING**

- A. Deliver with mill register numbers attached.
- B. Tag and mark accessory items for identification.
- C. Store Carpet and related materials in a climate-controlled, dry space.
  1. Protect Carpet from soil, dust, moisture and other contaminants.
  2. Store on a flat surface.
  3. Do not stacking heavy objects on top of carpet packages.

### **1.4 JOB CONDITIONS**

- A. Install after wall and other floor finishing operations in area are complete.
- B. Install after lighting system in area is complete.
- C. Install prior to acoustical ceiling tile.
- D. Maintain temperature of 65-95 DegF for not less than 48 hours prior to installation.
  1. Do not allow relative humidity to exceed 65%.
  2. Maintain same temperature and RH conditions throughout installation.

### **1.5 WARRANTY/GUARANTEE**

- A. Guarantee entire carpet installation complies with specifications, and damaged or defective carpet or carpet stained by adhesives will be removed and replaced for a period of 2 years.
- B. Guarantee carpet color consisting of thermally pigmented yarns will not show significant change when exposed to normal light for period of 15 years.
  1. AATCC-16E.
- C. Guarantee carpet color will not show significant change when exposed to normal atmospheric contaminates for period of 15 years.
- D. Guarantee carpet will not show excessive wear for period of 15 years.
  1. Excessive wear is defined as wearing away of face yarns which reduces pile height by more than 15 percent in any area or pulling out of nap.
- E. Guarantee carpet backing structure will not delaminate from face structure and there will be no shrinkage or stretching affecting performance of face or backing structure for period of 15 years when installed and maintained in accordance with published procedures.
  1. Guarantee when installed and maintained in accordance with published procedures will not edge ravel for a period of 15 years.
  2. Guarantee ability of the carpet to lay flat; will not curl or dome.

- F. Guarantee entire cost of replacement, including removal, replacement, and disposal of defective carpet.

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS**

- A. Acceptable manufacturers:
  - 1. Carpet Tile (CPTT):
    - a. Base:
      - 1) As noted on Finish Key on Drawings for individual types.
  - 2. Carpet Edging Strips:
    - a. Base:
      - 1) BurkeMercer.
- B. Carpet Tile (CPTT):
  - 1. First quality, no seconds or imperfections.
  - 2. Comply with applicable state and local codes.
  - 3. All carpet tile shall be Green Label Plus certified by Carpet and Rug Institute.
- C. Carpet Edging Strips:
  - 1. Base Product: "Carpet to Resilient Transition 170" by BurkeMercer.
  - 2. Thickness to match carpet.
  - 3. Color as selected by Architect.
- D. Water vapor emission control system: See Section 09 60 05.
- E. Adhesive:
  - 1. Non-staining, non-bleeding strippable type.
  - 2. As recommended by carpet manufacturer with VOC content no greater than 50 g/L in accord with SCAQMD Rule #1168.

### **2.2 CARPET TYPES**

- A. Carpet CPTT-01:
  - 1. Manufacturer: Shaw Contract Group.
  - 2. Collection: Shade
  - 3. Style name: Brilliance Tile
  - 4. Style number: 59529
  - 5. Construction: Multi-level pattern loop.
  - 6. Fiber: Eco solution q@ nylon
  - 7. Dye method: 100 percent solution dyed
  - 8. Color: 29585 grey mist
  - 9. Face weight: 26.0
  - 10. Gauge: 1/12
  - 11. Stitches per inch: 9.0
  - 12. Finished pile thickness: 0.123
  - 13. Total thickness: 0.273
  - 14. Average density: 7610
  - 15. Product size: 24 IN x 24 IN
  - 16. Primary backing: Synthetic
  - 17. Secondary backing: Ecoworx Tile
  - 18. Protective treatments: ssp shaw soil protection
  - 19. Radiant panel: Class I
  - 20. NBS smoke: Less than 450
  - 21. Electrostatic propensity: Less than 3.5 kv
  - 22. Average critical radiant flux: .84 watts/sq. cm.

23. Warranties: Lifetime commercial limited.
  24. Installation method: Monolithic
  25. Green label plus certification number: glp9968
  26. NSF140 platinum
  27. Cradle to cradle: Silver certified
- B. Carpet CPTT-02:
1. Manufacturer: J&J Invision.
  2. Style: Shantung Modular #7960.
  3. Color: 350 Prussian.
  4. Yarn: 100 percent Nylon: Ultron Nylon 6,6
  5. Dye method: Piece dyed
  6. Surface texture: Inter-Lok Tuftin System
  7. Pattern repeat: 24 IN W x 24 IN L approximately
  8. Gauge: 1/10
  9. Tufted stitches per inch: 13
  10. Yarn weight: 33 oz/sy
  11. Finished pile thickness: 0.19 IN (ASTM D-418)
  12. Density: 6,253
  13. Weight density: 206,337
  14. Secondary backing: Nexus Modular
  15. Special treatments: ProTex Fluorochemical
  16. Tile size: 24 IN x 24 IN
  17. Flammability: Class 1
  18. Smoke: Less than 450 flaming
  19. Average critical radiant flux: 0.57 watts/sq. cm
  20. Static generation: Less than 3.0 kv (AATCC-134)
  21. ADA compliance: Compliant for accessible routes.
  22. Warranties:
    - a. Lifetime fiber performance for wear.
    - b. Lifetime fiber performance for static.
    - c. Lifetime protection from delamination failure.
    - d. Lifetime for tuft bind strength (edge ravel, yarn pulls, zippering)
    - e. Lifetime moisture barrier.
    - f. Lifetime dimensional stability.

### **2.3 EXTRA MATERIAL**

- A. Furnish BNL with minimum of 5 percent additional material of each type, pattern and color for maintenance purposes.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Verify suitability of substrate to accept installation.
- B. Concrete preparation for floor finishes: See Section 09 60 05.
- C. Verify concrete is sealed. New concrete requires approximately 90 days to cure.
- D. Repair or patch existing vinyl composition tile.
  1. Remove old wax.
  2. Seal cut-back exposed adhesive.
- E. Sand wood finish on subfloor repair loose or broken boards and other defects.
- F. Patch or fill cracks and irregularities on granolithic terrazzo marble ceramic subfloors.
  1. Fill grout lines with approved latex patching compound.

### 3.2 PREPARATION

- A. Thoroughly clean areas to receive carpet tile, seal new concrete, strip waxes and finishes.
- B. Thoroughly remove dust and vacuum, also wet mop then seal concrete.
- C. Fill cracks, joints, holes or uneven areas with non-crumbling latex base floor filler such as Lev-L-Astic, patching compound must be mixed with latex mix not water.
- D. Before commencing work, test an area with glue and carpet tile to determine "open-time" and bond.
- E. Layout:
  - 1. Arrange joints symmetrically about centerline of rooms.
  - 2. Lay so pile and pattern of adjacent pieces match.
  - 3. Carefully check dimensions.

### 3.3 INSTALLATION

- A. General:
  - 1. Comply with manufacturer's instructions and recommendations for uniformity of direction, seam locations, and lay of carpet pile.
  - 2. Place tile with sight butted joints.
  - 3. Install carpet under open-bottom obstructions and under removable flanges and furnishings, and into alcoves and closets of each space.
  - 4. Provide cut outs where required.
    - a. Conceal cut edges with protective edge guards or overlapping flanges.
  - 5. Run carpet under open-bottom items such as heating convectors and install tight against walls, columns and cabinets so entire floor area is covered with carpet.
    - a. Cover over all floor type door closers.
  - 6. Install edging guard at all openings and doors wherever carpet terminates, unless indicated otherwise.
    - a. Prior to installation, report to the Construction Manager all other obstructions which may occur.
  - 7. Cutting shall be done in accordance with the manufacturer's recommendation, using the tools designed for the carpet being installed, making sure carpet knives are sharp.
  - 8. Edges shall be butted together with the proper pressure to produce the tightest joint possible without distortion.
  - 9. All carpet shall be installed with pile-lay in the same direction.
  - 10. Use leveling compound where necessary.
    - a. Any floor filling or leveling shall have a minimum of 4 FT- 0 IN of feather.
  - 11. Expansion joints:
    - a. Do not bridge building expansion joints with continuous carpeting.
    - b. Provide for movements.
- B. Install in accordance with manufacturer's instructions.
  - 1. Follow instructions on adhesives.
    - a. Adhesive must have recommended flash time before carpet is positioned.
  - 2. Do not mix dye lots in the same area.
  - 3. Install all carpet tiles so arrows point in the same direction.
- C. Where carpet terminates at non-carpeted floor surface, install Carpet Edging Strips (a.k.a. transition strips, reducer strips).
  - 1. Install with contact adhesive.
  - 2. Score and trim narrow end of reducer strip to conform to adjacent floor finish.
- D. Install according to Architect's directions for overall patterns and borders.
  - 1. Install carpet patterns according to drawings with no deviation.
  - 2. Develop templates as necessary.

### **3.4 CLEAN**

- A. Remove spillage of glue or adhesive from face or seam using remover provided by manufacturer.
- B. Clean spots; remove loose threads with broadloom scissors.
- C. Completely and thoroughly vacuum using a pile lifter.
- D. Advise maintenance personnel regarding care and maintenance.
- E. Save cuts over 9 IN for BNL stock.

### **3.5 PROTECTION**

- A. After cleaning and prior to final acceptance, protect carpeting subject to traffic with nonstaining building material paper runners or other approved material.
- B. Protect installation from rolling traffic by using sheets of hardboard or plywood in potentially affected areas
- C. Protect carpeting against damage during construction:
  - 1. Cover with nonstaining building material paper with taped joints during the construction period, wherever protection is required, so carpet will be without any indication of deterioration, wear, or damage at the time of acceptance.
  - 2. Damaged carpeting will be rejected.
  - 3. As the carpet is laid, remove trimmings, excess pieces of carpet and laying materials from each area as it is completed.
- D. Maintain protection of carpeting on each floor or area until accepted, without waiting until the entire project is complete.

### **3.6 INSPECTION**

- A. Upon completion of the installation inspect installation and verify work is complete, properly installed, and acceptable.
- B. Remove and replace work not found acceptable at the installers expense.

**END OF SECTION**

**SECTION 09 77 13**  
**STRETCHED FABRIC PANEL SYSTEM**

**PART 1 - GENERAL**

**1.1 REFERENCES**

- A. Publications listed herein are part of this specification to extent referenced.
- B. American Society for Testing and Materials:
  - 1. ASTM-C423 Test Method for Sound Absorption and Sound Absorption Coefficients by Reverberation Room Method.
  - 2. ASTM-E84 Test Methods for Surface Burning Characteristics of Building Materials.
  - 3. ASTM-E2573-07 Specimen Preparation and Mounting of Site – Fabricated Stretch Systems to Access Surface Burning Characteristics.
- C. National Fire Protection Association:
  - 1. NFPA-255 Method of Test of Surface Burning Characteristics of Building Materials.

**1.2 SYSTEM DESCRIPTION**

- A. Design Requirements:
  - 1. Stretched fabric panel system shall consist of continuous perimeter and butt seam mounting extrusions, site-fabricated, and applied directly to substrate.
  - 2. Facing fabric shall be stretched over core materials, leaving fabric floating above core surface. Fabric facing application shall not utilize adhesives, nails, tacks, screws, or tapes. Nails, tacks, screws or similar items shall not installed through facing fabric to secure panel.
  - 3. System shall allow for removal and replacement of fabric facing from individual panels. Removal of fabric shall provide access to surface behind fabric, without dismantling, removal, or replacement of mounting extrusions.
  - 4. Hinged, self-locking (snap-lock) type mounting extrusions and extrusions using tape to adhere fabrics do not satisfy intent of this specification.
  - 5. Prefabricated panels do not satisfy intent of this specification.

**1.3 SUBMITTALS**

- A. Shop Drawings:
  - 1. Submit scaled shop drawings showing general layout, jointing, anchoring sizes and types, shapes, thickness, and other similar detailed information necessary to fully describe installation.
  - 2. Elevations shall indicate arrangement of joints. Clearly indicate locations of seams, methods of joining seams, direction of fabric, and notations as to where dye lot changes occur.
  - 3. Shop drawings shall be of sufficient detail and scale to determine compliance with design intent. Scales shall generally be as follows:
    - a. Key Plans: 1/8 IN = 1 FT-0 IN.
    - b. Elevations: 1/2 IN = 1 FT-0 IN.
    - c. Plan Sections: 3 IN = 1 FT-0 IN.
    - d. Details: Full size or 3 IN = 1 FT-0 IN.
- B. Product Data:
  - 1. Submit manufacturer's literature describing system to be provided.
- C. Samples:
  - 1. Submit 2 samples as follows:
    - a. Each type mounting extrusion.
    - b. Each type fabric facing.

- c. Each type core material.
  - 2. Sample Size: 12 x 12 IN or 12 IN long as appropriate to material
- D. Project Information:
- 1. Manufacturer's Instructions:
    - a. Submit manufacturer's installation procedures which shall be basis for accepting or rejecting actual installation procedures.
  - 2. Test Reports:
    - a. Submit complete, unedited test reports for stretched fabric panel system prepared by an independent testing laboratory indicating full compliance with both acoustical and fire resistance performance requirements.
      - 1) Fire ratings shall be for a complete assembly, including perimeter and longitudinal butt joint framing extrusions, core material, and fabric covering as required by Appendix X of ASTM-E84 (NFPA-255).
    - b. Submit complete test reports for fabric covering prepared by an independent testing laboratory indicating compliance with specified fire resistance performance requirements.
  - 3. Certificates:
    - a. Provide certification from manufacturer of stretched fabric panel system attesting to their product's compliance with specified requirements including fire performance characteristics.
    - b. Provide certification that specialized equipment as may be required by manufacturer for proper installation of system shall be utilized.
    - c. Provide certification that technicians utilized for installation have been trained or qualified by manufacturer.
- E. Contract Closeout Information:
- 1. Submit procedures to be followed in cleaning and maintaining stretched fabric panels. Include a copy of instruction in Operation and Maintenance Data Manual.
  - 2. Interior finish fire performance data:
    - a. Provide for each finish material and type specified:
      - 1) Manufacturer's printed information including:
        - a) Fire class.
        - b) NFPA test number.
        - c) Photograph.
      - 2) Proof of purchase.
- F. LEED Information:
- 1. LEED Credits MR 4.1 and 4.2, Recycled Content: Product data indicating percentages by weight of post-consumer and post-industrial recycled content for products having recycled content; include statement indicating costs for each product having recycled content.
  - 2. LEED Credits MR 5.1 and 5.2, Regional Materials: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.

## 1.4 QUALITY ASSURANCE

- A. Qualifications:
- 1. Installer trained, or qualified by manufacturer in installation techniques and procedures of stretched fabric panel system and shall demonstrate a minimum of 3 years successful experience in such installation. Employ, on Project, mechanics with a minimum of 2 years documented experience.
  - 2. Single Source Responsibility:
    - a. To greatest extent possible, materials shall be products of a single manufacturer or items standard with manufacturer of stretched fabric panel system.

- b. Provide secondary materials which are produced, or are specifically recommended by stretched fabric panel system manufacturer to ensure compatibility.
- B. Field Samples:
1. Request a review of first finished elevation of each fabric facing for workmanship.
  2. Revise as necessary to secure Architects acceptance. Accepted field samples shall be used as datum for comparison with remainder of work of this Section for purposes of acceptance or rejection.
  3. Accepted field samples may be included in finished Work.

## **1.5 DELIVERY, STORAGE, AND HANDLING**

- A. Packing, Shipping, Handling, and Unloading:
1. Deliver materials in manufacturer's original unopened packaging.
- B. Acceptance of Fabric Facing:
1. Remove paper type wrappings and inter-leavings that are wet.
  2. Fabric facings shall be unwrapped and inspected upon arrival for flaws and defects. Notify Architect at least 24 hours in advance of inspection.
  3. Fabric that is flawed by inclusion of excessive misweaves, poor color match with goods specified, water damage, inadequate continuous drops without seaming, or other unacceptable conditions, shall be rejected.
- C. Storage and Protection:
1. Store materials in a clean area, free from dust and damage from construction activities.
  2. Do not store fabric in bolts in an upright position, or beneath other materials.
  3. Cover materials with plastic in a manner to provide air circulation.
  4. Remove damaged, defective, or rejected materials from Site.

## **1.6 PROJECT CONDITIONS**

- A. Environmental Requirements:
1. Maintain ambient temperature and humidity within spaces to receive stretched fabric panel system at levels indicated for final acceptance. Levels shall be maintained continuously from at least 48 hours prior to installation until space is turned over to BNL.
  2. Provide an illumination level of not less than 80 foot-candles measured at mid-height of substrate surface.
- B. Field Measurements:
1. Verify field dimensions prior to fabrication. Be responsible for details and dimensions not controlled by job conditions and indicate, on shop drawings, field measurements beyond control. Contractor and installer cooperate to establish and maintain these field dimensions.
  2. Measure each wall area and establish layout of panels to balance [borders] [widths] at opposite edges of each wall.
  3. Locate electrical receptacles, switch-boxes, elevator call buttons, and other similar devices which will be exposed in finished work.

## **1.7 SEQUENCING AND SCHEDULING**

- A. Schedule installation of stretched fabric system as late as possible in sequence of construction schedule to reduce damage.
1. Do not install stretched fabric system until space is enclosed, weather tight and conditioned.
  2. Under no circumstances shall installation begin prior to completion of abutting grid ceiling installation.
  3. No wet work shall remain with exception of touchup.

## 1.8 SPECIAL WARRANTY

- A. Stretched fabric system shall be warranted for a period of 5 years from Date of Substantial Completion. Upon notification of defects, replace, repair, re-stretch, or re-install fabric facing at no additional cost to BNL. Warranty shall include, but not be limited to conditions as follow:
  - 1. Stretched fabric system shall remain dimensionally stable and shall not sag or distort due to normal variances of temperature or humidity.
  - 2. Grain and weave of fabric shall be level and true with seams plumb and equally spaced.
  - 3. Patterns shall be aligned and matched at butt seams.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Acceptable manufacturers:
  - 1. Stretched Fabric Panel Systems:
    - a. Base:
      - 1) NOVAWALL Systems, Inc.
- B. Stretched Fabric Panel System:
  - 1. Panel Size and Thickness: As indicated on Drawings
  - 2. Framework: Extruded polymer
  - 3. Edge Configuration:
    - a. Square-Classic
  - 4. Mid-Wall Configuration:
    - a. 1/4 IN Reveal.
  - 5. Acoustical Core Material: Semi-rigid fiberglass board
    - a. Density:
      - 1) 6 pcf.
    - b. Thickness:
      - 1) 1 IN nominal.
    - c. Noise Reduction Coefficient; determined by ASTM-C423 Type A Mounting:
      - 1) 1/2 IN thickness: .55 minimum
  - 6. Tackable Core Material: Mineral fiberboard
    - a. Density:
      - 1) 24 PCF.
    - b. Thickness:
      - 1) 1/2 IN.
  - 7. Fire Resistance: ASTM-E84 or NFPA 255.
    - a. Complete panel assembly, including framework, mid-wall support, mounting devices, core, and fabric shall have a Class A rating.
      - 1) Flame Spread: 25 or less.
      - 2) Smoke Developed: Not to exceed 450.
  - 8. Product: NOVAWALL®.
- C. Fabric Facing:
  - 1. Source: Knoll Textiles, Inc.
  - 2. Fabric Content: 100 percent polyester.
  - 3. Pattern: K10906, Interknit.
  - 4. Color: Chalk.
  - 5. Width: 66 IN.
  - 6. Provide acrylic backing.

## **2.2 FABRICATION**

### **A. Fabric Treatment:**

1. Provide fabric with single pass, upholstery grade acrylic backing when required for proper installation. Other backings shall not be used without written approval from stretched fabric panel system manufacturer.
2. Provide liner when required to ensure uniform appearance of face fabric.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

#### **A. Site Verification of Conditions:**

1. Examine substrate and spaces in which work is to be performed.
2. Do not begin installation until:
  - a. Space has been enclosed and is weather-tight
  - b. Wet work has been completed and is dry
  - c. Painting is completed and wall base and floor covering is installed
  - d. Adjacent work of other trades such as woodwork, ceilings, wall coverings, etc. have been completed
3. Drywall surfaces shall be taped, bedded, sanded, and primed. Penetrations shall be sealed against air and moisture leakage through wall.
4. Do not proceed with installation until unsatisfactory conditions have been corrected. Beginning of installation indicates acceptance of existing substrate conditions.

### **3.2 INSTALLATION**

#### **A. General Requirements:**

1. Panel edges shall abut adjacent finishes or surfaces or to conform to adjacent joint conditions without reveals or gaps unless required by design.
2. Visible surfaces shall be fully covered and free from wrinkles, sags, blisters, and foreign matter.
3. Panel joints shall be tight, straight, true, plumb, and in proper relation to building lines without ripples, waviness, and "hourglass" effects.
4. Seaming of fabric by sewing shall not be allowed.

#### **B. Framework:**

1. Install framework in strict compliance with shop drawings and manufacturer's instructions.
2. Framework shall be installed around perimeter of each panel area. To greatest extent possible, install members in continuous lengths.
3. Install framework shimmed, plumbed, and scribed to align with adjacent surfaces. Attach in a manner to prevent sagging or moving out of position after fabric has been stretched tightly. Framework members shall not telescope through face of fabric.
4. Secure framework to wall surface using pneumatically driven 18 gauge staples with a diverging head to form divergent-tine wall anchors spaced at 2-3" on center.
5. Provide framework flush with face of panel around outlet boxes, duplex receptacles, thermostats, etc., which may occur within fabric panel area.

#### **C. Core Materials:**

1. Materials shall be installed in a continuous manner, flush and level with framework. Material shall be tight to the framework.

#### **D. Fabric Facing:**

1. Cut fabric from each roll maintaining sequence of drops and matching direction of weave for sequential and uniform installation.

2. Install fabric with warp and weft threads plumb, level, and true. Patterns, textures, and grain of fabric shall be aligned and matched at seams. Throughout entire seam, join wall panels without distortion to geometry of fabric or pattern.
  3. Fabric shall be stretched, re-stretched, and tensioned over framework and left to atmospherically cure for a minimum of 24 hours between stretchings until sufficiently taught to avoid sagging under varying year-round temperature and humidity conditions.
  4. Installed fabric shall be stretched taut so as not to puddle or dent when touched or leaned upon. Fabric shall be self-healing when pushed, punched, or hit, and shall revert back to original finished condition.
  5. Fabric shall be applied securely to grounds using a hand tool appropriate for joint condition and nature of fabric. No nailing, tacking, stapling, adhesive taping, or gluing of fabric shall be permitted. Ensure that fabric surface is free of wrinkles and that weave is plumb and straight and properly aligned horizontally and vertically.
- E. Site Tolerances:
1. Maximum variation of panels from true location shall be 1/8 IN.
  2. Maximum variation of surfaces intended to be flush shall be 1/32 IN.
  3. Maximum variation of reveal width shall be 1/16 IN.

### **3.3 CLEANING**

- A. Clean exposed surfaces of wall fabric. Trim and remove loose threads.
- B. Remove surplus materials, rubbish and debris, leaving area in a neat and clean condition.

### **3.4 PROTECTION**

- A. Cover wall fabric installation with new, clean vinyl sheeting.

**END OF SECTION**

**SECTION 09 84 13**  
**ACOUSTICAL PANEL SYSTEM**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. Section Includes:
1. Sculptured foam based acoustical panel system and installation adhesive.

**1.2 QUALITY ASSURANCE**

- A. Installer Qualifications:
1. Experience on projects of similar size and complexity.
- B. Performance Requirements:
1. Noise reduction coefficient (NRC) as tested in accordance with ASTM-C423 of at least 1.05 with mounting Type A.
  2. Class I/Class A acoustical panel assembly designed and tested in accordance with ASTM-E84 to provide surface burning characteristics as follows:
    - a. Flame Spread: 25 or less.
    - b. Smoke Developed: 50 or less.
  3. Comply with UL 1715 fire resistance requirements.
  4. Passes UL 181, Section 11, for microbial growth resistance.
  5. Rated 0 as determined in accordance with ASTM-G21 for fungus resistance.

**1.3 SUBMITTALS**

- A. Shop Drawings:
1. Elevations as required to show panel joints.
  2. Attachment details.
- B. Product Data.
- C. Samples:
1. Minimum 6 x 6 IN specimens of panel type specified showing full range of exposed texture to be expected in completed work.
- D. Contract Closeout Information:
1. Maintenance Data
  2. Certificates.
- E. LEED Information:
1. LEED Credits MR 4.1 and 4.2, Recycled Content: Product data indicating percentages by weight of post-consumer and post-industrial recycled content for products having recycled content; include statement indicating costs for each product having recycled content.
  2. LEED Credits MR 5.1 and 5.2, Regional Materials: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.
  3. LEED Credit EQ 4.1, Low-Emitting Materials, Adhesives and Sealants: Manufacturers' product data for construction adhesive, including printed statement of VOC content.

**1.4 DELIVERY, STORAGE & HANDLING**

- A. Store materials protected from exposure to harmful environmental conditions and at temperature and humidity conditions recommended by the manufacturer.

1. Prevent soiling, physical damage and wetting.
2. Store cartons open at each end to stabilize moisture content and temperature.

## **1.5 PROJECT SITE CONDITIONS**

- A. Environmental Requirements:
1. Do not install acoustical panels until building is closed in and HVAC system is operational.
  2. Locate materials onsite at least 24 hours before beginning installation to allow materials to reach temperature and moisture content equilibrium.
  3. Maintain the following conditions in areas where acoustical materials are to be installed 24 hours before, during and after installation:
    - a. Maximum Relative Humidity: 75 percent.
    - b. Uniform Temperature: 55 to 70 DegF.

## **1.6 EXTRA MATERIALS**

- A. Provide 10 percent additional material for use by BNL in building maintenance and repair.
1. Material shall be in new, unopened cartons, and packaged with protective covering for storage.
  2. Identify materials with appropriate labels.

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS**

- A. Acceptable manufacturers:
1. Acoustical Panel System:
    - a. Base:
      - 1) Pinta Acoustic.

### **2.2 ACOUSTICAL PANEL SYSTEM**

- A. Acoustical Panels:
1. Material: Open-cell melamine-based foam.
  2. Thickness: 3 IN.
  3. Width: 24 IN.
  4. Length: 48 IN.
  5. Edges: Beveled.
  6. Color: Natural white.
  7. Mounting Type: Direct adhesive attachment to substrate.
  8. Base Product: SONEXone panels by Pinta Acoustic.
- B. Adhesive:
1. As recommended by panel system manufacturer for substrate materials and conditions with VOC content no greater than 50 g/L in accord with SCAQMD Rule #1164.
- C. Miscellaneous Accessories:
1. Provide all items necessary for a complete single-source installation.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Site Verification of Conditions:
1. Examine surfaces scheduled to receive suspended or directly attached acoustical units for unevenness, irregularities and dampness that would affect quality and execution of work.
  2. Do not proceed with installation of wall panel system until unacceptable conditions are corrected.

### **3.2 INSTALLATION**

- A. General:
  - 1. Comply with the instructions and recommendations of the acoustical wall panel system manufacturer.
  - 2. Install materials in accordance with governing regulations, fire resistance rating requirements and industry standards applicable to work.
- B. Secure panels using adhesive.

### **3.3 CLEANING, PROTECTION & REPAIRS**

- A. Protect installed work from damage due to subsequent construction activity, including temperature and humidity limitations and dust control, so that the work will be without damage and deterioration at the time of acceptance by the BNL.
- B. Clean exposed surfaces of acoustical panel members.
  - 1. Comply with manufacturer's instructions for cleaning.
- C. Touch up any minor finish damage as recommended by manufacturer.
- D. Remove and replace work which cannot be successfully cleaned or repaired.

**END OF SECTION**



**SECTION 09 91 13**  
**EXTERIOR PAINTING**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. Definitions:
  - 1. "Paint" and "painting" refer to applied coatings.
  - 2. Mechanical work (and equipment): Work included in Mechanical Specification Divisions.
  - 3. Electrical work (and equipment): Work included in Electrical Specification Divisions.
- B. Work included:
  - 1. Exterior surfaces scheduled to be painted, unless indicated to be painted under other sections.
  - 2. Except for colored, split-face, patterned, ground-face, glazed, and other concrete masonry units with integral architectural finish; paint exposed exterior and on-site concrete masonry unit surfaces, including areaway walls, backside faces of parapets, screen walls, and retaining walls.
- C. Mechanical/Electrical Painting:
  - 1. Work included:
    - a. Mechanical equipment.
    - b. Electrical equipment.

**1.2 QUALITY ASSURANCE**

- A. Standard of workmanship: Before proceeding, finish following items with specified materials for approval as standard of quality for completed work:
  - 1. One area or item of each color.

**1.3 SUBMITTALS**

- A. Product data:
  - 1. Manufacturer's data for each paint type to be applied indicating conformance to specifications.
- B. Samples:
  - 1. Manufacturers complete range of colors for selection.
  - 2. Gloss samples.
- C. Contract closeout information:
  - 1. Maintenance data.
- D. LEED Information:
  - 1. LEED Credits MR 5.1 and 5.2, Regional Materials: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.

**1.4 PRODUCT DELIVERY, STORAGE AND HANDLING**

- A. Deliver in original labeled containers.
- B. Protect from freezing or damage.
- C. Store materials in place designated by BNL or Architect.

- D. Keep storage neat and clean.
- E. Repair damage thereto or to surroundings.
- F. Remove rags and waste from building daily.
- G. Avoid danger of fire.

## 1.5 JOB CONDITIONS

- A. Install when temperature, humidity, and surface conditions are acceptable to manufacturer.
- B. Maintain schedule indicating when painter expects to complete respective coats of paint for various areas.
  - 1. Keep schedule current as job progress dictates.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Acceptable manufacturers:
  - 1. Provide paint as product of one manufacturer as far as possible.
  - 2. Paint, stain, and coating systems listed are Sherwin Williams unless noted otherwise.
    - a. Use comparable performance and aesthetic requirements for paints by Optional manufacturers.
  - 3. Paints:
    - a. Base:
      - 1) Sherwin-Williams.
      - 2) As noted for individual types in Room Finish and Color Schedule.
    - b. Optional:
      - 1) Benjamin Moore.
      - 2) ICI Dulux Paint.
      - 3) PPG Architectural Finishes.
      - 4) Pratt & Lambert.
      - 5) Kwal Paint.
      - 6) MAB Paints and Coatings.
      - 7) Tnemec.
  - 4. Stains:
    - a. Base:
      - 1) Sherwin-Williams.
    - b. Optional:
      - 1) Benjamin Moore.
      - 2) ICI Dulux Paint.
      - 3) PPG Architectural Finishes.
      - 4) Pratt & Lambert.
- B. Paints and stains: As Scheduled in Part 3.
  - 1. Unscheduled items: Bring to the attention of Architect.
  - 2. Colors:
    - a. Architect reserves right to select colors from entire range of manufacturer's colors, including deep colors.
    - b. Mechanical: See Section 20 05 53.
  - 3. Gloss range: MPI Standards as measured in accordance with ASTM-D523:
    - a. Gloss Level 1 (Flat): Maximum 5 at 60 degrees, maximum 10 at 85 degrees.
    - b. Gloss Level 2 (Velvet): Maximum 10 at 60 degrees, 10-35 at 85 degrees.
    - c. Gloss Level 3 (Eggshell): 10-25 at 60 degrees, 10-35 at 85 degrees.
    - d. Gloss Level 4 (Satin): 20-35 at 60 degrees, minimum 35 at 85 degrees.
    - e. Gloss Level 5 (Semi-gloss): 35-70 at 60 degrees.

- f. Gloss Level 6 (Gloss): 70-85 at 60 degrees.
- g. Gloss Level 7 (High gloss): More than 85 at 60 degrees.
- 4. If the gloss range is not indicated, provide top coat with a MPI Gloss Level 3 (Eggshell) finish.
- 5. Submit gloss samples for approval prior to use.
- 6. Add flatteners if necessary to achieve specified gloss.
- 7. Part 3 includes a listing of surfaces and type of paint to be applied.

## **PART 3 - EXECUTION**

### **3.1 INSPECTION**

- A. Examine surfaces carefully for defects which cannot be corrected and might prevent satisfactory results.
- B. Commencing of work in a specific area constitutes acceptance of surfaces, and responsibility for performance.

### **3.2 SURFACES NOT TO BE PAINTED**

- A. Anodized aluminum, stainless steel, chromium plate, glass, copper, bronze or similar materials.
- B. Moving parts of valves, operating units, mechanical and electrical parts, such as valve and damper operators, sending devices, motor and fan shafts.
- C. Code labels, such as UL, FM that are mylar or flat (non-embossed) plates.
  - 1. Embossed plates and labels stamped into frames will be painted, label and information on label to be readily visible and convenient for identification by authority having jurisdiction.
- D. Equipment identification or rating plates.
- E. Items having complete factory finish with exception of:
  - 1. Exterior mechanical equipment.
  - 2. Exterior electrical equipment.

### **3.3 PREPARATION - GENERAL**

- A. Assure that surfaces are clean and dry.
- B. Assure that surfaces are free of foreign materials which will affect adhesion or appearance.
- C. Remove mildew and neutralize surface.
- D. Eliminate efflorescence before painting.
- E. Before painting, test surfaces with moisture meter.
- F. Paint when moisture is within paint manufacturer's acceptable limits.

### **3.4 PREPARATION - EXISTING SURFACES**

- A. Wherever existing work is cut, patched, or added to; touch up to match new work as closely as possible.
  - 1. Check compatibility of new coating to previously painted surfaces by applying test patch. Allow to dry and test adhesion before continuing painting work.
- B. Put existing work scheduled for repainting in condition to provide good adhesion and to receive paint.
  - 1. Wash thoroughly surfaces to be repainted with abrasive kitchen cleaner or sand to manufacturer's recommendations.
  - 2. Remove residue from cleaning and abrading procedures.
  - 3. Spot prime bare areas.

- C. Where a wall or ceiling is disturbed and patched, repaint entire wall or ceiling.
- D. On surfaces to be refinished remove hardware, accessories, plates, surface mounted lighting fixtures, and similar items not to be coated, or provide protection during preparation and coating operations.
- E. Protect (and do not paint) code labels, such as UL, FM that are mylar or flat (non-embossed) plates.
  - 1. Embossed plates and labels stamped into frames may be painted, label and information on label to be readily visible and convenient for identification by authority having jurisdiction.

### **3.5 MATERIAL PREPARATION**

- A. Mix and prepare materials per manufacturer's specifications.
- B. Stir, agitate or blend materials to produce a mixture of uniform density as required for application of materials.

### **3.6 PREPARATION - WOOD**

- A. General:
  - 1. Immediately before applying finish:
    - a. Sand all surfaces with 180-grit, or finer, as necessary to accomplish the following:
      - 1) Remove fingerprints and other marks which may have occurred during shipment to site and during installation.
      - 2) Restore surface to smooth surface texture.
      - 3) Prepare grain to receive finish.
    - b. Remove dust.
- B. Opaque Finishes:
  - 1. After priming coat has dried, seal knots, pitch and resinous sapwood.
- C. Stained and Clear Finishes:
  - 1. Treat wood with compatible wash-coat prior to stain application.
  - 2. Putty nail holes and minor defects, to match wood color.

### **3.7 PREPARATION - FERROUS METAL SURFACES AND HOLLOW METAL**

- A. Follow requirements of SSPC SP1 and SP3.
  - 1. Except where higher prep levels are indicated.
- B. Wire brush, or grind as necessary to remove shoulders at edge of sound paint to prevent telegraphing.
- C. Touch up damaged shop coats.
- D. For surfaces with touched up shop coat, omit first coat.
- E. Hollow metal frame joints at intersections of Rabbets, Stops, and Soffit Joints:
  - 1. Neatly fill corner seam with painter's caulk (in field) prior to painting.

### **3.8 PREPARATION - GALVANIZED METAL SURFACES AND NON-ANODIZED ALUMINUM**

- A. Follow requirements of SSPC SP1.
- B. Treat surfaces with galvanized surface cleaner as recommended by primer and topcoat manufacturer.

### **3.9 PREPARATION - GYPSUM WALLBOARD**

- A. Repair minor irregularities left by finishers.
- B. Exercise care to avoid raising nap of paper.

- C. Apply prime coat.
- D. Notify gypsum wallboard finisher to repair and refinish areas which indicate defects after application of primer.
- E. Re-prime refinished areas.

### **3.10 PREPARATION – CONCRETE AND MASONRY**

- A. Repair minor defects.
- B. Remove oil from concrete by washing with xylol.
- C. Block Filler:
  - 1. Apply to masonry to fill pinholes and minor surface defects, and to prime surface for topcoat(s).
  - 2. Apply by brush, roller or sprayer.
    - a. Where spray-applied: Back-roll with roller or squeegee.
  - 3. Minimum Nominal Thickness: 10 mil DFT.
    - a. Comply with manufacturer's recommended coverage rates for conditions encountered.
  - 4. Provide complete cover with recommended coating system.
- D. Obtain architect's approval of finish for surfaces to receive high build glazed coatings.

### **3.11 PREPARATION - NEW CONCRETE SURFACE**

- A. Repair minor defects.
- B. Flush clean with water.
- C. Apply Tenant 409 Pre-Kote/Cleaner to manufacturer's specifications.

### **3.12 APPLICATION - GENERAL**

- A. Paint surfaces as specified in paragraphs "Schedule - Exterior Paint Systems".
- B. Provide complete coverage and hide.
  - 1. Paint systems are to cover.
  - 2. When color or undercoats show through, apply additional coats at no additional cost until paint film is of uniform finish and color.
- C. Employ only skilled mechanics.
- D. Mix and apply as recommended by manufacturer.
- E. If Architect so directs, do not apply succeeding coats until Architect has an opportunity to observe previous coat.
- F. Remove and protect hardware, accessories, plates, fixtures, finished work, and similar items; or provide ample in-place protection.
- G. Upon completion of painting, carefully replace removed items and/or remove protection.
- H. Apply materials under adequate illumination.
- I. Evenly spread and smoothly flow on for full, smooth cover.
- J. Assure that coats are dry before recoating.
- K. Touch up suction or hot spots in plaster, concrete block, and concrete before painting.
- L. Touch up abraded areas of shop prime coats before subsequent coats are applied.
- M. Back prime wood trim with penetrating sealer.
- N. Finish colors not indicated shall be selected by Architect from paint manufacturer's standard colors.

### 3.13 PROTECTION AND CLEANUP

- A. Protect adjacent work against damage by painting and finishing work.
- B. Clean, repair or replace, and repaint damaged work as directed by Architect.
- C. Provide "WET PAINT" signs.
- D. Remove temporary protective wrappings, after completion of operations.
- E. Clean paint spattered surfaces.
- F. Use care not to damage finished surfaces.
- G. Remove surplus materials, scaffolding and debris.
- H. Leave areas broom clean.

### 3.14 SCHEDULE - EXTERIOR PAINT SYSTEMS

- A. Concrete and GFRC:
  - 1. Latex:
    - a. Sherwin Williams:
      - 1) Primer coat: Loxon Acrylic Primer; A24 W300.
      - 2) Topcoat: Duration Exterior Latex Satin; K33.
    - b. ICI:
      - 1) Primer coat: Prep & Prime Hydrosealer Waterborn Multipurpose Primer Sealer; 6001.
      - 2) Intermediate coat: Exterior 100% Acrylic Satin Finish; 2402.
      - 3) Topcoat: Exterior 100% Acrylic Satin Finish; 2402.
    - c. PPG:
      - 1) Primer coat: Perma-Crete Acrylic Primer; 4-2.
      - 2) Topcoat: Timeless Exterior Satin Latex; 73-410.
- B. Concrete block:
  - 1. Latex:
    - a. Sherwin Williams:
      - 1) Primer coat: Loxon Block Surfacer; A24 W200.
      - 2) Topcoat: Duration Exterior Latex Satin; K33.
    - b. ICI:
      - 1) Primer coat: Bloxfil Interior/Exterior Heavy Duty Acrylic Block Filler; 4000.
      - 2) Intermediate coat: Exterior 100% Acrylic Satin Finish; 2402.
      - 3) Topcoat: Exterior 100% Acrylic Satin Finish; 2402.
    - c. PPG:
      - 1) Primer coat: Perma-Crete Block Surfacer; 4-100.
      - 2) Topcoat: Timeless Exterior Satin Latex; 73-410.
- C. Gypsum wallboard soffits:
  - 1. Latex:
    - a. Sherwin Williams:
      - 1) Primer coat: Exterior Latex Primer; B42W41.
      - 2) Intermediate coat: Duration Exterior Latex Satin; K33.
      - 3) Topcoat: Duration Exterior Latex Satin; K33.
    - b. PPG:
      - 1) Primer coat: Speedhide Exterior Latex Wood Primer; 6-609.
      - 2) Primer coat: Timeless Exterior Satin Latex; 73-410.
      - 3) Top coat: Timeless Exterior Satin Latex; 73-410.
- D. Metal doors and frames; Metal stairs, handrails, and guardrails; Miscellaneous metals (ferrous, primed, zinc-coated, and aluminum):
  - 1. Water based urethane, Gloss Level 6 (Gloss):

- a. Sherwin Williams:
    - 1) Primer coat: Pro-Cryl Universal Acrylic Primer, B66-310 Series.
    - 2) Intermediate coat: Acrolon 100 Water Based Urethane Gloss, B65-720.
    - 3) Topcoat: Acrolon 100 Water Based Urethane Gloss, B65-720.
  - b. ICI:
    - 1) Primer coat: Universal Epoxy Primer; 205.
    - 2) Intermediate coat: Devthane UVA Aliphatic Urethane; 379.
    - 3) Topcoat: Devthane UVA Aliphatic Urethane; 379.
  - c. PPG:
    - 1) Primer coat: Pitt Tech 100% Acrylic Primer; 90-712.
    - 2) Intermediate coat: Durethane WB Water Based Urethane; 98-8200.
    - 3) Topcoat: Durethane WB Water Based Urethane; 98-8200.
- E. Structural steel (exposed):
- 1. Water based urethane, Gloss Level 6 (Gloss):
    - a. Sherwin Williams:
      - 1) Primer coat: Shop-applied. See Section 05 12 10.
        - a) Touch-up in field as required.
      - 2) Intermediate coat: Acrolon 100 Water Based Urethane Gloss, B65-720.
      - 3) Topcoat: Acrolon 100 Water Based Urethane Gloss, B65-720.
      - 4) Clear coat: Diamond-Clad Clear Coat Urethane, B65 Series.
    - b. ICI:
      - 1) Primer coat: Shop-applied. See Section 05 12 10.
        - a) Touch-up in field as required.
      - 2) Intermediate coat: Devthane UVA Aliphatic Urethane Gloss Enamel; 389.
      - 3) Topcoat: Devthane UVA Aliphatic Urethane Gloss Enamel; 389.
    - c. PPG:
      - 1) Primer coat: Shop-applied. See Section 05 12 10.
        - a) Touch-up in field as required.
      - 2) Intermediate coat: Durethane WB Water Based Urethane; 98-8200.
      - 3) Topcoat: Durethane WB Water Based Urethane; 98-8200.
      - 4) Clear coat: Durethane WB Water Based Urethane; 98-8200.

### **3.15 SCHEDULE - EXTERIOR PAINT SYSTEMS (HIGH-TEMP)**

- A. Metal smokestacks:
  - 1. Sherwin Williams:
    - a. Primer coat: Kem Hi-Temp 450.
    - b. Topcoat: Kem Hi-Temp 450.
  - 2. ICI:
    - a. Primer coat: Modified Silicone High Heat Coating; HT10.
    - b. Topcoat: Modified Silicone High Heat Coating; HT10.

**END OF SECTION**



**SECTION 09 91 23**  
**INTERIOR PAINTING**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. Definitions:
  - 1. "Paint" and "painting" in this section refers to applied coatings, except for exterior painting specified in Section 09 91 13.
  - 2. Finished room or space: One that has finish called for on Room Finish and Color Schedule.
  - 3. Mechanical work (and equipment): Work included in Mechanical Specification Divisions.
  - 4. Electrical work (and equipment): Work included in Electrical Specification Divisions.
- B. Work included:
  - 1. Interior surfaces in finished rooms or spaces, unless indicated not to be painted or indicated to be painted under other sections.
  - 2. Mechanical and electrical work:
    - a. Interior mechanical and electrical equipment not completely factory finished.
    - b. In finished rooms and spaces with finished ceilings: Exposed ductwork, piping, insulated piping, conduit, busways, raceways, and associated accessories.

**1.2 SUBMITTALS**

- A. Product data:
  - 1. Manufacturer's data for each paint type to be applied indicating conformance to specifications.
- B. Samples:
  - 1. Manufacturers complete range of colors for selection.
  - 2. Three 8-1/2 IN x 11 IN samples of each paint as selected in Room Finish and Color Schedule, as shown on Drawings.
    - a. Samples shall show specified color and finish.
  - 3. Gloss samples.
- C. Contract closeout information:
  - 1. Maintenance data.
- D. LEED Information:
  - 1. LEED Credits MR 5.1 and 5.2, Regional Materials: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.
  - 2. LEED Credit EQ 4.2, Low-Emitting Materials, Paints and Coatings: Manufacturer's product data for paints and coatings, included printed statement of VOC content and chemical components and material safety data sheets.
    - a. Provide VOC data and gallons furnished for each coating.

**1.3 PRODUCT DELIVERY, STORAGE AND HANDLING**

- A. Deliver in original labeled containers.
- B. Protect from freezing or damage.
- C. Store materials in place designated by BNL or Architect.
- D. Keep storage neat and clean.

- E. Repair damage thereto or to surroundings.
- F. Remove rags and waste from building daily.
- G. Avoid danger of fire.

#### **1.4 JOB CONDITIONS**

- A. Install when temperature and humidity conditions approximate conditions that will exist when building is occupied. Maintain conditions after installation.
- B. Install prior to adhesively applied flooring and wall covering.
- C. Install prior to carpet and acoustical material.
- D. Schedule installation to minimize accumulation of air contaminants that cannot be removed prior to occupancy.
- E. Air out construction with 100% outside air.
  - 1. Do not recirculate prior to occupancy.
  - 2. Ventilate during installation. Seal return air ducts and use direct exhaust to outdoors.
- F. Maintain schedule indicating when painter expects to complete respective coats of paint for various areas.
  - 1. Keep schedule current as job progress dictates.

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS**

- A. Acceptable manufacturers:
  - 1. Provide paint as product of one manufacturer as far as possible.
  - 2. Paint, stain, and coating systems listed are Sherwin Williams, ICI and PPG products.
    - a. Use comparable performance, environmental, and aesthetic requirements for paints by other listed manufacturers.
    - b. Manufacturers listed in Room Finish and Color Schedule are for color reference only.
  - 3. Paints:
    - a. Sherwin-Williams.
    - b. Benjamin Moore.
    - c. ICI Dulux Paint.
    - d. PPG Architectural Finishes.
    - e. Pratt & Lambert.
  - 4. Stains:
    - a. Sherwin-Williams.
    - b. Benjamin Moore.
    - c. ICI Dulux Paint.
    - d. PPG Architectural Finishes.
    - e. Pratt & Lambert.
- B. Paints and stains: As scheduled in Part 3.
  - 1. Unscheduled items: Bring to the attention of Architect.
  - 2. Colors: As noted in Room Finish and Color Schedule and as indicated in Section 20 05 53.
    - a. Architect reserves right to select accent colors from entire range of manufacturer's colors, including deep colors.
    - b. Architect reserves right to require that one or more walls in a room or space be painted a contrasting accent color, except in janitor's and electric closets and other small miscellaneous rooms and spaces.
    - c. Primer color: White.
      - 1) Bold, deep, vivid, and transparent top coats: Gray tint.
      - a) Coordinate with top coat color.

3. Gloss range: MPI Standards as measured in accordance with ASTM-D523:
    - a. Gloss Level 1 (Flat): Maximum 5 at 60 degrees, maximum 10 at 85 degrees.
    - b. Gloss Level 2 (Velvet): Maximum 10 at 60 degrees, 10-35 at 85 degrees.
    - c. Gloss Level 3 (Eggshell): 10-25 at 60 degrees, 10-35 at 85 degrees.
    - d. Gloss Level 4 (Satin): 20-35 at 60 degrees, minimum 35 at 85 degrees.
    - e. Gloss Level 5 (Semi-gloss): 35-70 at 60 degrees.
    - f. Gloss Level 6 (Gloss): 70-85 at 60 degrees.
    - g. Gloss Level 7 (High gloss): More than 85 at 60 degrees.
  4. If the gloss range is not indicated, provide top coat with a MPI Gloss Level 3 (Eggshell) finish.
  5. Submit gloss samples for approval prior to use.
  6. Add flatteners if necessary to achieve specified gloss.
  7. Part 3 includes a listing of surfaces and type of paint to be applied.
- C. LEED Requirements:
1. Flats: VOC content shall be no greater than 50 g/L.
  2. Non-Flats and Primers: VOC content shall be no greater than 150 g/L.
  3. Anti-corrosive paint applied to interior ferrous surfaces VOC content shall be no greater than 250 g/L.
  4. Varnish: VOC content shall be no greater than 350 g/L.
  5. Lacquer: VOC content shall be no greater than 550 g/L.
  6. Stains: VOC content shall be no greater than 250 g/L.
  7. Sanding Sealers: VOC content shall be no greater than 275 g/L.

## **PART 3 - EXECUTION**

### **3.1 INSPECTION**

- A. Examine surfaces carefully for defects which cannot be corrected and might prevent satisfactory results.
- B. Commencing of work in a specific area constitutes acceptance of surfaces, and responsibility for performance.

### **3.2 SURFACES NOT TO BE PAINTED**

- A. Anodized aluminum, stainless steel, chromium plate, glass, copper, bronze or similar materials.
- B. Moving parts of valves, operating units, mechanical and electrical parts, such as valve and damper operators, sending devices, motor and fan shafts.
- C. Code labels, such as UL, FM that are mylar or flat (non-embossed) plates.
  1. Embossed plates and labels stamped into frames will be painted, label and information on label to be readily visible and convenient for identification by authority having jurisdiction.
- D. Equipment identification or rating plates.
- E. Items having complete factory finish with exception of:
  1. Electrical panels.
  2. Control cabinets.
  3. Similar surfaces in finished areas.

### **3.3 PREPARATION - GENERAL**

- A. Assure that surfaces are clean and dry.
- B. Assure that surfaces are free of foreign materials which will affect adhesion or appearance.
- C. Remove mildew and neutralize surface.
- D. Eliminate efflorescence before painting.

- E. Before painting, test surfaces with moisture meter.
- F. Paint when moisture is within paint manufacturer's acceptable limits.

### **3.4 MATERIAL PREPARATION**

- A. Mix and prepare materials per manufacturer's specifications.
- B. Stir, agitate or blend materials to produce a mixture of uniform density as required for application of materials.

### **3.5 PREPARATION - WOOD**

- A. General:
  - 1. Immediately before applying finish:
    - a. Sand all surfaces with 180-grit, or finer, as necessary to accomplish the following:
      - 1) Remove fingerprints and other marks which may have occurred during shipment to site and during installation.
      - 2) Restore surface to smooth surface texture.
      - 3) Prepare grain to receive finish.
    - b. Remove dust.
- B. Opaque Finishes:
  - 1. After priming coat has dried, seal knots, pitch and resinous sapwood.
- C. Stained and Clear Finishes:
  - 1. Treat wood with compatible wash-coat prior to stain application.
  - 2. Putty nail holes and minor defects, to match wood color.

### **3.6 PREPARATION - FERROUS METAL SURFACES AND HOLLOW METAL**

- A. Follow requirements of SSPC SP1 and SP3.
  - 1. Except where higher prep levels are indicated.
- B. Wire brush, or grind as necessary to remove shoulders at edge of sound paint to prevent telegraphing.
- C. Touch up damaged shop coats.
- D. For surfaces with touched up shop coat, omit first coat.
- E. Hollow metal frame joints at intersections of Rabbets, Stops, and Soffit Joints:
  - 1. Neatly fill corner seam with painter's caulk (in field) prior to painting.
- F. For windows, and door assemblies that access to, or egress out directly from the Clean Zone, or are interior to the Clean Zone such that they are in contact with the clean air management systems, provide paint system PNTE-CR to the cleanroom side and half of the edges and frames.

### **3.7 PREPARATION - GALVANIZED METAL SURFACES AND NONANODIZED ALUMINUM**

- A. Follow requirements of SSPC SP1.
- B. Treat surfaces with galvanized surface cleaner as recommended by primer and topcoat manufacturer.

### **3.8 PREPARATION - GYPSUM WALLBOARD**

- A. Repair minor irregularities left by finishers.
- B. Exercise care to avoid raising nap of paper.
- C. Apply prime coat.

- D. Notify gypsum wallboard finisher to repair and refinish areas which indicate defects after application of primer.
- E. Re-prime refinished areas.

### **3.9 PREPARATION – CONCRETE AND MASONRY**

- A. Repair minor defects.
- B. Remove oil from concrete by washing with xylol.
- C. Block Filler:
  - 1. Apply masonry to fill pinholes and minor surface defects, and to prime surface for topcoat(s).
  - 2. Apply by brush, roller or sprayer.
    - a. Where spray-applied: Back-roll with roller or squeegee.
  - 3. Minimum Nominal Thickness: 10 mil DFT.
    - a. Comply with manufacturer's recommended coverage rates for conditions encountered.
  - 4. Provide complete cover with recommended coating system.
- D. For concrete exposed to view anywhere within the Clean Zone boundaries fill concrete voids, bugholes, and other cavities with paint system Manufacturer's recommended filler/sealer.
  - 1. Criteria definitions for voids, bugholes, and cavities shall be as provided by the finish manufacturer's written documentation.
- E. Obtain architect's approval of finish for surfaces to receive high build glazed coatings.

### **3.10 APPLICATION - GENERAL**

- A. Paint surfaces as specified in paragraphs "Schedule - Interior Paint Systems".
- B. Provide complete coverage and hide.
  - 1. Paint systems are to cover.
  - 2. When color or undercoats show through, apply additional coats at no additional cost until paint film is of uniform finish and color.
- C. Employ only skilled mechanics.
- D. Mix and apply as recommended by manufacturer.
- E. If Architect so directs, do not apply succeeding coats until Architect has an opportunity to observe previous coat.
- F. Remove and protect hardware, accessories, plates, fixtures, finished work, and similar items; or provide ample in-place protection.
- G. Upon completion of painting, carefully replace removed items and/or remove protection.
- H. Apply materials under adequate illumination.
- I. Evenly spread and smoothly flow on for full, smooth cover.
- J. Assure that coats are dry before recoating.
- K. Touch up suction or hot spots in plaster, gypsum wallboard, concrete block, and concrete before painting.
- L. Touch up abraded areas of shop prime coats before subsequent coats are applied.
- M. Back prime wood trim with penetrating sealer.

### **3.11 APPLICATION - INTERIOR**

- A. Finish door edges same as faces of doors.

- B. Finish closets, semi-exposed surfaces behind grilles, radiation, etc., to match nearest adjoining surfaces.

### 3.12 PROTECTION AND CLEANUP

- A. Protect adjacent work against damage by painting and finishing work.
- B. Clean, repair or replace, and repaint damaged work as directed by Architect.
- C. Provide "WET PAINT" signs.
- D. Remove temporary protective wrappings, after completion of operations.
- E. Clean paint spattered surfaces.
- F. Use care not to damage finished surfaces.
- G. Remove surplus materials, scaffolding and debris.
- H. Leave areas broom clean.

### 3.13 SCHEDULE - INTERIOR PAINT SYSTEMS

- A. Concrete and concrete block walls:
  - 1. Low Odor (PNTLO), Gloss Level 2 (Velvet):
    - a. Sherwin Williams:
      - 1) Primer coat: Latex block filler, PrepRite Block Filler; B25W25.
      - 2) Intermediate coat: Harmony Interior Low Odor Latex Eg-Shel, B9.
      - 3) Topcoat: Harmony Interior Low Odor Latex Eg-Shel, B9.
    - b. ICI:
      - 1) Primer coat: Prep & Prime Block Filer; 3010.
      - 2) Intermediate coat: Lifemaster Eggshell Interior Enamel; LM9300.
      - 3) Topcoat: Lifemaster Eggshell Interior Enamel; LM9300.
    - c. PPG:
      - 1) Primer coat: Speedhide Latex Block Filler; 6-7.
      - 2) Intermediate coat: Pure Performance 0 VOC Latex; 9-300.
      - 3) Topcoat: Pure Performance 0 VOC Latex; 9-300.
  - 2. Epoxy (PNTE), Gloss Level 5 (Semi-gloss):
    - a. Sherwin Williams:
      - 1) Primer coat: Loxon Block Surfacer, A24W200.
      - 2) Intermediate coat: Water-Based Catalyzed Epoxy, Semi-Gloss, B70W/B60V25.
      - 3) Topcoat: Water-Based Catalyzed Epoxy, Semi-Gloss, B70W/B60V25.
    - b. ICI:
      - 1) Primer coat: Bloxfil Heavy Duty Acrylic Block Filler; 4000.
      - 2) Intermediate coat: Tru-Glaze-WB Wateborn Epoxy Semi-Gloss; 4406.
      - 3) Topcoat: Tru-Glaze-WB Wateborn Epoxy Semi-Gloss; 4406.
    - c. PPG:
      - 1) Primer coat: Perma-Crete Block Surfacer; 4-100.
      - 2) Intermediate coat: Aquapon WB Water Based Epoxy; 98-1.
      - 3) Topcoat: Aquapon WB Water Based Epoxy; 98-1.
  - 3. Epoxy – Cleanroom (PNTE-CR), Gloss Level 6-7 (Gloss):
    - a. Sherwin Williams:
      - 1) Primer coat: As recommended by the paint system manufacturer's written instructions.
      - 2) Intermediate and Topcoat: Water-Based Epoxy, Saniglaze High Build, 3497; 6-8 mils DFT per coat, total thickness 12-16 mils DFT.
- B. Gypsum wallboard walls:
  - 1. Low Odor (PNTLO), Gloss Level 3 (Eggshell):
    - a. Sherwin Williams:
      - 1) Primer coat: Harmony Interior Latex Primer, B11W900.

- 2) Intermediate coat: Harmony Interior Low Odor Latex Eg-Shel, B9.
  - 3) Topcoat: Harmony Interior Low Odor Latex Eg-Shel, B9.
  - b. ICI:
    - 1) Primer coat: Lifemaster Prep & Prime Primer-Sealer; LM9116.
    - 2) Intermediate coat: Lifemaster Eggshell Interior Enamel; LM9300.
    - 3) Topcoat: Lifemaster Eggshell Interior Enamel; LM9300.
  - c. PPG:
    - 1) Primer coat: Pure Performance 0 VOC Latex Primer; 9-900.
    - 2) Intermediate coat: Performance 0 VOC Latex; 9-300.
    - 3) Topcoat: Performance 0 VOC Latex; 9-300.
  - 2. Epoxy (PNTE), Gloss Level 5 (Semi-gloss):
    - a. Sherwin Williams:
      - 1) Primer coat: Prep Rite 200 Prime, B28W201.
      - 2) Intermediate coat: Water-Based Catalyzed Epoxy, Semi-Gloss, B70W/B60V25.
      - 3) Topcoat: Water-Based Catalyzed Epoxy, Semi-Gloss, B70W/B60V25.
    - b. ICI:
      - 1) Primer coat: Prep & Prime Griper Multi-Purpose Primer; 3210.
      - 2) Intermediate coat: Tru Glaze Waterborne Acrylic Epoxy Coating 4418.
      - 3) Topcoat: Tru Glaze Waterborne Acrylic Epoxy Coating 4418.
    - c. PPG:
      - 1) Primer coat: Primer coat: Pure Performance 0 VOC Latex Primer; 9-900.
      - 2) Intermediate coat: Aquapon WB Water based Epoxy; 98-1.
      - 3) Topcoat: Aquapon WB Water based Epoxy; 98-1.
  - 3. Epoxy – Cleanroom (PNTE-CR), Gloss Level 6-7 (Gloss):
    - a. Sherwin Williams:
      - 1) Primer coat: As recommended by the paint system manufacturer’s written instructions.
      - 2) Intermediate and Topcoat: Water-Based Epoxy, Saniglaze High Build, 3497; 6-8 mils DFT per coat, total thickness 12-16 mils DFT.
- C. Gypsum wallboard ceiling:
- 1. Low Odor (PNTLO), Gloss Level 1 (Flat):
    - a. Sherwin Williams:
      - 1) Primer coat: Harmony Interior Latex Primer, B11W900.
      - 2) Intermediate coat: Harmony Interior Low Odor Latex Flat, B5.
      - 3) Topcoat: Harmony Interior Low Odor Latex Flat, B5.
    - b. ICI:
      - 1) Primer coat: Lifemaster Prep & Prime Primer-Sealer; LM9116.
      - 2) Intermediate coat: Lifemaster Flat Interior Enamel; LM9100.
      - 3) Topcoat: Lifemaster Flat Interior Enamel; LM9100.
    - c. PPG:
      - 1) Primer coat: Pyre Performance 0 VOC Latex Primer; 9-900.
      - 2) Intermediate coat: Performance 0 VOC Latex; 9-45.
      - 3) Topcoat: Performance 0 VOC Latex; 9-45.
- D. Metal stairs, handrails, and guardrails and miscellaneous metals (ferrous, primed, zinc-coated, and aluminum):
- 1. Water based urethane, Gloss Level 6 (Gloss):
    - a. Sherwin Williams:
      - 1) Primer coat: Pro-Cryl Universal Acrylic Primer, B66-310 Series.
      - 2) Intermediate coat: Acrolon 100 Water Based Urethane Gloss, B65-720.
      - 3) Topcoat: Acrolon 100 Water Based Urethane Gloss, B65-720.
    - b. PPG:
      - 1) Primer coat: Pitt Tech 100% Acrylic Primer; 90-712.
      - 2) Intermediate coat: Durethane WB Water Based Urethane; 98-8200.
      - 3) Topcoat: Durethane WB Water Based Urethane; 98-8200.

2. Epoxy – Cleanroom (PNTE-CR), Gloss Level 6-7 (Gloss):
    - a. Sherwin Williams:
      - 1) Primer coat: As recommended by the paint system manufacturer’s written instructions.
      - 2) Intermediate and Topcoat: Water-Based Epoxy, Saniglaze High Build, 3497; 6-8 mils DFT per coat, total thickness 12-16 mils DFT.
    - b. Optional: Manufacturer’s identified in Item 2.1.A matching the performance, manufacturer, and chemical-resistance of the Base product.
- E. Metal doors and frames:
1. Waterborne acrylic, Gloss Level 5 (Semi gloss):
    - a. Sherwin Williams:
      - 1) Primer coat: Pro-Cryl Universal Acrylic Primer, B66-310 Series.
      - 2) Intermediate coat: Pro Classic Waterborne Acrylic Semi-Gloss, B31 Series.
      - 3) Topcoat: Pro Classic Waterborne Acrylic Semi-Gloss, B31 Series.
    - b. PPG:
      - 1) Primer coat: Pitt Tech 100% Acrylic Primer; 90-712.
      - 2) Intermediate coat: Acrylic Metal Finish S/G; 7-374.
      - 3) Topcoat: Acrylic Metal Finish S/G; 7-374.
  2. Epoxy – Cleanroom (PNTE-CR), Gloss Level 6-7 (Gloss):
    - a. Sherwin Williams:
      - 1) Primer coat: As recommended by the paint system manufacturer’s written instructions.
      - 2) Intermediate and Topcoat: Water-Based Epoxy, Saniglaze High Build, 3497; 6-8 mils DFT per coat, total thickness 12-16 mils DFT.
    - b. Optional: Manufacturer’s identified in Item 2.1.A matching the performance, manufacturer, and chemical-resistance of the Base product.
- F. Structural steel (primed in Section 05 12 10):
1. Water based urethane, Gloss Level 6 (Gloss):
    - a. Sherwin Williams:
      - 1) Primer coat: Shop-applied product specified elsewhere.
        - a) Touch-up in field as required.
      - 2) Intermediate coat: Acrolon 100 Water Based Urethane Gloss, B65-720.
      - 3) Topcoat: Acrolon 100 Water Based Urethane Gloss, B65-720.
    - b. PPG:
      - 1) Primer coat: Shop-applied product specified elsewhere.
        - a) Touch-up in field as required.
      - 2) Primer coat: Pitt Tech 100% Acrylic Primer; 90-712.
      - 3) Intermediate coat: Durethane WB Water Based Urethane; 98-8200.
      - 4) Topcoat: Durethane WB Water Based Urethane; 98-8200.
  2. Epoxy – Cleanroom (PNTE-CR), Gloss Level 6-7 (Gloss):
    - a. Sherwin Williams:
      - 1) Primer coat: As recommended by the paint system manufacturer’s written instructions.
      - 2) Intermediate and Topcoat: Water-Based Epoxy, Saniglaze High Build, 3497; 6-8 mils DFT per coat, total thickness 12-16 mils DFT.
    - b. Optional: Manufacturer’s identified in Item 2.1.A matching the performance, manufacturer, and chemical-resistance of the Base product.
- G. Wood:
1. Exposed items, Gloss Level 3 (Eggshell):
    - a. Sherwin Williams:
      - 1) Primer coat: Harmony Interior Latex Primer, B11W900.
      - 2) Intermediate coat: Harmony Interior Low Odor Latex Eg-Shel, B9.
      - 3) Topcoat: Harmony Interior Low Odor Latex Eg-Shel, B9.

- b. ICI:
  - 1) Primer coat: Lifemaster Prep & Prime Primer-Sealer; LM9116.
  - 2) Intermediate coat: Lifemaster Eggshell Interior Enamel; LM9300.
  - 3) Topcoat: Lifemaster Eggshell Interior Enamel; LM9300.
- c. PPG:
  - 1) Primer coat: Pure Performance 0 VOC Latex Primer; 9-900.
  - 2) Intermediate coat: Pure Performance 0 VOC Latex; 9-300.
  - 3) Topcoat: Pure Performance 0 VOC Latex; 9-300.
- 2. Concealed items, Gloss Level 3 (Eggshell):
  - a. Sherwin Williams:
    - 1) Primer coat: ProGreen Primer, B28W600.
    - 2) Intermediate coat: ProGreen 200 Interior Latex Eg-Shel; B20W651.
    - 3) Topcoat: ProGreen 200 Interior Latex Eg-Shel; B20W651.
  - b. ICI:
    - 1) Primer coat: Ultra-Hide Interior Primer; 1030.
    - 2) Intermediate coat: Pro Premium Eggshell Interior Wall & Trim Enamel; 1402.
    - 3) Topcoat: Pro Premium Eggshell Interior Wall & Trim Enamel; 1402.
  - c. PPG:
    - 1) Primer coat: Pure Performance 0 VOC Latex Primer; 9-900.
    - 2) Intermediate coat: Speedhide Interior Latex Eggshell; 6-411.
    - 3) Topcoat: Speedhide Interior Latex Eggshell; 6-411.

### **3.14 SCHEDULE – FIELD NATURAL FINISH SYSTEM FOR INTERIOR WOOD**

- A. General:
  - 1. Factory finishing of wood items specified elsewhere:
    - a. Factory finishing of wood veneer-faced casework: Specified in Section 12 34 00.
    - b. Factory finishing of wood veneer-faced wood doors: Specified in Section 08 14 16.
- B. Interior Wood
  - 1. Washcoat: Prepare wood to accept stain uniformly by application of a washcoat.
    - a. Sherwin Williams.
      - 1) Wood Classics Natural.
    - b. ICI:
      - 1) Woodpride.
    - c. PPG:
      - 1) Olympic Wood Conditioner; 41001.
  - 2. Wood Stain:
    - a. Sherwin Williams:
      - 1) Wood Classics Oil Stain, A49V200.
    - b. ICI:
      - 1) Woodpride Oil Based Stain; 1700 series.
    - c. PPG:
      - 1) Rez Interior Oil Stain; 77-560.
  - 3. Filler Coat (horizontal surfaces where open-grained wood is indicated): Exception: Omit filler coat at closed grained wood specie.
    - a. Sherwin Williams:
      - 1) SherWood Natural Filler, D70T1.
    - b. PPG:
      - 1) Olympic Wood Filler; 41003.
  - 4. Sanding Sealer:
    - a. Sherwin Williams:
      - 1) Wood Classics FastDry Sanding Sealer, B26.
    - b. ICI:
      - 1) Woodpride 1800 or 1900 series thinned 25 percent.
    - c. PPG:
      - 1) Speedhide Interior Oil Sanding Sealer; 6-10.

- 2) Selected polyurethane varnish thinned 25 percent.
5. Clear Topcoat:
  - a. Quality Assurance: 8<sup>th</sup> Edition, Version 2.0 (or more current) of “Architectural Woodwork Quality Standards” by AWI and AWMAC.
    - 1) Comply with Section 1500; Premium Quality.
    - 2) Comply with Section 1500; Custom Quality
  - b. Sheen (measured with 60 degree gloss meter):
    - 1) Flat; 15 to 30 points.
    - 2) Satin: 31 to 45 points.
    - 3) Semi-gloss: 46 to 60 points.
    - 4) Gloss: greater than 61 points.
  - c. Apply following product in at least 2 coats.
    - 1) Lightly scuff sand in between coats.
6. Water-based Polyurethane Varnish (non-yellowing):
  - a. Sherwin Williams:
    - 1) Wood Classics Waterborne Polyurethane Varnish; A68.
  - b. ICI:
    - 1) Woodpride Waterbased Varnish; 1800 series.
  - c. PPG:
    - 1) Rez Interior Water Based Varnish; 77-45 (Gloss) or 77-49 (Satin).

**END OF SECTION**

**HDR**

**D I V I S I O N    1 0**

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**SPECIALTIES**

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**SECTION 10 11 00**  
**MARKERBOARDS AND TACKBOARDS**

**PART 1 - GENERAL**

**1.1 SUBMITTALS**

- A. Contract closeout information:
  - 1. Maintenance data.
  - 2. Warranty.
- B. LEED Information:
  - 1. LEED Credits MR 4.1 and 4.2, Recycled Content: Product data indicating percentages by weight of post-consumer and post-industrial recycled content for products having recycled content; include statement indicating costs for each product having recycled content.
  - 2. LEED Credits MR 5.1 and 5.2, Regional Materials: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.
  - 3. LEED Credit MR 6.0, Rapidly Renewable Materials: Manufacturers' product data for products manufactured from rapidly renewable material; indicate type of rapidly renewable material.

**1.2 PRODUCT DELIVERY, STORAGE AND HANDLING**

- A. Deliver completely assembled whenever possible.
- B. Where dimensions exceed available panel size, provide 2 or more pieces of length acceptable to Architect.
- C. When dimensions require delivery in separate units, prefit at factory, disassemble for delivery, and make final joint at site.
- D. Provide all required packing and unpacking at site.

**1.3 WARRANTY**

- A. Lifetime warranty against fading, crazing, cracking and delamination for markerboards.
- B. Warranty signed jointly by manufacturer and Contractor.

**PART 2 - PRODUCTS**

**2.1 MATERIALS**

- A. Acceptable manufacturers:
  - 1. Markerboards and Tackboards:
    - a. Base:
      - 1) Claridge Products & Equipment.
    - b. Optional:
      - 1) PolyVision.
      - 2) ADP Lemco.
  - 2. Tackboards:
    - a. Forbo Flooring Products, Inc.
  - 3. Furnish all Markerboards and tackboards by one manufacturer for entire project.

- B. Markerboard, metal (MB):
  - 1. Balanced, high pressure laminated, 3-ply laminated construction, with facing sheet, core, and backer.
  - 2. Finish:
    - a. Type A porcelain enamel over ground coat on writing surface with seal coat on reverse side.
    - b. Comply with Porcelain Enamel Institute Specifications.
  - 3. Face sheet:
    - a. Enameling steel, minimum 22 GA.
    - b. Finish to accommodate dry and liquid markers without residual staining.
  - 4. Core: Minimum 1/4 IN thick plywood or hardboard.
  - 5. Backer: Minimum 26 GA zinc plated steel, 28 GA random porcelain coil, or 0.015 IN aluminum sheet.
  - 6. Backing panel: Moisture resistant plywood or hardboard 1/4 IN thick, with 1/4 IN backing.
- C. Tackboards, natural homogeneous resilient surface material:
  - 1. Single layer 1/4 IN thick, seamless compressed cork sheet.
  - 2. 72 IN wide x full height as shown on drawings.
  - 3. Linoleum resilient tackable surface consisting of linseed oil, granulated cork, rosin binders and dry pigments.
  - 4. Laminated to a natural jute backing.
  - 5. Integral color throughout.
  - 6. Washable finish using ph neutral cleaning method.
  - 7. Self-healing.
- D. Markerboard frames and trim:
  - 1. Minimum 0.062 IN thick aluminum.
  - 2. Size and shape as indicated.
  - 3. Single length units to minimize joints.
  - 4. Miter all corners to a neat, hairline closure.
  - 5. Satin anodized finish, AA-M30C22A31.
  - 6. Manufacturer's standard "narrow" trim, approximately 1/2 IN wide.
  - 7. When structural support accessories are required for boards in addition to normal trim, provide such additional support or modify trim as required to provide necessary support.
- E. Troughs:
  - 1. Continuous, for each board.
  - 2. Box type, with slanted front and cast aluminum end closures.

## **PART 3 - EXECUTION**

### **3.1 INSPECTION**

- A. Verify suitability of substrate to accept installation.
- B. Insure that adequate Wall Backing has been installed.
  - 1. Metal Wall Backing: Specified in Section 09 22 16.
  - 2. Coordinate and direct installation of backing where required.
- C. Correct unsatisfactory conditions.
- D. Installation constitutes acceptance of responsibility for performance.

### **3.2 INSTALLATION**

- A. Railroad writing surface to avoid vertical joints.
- B. Provide trim at joints between Markerboards and Tackboards, as needed. Trim out vertical joints with aluminum H type divider bars.

- C. Provide additional backing as indicated or necessary to properly stiffen and support boards.
- D. Install at locations and heights indicated in accordance with manufacturer's instructions.
- E. Install with concealed hangers, plumb and level.
- F. Coordinate job assembled units with grounds, trim, and accessories.
- G. Join all parts with neat, precision fit.
- H. In addition to requirements of these specifications, comply with manufacturer's instructions and recommendations.
- I. Install with bottom 3 FT AFF unless indicated otherwise.
- J. Protect after installation until accepted by BNL.

**END OF SECTION**



## **SECTION 10 14 23**

### **INTERIOR SIGNAGE**

#### **PART 1 - GENERAL**

##### **1.1 DESCRIPTION**

- A. Interior sign system to include items for identification, direction, control, and information of building where installed as a complete integrated system.
- B. ADA Design Requirements:
  - 1. Signage requiring tactile graphics:
    - a. Wall mounted signs designating permanent rooms and spaces such as, room numbers and restroom, department, office, and fire exit identifications.
    - b. Individually applied characters are prohibited.
  - 2. Signage not requiring tactile graphics, but requiring compliance to other ADA requirements:
    - a. Signs providing direction to or information about function of space such as, directional signs (signs with arrow), informational signs (operating hours, policies, etc.), regulatory signs (no smoking, do not enter), and ceiling and projected wall mount signs.
- C. ADA Performance Requirements:
  - 1. Tactile graphics signs mounting requirements:
    - a. Single doors: Mount 60 IN to sign centerline above finish floor and on wall adjacent to latch side of door.
    - b. Openings: Mount 60 IN to sign centerline above finish floor adjacent opening.
    - c. No wall space adjacent latch side of door, opening, or double doors: Mount 60 IN to sign centerline above finish floor on nearest adjacent wall.
  - 2. It shall be the responsibility of the successful bidder to meet any and all local, state, and federal code requirements in fabricating and installing signs.

##### **1.2 QUALITY ASSURANCE**

- A. Standards:
  - 1. American National Standards Institute (ANSI):
    - a. ANSI A117.1: Providing Accessibility and Usability for Physically Handicap People, 1986 edition.
  - 2. Department of Justice, Office of the Attorney General, "Americans with Disabilities Act", Public Law 101-336, (ADA).
  - 3. Federal Register Part III, Department of Justice, Office of the Attorney General, 28 CFR Part 36: Nondiscrimination on the Basis of Disability by Public Accommodations and in Commercial Facilities, Final Rule, July 26, 1991.
  - 4. Federal Register Part II, Architectural and Transportation Barriers Compliance Board, 36 CFR Part 1191: Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Amendment to Final Guidelines, September 6, 1991.
- B. Definitions:
  - 1. Braille: Grade 2 Braille including 189 part-word or whole word contractions in addition to Grade 1 Braille 63 characters. Tactile is required whenever Braille is required.
  - 2. Non-tactile: Letters and numbers on signs with width-to-height ratio between 3:5 and 1:1 and stroke width ratio between 1:5 and 1:10 using upper case "X" to calculate ratios. Use typestyles with medium weight; upper and lower case lettering is permitted; serif typestyles are permitted.
  - 3. Symbols: Symbol itself is not required to be tactile but equivalent verbal description is required both in tactile letters and Braille.

4. Tactile: 1/32 IN raised capital letters without serifs at least 5/8 IN height and not more than 2 IN height based on upper case "X". Braille is required whenever tactile is required.

### **1.3 SUBMITTALS**

- A. Shop Drawings:
  1. Indicate materials, sizes, configurations, and applicable substrate mountings.
  2. Typography sample for message strips and headers copy.
  3. Artwork for special graphics.
  4. Signage schedule complete with location of each sign and required copy:
    - a. Include floor plans indicating locations of scheduled signs.
- B. Product Data:
  1. Manufacturer's product literature indicating units and designs selected.
  2. Evidence of manufacturer's computerized data retrieval program for tracking of Project for sign typography, message strip requirements and other pertinent data from schedule input to final computerized typography on finished product.
- C. Samples: Full size samples for holder, insert, and copy in colors specified. Provide sample in small size sign:
  1. Samples will be returned after substantial completion.
- D. Contract Closeout Information:
  1. Furnish appropriate checklist for aiding in reordering after Date of Substantial Completion. Maintain computer schedule program for five (5) years for ordering new signage required by BNL.
- E. LEED Information:
  1. LEED Credits MR 4.1 and 4.2, Recycled Content: Product data indicating percentages by weight of post-consumer and post-industrial recycled content for products having recycled content; include statement indicating costs for each product having recycled content.
  2. LEED Credits MR 5.1 and 5.2, Regional Materials: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.
  3. LEED Credit MR 7, Certified Wood: Certificates of chain-of-custody signed by manufacturers certifying that products specified to be made from certified wood obtained from forests certified by an FSC-accredited certification agency to comply with FSC 1.2, "Principles and Criteria":
    - a. Include evidence that mill is certified for chain-of-custody by an FSC-accredited certification body.

### **1.4 SEQUENCING AND SCHEDULING**

- A. Schedule system installation after related finishes have been completed.

## **PART 2 - PRODUCTS**

### **2.1 NON-ILLUMINATED INTERIOR SIGN SYSTEM**

- A. Acceptable Manufacturers:
  1. Takeform.
  2. ASI/Modulex
  3. Innerface

## 2.2 SYSTEM DESCRIPTION

- A. General:
  - 1. Acceptable Product: "Fusion Collection" by Takeform.
- B. Provide the following assemblies and locate where indicated in SCHEDULES:
  - 1. Interior sign system: Combination of Fusion Collection components, consisting of holder unit mounted to substrate and insert panels secured to holder providing graphic and visual information.
  - 2. Informer:
    - a. Combination holder unit mounted to substrate and insert panel secured to holder allowing use of panel as:
      - 1) Suite Indicator.
      - 2) Floor Directory.
      - 3) Emergency Evacuation Plan.
      - 4) Workstation Holder.
- C. Design glazing cover with integral header/base so no locking devices are required; removal of glazing cover is accomplished by use of special tool supplied with each unit.
- D. Design units with selected components below.

## 2.3 SIGNS

- A. Architectural Signage System:
  - 1. The signage shall incorporate a decorative laminate face with applied graphics including all tactile requirements in adherence to ADA specifications.
  - 2. All signs, including work station and room ID's, overheads and flag mounts, directionals and directories shall have a matching appearance and constructed utilizing the same manufacturing process to assure a consistent look throughout.
- B. Materials:
  - 1. Sign face shall be 0.035 IN (nominal) standard grade, high pressure surface laminate. A painted sign face shall not be acceptable.
  - 2. The sign core shall be FSC certified natural fiber wood product. The sign shall incorporate balanced construction with the core sandwiched between laminates to prevent warping. An acrylic core shall not be acceptable. Laminate on the sign face only shall not be acceptable.
  - 3. Tactile lettering shall be precision machined, raised 1/32 IN, matte PETG and subsurface colored for scratch resistance.
  - 4. Signs shall incorporate a metal accent bar. Bars shall be anodized with a brushed satin finish.
- C. Standard Colors:
  - 1. Face/background color shall be standard grade, high pressure laminate, all colors and finishes.
  - 2. Standard tactile colors shall match manufacturer's ADA standard color selection.
  - 3. Sign and backer edge shall be treated with a hot wax seal for moisture integrity.
- D. Construction:
  - 1. The signage shall be capable of accepting paper or acetate inserts to allow changing and updating as required. Insert components shall have a 0.080 IN thickness non-glare acrylic window and shall be inlaid flush to sign face for a smooth, seamless appearance.
  - 2. The signage shall, with the exception of directories and directionals, be a uniform 8-1/2 IN width to facilitate inserts printed on standard width paper.
  - 3. The signage contractor shall provide and install all signage inserts.
  - 4. Manufacturer shall provide a template containing layout, font, color, artwork and trim lines to allow BNL to produce inserts on laser or ink jet printer. The template shall be in an Acrobat or Word format (.pdf).

5. The signage shall include modules allowing for inserts, notice holders, occupancy sliders, marker, magnetic, and cork pin boards. All modules shall be flush to sign face for a smooth, seamless appearance.
6. The laminates (front and back) shall be pressure laminated and precision machined together to a 90-degree angle. Edges shall be smooth, void of chips, burrs, sharp edges, marks and shall be treated with a hot wax seal for moisture integrity.
7. The signage shall utilize an acrylic sphere for Grade II Braille inserted directly into a scratch resistant, high pressure laminate sign face. Braille dots are to be pressure fit in high tolerance drilled holes.
8. Braille dots shall be half hemispherical domed and protruding a minimum 0.025 IN.
9. The signage shall utilize a silicone adhesive. The adhesive shall be non-hazardous and shall allow for flexing and deflection of the adhered components due to changes in temperature and moisture without bond failure. Type I signs are mounted on systems furniture panels by means of velcro application. See Sign Message Schedule.

## **2.4 FABRICATION**

- A. Shop assembly:
  1. Fabricate units to configurations indicated.
  2. Internally reinforce units in accord with manufacturer's requirements.
  3. Provide copy on inserts, message strips, and covers in accord with ADA requirements.
  4. Fill directories with combination of reviewed copy on message strips and blank message strips.
  5. Wrap each individual unit with polyethylene.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Verification of existing conditions:
  1. Examine areas to receive signage; notify Contractor and BNL in writing of unacceptable substrate.
  2. Beginning work indicates acceptance of substrate.
  3. Subsequent modifications to substrate or signage becomes this section's complete responsibility.
- B. The sign vendor shall prove and install the location plan, message schedule, and fire/evacuation graphics. All such information shall be submitted for approval.

### **3.2 INSTALLATION**

- A. Pre-installation preparation: Four weeks prior to installation, the City shall provide the vendor with final messaging for their approval.
- B. Install signage holders square, plumb and level in locations with mounting types indicated in Schedule. Mounting methods are to be in compliance with manufacturer's written mounting instructions.

### **3.3 CLEANING**

- A. Clean exposed surfaces not more than 48 hours prior to Date of Substantial Completion in accord with manufacturer's written cleaning instructions.

### **3.4 SCHEDULES**

- A. See attached Appendix A - Message Schedules.

## **END OF SECTION**

| SIGN MESSAGE SCHEDULE |      |         |           |          |       |
|-----------------------|------|---------|-----------|----------|-------|
| NO.                   | NAME | MESSAGE | SIGN TYPE | QUANTITY | NOTES |

| BASEMENT |                |  |       |   |   |
|----------|----------------|--|-------|---|---|
| B26      | SHOWER/ TOILET |  | M     | 1 |   |
| B02      | OFFICE         | B02  | B.1   | 1 |   |
| B03      | OFFICE         | B03  | B.1   | 1 |   |
| B05      | MECH ROOM      | B05,MECH ROOM  | K     | 1 |   |
| B06      | OFFICE         | B06  | B.1   | 1 |   |
| B07      | OFFICE         | B07  | A.1   | 1 |   |
| B08      | OFFICE         | B08  | B.1   | 1 |   |
| B09      | IT ROOM        | B09, IT ROOM   | K     | 1 |   |
| B10      | CONTROL ROOM   | B10, CONTROL ROOM  | K     | 2 |   |
| B11      | PUMP ROOM      | B11, PUMP ROOM   | K     | 1 |   |
| B12      | ULV            | B12, ULV   | K     | 1 |   |
| B13      | ULV CHAMBER    |  | ----- |   |   |
| B14      | ULV            | B14, ULV   | K     | 1 |   |
| B15      | ULV CHAMBER    |  |       |   |   |
| B16      | PUMP ROOM      | B16, PUMP ROOM   | K     | 1 |   |
| B17      | CORRIDOR       |  | L     | 1 |   |
| B18      | CORRIDOR       |  | ----- |   |   |
| B19      | CONTROL ROOM   | B19, CONTROL ROOM  | K     | 1 |   |
| B20      | RF CLOSET      | CLOSET   | K     | 1 |   |
| B21      | RF CLOSET      | CLOSET   | K     | 1 |   |
| ST-02    | STAIR #2       |  | F     | 1 |   |
|          |                | STAIR 2, FLOOR B THRU P, ROOF ACCESS, B, FLOOR 1 FOR EXIT    | H     | 1 |   |
|          |                |  | Q     | 4 | PROVIDE TYPE Q AT EACH CHANGE IN DIRECTION ON STAIR LANDING |
| ST-12    | STAIR #2       | STAIR 2, FLOOR B THRU P, ROOF ACCESS, 1, FLOOR 1 FOR EXIT    | H     | 1 |   |
|          |                |  | F     | 1 |   |
|          |                |  | Q     | 4 | PROVIDE TYPE Q AT EACH CHANGE IN DIRECTION ON STAIR LANDING |
| ST-04    | STAIR #4       |  | F     | 1 |   |
|          |                | STAIR 4, FLOOR B THRU 1, NO ROOF ACCESS, B, FLOOR 1 FOR EXIT | H     | 1 |   |
|          |                |  | Q     | 4 | PROVIDE TYPE Q AT EACH CHANGE IN DIRECTION ON STAIR LANDING |
| EL-01    | ELEVATOR       | BASEMENT   | E     | 1 |   |
|          |                | BASEMENT   | J     | 1 |   |

| FIRST FLOOR |                          |             |       |   |  |
|-------------|--------------------------|-------------|-------|---|--|
| 101         | VESTIBULE                |             | ----- |   |  |
| 102         | LOBBY                    |             | L     | 1 |  |
| 103         | INTERACTION/WAITING AREA |             | ----- |   |  |
| 104         | PANTRY                   | 104, PANTRY | K     | 1 |  |
| 105         | OFFICE                   | 105         | B.1   | 1 |  |
| 106         | OFFICE                   | 106         | B.1   | 1 |  |
| 107         | OFFICE                   | 107         | A.1   | 1 |  |
| 108         | OFFICE                   | 108         | A.1   | 1 |  |

| SIGN MESSAGE SCHEDULE |                                 |                                 |           |          |       |
|-----------------------|---------------------------------|---------------------------------|-----------|----------|-------|
| NO.                   | NAME                            | MESSAGE                         | SIGN TYPE | QUANTITY | NOTES |
| 109                   | OFFICE                          | 109                             | A.1       | 1        |       |
| 110                   | OFFICE                          | 110                             | A.1       | 1        |       |
| 111                   | MAIL ROOM                       | 111                             | -----     |          |       |
| 112                   | OFFICE                          | 112                             | B.1       | 1        |       |
| 113                   | OFFICE                          | 113                             | B.1       | 1        |       |
| 114                   | OFFICE                          | 114                             | A.1       | 1        |       |
| 115                   | OFFICE                          | 115                             | A.1       | 1        |       |
| 116                   | OFFICE                          | 116                             | A.1       | 1        |       |
| 117                   | OFFICE                          | 117                             | A.1       | 1        |       |
| 118                   | OFFICE                          | 118                             | A.1       | 1        |       |
| 119                   | ELEC. ROOM                      | 119, ELECTRICAL ROOM            | K         | 1        |       |
| 120                   | DEVICE FABRICATION              | 120, DEVICE FABRICATION         | K         | 2        |       |
| 121                   | SOLAR MAT. PROCESS              | 121, SOLAR MATERIAL PROCESS     | K         | 2        |       |
| 122                   | ICP ROOM                        | 122, ICP ROOM                   | K         | 1        |       |
| 123                   | OPTICS                          | 123, OPTICS                     | K         | 1        |       |
| 124                   | OPTICS                          | 124, OPTICS                     | K         | 1        |       |
| 125                   | PREP. LAB                       | 125, PREP LAB                   | K         | 1        |       |
|                       |                                 | 125, PREP LAB                   | O         | 1        |       |
| 126                   | CHEM. LAB                       | 126, CHEM LAB                   | K         | 2        |       |
|                       |                                 | 126, CHEM LAB                   | O         | 1        |       |
| 127                   | AFM                             | 127, AFM                        | K         | 1        |       |
| 128                   | AFM                             | 128, AFM                        | K         | 1        |       |
| 129                   | CRYSTAL GROWTH LAB              | 129, CRYSTAL GROWTH LAB         | K         | 2        |       |
|                       |                                 | 129, CRYSTAL GROWTH LAB         | O         | 2        |       |
| 130                   | MATERIAL/ CHARACTERIZATION      | 130, MATERIAL CHARACTERIZATION  | K         | 1        |       |
|                       |                                 | 130, MATERIAL CHARACTERIZATION  | O         | 2        |       |
| 131                   | PROCESS LAB                     | 131, PROCESS LAB                | K         | 2        |       |
|                       |                                 | 131, PROCESS LAB                | O         | 1        |       |
| 132                   | MDF ROOM                        | 132, MDF ROOM                   | K         | 1        |       |
| 133                   | SAMPLE MEASUREMENT              | 133, SAMPLE MEASUREMENT         | K         | 2        |       |
| 134                   | FURANCE ROOM                    | 134, FURNACE ROOM               | K         | 2        |       |
| 135                   | FLEX LAB                        | 135, FLEX LAB                   | K         | 1        |       |
|                       |                                 | 135, FLEX LAB                   | O         | 1        |       |
| 136                   | STRUC. CHAR.                    | 136, STRUCRUAL CHARACTERIZATION | K         | 1        |       |
|                       |                                 | 136, STRUCRUAL CHARACTERIZATION | O         | 1        |       |
| 137                   | SYNTHESIS LAB                   | 137, SYNTHESIS LAB              | K         | 2        |       |
| 138                   | CHARACTERIZATION LAB            | 138, CHARACTERIZATION LAB       | K         | 2        |       |
| 139                   | GOWN ROOM                       | 139, GOWN ROOM                  | K.1       | 1        |       |
| 140                   | PREGOWN ROOM                    | 140, PREGOWN ROOM               | K         | 1        |       |
| 142                   | CHASE A                         |                                 | -----     |          |       |
| 143                   | LITHOGRAPHY BAY CLASS 100       |                                 | -----     |          |       |
| 144                   | CHASE B                         |                                 | -----     |          |       |
| 145                   | CMPMSD DRY ETCH BAY CLASS 1,000 |                                 | -----     |          |       |

| SIGN MESSAGE SCHEDULE |                            |                                  |           |          |       |
|-----------------------|----------------------------|----------------------------------|-----------|----------|-------|
| NO.                   | NAME                       | MESSAGE                          | SIGN TYPE | QUANTITY | NOTES |
| 146                   | CHASE C                    |                                  | -----     |          |       |
| 147                   | CLASS 1,000 CLEAN ROOM BAY |                                  | -----     |          |       |
| 149                   | ELEVATOR MACH. ROOM        | 149, ELEVATOR MACHINE ROOM       | K         | 1        |       |
| 150                   | LAB UTILITY /MECH. ROOM    | 150, LAB UTILITY/MECHANICAL ROOM | K         | 1        |       |
|                       |                            |                                  | S         | 1        |       |
| 151                   | SERVICE CORRIDOR           | 151,SERVICE CORRIDOR             | S         | 1        |       |
| 153                   | MAIN ELEC. ROOM            | 153,MAIN ELECTRICAL ROOM         | K         | 1        |       |
|                       |                            |                                  | S         | 1        |       |
| 154                   | WASTE STORAGE              | 154, WASTE STORAGE               | K         | 1        |       |
| 155                   | RECEIVING                  | 155, RECEIVING                   | K         | 1        |       |
|                       |                            |                                  | G         | 2        |       |
| 157                   | OFFICE                     | 157                              | B.1       | 1        |       |
| 158                   | OFFICE                     | 158                              | B.1       | 1        |       |
| 159                   | OFFICE                     | 159                              | B.1       | 1        |       |
| 160                   | OFFICE                     | 160                              | B.1       | 1        |       |
| 161                   | OFFICE                     | 161                              | B.1       | 1        |       |
| 162                   | OFFICE                     | 162                              | B.1       | 1        |       |
| 163                   | OFFICE                     | 163                              | B.1       | 1        |       |
| 164                   | OFFICE                     | 164                              | B.1       | 1        |       |
| 165                   | SAMPLE PREP                | 165, SAMPLE PREP                 | K         | 2        |       |
| 166                   | CHARACTERIZATION LAB       | 166, CHARACTERIZATION LAB        | K         | 1        |       |
| 167                   | MBE LAB                    | 167, MBE LAB                     | K         | 1        |       |
| 168                   | CONFERENCE ROOM            | 168, CONFERENCE ROOM             | K         | 1        |       |
| 171                   | MEN'S TOILET ROOM          |                                  | C         | 1        |       |
| 172                   | WOMEN'S TOILET ROOM        |                                  | D         | 1        |       |
| 173                   | J.C                        | 173, JANITOR'S CLOSET            | K         | 1        |       |
| 174                   | OFFICE                     | 174                              | B.1       | 1        |       |
| 175                   | OFFICE                     | 175                              | B.1       | 1        |       |
| 176                   | OFFICE                     | 176                              | A.1       | 1        |       |
| 177                   | OFFICE                     | 177                              | B.1       | 1        |       |
| 178                   | OFFICE                     | 178                              | A.1       | 1        |       |
| 181                   | PREP LAB                   | 180, PREP LAB                    | K         | 2        |       |
| 182                   | OPTICAL SPECTROSCOPY       | 182, OPTICAL SPECTROSCOPY        | K         | 1        |       |
|                       |                            | 182, OPTICAL SPECTROSCOPY        | K.1       | 1        |       |
| 183                   | PREP LAB                   | 183, PREP LAB                    | O         | 1        |       |
| 184                   | LASER LAB                  | 184, LASER LAB                   | K         | 2        |       |
| 185                   | OFFICE                     | 185                              | A.1       | 1        |       |
| 186                   | OFFICE                     | 186                              | B.1       | 1        |       |
| 187                   | OFFICE                     | 187                              | A.1       | 1        |       |
| 188                   | OFFICE                     | 188                              | B.1       | 1        |       |
| 189                   | OFFICE                     | 189                              | A.1       | 1        |       |
| 190                   | OFFICE                     | 190                              | A.1       | 1        |       |
| 191                   | OFFICE                     | 191                              | B.1       | 1        |       |

| SIGN MESSAGE SCHEDULE |                   |  |           |          |   |
|-----------------------|-------------------|--|-----------|----------|---|
| NO.                   | NAME              | MESSAGE  | SIGN TYPE | QUANTITY | NOTES   |
| 192                   | OFFICE            | 192  | B.1       | 1        |   |
| 193                   | OFFICE            | 193  | B.1       | 1        |   |
| 194                   | INTERACTION SPACE |  | -----     |          |   |
| 196                   | PUMP ROOM         | 196, PUMP ROOM   | K         |          |   |
| 197                   | PUMP ROOM         | 197,PUMP ROOM  | K         |          |   |
| 198                   | FLEX LAB          | 198,FLEX LAB   | O         | 1        |   |
| 199                   | SHOP              | 199, SHOP  | K         | 1        |   |
| C01                   | CORRIDOR          |  | -----     |          |   |
| C02                   | SERVICE CORRIDOR  | FLOOR 1  | E         | 2        |   |
| C04                   | CORRIDOR          |  | -----     |          |   |
| C05                   | CORRIDOR          |  | -----     |          |   |
| C06                   | CORRIDOR          |  | -----     |          |   |
| C07                   | CORRIDOR          |  | -----     |          |   |
| C08                   | CORRIDOR          |  | -----     |          |   |
| C09                   | CORRIDOR          |  | -----     |          |   |
| C10                   | SERVICE CORRIDOR  | FLOOR 1  | E         | 1        |   |
| C11                   | CORRIDOR          |  | -----     |          |   |
| EL-01                 | ELEVATOR          | FLOOR 1  | J         | 1        |   |
| EL-02                 | SERVICE ELEVATOR  | FLOOR 1  | J         | 1        |   |
|                       |                   | FLOOR 1  | E         | 1        |   |
| ST-11                 | STAIR #1          |  | -----     |          |   |
| ST-12                 | STAIR #2          | STAIR 2, FLOOR B THRU P, ROOF ACCESS, 1, FLOOR 1 FOR EXIT    | H         | 1        |   |
|                       |                   |  | F         | 1        |   |
|                       |                   |  | R         | 3        | PROVIDE TYPE R AT EACH CHANGE IN DIRECTION ON STAIR LANDING |
|                       |                   |  | S         | 1        |   |
|                       |                   |  | P         | 1        |   |
| ST-12                 | STAIR #2          | STAIR 2, FLOOR B THRU P, ROOF ACCESS, 1, FLOOR 1 FOR EXIT    | H         | 1        |   |
|                       |                   |  | F         | 1        |   |
|                       |                   |  | R         | 3        | PROVIDE TYPE R AT EACH CHANGE IN DIRECTION ON STAIR LANDING |
|                       |                   |  | S         | 1        |   |
| ST-13                 | STAIR #3          | STAIR 3, FLOOR 1 THRU P, NO ROOF ACCESS, 1, FLOOR 1 FOR EXIT | H         | 1        |   |
|                       |                   |  | F         | 1        |   |
|                       |                   |  | S         | 1        |   |
|                       |                   |  | P         | 1        |   |
| ST-14                 | STAIR #4          | STAIR 4, FLOOR B THRU 1, NO ROOF ACCESS, 1, FLOOR 1 FOR EXIT | H         | 1        |   |
|                       |                   |  | F         | 1        |   |
|                       |                   |  | S         | 1        |   |
|                       |                   |  | P         | 1        |   |

| SIGN MESSAGE SCHEDULE |                             |                                 |           |          |       |
|-----------------------|-----------------------------|---------------------------------|-----------|----------|-------|
| NO.                   | NAME                        | MESSAGE                         | SIGN TYPE | QUANTITY | NOTES |
| SECOND FLOOR          |                             |                                 |           |          |       |
| 201                   | SEMINAR ROOM                |                                 |           |          |       |
| 205                   | INTERACTION SPACE           |                                 |           |          |       |
| 209                   | OFFICE                      | 209                             | B.1       | 1        |       |
| 210                   | OFFICE                      | 210                             | B.1       | 1        |       |
| 211                   | OFFICE                      | 211                             | B.1       | 1        |       |
| 212                   | OFFICE                      | 212                             | B.1       | 1        |       |
| 213                   | OFFICE                      | 213                             | B.1       | 1        |       |
| 214                   | OFFICE                      | 214                             | B.1       | 1        |       |
| 215                   | MAIL ROOM                   |                                 | -----     |          |       |
| 216                   | OFFICE                      | 216                             | B.1       | 1        |       |
| 217                   | OFFICE                      | 217                             | B.1       | 1        |       |
| 218                   | OFFICE                      | 218                             | B.1       | 1        |       |
| 219                   | OFFICE                      | 219                             | B.1       | 1        |       |
| 220                   | OFFICE                      | 220                             | B.1       | 1        |       |
| 221                   | OFFICE                      | 221                             | B.1       | 1        |       |
| 222                   | ELEC. ROOM                  | 222, ELECTRICAL ROOM            | K         | 1        |       |
| 223                   | TORCH LAB                   | 223, TORCH LAB                  | K         | 1        |       |
|                       |                             | 223, TORCH LAB                  | K.1       | 1        |       |
| 224                   | PROCESS LAB                 | 224, PROCESS LAB                | K         | 1        |       |
|                       |                             | 224, PROCESS LAB                | K.1       | 1        |       |
| 225                   | FURNACE LAB                 | 225, FURNACE LAB                | K         | 1        |       |
|                       |                             | 225, FURNACE LAB                | K.1       | 1        |       |
| 226                   | CRYSTAL GROWTH              | 226,CRYSTAL GROWTH              | K         | 1        |       |
|                       |                             |                                 | K.1       | 1        |       |
| 227                   | CRYSTAL GROWTH              | 227,CRYSTAL GROWTH              | K         | 1        |       |
|                       |                             |                                 | K.1       | 1        |       |
| 228                   | XRAY LAB                    | 228,XRAY LAB                    | K         | 1        |       |
|                       |                             |                                 | K.1       | 1        |       |
| 229                   | GENERAL PURPOSE LAB         | 229,GENERAL PURPOSE LAB         | K         | 1        |       |
|                       |                             |                                 | K.1       | 2        |       |
| 230                   | SAMPLE PREP                 | 230,SAMPLE PREP                 | K         | 1        |       |
|                       |                             |                                 | K.1       | 1        |       |
| 231                   | MDF ROOM                    | 231,MDF ROOM                    | K         | 1        |       |
| 232                   | BATTERY LAB                 | 232,BATTERY LAB                 | K         | 1        |       |
|                       |                             |                                 | K.1       | 1        |       |
| 233                   | FLEX LAB                    | 233,FLEX LAB                    | K         | 1        |       |
| 234                   | LIQUID FUELS LAB            | 234,LIQUID FUELS LAB            | K         | 1        |       |
|                       |                             |                                 | K.1       | 1        |       |
| 235                   | LASER RM                    | 235,LASER RM                    | K         | 1        |       |
| 236                   | ADVANCED ENERGY SYS CONCEPT | 236,ADVANCED ENERGY SYS CONCEPT | K         | 1        |       |
| 237                   | BIOFUEL PROCESS SCIENCE     | 237,BIOFUEL PROCESS SCIENCE     | K         | 2        |       |
| 238                   | BIOFUELS CHARACTERIZATION   | 238,BIOFUELS CHARACTERIZATION   | K         | 2        |       |

| SIGN MESSAGE SCHEDULE |                          |                              |           |          |       |
|-----------------------|--------------------------|------------------------------|-----------|----------|-------|
| NO.                   | NAME                     | MESSAGE                      | SIGN TYPE | QUANTITY | NOTES |
| 239                   | CLEAN ROOM MECHANICAL    | 239,CLEAN ROOM MECHANICAL    | K         | 2        |       |
| 240                   | OFFICE                   | 240                          | B.1       | 1        |       |
| 241                   | OFFICE                   | 241                          | B.1       | 1        |       |
| 242                   | OFFICE                   | 242                          | B.1       | 1        |       |
| 243                   | OFFICE                   | 243                          | B.1       | 1        |       |
| 244                   | OFFICE                   | 244                          | B.1       | 1        |       |
| 245                   | OFFICE                   | 245                          | B.1       | 1        |       |
| 246                   | OFFICE                   | 246                          | B.1       | 1        |       |
| 247                   | OFFICE                   | 247                          | B.1       | 1        |       |
| 248                   | OFFICE                   | 248                          | B.1       | 1        |       |
| 249                   | OFFICE                   | 249                          | B.1       | 1        |       |
| 250                   | OFFICE                   | 250                          | B.1       | 1        |       |
| 251                   | OFFICE                   | 251                          | B.1       | 1        |       |
| 252                   | OFFICE                   | 252                          | B.1       | 1        |       |
| 253                   | CONFERENCE ROOM          | 253, CONFERENCE ROOM         | K.1       | 1        |       |
| 255                   | COPY                     | 255, COPY                    | K.1       | 1        |       |
| 256                   | MEN'S TOILET ROOM        |                              | C         | 1        |       |
| 257                   | WOMEN'S TOILET ROOM      |                              | D         | 1        |       |
| 258                   | J.C.                     | 258, JANITOR'S CLOSET        | K         | 1        |       |
| 259                   | OFFICE                   | 259                          | B.1       | 1        |       |
| 260                   | OFFICE                   | 260                          | B.1       | 1        |       |
| 261                   | OFFICE                   | 261                          | B.1       | 1        |       |
| 262                   | OFFICE                   | 262                          | B.1       | 1        |       |
| 263                   | OFFICE                   | 263                          | B.1       | 1        |       |
| 264                   | DARK ROOM                | 264,DARK ROOM                | K         | 1        |       |
| 265                   | CHARACTERIZATION         | 265,CHARACTERIZATION         | K         | 1        |       |
|                       |                          |                              | K.1       | 1        |       |
| 266                   | SAMPLE PREP LAB          | 266,SAMPLE PREP LAB          | K         | 1        |       |
|                       |                          |                              | K.1       | 1        |       |
| 267                   | HYDRIDE SYNTHESIS        | 267,HYDRIDE SYNTHESIS        | K         | 1        |       |
| 268                   | HYDRIDE CHARACTERIZATION | 268,HYDRIDE CHARACTERIZATION | K.1       | 1        |       |
| 269                   | OFFICE                   | 269                          | B.1       | 1        |       |
| 270                   | OFFICE                   | 270                          | B.1       | 1        |       |
| 271                   | OFFICE                   | 271                          | B.1       | 1        |       |
| 272                   | OFFICE                   | 272                          | B.1       | 1        |       |
| 273                   | OFFICE                   | 273                          | B.1       | 1        |       |
| 274                   | OFFICE                   | 274                          | B.1       | 1        |       |
| 275                   | OFFICE                   | 275                          | B.1       | 1        |       |
| 276                   | OFFICE                   | 276                          | B.1       | 1        |       |
| 277                   | OFFICE                   | 277                          | B.1       | 1        |       |
| 281                   | PANTRY/RECYLCING         | 278, PANTRY                  | K         | 1        |       |
| 282                   | SEATING AREA             |                              | -----     |          |       |
| C22                   | CORRIDOR                 |                              | -----     |          |       |

| SIGN MESSAGE SCHEDULE |                  |  |           |          |   |
|-----------------------|------------------|--|-----------|----------|---|
| NO.                   | NAME             | MESSAGE  | SIGN TYPE | QUANTITY | NOTES   |
| C23                   | SERVICE CORRIDOR | FLOOR 2  | E         | 2        |   |
| C24                   | CORRIDOR         |  | -----     |          |   |
| C25                   | CORRIDOR         |  | -----     |          |   |
| C26                   | CORRIDOR         |  | -----     |          |   |
| C27                   | CORRIDOR         |  | -----     |          |   |
| C28                   | CORRIDOR         |  | -----     |          |   |
| C29                   | CORRIDOR         |  | -----     |          |   |
| C30                   | SERVICE CORRIDOR | FLOOR 2  | E         | 1        |   |
| C31                   | CORRIDOR         |  | -----     |          |   |
| ST-21                 | STAIR #1         |  | -----     |          |   |
| ST-22                 | STAIR #2         |  | F         | 1        |   |
|                       |                  | STAIR 2, FLOOR B THRU P, ROOF ACCESS, 1, FLOOR 1 FOR EXIT    | H         | 1        |   |
|                       |                  |  | R         | 3        | PROVIDE TYPE R AT EACH CHANGE IN DIRECTION ON STAIR LANDING |
|                       |                  |  | P         | 1        |   |
| ST-22                 | STAIR #2         | STAIR 2, FLOOR B THRU P, ROOF ACCESS, 1, FLOOR 1 FOR EXIT    | H         | 1        |   |
|                       |                  |  | F         | 1        |   |
|                       |                  |  | R         | 3        | PROVIDE TYPE R AT EACH CHANGE IN DIRECTION ON STAIR LANDING |
|                       |                  |  | P         | 1        |   |
| ST-23                 | STAIR #3         |  | F         | 1        |   |
|                       |                  |  | P         | 1        |   |
|                       |                  | STAIR 3, FLOOR 1 THRU P, NO ROOF ACCESS, 1, FLOOR 1 FOR EXIT | H         | 1        |   |

| PENTHOUSE |                  |  |       |   |   |
|-----------|------------------|--|-------|---|---|
| EL-03     | SERVICE ELEVATOR | PENTHOUSE  | J     | 1 |   |
|           |                  | PENTHOUSE  | E     | 1 |   |
| 301       | PENTHOUSE        |  | ----- |   |   |
| ST-32     | STAIR #2         |  | F     | 1 |   |
|           |                  | STAIR 2, FLOOR B THRU P, ROOF ACCESS, 1, FLOOR 1 FOR EXIT    | H     | 1 |   |
|           |                  |  | R     | 4 | PROVIDE TYPE R AT EACH CHANGE IN DIRECTION ON STAIR LANDING |
|           |                  |  | P     | 1 |   |
| ST-32     | STAIR #2         | STAIR 2, FLOOR B THRU P, ROOF ACCESS, 1, FLOOR 1 FOR EXIT    | H     | 1 |   |
|           |                  |  | F     | 1 |   |
|           |                  |  | R     | 4 | PROVIDE TYPE R AT EACH CHANGE IN DIRECTION ON STAIR LANDING |
|           |                  |  | P     | 1 |   |
| ST-33     | STAIR #3         |  | F     | 1 |   |
|           |                  | STAIR 3, FLOOR 1 THRU P, NO ROOF ACCESS, 1, FLOOR 1 FOR EXIT | H     | 1 |   |



**SECTION 10 14 43**  
**PHOTO-LUMINESCENT SIGNAGE**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. Provide photo-luminescent signs indicated.
- B. Types of photo-luminescent signs:
  - 1. Floor markings consisting of arrows and stripes.
  - 2. Wall markings consisting of stripes.
  - 3. Exit signs mounted on walls
  - 4. Exit signs mounted on doors.
  - 5. Stair marker strips.
  - 6. Handrail markings consisting of stripes.

**1.2 QUALITY ASSURANCE**

- A. Photo-luminescent signs shall comply as follows:
  - 1. Accepted by NFPA 101 for safety markings.
  - 2. Non-combustible.
  - 3. Resistant to:
    - a. Cold solvent cleaners.
    - b. Gasoline.
    - c. Diesel fuel.
    - d. Detergent.
    - e. Salt water spray.
  - 4. Produced under ISO 9001 Certified Quality Standards.
  - 5. Photo-luminescent material shall be rare earth aluminate with non-radioactive pigment that is safe for use in toys, and provides at least the following luminescent properties in accordance with ANSI/UL 1994, or ASTM E2072 except as follows:
    - a. Charging Source: Minimum 11 lux of fluorescent illuminator for 60 minutes.
    - b. Minimum luminance:
      - 1) 30 mcd/m<sup>2</sup> after 10 minutes.
      - 2) 5 mcd/m<sup>2</sup> after 90 minutes.

**1.3 SUBMITTALS**

- A. Shop drawings:
  - 1. Plan drawings showing locations of each type of photo-luminescent sign, keyed to large scale drawings showing typical placements for each condition.
- B. Product data:
  - 1. Manufacturer's literature describing each type of photo-luminescent sign.
  - 2. Installation instructions.
- C. Samples:
  - 1. Full size samples of each basic type of photo-luminescent sign.
- D. Contract closeout information:
  - 1. Warranty.
  - 2. Maintenance data.

E. LEED Information:

## **1.4 WARRANTY**

- A. Photo-luminescent signage shall be warranted by manufacturer to remain fully secured in place and to retain specified luminescent properties under conditions of normal usage and maintenance; including cleaning operations.
- B. Warranty period: Minimum 5 years.

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS**

- A. Acceptable manufacturers:
  - 1. Photo-luminescent signage:
    - a. Base:
      - 1) EverGlow.
      - 2) Balco Inc.
      - 3) 2/90 Sign Systems.
    - b. Optional:
      - 1) ASSA ABLOY (Lite Guide).
      - 2) InPro Corporation.
- B. Photo-luminescent Signage:
  - 1. Luminescent color: Yellowish green.
  - 2. Floor and wall markings:
    - a. Substrate: Adhesive vinyl.
    - b. Arrow: 7 by 4.3 IN.
    - c. Stripes: 1 to 2 IN wide by length to fit.
  - 3. Exit signs:
    - a. Substrate: Aluminum
    - b. Exit left arrow.
  - 4. Stair marker strips:
    - a. Substrate: Adhesive vinyl.
    - b. Strip: 1 to 2 IN wide by length to fit.
  - 5. Handrail markings:
    - a. Substrate: Adhesive vinyl.
    - b. Stripes: 1 IN wide by length to fit.
- C. Accessories: Separate adhesives, mastics, preparation materials and other accessories shall be recommended by manufacturer to suit application surfaces and other conditions of installation.
- D. Refer to Sign Message Schedule in Specification Section 10 14 23.
- E. Refer to Miscellaneous Materials Specification Section 05 50 10 and Steel Stair Specification Section 05 50 13.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- A. Photo-luminescent signs shall be installed where indicated in accordance with the manufacturer's instructions.
- B. Application surfaces shall be cleaned and otherwise prepared for permanent installation of signage.
- C. Signage shall be adhesively secured without exposed fasteners.

- D. Floor mounted signs shall be fully adhered, straight and parallel or perpendicular to walls and other building lines, and free from wrinkles, mismatches or other visual irregularities.
- E. Wall and door mounted signs shall be located within 457 mm 18 IN above floor, full adhered, plumb and level unless otherwise indicated.
- F. Stripes and arrows shall be adhesively applied, accurately aligned, and free of wrinkles and other visual irregularities.
- G. Floor stripes shall be uniformly located within 100 mm 4 IN from and parallel to walls.
- H. Wall stripes shall be uniformly located 100 mm 4 IN above floor.
- I. Stair marker strips shall be applied full length of treads and landing nosings, with leading edge placed maximum 13 mm 1/2 IN from leading edge of step or overlapping edge of step maximum 13 mm 1/2 IN vertically down the face.
- J. Handrail stripes shall be applied on top surface of rail, extending full length with maximum 100 mm 4 IN interruptions at turns and post newel caps.

**END OF SECTION**



**SECTION 10 21 12**  
**METAL TOILET PARTITIONS**

**PART 1 - GENERAL**

**1.1 SUBMITTALS**

- A. Shop Drawings.
- B. Samples:
  - 1. Full range of colors for Architect's selection.
- C. LEED Information:
  - 1. LEED Credits MR 4.1 and 4.2, Recycled Content: Product data indicating percentages by weight of post-consumer and post-industrial recycled content for products having recycled content; include statement indicating costs for each product having recycled content.
  - 2. LEED Credits MR 5.1 and 5.2, Regional Materials: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.

**1.2 PRODUCT DELIVERY, STORAGE AND HANDLING**

- A. Deliver anchorage items in time to allow installation.

**1.3 JOB CONDITIONS**

- A. Verify dimensions by field measurements before fabrication, wherever possible without delaying project.

**PART 2 - PRODUCTS**

**2.1 MATERIALS - GENERAL**

- A. Acceptable manufacturers:
  - 1. Toilet partitions:
    - a. Base:
      - 1) Accurate Partitions.
    - b. Optional:
      - 1) Hadrian Manufacturing.
      - 2) American Sanitary Partition Corp.
      - 3) Bradley.
      - 4) General Partitions Manufacturing Corp.
      - 5) Global Steel Products.

**2.2 MOUNTING CONFIGURATION**

- A. Floor-mounted / Overhead-braced.

**2.3 PANEL MATERIALS**

- A. General:
  - 1. Steel sheet formed over sound-deadening Bridgecore material.
  - 2. Provide materials selected for their surface flatness and smoothness.
  - 3. Panel core material: Vermin and moisture resistant, sound deadened, double-faced honeycomb, impregnated Kraft paper.

4. Exposed surfaces that exhibit pitting, seam marks, roller marks, stains, discoloration, or other surface imperfections on finished units not acceptable.
5. Component Thicknesses:
  - a. Pilasters: 1-1/4 IN.
  - b. Doors, Panels and Urinal Screens: 1 IN.
6. Panel Height: 58 IN high.
  - a. Mounting Height: 12 IN AFF to bottom of panel; 70 IN AFF to top.
7. Stall Depth(s): As indicated on Drawings.
8. Minimum sheet steel thicknesses: As indicated on the following Table, based on the Mounting Configuration listed in 2.2.

| <b>Minimum Sheet Steel Thickness</b>   |                  |                           |              |
|--|------------------|---------------------------|--------------|
| <b>Mounting Configuration</b>          | <b>Pilasters</b> | <b>Panels<br/>Screens</b> | <b>Doors</b> |
| <b>Floor Mounted / Overhead Braced</b> | 20 GA            | 22 GA                     | 22 GA        |
| <b>Floor-Mounted</b>                   | 18 GA            |                           |              |
| <b>Ceiling-Hung</b>                    | 18 GA            |                           |              |
| <b>Floor-to-Ceiling Anchored</b>       | 20 GA            |                           |              |

- a. Note: Disregard Mounting Configurations which are listed on above table but are not called for in Part 2.2.
- B. Stainless Steel Partitions:
1. Type 304 18-8 Stainless Steel.
  2. Finish: #4 (brushed).
- C. Accessible stalls:
1. Minimum 5 FT wide.
  2. Doors:
    - a. Swing out.
    - b. Clear Opening Width: Minimum 32 IN.
  3. Comply with and all locally adopted building codes and standards with regard to accessibility.
- D. Doors:
1. For 32 IN or wider stalls (except accessible stalls): Minimum 26 IN wide.
  2. For stalls less than 32 IN wide: Minimum 24 IN wide.
- E. Pilasters:
1. General:
    - a. Galvanized steel or stainless steel anchorage devices.
    - b. Adjustable hanger and/or leveling bolts.
    - c. Provide shoes at each pilaster.
  2. Floor-mounted / Overhead-braced:
    - a. Secure pilaster to floor with minimum of 2 lead expansion shields and anchor screws.
    - b. Overhead brace:
      - 1) Continuous anti-grip aluminum tube, minimum 1/8 IN wall thickness, clear anodized.
      - 2) Install brace at 82 IN AFF.
    - c. Securely attach brace into top of each pilaster and to wall.
- F. Urinal Screens:
1. Wall-hung (cantilever):

- a. Size:
    - 1) 18 IN x 42 IN.
  - b. Same construction and finish as toilet compartments.
  - c. Provide extra heavy stirrups for securing to walls.
- G. Pilaster shoes:
- 1. AISI Type 302/304 18-8 stainless steel.
  - 2. 20 GA, 3 IN high.
- H. Stirrup brackets:
- 1. Manufacturer's heavy duty design for attaching panels to walls and pilasters.
  - 2. Chromium plated brass or Type 302 stainless steel.
- I. Operational Hardware:
- 1. General:
    - a. Provide the following at all stalls.
    - b. Material: All items are chromium plated brass or stainless steel.
  - 2. Universal Knob/Lever.
    - a. Concealed in door.
    - b. ADA compliant.
    - c. Emergency Access.
  - 3. Strike:
    - a. Wrap around type strike/keeper designed to properly receive and hold latch.
    - b. Integral bumper.
  - 4. Door pull.
- J. Bumper coat hook:
- 1. Rubber tipped combination bumper and coat hook.
  - 2. Provide one for each compartment.
- K. Pivot hinges:
- 1. Cam action, self closing, inset into cut-out in door.
  - 2. Top Pivot: 13mm 1/2 IN nylon pin.
  - 3. Bottom Pivot: 4.8mm 3/16 IN Stainless Steel pin.
  - 4. Body Material: Chromium plated brass or stainless steel.
  - 5. Adjustable to permit doors to rest position at any angle within a 270 Deg arc.
- L. Toilet Paper holders: As specified in Section 10 28 13.
- M. Related Toilet Accessories: As specified in Section 10 28 13, Toilet Accessories.
- N. Anchorages and fasteners:
- 1. Exposed fasteners: Tamper-resistant, stainless steel or brass, finish to match hardware.
  - 2. Concealed anchors: Galvanized steel, hot dip coated after fabrication complying with ASTM-A385.

## 2.4 FABRICATION

- A. Pre-assemble units in shop to greatest extent possible to minimize any field cutting and assembly of units.
- B. Fabricate system in accordance with manufacturer's specifications.
- C. Pressure laminate face sheets to core material.
  - 1. Seal edges with continuous locking strip.
  - 2. Miter, weld and grind smooth all corners, or cap with manufacturer's standard stainless steel edge and corner fittings.
- D. Provide concealed reinforcement for installation of hardware, fittings, brackets, and required accessories.
- E. Reinforce for attachment of grab bars, as required.

- F. Exposed metal and hardware finishes:
  - 1. Stainless steel:
    - a. ASTM-A480, bright polished finish No. 4; or
    - b. ANSI/BHMA-A156.18, Code 629; to match US32.
  - 2. On brass, bronze and steel:
    - a. ASTM-B456, SC-2 bright chromium plated over nickel plating; or
    - b. ANSI/BHMA-A156.18, Code 625 on brass and bronze, Code 651 on steel; to match US26.
  - 3. Aluminum:
    - a. AA-M12C22A31 clear satin anodized; or
    - b. ANSI/BHMA-A156.18, Code 628; to match US28.

## **PART 3 - EXECUTION**

### **3.1 INSPECTION**

- A. Verify suitability of substrate to accept installation.
- B. Insure that adequate Wall Backing has been installed.
  - 1. Metal Wall Backing: Specified in Section 09 22 16.
  - 2. Coordinate and direct installation at locations required for Toilet Partitions and accessories.
- C. Correct unsatisfactory conditions.
- D. Installation constitutes acceptance of responsibility for performance.

### **3.2 INSTALLATION**

- A. Install in a rigid, straight, plumb and level manner, to indicated lay out.
- B. Clearances:
  - 1. Between pilasters and panels: Maximum 1/2 IN.
  - 2. Between panels and walls: Maximum 1 IN.
  - 3. Between doors and pilasters: Maximum 3/16 IN.
  - 4. Between floor and bottom of panels: 12 IN.
- C. Secure to walls with minimum of 2 stirrup brackets near top and bottom of panel.
  - 1. Locate brackets so holes occur in masonry or tile joints.
  - 2. Use manufacturer's recommended anchoring devices, as indicated on shop drawings.
- D. Floor-mounted / Overhead-braced partitions:
  - 1. Secure pilasters to floor.
  - 2. Level, plumb, and tighten.
  - 3. Secure overhead brace with minimum of two fasteners per pilaster.
  - 4. Set tops of closed doors parallel with overhead brace.
- E. Urinal Screens:
  - 1. Attach with heavy duty concealed anchoring devices.
  - 2. Provide wall channels, wall plates and studs as recommended by manufacturer to suit wall construction.
  - 3. Provide floor and ceiling attachment devices where applicable.
  - 4. Set units in accordance with manufacturer's instructions to support units and resist impact.

### **3.3 ADJUST AND CLEAN**

- A. Adjust and lubricate hardware for proper operation after installation.
  - 1. Set hinges on in-swing doors to hold unlatched doors open approximately 30 degrees.
  - 2. Set hinges on out-swing doors to return to fully closed position.
- B. Protect until time of acceptance by BNL.

- C. Replace damaged work as directed.
- D. Perform final adjustments just prior to final inspection.
- E. Clean exposed surfaces, hardware, fittings and accessories and touch up minor scratches and other imperfections using materials and methods recommended by manufacturer.

**END OF SECTION**



## **SECTION 10 21 31**

### **SHOWER CURTAINS**

#### **PART 1 - GENERAL**

##### **1.1 SUBMITTALS**

- A. Samples:
  - 1. Fabric.
- B. Contract closeout information:
  - 1. Maintenance data.
  - 2. Guarantee.
- C. LEED Information:
  - 1. LEED Credits MR 4.1 and 4.2, Recycled Content: For products having recycled content, documentation indicating percentages by weight of postconsumer and preconsumer recycled content; include statement indicating costs for each product having recycled content.
  - 2. LEED Credits MR 5.1 & 5.2, Regional Materials: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.

##### **1.2 GUARANTEE**

- A. Guarantee entire installation of shower curtains complies with specifications and shall be free of defective workmanship for a period of 2 years. Guarantee entire cost of replacement curtain, including removal, replacement, and disposal of defective material.

#### **PART 2 - PRODUCTS**

##### **2.1 MATERIALS**

- A. Acceptable manufacturers:
  - 1. Fabrics:
    - a. Base:
      - 1) Standard Textile Co., Inc. (Fantagraph).
    - b. Alternates:
      - 1) Architex.
      - 2) Designtex.
      - 3) Maharam.

##### **2.2 CURTAINS**

- A. General:
  - 1. Fabric shall be made from pre-shrunk, yarn dyed, permanently flame proofed, manufacturer's standard pattern and texture.
  - 2. Provide and install shower curtains in rooms as shown on Finish Schedule.
  - 3. Field verify all dimensions prior to installation to provide complete enclosure.
  - 4. Curtains shall be manufactured to a length with a tolerance of plus or minus 1". Care and location labels are sewn into the reverse side of right hem, approximately 6" above bottom hem.

- B. Fabrication:
1. Curtains to be made to the industry standard for shower curtains mounted on a standard shower rod.
  2. Shower curtain rod and rings provided by BNL.
  3. Fabric A as specified in Finish Schedule on Drawings:
    - a. 76 IN width.
    - b. Pattern repeat: 2 IN x 2 IN.
    - c. Railroad fabric.
    - d. Content: 100% FR Polyester.
    - e. Machine washable to 160 degF. Tumble Dry to 140 degF.
    - f. Textile shall meet all appropriate flammability requirements, included NFPA-701, 1999 Test Method #1, and CA 19.
  4. Construct with a reinforced triple-folded header, 3/8 IN width with a strip of no-tear buckram. Side hems shall be 1 IN width with a double fold.
  5. Provide 6 IN grommet spacing.
  6. Provide minimum of 20% fabric for fullness.

## **PART 3 - EXECUTION**

### **3.1 INSPECTION**

- A. Examine surfaces and conditions.
- B. Correct unsatisfactory conditions.

### **3.2 INSTALLATION**

- A. Install where indicated, level, plumb, secure.
- B. Repair or replace damaged or defective units.
- C. Protect units so they will be operable and undamaged at completion of project.
- D. Install curtains just before final inspection.
- E. Position units plumb and true.
- F. Anchor securely in place with proper clips, brackets and bolts for mounting.
- G. Curtains shall be wrinkle free.

### **3.3 SCHEDULE**

- A. Install shower curtains on rods as indicated in Finish Schedule.

## **END OF SECTION**

**SECTION 10 28 13**  
**TOILET AND BATH ACCESSORIES**

**PART 1 - GENERAL**

**1.1 SUBMITTALS**

- A. Contract Closeout Information:
  - 1. Maintenance data.
  - 2. Letter stating that extra material has been delivered.
- B. LEED Information:
  - 1. LEED Credits MR 4.1 and 4.2, Recycled Content: Product data indicating percentages by weight of post-consumer and post-industrial recycled content for products having recycled content; include statement indicating costs for each product having recycled content.
  - 2. LEED Credits MR 5.1 and 5.2, Regional Materials: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.

**1.2 PRODUCT DELIVERY, STORAGE AND HANDLING**

- A. Deliver anchorage items in time to allow installation.

**PART 2 - PRODUCTS**

**2.1 MATERIALS**

- A. Acceptable manufacturers:
  - 1. General:
    - a. As noted for individual items.
    - b. Not all manufacturers are approved for each item.
    - c. Provide equipment from one manufacturer as far as is practicable.
  - 2. Toilet and Bath Accessories:
    - a. Base:
      - 1) American Specialties (unless otherwise noted for specific items).
    - b. Optional:
      - 1) Bobrick Washroom Equipment.
      - 2) Bradley.

**2.2 TOILET ACCESSORIES – GENERAL**

- A. Materials:
  - 1. Stainless steel (unless noted otherwise):
    - a. Quality: ASTM-A167, Type 304 (18-8).
    - b. Finish: Satin finish on exposed surfaces.
  - 2. Exception: TA-2 and TA-3, aluminum.
- B. See drawings for items, quantities, and locations required.
- C. Grab Bars - General:
  - 1. Material: Satin stainless steel, ASTM-A167, Type 304 (18-8).
  - 2. Bar Diameter: 1-1/2 IN OD.
  - 3. Concealed mounting.
  - 4. 1-1/2 IN clearance between bar and wall.

5. Modify manufacturer's standard units if required.
  6. Fully weld bars to flanges.
  7. Base Products: "3800 Series" by American Specialties.
  8. Provide anchoring devices to withstand minimum concentrated load of 250 LB:
    - a. Mounting devices for metal stud, gypsum wall board or plaster walls.
    - b. Mounting devices for concrete block walls.
    - c. Mounting devices for concrete walls.
    - d. Mounting devices for toilet partitions.
    - e. Mounting on other surfaces: As recommended by manufacturer.
- D. Locks:
1. Tumbler locks keyed alike.
- E. Provide corrosion resistant fasteners and attachment devices, and other fittings necessary to assure function and operation of accessories

**2.3 EXTRA MATERIAL**

- A. Provide one extra TA item of each type; except TA-4, TA-20, TA-G series; per 100 items furnished.
- B. Minimum extra pieces regardless total number: One.
- C. Furnish packed in original boxes, identified on outside of package to TA number and description.

**2.4 TOILET ACCESSORY TYPES**

- A. Hooks:

| DECORATIVE COAT HOOKS |                  |        |         |         |               |
|-----------------------|------------------|--------|---------|---------|---------------|
| TA                    | NAME             | ASI    | Bobrick | Bradley | REMARKS       |
| 1A                    | Single Robe Hook | 7340-S | B-671   | 9114    | 66 IN AFF     |
| 1B                    | Single Robe Hook | 7340-S | B-671   | 9114    | 48 IN AFF ADA |

- B. Paper Towel Dispensers:

| PAPER TOWEL DISPENSERS - MANUAL |                       |                           |         |         |                          |
|---------------------------------|-----------------------|---------------------------|---------|---------|--------------------------|
| TA                              | NAME                  | ASI                       | BOBRICK | BRADLEY | REMARKS                  |
| 7C                              | Paper Towel Dispenser | Kimberly-Clark<br>0973601 | --      | --      | Transparent/Grey Plastic |

- C. Soap Dispensers:

| SOAP DISPENSERS |                                   |                         |         |         |         |
|-----------------|-----------------------------------|-------------------------|---------|---------|---------|
| TA              | NAME                              | ASI                     | BOBRICK | BRADLEY | REMARKS |
| 9A              | Hand Wash Soap Dispenser (manual) | Foam<br>Gojo<br>1250 ML | --      | --      | Grey    |

D. Miscellaneous:

| <b>MISCELLANEOUS</b> |   |            |                |                |                               |
|----------------------|---|------------|----------------|----------------|-------------------------------|
| <b>TA</b>            | <b>NAME</b>   | <b>ASI</b> | <b>BOBRICK</b> | <b>BRADLEY</b> | <b>REMARKS</b>                |
| <b>10</b>            | Mop-Broom Rack<br>(26 IN,<br>3 Holders)                     | 8215-3     | B-223X24       | 9953-3         | 60 IN AFF                     |
| <b>11</b>            | Shower Curtain<br>Rod                                       | 1204       | B-6047         | 9531           | Length as indicated 78 IN AFF |
| <b>12</b>            | Soap Dish (without<br>bar or soap lip) (for<br>stud walls): | NA         | NA             | 9403-96        | 40 IN AFF                     |

E. Towel Bars:

| <b>TOWEL BARS</b> |                  |            |                |                |                |
|-------------------|------------------|------------|----------------|----------------|----------------|
| <b>TA</b>         | <b>NAME</b>      | <b>ASI</b> | <b>BOBRICK</b> | <b>BRADLEY</b> | <b>REMARKS</b> |
| <b>16</b>         | Towel Bar, 18 IN | 0755-SS    | B-673          | 908            | 48 IN AFF      |

F. Shower Seats:

| <b>SHOWER SEATS</b> |                          |            |                |                |                   |
|---------------------|--------------------------|------------|----------------|----------------|-------------------|
| <b>TA</b>           | <b>NAME</b>              | <b>ASI</b> | <b>BOBRICK</b> | <b>BRADLEY</b> | <b>REMARKS</b>    |
| <b>17</b>           | Shower Seat<br>(fold-up) | 8206       | B-5181         | 9567           | Capacity: 250 LBS |

G. Combination Unit:

| <b>SEATCOVER, NAPKIN DISPENSER, TOILET PAPER</b> |  |                |                |                |                       |
|--|--|----------------|----------------|----------------|-----------------------|
| <b>TA</b>  | <b>NAME</b>                                      | <b>ASI</b>     | <b>BOBRICK</b> | <b>BRADLEY</b> | <b>REMARKS</b>        |
| <b>25</b>  | Toilet Paper<br>Dispenser                        | Scott<br>09665 | --             | --             | Transparent/Grey Back |
| <b>26</b>  | Recessed Men<br>Combination Unit                 | 0485           | B-3474         | 5922           |                       |
| <b>27</b>  | Partition Mounted<br>Women's<br>Combination Unit | 0481           | B-357          | 592            |                       |
| <b>30</b>  | Surface Mounted<br>Combination Unit              | 0486           | B-3479         | 5921           |                       |

H. Grab Bar Types:

| <b>GRAB BARS</b> |                               |            |                |                |                |
|------------------|-------------------------------|------------|----------------|----------------|----------------|
| <b>TA</b>        | <b>NAME</b>                   | <b>ASI</b> | <b>BOBRICK</b> | <b>BRADLEY</b> | <b>REMARKS</b> |
| <b>G24</b>       | Grab Bar, 24 IN<br>Horizontal | 3801-24    | B-6806-24      | 812-001-24     | 36 IN AFF      |
| <b>G36</b>       | Grab Bar, 36 IN               | 3801-36    | B-6806-36      | 812-001-36     | 36 IN AFF      |

|            |                                      |         |           |            |           |
|------------|--------------------------------------|---------|-----------|------------|-----------|
|            | Horizontal                           |         |           |            |           |
| <b>G42</b> | Grab Bar, 1070mm<br>42 IN Horizontal | 3801-42 | B-6806-42 | 812-001-42 | 36 IN AFF |
| <b>G48</b> | Grab Bar, 48 IN<br>Horizontal        | 3801-48 | B-6806-48 | 812-001-48 | 36 IN AFF |

## **PART 3 - EXECUTION**

### **3.1 INSPECTION**

- A. Verify suitability of substrate to accept installation.
- B. Insure that adequate Wall Backing has been installed:
  - 1. Utilize proprietary backing devices where specified:
    - a. Where not specified: Utilize sheet metal strap-type Wall Backing, Specified in Section 09 22 16.
    - b. Coordinate and direct installation backing where required for Toilet Accessories.
- C. Verify substrate and blocking for attachment of wall-mounted accessories is ready for installation of accessories.
- D. Correct deficiencies before proceeding to install accessories.
- E. Where item is mounted on or in a toilet partition, coordinate interior reinforcing location with partition manufacturer.
- F. Installation constitutes acceptance of responsibility for performance.

### **3.2 INSTALLATION**

- A. Install accessories in accordance with manufacturer's instructions:
  - 1. Install plumb, level, and rigidly anchored to substrates.
- B. Where drawings or schedule require barrier-free accessibility, install accessories in accordance with applicable regulations.
- C. Coordinate accessory locations to fit spaces.
- D. Coordinate items to avoid mounting conflicts.
- E. Provide additional accessories indicated on drawings.
- F. Mount at height indicated.
- G. Mount items with theft-resistant fasteners.

### **3.3 ADJUSTING AND CLEANING**

- A. Protect accessories from damage due to construction:
  - 1. Remove protective coverings when no longer required.
- B. Test accessories and adjust for proper operation.
- C. Clean exposed surfaces.

**END OF SECTION**

**SECTION 10 44 00**  
**FIRE PROTECTION SPECIALTIES**

**PART 1 - GENERAL**

**1.1 QUALITY ASSURANCE**

- A. Conform to NFPA 10 requirements for portable fire extinguishers.
- B. Provide fire extinguishers, cabinets and accessories by a single manufacturer.
- C. Fire-Rated Cabinets: Listed and labeled to comply with requirements in ASTM-E814 for fire-resistance rating of walls where they are installed.
- D. Conform to Americans with Disabilities Act (ADA) regarding mounting heights and maximum projection of cabinets into corridors.

**1.2 SUBMITTALS**

- A. Contract Closeout Information:
  - 1. Maintenance data.
- B. LEED Information:
  - 1. LEED Credits MR 4.1 and 4.2, Recycled Content: Product data indicating percentages by weight of post-consumer and post-industrial recycled content for products having recycled content; include statement indicating costs for each product having recycled content.
  - 2. LEED Credits MR 5.1 and 5.2, Regional Materials: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.

**1.3 PRODUCT DELIVERY, STORAGE AND HANDLING**

- A. Deliver cabinets in time to allow installation.
- B. Deliver and install filled and charged extinguishers just prior to building occupancy.

**PART 2 - PRODUCTS**

**2.1 MATERIALS**

- A. Acceptable manufacturers:
  - 1. Fire Protection Specialties:
    - a. Base:
      - 1) JL Industries.
    - b. Optional:
      - 1) Larsen's Manufacturing.
      - 2) Potter Roemer.

**2.2 FIRE EXTINGUISHER CABINETS (FEC)**

- A. General:
  - 1. Provide FIRE EXTINGUISHER decal for each cabinet. Orient letters vertically.
  - 2. Provide fixed door pull at each cabinet.
  - 3. Keys to Door Locks: Three per lock.

- B. **FEC-1** – Semi-recessed, Steel Fire Extinguisher Cabinet w/Stainless Steel Trim & Door:
  - 1. Description: Semi-recessed (carbon) steel tub with 1-1/4 IN (face width) stainless steel trim and door.
    - a. Fire-rated Cabinets: Provide fire-rated cabinets where FEC-2 is indicated to be installed in fire-rated walls.
    - b. Maximum projection from wall surface: 1-1/2 IN.
  - 2. Tub Construction:
    - a. Non-fire rated Units: Single-wall, 0.026 IN (26 GA) cold-rolled steel.
    - b. Fire Rated Units: Double-wall construction fabricated from 0.043 IN (18 GA) cold-rolled steel lined with minimum 5/8 IN thick, fire-barrier material.
  - 3. Tub Finish: Powder coated.
    - a. Color: White.
  - 4. Trim and Door Material: 0.026 IN (26 GA) stainless steel.
    - a. Finish: #4 brushed.
  - 5. Tub Size, inside clear (WxTxD): 10-1/2 x 24 x 6 IN.
  - 6. Door Style: Full Glazing; Clear acrylic.
  - 7. Lock: Cam lock with emergency break-away release mechanism.
    - a. Base Product: “Saf-T-Lok” by JL Industries.
  - 8. Base Product(s): “Cosmopolitan” and “Cosmopolitan FX” series by JL Industries.
- C. Wall Brackets:
  - 1. Manufacturer's standard steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated
  - 2. Finish: Baked-enamel or powder coat.
  - 3. Color: Black.
  - 4. Locations: Install wall brackets for each extinguisher (FE) not indicated to be installed in a cabinet.
  - 5. Include mounting accessories suitable for substrate wall type.

## 2.3 FIRE EXTINGUISHERS (FE)

- A. General:
  - 1. Determine proper type of extinguisher is required for room in which they are indicated.
  - 2. Coordinate cabinet and extinguisher sizes. Bring discrepancies to attention of Architect prior to or during submittal phase.
  - 3. Include wall brackets where extinguishers are indicated without cabinets.
- B. Fire Extinguishers will be provided by BNL, Installed by BNL.
  - 1. Preliminary Capacity of BNL-provided extinguishers: 10 LBS (verify).

## 2.4 MISCELLANEOUS ITEMS (SPECIFIED ELSEWHERE)

- A. **FVC** - Fire Valve Cabinets:
  - 1. Specified in Section 21 10 00 and shown on Mechanical Drawings where required.

## 2.5 FABRICATION

- A. Cabinets:
  - 1. Provide manufacturer's standard box (tub) with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.
  - 2. Weld joints and grind smooth.
  - 3. Provide factory-drilled mounting holes.
  - 4. Prepare doors and frames to receive locks.
  - 5. Install door locks at factory.
- B. Cabinet Doors:
  - 1. Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles selected.
  - 2. Fabricate door frames with tubular stiles and rails and hollow-metal design, 1/2 IN thick.

- C. Cabinet Trim:
  - 1. Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

## **2.6 GENERAL FINISH REQUIREMENTS**

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces of fire protection cabinets from damage by applying a strippable, temporary protective covering before shipping.
- C. Finish fire protection cabinets after assembly.
- D. Appearance of Finished Work: Noticeable variations in same piece are not acceptable.

## **PART 3 - EXECUTION**

### **3.1 INSPECTION**

- A. Verify suitability of substrates to accept installation.
- B. Installation constitutes acceptance of responsibility for performance.

### **3.2 INSTALLATION**

- A. General:
  - 1. Install items included in this section in locations and at mounting heights indicated, or if not indicated, at heights to comply with applicable regulations of governing authorities.
  - 2. Prepare recesses in walls for cabinets as required by type and size of cabinet and style of trim and to comply with manufacturers instructions.
  - 3. Securely fasten mounting brackets and cabinets to structure, square and plumb, to comply with manufacturer's instructions.
  - 4. Install in accordance with NFPA-10 and manufacturer's instructions.
  - 5. Provide required closures.
- B. Installation Heights:
  - 1. General:
    - a. Install extinguishers and cabinets with in limitations of NFPA-10 and ADA.
  - 2. Fire Extinguisher Cabinets (FEC):
    - a. Locate with centerline of cabinet door handle not more than 48 IN AFF.
    - b. Exception: Extinguishers with at gross weight > 40 LBS: Locate with centerline of cabinet door handle not higher than 24 IN AFF.
  - 3. Fire Extinguishers (FE) not contained in a cabinet:
    - a. Locate wall brackets such that top of extinguisher will not be higher 48 IN AFF.
    - b. Exception: Extinguishers with at gross weight greater than 40 LBS: Install with extinguisher top not more than 36 IN above floor.

### **3.3 PROTECTION**

- A. Protect installed items from damage.

### **3.4 ADJUSTING AND CLEANING**

- A. Remove temporary protective coverings and strippable films.
- B. Adjust fire protection cabinet doors to operate easily without binding.
  - 1. Verify that integral locking devices operate properly.
- C. Clean interior and exterior surfaces.
- D. Touch up marred finishes, or replace cabinets that cannot be restored to factory-finished appearance.

1. Conform with procedures recommended by manufacturer.
- E. Replace items that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

**END OF SECTION**

## **SECTION 10 51 13**

### **METAL LOCKERS**

#### **PART 1 - GENERAL**

##### **1.1 SUBMITTALS**

- A. Shop Drawings:
  - 1. Indicate elevations, layouts, base conditions and trim.
- B. Samples:
  - 1. Full range of colors for selection.
- C. LEED Information:
  - 1. LEED Credits MR 4.1 and 4.2, Recycled Content: Product data indicating percentages by weight of post-consumer and post-industrial recycled content for products having recycled content; include statement indicating costs for each product having recycled content.
  - 2. LEED Credits MR 5.1 and 5.2, Regional Materials: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.

#### **PART 2 - PRODUCTS**

##### **2.1 MATERIALS**

- A. Acceptable manufacturers:
  - 1. Standard Metal Lockers:
    - a. Base:
      - 1) Penco Products.
    - b. Optional:
      - 1) Republic Storage Systems.
      - 2) Lyon Metal Products.
      - 3) List Industries.

##### **2.2 LOCKERS – GENERAL**

- A. Sheet steel:
  - 1. Cold rolled for doors and door frames.
  - 2. Cold rolled or annealed for other parts.
  - 3. All free from surface imperfections.
- B. Fasteners:
  - 1. Cadmium plated steel, including washers.
  - 2. Exposed bolt heads, slot-less type.
  - 3. Provide lock washers for nuts on moving parts.
  - 4. Do not expose bolts or rivet heads on fronts of lockers or frames.
- C. Frames:
  - 1. Minimum 0.060 IN (16 GA) channels or 0.093 IN (12 GA) angles, with corners electrically welded to form solid one piece structure.
  - 2. Door stops at door openings.
  - 3. Provide minimum 0.060 IN (16 GA) horizontal members between doors of multiple-tier lockers, or other method, to ensure rigidity.

4. Provide cushioning bumpers at top and bottom of door frame.
  5. Extend vertical members to floor to form 6 IN legs.
  6. Provide adjusting devices at legs to permit leveling.
- D. Backs and sides:
1. Minimum 0.024 IN (24 GA) steel.
  2. Flange backs on vertical edges and sides where they inter-member with backs, making double flanged rear corners.
- E. Exposed ends of lockers: Minimum 0.060 IN (16 GA).
- F. Tops, bottoms and shelves: Minimum 0.024 IN (24 GA) steel, flanged on all sides.
- G. Continuous Sloping Tops:
1. Continuous sloped, minimum 0.036 IN (19 GA) steel.
  2. Provide end closure pieces, corner and other fillers.
- H. Doors:
1. One piece, minimum 0.060 IN (16 GA) steel, flanged at all edges.
  2. Extra reinforcing on inside of doors over 15 IN wide.
  3. Construct to prevent springing.
  4. Door swing: 180 degrees.
  5. Stamped louvered vents in door faces.
  6. Single tier lockers: Minimum 6 louver openings top and bottom of each door.
  7. Double tier lockers: Minimum 6 louver openings top and bottom of each door.
- I. Door Hinges:
1. Heavy duty, steel, full loop, 5-knuckle, tight pin.
  2. Minimum 0.050 IN thick, 2 IN high.
  3. Minimum 3 hinges per door 42 IN high and over.
  4. Minimum 2 hinges for other doors.
- J. Base Closure for freestanding lockers:
1. Fill spaces between legs with minimum 0.032 IN (20 GA) steel.
  2. Cover entire front and exposed ends of lockers.
  3. Flange bottoms inward for stiffening.
  4. Factory finish base to match lockers.
- K. Trim for Lockers shown to be recessed into surrounding wall:
1. Minimum 0.042 IN (18 GA) steel.
  2. Provide at jambs and head of recessed lockers.
  3. 2 IN or 3 IN wide as necessary.
  4. Factory finish to match lockers.
  5. Secure to lockers with concealed fastening clips.
- L. Latching:
1. Automatic, pry resistant latch and pull.
  2. Rubber silencers.
  3. Chromium plated or stainless steel, heavy duty, vandal-proof lift-up handle, containing strike and hole for padlock.
  4. Enclose latch on 4 sides in a boxed receptacle in lock bar channel, and engaging latch hooks with polyethylene guides.
  5. 3 point latching for single tier lockers.
  6. 2 point latching for double tier lockers.
  7. Spring latch with padlock lugs for box lockers.
- M. Accessible Lockers:
1. Where handicapped lockers are designated: Provide fully ADA/ANSI-compliant units.
    - a. If not specifically designated: Provide a minimum of 5%, but not less than 1 locker per cluster that is accessible.

2. Requirements of Accessible Lockers:
  - a. Recessed handles or of type that meets criteria of ADA/ANSI standards.
  - b. Apply appropriate symbol sign on exterior face of door.
  - c. Locker bottoms: Not less than 9 IN AFF or include an additional shelf located at 9 IN AFF.
  - d. Double Tier lockers:
    - 1) Accessible compartment may not be in the upper tier.
  - e. Single Tier lockers:
    - 1) Locate top shelf no higher than 48 IN AFF.
    - 2) Locate clothes rods and hooks no higher than 48 IN AFF.
  - f. Locker bottoms: Not less than 9 IN AFF or include an additional shelf located at 9 IN AFF.
- N. Description of Locking Type(s):
  1. General:
    - a. Refer to schedule for indication of where the following Type(s) are required.
  2. Captive-Key Lock (key retaining feature):
    - a. Keyed separately and master keyed.
    - b. 2 keys for each lock and 5 master keys.
    - c. Lock with spring bolt action.
    - d. Key removable from lock only in locked position.
    - e. Provide where scheduled.
- O. Accessories: Furnish each locker with following:
  1. Full-height:
    - a. Provide (1) double-prong wall hook at back.
    - b. Provide (1) single-prong wall hook at each side wall (2 total).
  2. For Full-height lockers only:
    - a. Provide Hat shelf.
  3. For Full-height lockers which are 18 IN and deeper:
    - a. Provide hanger rod, in lieu of back hook.
- P. Number plates:
  1. Manufacturer's etched or stamped, non-ferrous metal number plates.
  2. Three digit numerals minimum 1/2 IN high.
  3. Sequence numbers as directed by Architect.
  4. Attach plates centered, near top of each locker door, with 2 fasteners of same finish as number plate.
  5. No manufacturer's name allowed.
- Q. Sealant: Specified in Section 07 92 16.

## 2.3 FABRICATION

- A. General:
  1. Fabricate metal lockers square, rigid, and without warp and with metal faces flat and free of dents or distortion.
  2. Make exposed metal edges safe to touch and free of sharp edges and burrs. Make all exposed metal edges safe to touch.
  3. Form body panels, doors, shelves, and accessories from one-piece steel sheet unless otherwise indicated.
  4. Provide fasteners, filler plates, supports, clips, and closures as required for complete installation.
  5. Fabricate each metal locker with an individual door and frame; individual top, bottom, and back; and common intermediate uprights separating compartments.
  6. Factory-weld frame members of each metal locker together to form a rigid, one-piece assembly. Weld, bolt, or rivet other joints and connections.
  7. Grind exposed welds flush.

- B. Continuous Base:
  1. Form into channel profile for stiffness.
  2. Fabricate in lengths as long as practical to enclose base and base ends of metal lockers.
  3. Finish: Match lockers.
- C. Continuous Sloping Tops:
  1. Fabricate in lengths as long as practical, without visible fasteners at splice locations.
  2. Finish: Match lockers.
  3. Miter corner filler pieces.
- D. Finishing:
  1. Pre-treat with degreasing and phosphatizing process.
  2. Apply baked on enamel finish to all surfaces, exposed and concealed, except plated and non-ferrous metal.
  3. Minimum finished film thickness: 0.75 mil for all exterior surfaces and 0.5 mil for all interior surfaces.
- E. Colors:
  1. As specified on Finish Key.
  2. Non-exposed surfaces may be manufacturer's standard neutral color.

**2.4 LOCKER SCHEDULE**

| <b>Locker Schedule – Metal Lockers</b>   |                  |                  |   |                     |                    |                  |                          |
|--|------------------|------------------|---|---------------------|--------------------|------------------|--------------------------|
| <b>Room#</b>   | <b>Room Name</b> | <b>Frame QTY</b> | <b>Frame Dimensions (Overall)</b>                 | <b>Frame Config</b> | <b>Total Units</b> | <b>Lock Type</b> | <b>REMARKS</b>           |
| B26  | Shower/Toilet    | 2                | 18" W x 18" D x 48" H                             |                     | 2                  |                  | Built-in                 |
| 140  | Pre-Gown         |                  | 18" W x 12" D x 36" H<br>each 72" total plus base |                     | 20                 | Captive Key Lock | Freestanding doublestack |
| <p><b>General Notes:</b></p> <p>"Frame QTY" refers to the number of locker frames. (a "frame" may be subdivided in to multiple locker compartments)</p> <p>"Frame Dimension" refers to overall dimension. To determine approximate height of individual compartments: Divide overall frame height by the number of tiers.</p> <p>"Total Units" refers to the total number of individual locker compartments.</p> |                  |                  |   |                     |                    |                  |                          |

**PART 3 - EXECUTION**

**3.1 EXAMINATION**

- A. Examine walls, floors, and support bases, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Insure that adequate Wall Backing has been installed:
  1. Metal Wall Backing: Specified in Section 09 22 16.
  2. Coordinate and direct installation of backing where required for Lockers and accessories.
- C. Correct unsatisfactory conditions.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

**3.2 INSTALLATION**

- A. Install lockers in accordance with the manufacturer's instructions:
  1. Install plumb, level, rigid, and flush.

- B. Space fasteners not over 36 IN OC and apply through suitable reinforcing plates where necessary to prevent metal distortion:
  - 1. Conceal all fasteners wherever possible.
  - 2. Use suitable anchors to provide secure anchorage.
- C. Install trim and metal base pieces to provide flush, hairline joint against adjacent surfaces:
  - 1. Install with concealed bolts.
  - 2. Provide filler and closure pieces as required.
- D. Touch up marred finishes, or replace as directed by Architect:
  - 1. Use only materials and finishes as recommended or furnished by locker manufacturer.
- E. Adjust doors and latches to operate easily without bind.
- F. Verify satisfactory operation of locking devices.

### **3.3 ADJUSTING, CLEANING, AND PROTECTION**

- A. Clean, lubricate, and adjust hardware:
  - 1. Adjust doors and latches to operate easily without binding.
  - 2. Verify that integral locking devices operate properly.
- B. Protect metal lockers from damage, abuse, dust, dirt, stain, or paint:
  - 1. Do not permit use during construction.
- C. Touch up marred finishes, or replace metal lockers that cannot be restored to factory-finished appearance:
  - 1. Use only materials and procedures recommended or furnished by locker manufacturer

**END OF SECTION**



**HDR**

**D I V I S I O N    1 1**

**EQUIPMENT**



**SECTION 11 13 17**  
**DOCK BUMPERS**

**PART 1 - GENERAL**

**1.1 SUBMITTALS**

- A. Project information:
  - 1. Manufacturer of listed products.

**1.2 PRODUCT DELIVERY, STORAGE AND HANDLING**

- A. Deliver anchorage items in time for installation.

**1.3 JOB CONDITIONS**

- A. Furnish templates and anchor accessories.

**PART 2 - PRODUCTS**

**2.1 MATERIALS**

- A. Acceptable manufacturers:
  - 1. Dock Bumpers:
    - a. Base:
      - 1) Rite-Hite.
    - b. Optional:
      - 1) Durable.
      - 2) Pawling.
      - 3) Serco.
- B. Dock Bumpers:
  - 1. Laminated tread type.
  - 2. Multiple plies cut from fabric reinforced rubber truck tires, assembled under high pressure on steel supporting rods or bar with steel closures and attachment assembly.
  - 3. Use plies cut to uniform size extending not less than 4 IN from face of dock when in place.
  - 4. Mount with structural steel angle closures not less than 1/4 IN thick.
  - 5. Size angles to allow face of tread plies to extend not less than 1 IN beyond standing legs of closure angles with other leg sized to allow for attachment.
  - 6. Bumper dimensions as indicated.

**PART 3 - EXECUTION**

**3.1 INSPECTION**

- A. Examine substrate for suitability for installation.
- B. Correct unsatisfactory conditions.
- C. Installation constitutes acceptance of responsibility for performance.

**3.2 INSTALLATION**

- A. Install bumpers, as indicated, 1 IN below dock level, and in horizontal direction.

- B. Attach to structure.
  - 1. Verify and coordinate location and size of inserts.
- C. Attach to concrete construction by drilling or anchoring as follows:
  - 1. Mount using drilled anchors.

**END OF SECTION**

## SECTION 11 24 26

### HORIZONTAL LIFE LINE SYSTEM FOR FALL ARRESTMENT

#### PART 1 - GENERAL

##### 1.1 DESCRIPTION

- A. Description of system:
  - 1. Design, fabrication, and installation of safety tie-backs anchored to the roof structure for the purpose of general building maintenance including:
    - a. Horizontal Life Line System.
    - b. Signage indicating safe usage and restrictions.
    - c. Instructional materials.
  - 2. Anchors located (see Roof Plan Drawings) such that trained personnel can safely perform maintenance with roof equipment. Coverage shall include the following areas:
    - a. Access to lightning protection and gutter system.

##### 1.2 QUALITY ASSURANCE

- A. Design criteria:
  - 1. Design to comply with OSHA 10 CFR 1936 Subpart M and ASNI/ASSE Z359 Fall Protective Code.
  - 2. Design to comply with Local Building Codes and Standards.
  - 3. Design system, to support a minimum of two workers attached to the same horizontal lifeline in the worst case configuration.
  - 4. Complete design of system with drawings and calculations sealed by a registered Engineer licensed to practice Structural Engineering in the State of New York, and meeting the requirements of a qualified person in ANSI/ASSE Z359.2-2007, Section 3.2.3.
  - 5. Locations shown on the Drawings are conceptual. Actual locations are to be determined by the qualified person designing the system. Considering the worst case configuration of two individuals attached to the horizontal lifeline using the specified components for the fall arrestment system while meeting the requirements of ANSI/ASSE Z359 Fall Protective Code.
- B. Applicator/erector qualifications:
  - 1. Fabricators minimum of 5 years experience in design, fabrication and installation of similar size and scope systems.
  - 2. Installation: By installer with minimum 5 years experience in installation of similar systems, or by fabricator.
  - 3. Manufacturers must have specific liability insurance in excess of \$2,000,000 to cover the failure on the installed system.

##### 1.3 SUBMITTALS

- A. Shop Drawings:
  - 1. Showing anchorage locations and details.
  - 2. Showing proposed rigging arrangements which might be used to reach windows, including Bosun's chair, drop-stage and/or other methods.
- B. Product data.
- C. Project Information:
  - 1. Manufacturer's installation instructions and recommendations.
  - 2. Certificate stating system has been designed by registered Engineer, licensed to practice Structural Engineering in the state where project is located.
  - 3. Instructional information regarding safe usage and restrictive uses.

- D. Contract Closeout Information:
  - 1. Operating and maintenance data.
  - 2. Certificate demonstrating manufacturer's liability insurance.
  - 3. Warranty.

#### **1.4 PRODUCT DELIVERY, STORAGE AND HANDLING**

- A. Deliver Horizontal Life Line System to steel erector for installation, and assist with installation.

#### **1.5 JOB CONDITIONS**

- A. Sequence and coordinate work with other affected component supplier/installers to create a totally integrated, functioning, weathertight system.

#### **1.6 WARRANTY**

- A. Manufacturers must have specific liability insurance in excess of \$2,000,000 to cover the failure on the installed system.
- B. Jointly with roofer, warrant water integrity of roof penetrations, for same period.
- C. Replace components which fail at no cost to BNL.

### **PART 2 - PRODUCTS**

#### **2.1 MATERIALS**

- A. Acceptable manufacturers:
  - 1. Horizontal Life Line System:
    - a. Base:
      - 1) Tractel, Inc..
    - b. Optional:
      - 1) HY-Safe Technology.
      - 2) Miller by Sperian, Sky Grip System.
      - 3) Soll.
      - 4) Guardian Fall Protection.
      - 5) Approved equal.
- B. Design of a system of roof anchorages including locations and details as required to meet codes and requirements specified in 1.2 QUALITY ASSURANCE above. Locations shown of roof anchorage on the Drawings are conceptual. Actual locations are to be determined by the qualified person designing the system, considering the worst case configuration of two individuals attached to the horizontal lifeline using the specified components for the fall arrestment system while meeting the requirements of ANSI/ASSE Z359 Fall Protection Code.
- C. Standards for components:
  - 1. Exposed structural stainless steel: Type 304, with a yield strength of 42 KSI.
  - 2. Non-Exposed structural components: ATSM-A36, Type 350W with yield strength of 50 KSI for Hollow Structural Steel and 42 KSI for Plate Steel and other sections.
  - 3. Galvanizing: ASTM-A123.
  - 4. Cold -Rolled Sections: ASTM-A500 with yield strength of 55 KSI.
  - 5. Fastening devices: ASTM A325 or Type 304 stainless steel.
  - 6. Fall Arrestment System Components: ASNI/ASSE Z359.2-2007.
- D. Provide anchorage components fabricated of materials compatible with substrates they are to be welded or otherwise attached to.
- E. Flashing/Counterflashing:
  - 1. Specified in Section 07 62 00.

## **2.2 FABRICATION**

- A. Provide continuous horizontal lifeline system, including but not limited to galvanized steel hollow section pier supports, stainless steel safety U-bars, cable, stainless steel standard and mobile intermediate support brackets, corner units, stainless steel end terminal hardware, and 4 sets of stainless steel lanyard cable runners, full body harnesses and lanyards complete with shock absorbers:
  - 1. Lanyard cable runners shall follow user along the cable and mechanically bypass intermediate brackets without disconnecting.
  - 2. Cable system entry points shall be equipped with prominently displayed non-corrosive data plate that clearly states maximum service capacity and number of users.
- B. Provide plates, bolts, nuts, washers and other fasteners, anchors and attachments required for complete installation and operation.
- C. Acceptable product: "Travsafe" by Tractel, Ltd.

## **PART 3 - EXECUTION**

### **3.1 INSPECTION**

- A. Correct unsatisfactory conditions.
- B. Start of work constitutes acceptance of conditions and responsibility for performance.

### **3.2 INSTALLATION/ERECTION**

- A. Install components required to be attached to or connected with structure.
- B. Coordinate as required.
- C. Install in accord with manufacturer's instructions and approved shop drawings.
- D. No through-wall style anchors may be used unless approved by Architect.
- E. Install top of safety tie-back at 6 IN (Minimum) above adjacent roofing height, taking into account the insulation thickness at each tie-back location.
- F. Where contact is made between dissimilar materials, protect to prevent corrosion.
- G. Coordinate components indicated to be installed on other affected building components with those supplier/installers.
- H. Retouch damaged galvanizing in accordance with manufacturer's instructions, if any.
- I. Design components for attachment directly to structural steel members.

### **3.3 FIELD QUALITY CONTROL**

- A. Check welds to structure.
- B. Verify water integrity of flashings, with roofer.
- C. Verify components are installed in accordance with manufacturer's instructions and approved shop drawings.

**END OF SECTION**



**SECTION 11 52 13**  
**PROJECTION SCREENS**

**PART 1 - GENERAL**

**1.1 SUBMITTALS**

- A. Contract closeout information:
  - 1. Operating and maintenance data.
  - 2. BNL instruction report.

**1.2 JOB CONDITIONS**

- A. Coordinate with ceiling installers where recessed units are specified.

**PART 2 - PRODUCTS**

**2.1 MATERIALS**

- A. Acceptable manufacturers:
  - 1. Projection screens:
    - a. Base:
      - 1) Da-Lite Screen.
      - 2) Draper Shade and Screen.
      - 3) Bretford Manufacturing.
  - 2. All components of each screen by same manufacturer.
- B. Projection screens, motor operated, recessed: Remotely controlled units for mounting indicated.
  - 1. UL listed.
  - 2. Mount top of screen fabric to metal roller supported on brackets with self-aligning bearings.
  - 3. Screen case: Wood with metal-lined motor compartment, with double top for rigidity, sound deadening, hinged or removable access panel to motor compartment, hinged motor driven bottom door which automatically opens and closes with raising and lowering of screen, electrical outlet box, and manufacturer's standard prime coat.
  - 4. Motor unit: Size and capacity recommended by screen manufacturer. Use instant reversing, gear drive motor with permanently lubricated ball bearings, automatic thermal overload protection.
  - 5. Controls: Limit switches to automatically stop screen in "up" and "down" positions. 3-button remote control switch ("up", "down", and "stop") in box with cover plate for flush wall-mounting. Positive stop action to prevent coasting.
  - 6. Screen: Flame and mildew-resistant, white, chemically coated glass bead surface with black border.
  - 7. Base Product: Da-Lite, "Executive Electrol".
  - 8. Size: 8 x 8 FT.

**PART 3 - EXECUTION**

**3.1 INSPECTION**

- A. Examine substrates and conditions under which units are to be installed.
- B. Correct unsatisfactory conditions.
- C. Installation constitutes acceptance of responsibility for performance.

### **3.2 INSTALLATION**

- A. Install screens and accessories at locations indicated in accordance with manufacturer's instructions.
- B. Install level, plumb, secure, and at proper height.
- C. Protect installed units so they will be in perfect condition at completion of project.

### **3.3 CONTRACT CLOSEOUT**

- A. Clean components: See Division 01.
- B. Perform demonstration and instruction: See Division 01.

**END OF SECTION**

**SECTION 11 53 00**  
**LABORATORY EQUIPMENT**

**PART 1 - GENERAL**

**1.1 SUMMARY**

A. Work Included:

1. Furnish and install all laboratory equipment with necessary components and accessories required to ensure a complete installation and ready for intended use as specified herein and shown on the Laboratory Furnishings Drawings.
2. Provide side panels to cover all exposed sides of cabinet-type equipment designed for under-counter installation.
3. Although such work is not specifically shown or specified, furnish and install all supplementary or miscellaneous items, appurtenances and devices incidental to or necessary for a sound, secure and complete installation.
4. Work of this section requires close coordination with work of Division 22, 23, 24 and 26 as well as installation of BNL furnished components and work specified in other Sections. Sequence all work to assure an orderly progress in the project without removal of previously installed work and so as to prevent damage to finishes and products.
5. Utility Requirements: Mechanical and electrical services have been designed for the services and loads as described for individual equipment items herein. If a manufacturer requires services in excess of those indicated, either of type, size, quantity or quality, that cost will be borne by the Contractor and shall not be justification for a change order.
6. Refer to Equipment Schedule included in this specification.
7. Refer to Laboratory Design Data for discipline specific utility information.
8. Equipment listed in this specification is classified by who furnishes (F) and installs (I) equipment items:
  - a. OFOI: BNL furnished/BNL installed.
  - b. OFCI: BNL furnished/contractor installed.
  - c. CFCI: Contractor furnished/contractor installed.

**1.2 LABORATORY EQUIPMENT SCHEDULE**

| EQ #       | DESCRIPTION                         | PROVIDED BY | REMARKS  |
|------------|-------------------------------------|-------------|--|
| E-1        | Vertical Laminar Flow Hood          | CFCI        | NuAire NU-430-600 – HEPA Filtered                      |
| E-2 & E-2A | Gas Cylinder Storage Cabinet        | CFCI        | Matheson Tri-Gas 1CE & 2CE w/ exhaust and alarm wiring |
| E-3        | Undercounter Glassware Washer/Dryer | CFCI        | Labconco Model 4400320                                 |
| E-4        | Cylinder Restraints                 | CFCI        | USA Safety Solutions GB—FS (Wall Mounted)              |
| E-5        | Cylinder Racks                      | CFCI        | Safe-T-Rack(Floor Mounted)                             |
| E-6        | Balance Station (4 Foot)            | CFCI        | Labconco 4' XPert Filtered Station Model # 3940461     |
| E-7        | Balance Station (5 foot)            | CFCI        | Labconco 5' XPert Filteres Station Model # 3946501     |

### **1.3 UNDIVIDED RESPONSIBILITY**

- A. Unless specified otherwise, because of special coordination requirements, the scope of work described in this Section shall be provided by the supplier of the Section 12 35 53 scope of work Related Sections.

### **1.4 REFERENCES**

- A. Standards:
  - 1. ASTM A167: Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip; 1999.
  - 2. ASTM E84: Standard Test Method for Surface Burning Characteristics of Building Materials; 2000a.
  - 3. ASTM MT1010: Support Columns.
  - 4. ASME Section VIII, Division 1, Unfired Pressure Vessels Code: for steam coils.
  - 5. UL 1262, as certified by ETL Testing Laboratory Inc. (except units with pH neutralization and detergent monitoring system).

### **1.5 SUBMITTALS**

- A. Submit as specified herein and under provisions of Section 01 33 00.
- B. Materials List/Product Data: Submit for review a complete materials list, including catalog data and performance data of all materials, equipment, and products for work in this Section.
- C. Shop Drawings: Submit complete shop fabrication and installation drawings, including plans, elevations, sections, details, finished and materials dimensions, utility connections and locations, sizes and loads, and schedules. Show relationship to adjoining materials and construction and requisite service, operating and installation clearances. Piping and wiring diagrams shall be included. Shop Drawings shall be in the form of reproducible or photocopies, not to exceed 11 inches by 17 inches (A3) in size. Blue-line or black-line prints are not acceptable.
- D. Samples: Submit for Architect's approval two (2) samples of each type of specified finish and color range available.
- E. Certifications: As a condition of acceptance, submit certification stating that equipment is complete and ready for intended function.
- F. Informational Submittals:
  - 1. Notice of factory testing.
  - 2. Manufacturer's installation, start-up and adjustment instructions.
  - 3. Statement of installer qualifications.
  - 4. Start-up report.
  - 5. Demonstration and instruction report.
  - 6. Factory Authorized Testing (FAT) Procedures: Requirements and Documentation. Include NIST calibration documentation.
  - 7. Operations/Maintenance Manuals: Accompanying certification, submit for Architect's review and BNL's use, complete operating and maintenance manuals that describe proper operating procedures, maintenance and replacement schedules, components parts list, including non-proprietary parts, and closest factory representative for components and service. Manual shall include non-proprietary list of all valves and other serviceable components.

## **1.6 REGULATORY REQUIREMENTS AND SUBSTITUTIONS**

- A. Regulatory:
  - 1. Specified products, materials, or systems for Project may include engineering or on file standards required by the Regulatory Agency. Contractor's substitution of products, materials or systems may require additional engineering, testing, reviews, approvals, assurances, or other information for compliance with Regulatory Agency requirements or both. Contractor shall provide all Agency approvals or other additional information required, and pay for additional costs required for Architect's services made necessary by the substitution at no increase in Contract Sum or schedule time, and as a part of substitution proposal.
  - 2. When applicable, comply with:
    - a. Underwriters Laboratory Standards.
    - b. National Electrical Code.
- B. Substitutions:
  - 1. Substitution shall not affect dimensions shown on Drawings.
  - 2. The Contractor shall pay for changes to the building design, including engineering design, detailing, utility and service requirements, and construction costs caused by the requested substitution.
  - 3. Substitutions shall have no adverse affect on other trades, the construction schedule, or specified warranty requirements.
  - 4. Maintenance and service parts shall be locally available for the proposed substitution.

## **1.7 PRODUCT HANDLING**

- A. Protection: Use all means necessary to protect work of this section before, during and after installation including installed work and materials of other trades. Maintain polyethylene film or other protective covering until start-up.
- B. Delivery of laboratory equipment shall occur after wet operations in building are completed.
- C. Receiving, distribution, and storage areas shall be of sufficient size and capacity to accommodate crated equipment.
- D. Laboratory equipment shall be stored in a ventilated area, protected from weather, with relative humidity of 50 percent or less at 70 degrees F (21 degrees C).
- E. Replacement: Any damage as a result of this contractors work will be replaced, repaired and restored to original condition to the approval of the Architect at no additional cost or inconvenience to BNL.

## **1.8 QUALIFICATIONS**

- A. Contractor for work in this section shall have an established organization and production facilities including all tools, equipment and special machinery necessary for specializing in the fabrication and installation of the type of equipment specified, with skilled personnel, factory trained workmen and an experienced engineering department. Each shall have the demonstrated knowledge, ability and the proven capability to produce the specified equipment of the required quality and the proven capacity to complete an installation of this size and type within the required time limits. Contractor and manufacturers for work of this section shall have a minimum of five years and ten installations experience installing products specified.

## **PART 2 - PRODUCTS**

### **2.1 EQUIPMENT LISTING**

- A. Vertical Laminar Flow Hood, 6'-0" (E-1): CFCI:
  - 1. Manufacturers:

- a. Nuair, 2100 Fernbrook Lane, Plymouth, MN 55447  
Phone: 800-328-3352  
[www.nuair.com](http://www.nuair.com)
  - b. Baker, POB Drawer E, Sanford, MA 04073  
Phone: 800-992-2537  
[www.bakerco.com](http://www.bakerco.com)
  - c. Fisher-Hamilton, 1316 18th Street, Two Rivers, WI 54241  
Phone: 414-793-1121  
[www.fisherhamilton.com](http://www.fisherhamilton.com)
2. Unit Designation:
    - a. Unit to be equal to the Nuair – Model NU-430-600 HEPA Filtered.
    - b. Options and accessories per equipment cut sheets:
  3. Cabinet shall provide airflows & biological safety performance as specified:
    - a. Cabinet shall provide containment protection for both operator and product proven by an actual test, (e.g. test conducted by NSF) and routinely validated by NuAir.
    - b. Cabinet shall be single pass flow through design in which all HEPA filtered work zone and work access inflow air, is drawn through the cabinet's internal exhaust HEPA filter and exhaust duct work to a remotely located roof exhaust blower.
    - c. Cabinet shall be constructed from 16GA, Type 304 stainless steel forming an all welded, monolith, sealed structure.
    - d. Cabinet shall be easily fumigated employing an established procedure such as that recommended by NIH or NSF.
    - e. Supply HEPA filter shall be of full cabinet work zone width and depth; work zone below supply HEPA shall be of fixed cross-sectional area (sloping back wall or viewing window is unacceptable).
    - f. Supply HEPA filter shall be protected by a perforated metal diffuser covering the entire top of the work zone.
    - g. Air velocity from the supply filter shall average 55 to 65 FPM (.28 to .33 m/s) with no single point outside the 20% of average range measured in a horizontal plane defined by 4 inches (102mm) above the bottom edge of window.
    - h. Work access opening shall be 8 inches (203mm) high. Average inflow velocity shall nominally be 105 LFPM (.53 m/s). The cabinet shall be ergonomically designed for maximum user comfort and adjustability to meet the requirements of the American Disabilities Act (ADA):
      - 1) Standard non-metallic armrest/airfoil incorporating a large 1-1/2 inch (38mm) forearm support area with 1/2 inch (12mm) recessed front grill, designed for arm rest comfort while maintaining containment performance.
      - 2) Maximum visibility into cabinet workzone shall be at least 20-1/2 inches (521mm) from front access airfoil to exterior light housing.
      - 3) Cabinet shall have a centrally located instrument panel within the control center that is easily serviced with quick disconnects.
      - 4) Cabinet shall have the capability of incorporating a user-adjustable basestand or base storage cabinet as an option.
      - 5) The cabinet shall have a smooth operating sliding window from 1.125 inches (29mm) closed to full opening at 18-1/2 inches (470mm).
      - 6) Cabinet shall have a large worktray (17.875 inch (454mm) depth) (17.375 inch (441mm) depth, NU-430-300) removable with coved corners for easy cleaning.
    - i. The cabinet shall have all positive pressure plenums surrounded by a vacuum relative to the room (the LABGARD™ employs the HEPEX™ Zero Leak Airflow System).
    - j. Electrical power shall be supplied with a 12 foot (2.5m), 3-wire cord. Electrical supply should be 115 or 230 VAC, 50 or 60 Hz protected with thermal circuit breaker from distribution panel.
    - k. The cabinet shall have three (115VAC) or four (230VAC) internal electrical circuits; one each for blower and lights and one for the duplex outlets (115VAC), one for each single outlet (230VAC). Each circuit shall be protected with a fuse located in the control center on the electronic module.

- l. The cabinet shall be listed by Underwriters Laboratories to meet the requirements of both the U.S. and Canada for electrical/mechanical integrity.
  - m. Cabinet shall contain a control system which is a self contained electronic module that will perform the following functions:
    - 1) Easy use interface via color LCD.
    - 2) Control blower motor via solid state triac.
    - 3) Monitor, display and control downflow via digital dual thermistor airflow probe.
    - 4) Monitor, display and optionally control exhaust flow (inflow) via digital differential velocity pressure flow grid.
    - 5) Alarm setpoints high/low for error conditions (downflow and exhaust flow).
    - 6) Date/Clock display and timer function.
    - 7) Control lights via solid state switch.
    - 8) Control outlets via solid state switch.
    - 9) Complete diagnostic functions.
  - n. The cabinet shall contain an exhaust interlock system that prevents operation of the internal supply blower unless the exhaust flow is sufficient to provide the correct air barrier inflow velocity at start up.
  - o. The cabinet shall be easily transportable through a standard 36 inch wide door without disassembly.
  - p. Sound level shall be no more than 63 dbA measured 15 inches above the work tray and 12 inches in front of viewing window.
  - q. Fluorescent lighting shall be externally mounted and provide 80 to 150 foot-candles on work surface. The ballast to be electronic containing thermal protection with automatic reset.
  - r. Cabinet shall come standard with one duplex outlet with drip proof covers on left front faring. Two gas valve/service couplings on right side wall:
    - 1) LCW.
    - 2) UN2.
  - s. Both supply and exhaust cabinet duct connections shall be 12 inches in diameter.
  - t. Cabinet shall be a free-standing console model with the addition of the base support stand.
  - u. Cabinet work zone shall be all 16 GA. stainless steel and reinforced with stainless steel U channels to minimize vibration.
  - v. A 3/8 inch (10mm) ball valve shall be provided in the drain trough beneath the work tray.
  - w. Motor/blower shall be positioned so as to create an even filter loading, thereby prolonging the life of the supply HEPA filter, and shall deliver over 80% of the initial HEPA filter static pressure with no more than a 10% decrease of CFM.
  - x. Cabinet shall be capable of front filter removal without disassembly of the control panel and sliding window tracks/hardware.
  - y. The following optional equipment shall be available to support installation and user requirements:
    - 1) Bag In/Bag Out of Exhaust HEPA Filter with Single Point External Filter Release
    - 2) Ultraviolet Light.
    - 3) Ground Fault Interrupter for Electrical System.
    - 4) Base Support Stand - (available in standard working surface heights of 30 or 36 inches with storage shelves).
    - 5) Sink with LCW Water Faucets.
    - 6) Storage Pull-Out Trays.
    - 7) Decorative Side Panels (hides plumbing fixture connections).
    - 8) HEPA Filters 99.999% @ 0.3 Micron.
- B. Gas Cylinder Storage Cabinet (E-2 & E-2A): CFCI:
1. Manufacturers:
    - a. Matheson Tri-Gas, 166 Keystone Drive, Montgomeryville, PA 18936  
Phone: 800-828-4313



Phone: 608-630-1572

[www.usasafety.com](http://www.usasafety.com)

2. Unit Designation:
    - a. Unit to be equal to Safe-T-Rack Models 2422 & 3422.
    - b. Options and accessories per equipment cut sheets.
    - c. Provide blocking in wall where applicable.
    - d. See plans for number of cylinders.
- F. Balance Station – 4’-0” (E-6): CFCI:
1. Manufacturers:
    - a. Labconco Corporation, 8811 Prospect Avenue, Kansas City, MO 64132-2696 Phone: 800-821-5525. [www.labconco.com](http://www.labconco.com)
    - b. Flow Sciences, Inc., 2025 Mercantile Drive, Leland, NC Labconco , Phone: Corporation, 8811 Prospect Avenue, Kansas City, MO 64132-2696 Phone: 800-849-3429. [www.flowsciences.com](http://www.flowsciences.com)
    - c. Rice Lake Weighing Systems, 230 West Coleman Street, Rice Lake, WI 54868. Phone: 800-472-6703. [www.ricelake.com](http://www.ricelake.com)
    - d. Substitutions are not permitted.
  2. Unit Designation:
    - a. Unit to be equal to Labconco XPert Filtered Balance Station #3940461.
    - b. Options and accessories per equipment cut sheets.
- G. Balance Station – 5’-0” (E-7): CFCI:
1. Manufacturers:
    - a. Labconco Corporation, 8811 Prospect Avenue, Kansas City, MO 64132-2696 Phone: 800-821-5525. [www.labconco.com](http://www.labconco.com)
    - b. Flow Sciences, Inc., 2025 Mercantile Drive, Leland, NC Labconco , Phone: Corporation, 8811 Prospect Avenue, Kansas City, MO 64132-2696 Phone: 800-849-3429. [www.flowsciences.com](http://www.flowsciences.com)
    - c. Rice Lake Weighing Systems, 230 West Coleman Street, Rice Lake, WI 54868. Phone: 800-472-6703. [www.ricelake.com](http://www.ricelake.com)
    - d. Substitutions are not permitted.
  2. Unit Designation:
    - a. Unit to be equal to Labconco XPert Filtered Balance Station #3946501.
    - b. Options and accessories per equipment cut sheets.

## **PART 3 - EXECUTION**

### **3.1 PREPARATION**

- A. Coordinate location, size, and type of mechanical, power and communications services required.
- B. Before shipping, equipment shall be cleaned inside and outside, be free of rust, loose scale, and other deposits. Finished surfaces shall be protected to prevent shipping and/or storage damage. All threaded connections, flanges, and couplings shall be protected.
- C. Equipment to be disassembled before shipment to allow for rigging through a 72 inch by 84 inch door frame at the job site. Delivery shall be coordinated so that equipment can be positioned in-place prior to installation of door frames of smaller dimensions.
- D. Equipment to be securely crated and/or packaged to prevent damage during shipment. Loose parts shipped inside of the unit shall be secured.
- E. The vendor shall be responsible for delivery of the unit(s) to the job site, setting the equipment in place, unpacking and reassembly.
- F. The vendor shall verify that required utilities are available, in proper locations, and ready for use.

- G. Beginning of installation means acceptance of existing conditions by the vendor.
- H. Upon unpacking of the equipment, the vendor shall remove all debris, crating material and packaging from the location.

### **3.2 SITE CONDITIONS**

- A. Inspection: Prior to installation of laboratory equipment, carefully inspect the installed work specified in other Sections and verify that all such work is complete to the point where this installation may properly commence.
- B. Discrepancies: In the event of discrepancy, immediately notify the Architect.

### **3.3 EXAMINATION**

- A. Examine surfaces designated to receive work for conditions that would adversely affect the finished work. Repair or replace surfaces not meeting tolerances or quality requirements governing substrate construction prior to start of work.
- B. Verify that surfaces, prepared openings, or support structures are ready to receive work.
- C. Verify field measurements and opening dimensions are as instructed by manufacturer.
- D. Inspect and verify that the required utilities are available, in proper locations and ready for use, prior to equipment installation.

### **3.4 WORK REQUIRED OF OTHER SECTIONS PRIOR TO INSTALLATION**

- A. Install shutoff valves on service lines.
- B. Install fused disconnect switches (with lockout in OFF position) in electric supply lines near the equipment.
- C. Provide building service lines supplying specified pressures and flow rates.
- D. Provide illumination of service area, with provision of convenience outlet for maintenance.

### **3.5 STARTUP AND TESTING**

- A. Test, clean, and adjust equipment and apparatus installed to ensure performance meets specified requirements.
- B. Operate each unit and test full range of cycles over a continuous period. Record test data.
- C. Adjust and re-test any units not meeting requirements.

### **3.6 DEMONSTRATION AND INSTRUCTIONS**

- A. Test equipment prior to demonstration. Ensure equipment, including specified accessories, is operational.
- B. Provide demonstration of equipment operation and instruction of BNL's personnel.
- C. Demonstrate operating capability of equipment and systems. Include control and safety features, and service and maintenance procedures.
- D. Engage services of qualified instructor to instruct and train BNL's operating and maintenance personnel in operation, service, and maintenance of equipment. Provide at least two hours of instruction for each type of equipment.

### **3.7 CLEANING AND PROTECTION**

- A. All equipment shall be protected before, during and after installation. Protect from paint, debris, and damage in the course of the construction sequence. Damage to material due to improper protection shall be cause for rejection.

- B. Packaging and debris and other waste resulting from installation of equipment shall be removed.
- C. At no time shall worker use the installed equipment as a work bench, scaffolding, or for other uses.
- D. Repair or remove and replace defective Work as directed by the Architect upon completion of installation.
- E. Clean finished equipment, touch up as required and remove and refinish damaged or soiled areas.
- F. Prior to final acceptance by BNL, equipment that has become damaged will be repaired or replaced according to the terms of the warranty and any external soiled surfaces will be cleaned.

**END OF SECTION**



**SECTION 11 53 13**  
**FUME HOODS AND EXHAUST DEVICES**

**PART 1 - GENERAL**

**1.1 SECTION INCLUDES**

- A. Chemical Fume Hoods, including bench mounted hoods, floor-mounted hoods, and high performance/low velocity hoods.
- B. Fume Extractor Arms (Snorkels).
- C. Ventilated Balance Safety Enclosures.
- D. Custom Ventilated Enclosures (Exhaust Enclosure).

**1.2 UNDIVIDED RESPONSIBILITY**

- A. Unless specified otherwise, because of special coordination requirements, the scope of work described in this Section shall be provided by the supplier of the Section 12 35 53 scope of work.

**1.3 RELATED SECTIONS**

- A. Canopy hoods and low slotted exhausts are specified in Section 12 35 53 under Stainless Steel Fabrications.

**1.4 DESCRIPTION**

- A. Provide chemical fume hoods, fume extractor arms, ventilated balance safety enclosures, and custom enclosures complete with accessories as described herein, and shown on Laboratory Furnishings drawings.
- B. Fume hoods with accessories shall be pre-piped and pre-wired:
  - 1. Pre-pipe service fittings to single point connection for each service at 6 IN above top of hood or as otherwise shown. Cup sink tailpiece shall be provided with fume hood. Refer to Section 11 53 43 and details on Laboratory Furnishings drawings for service fittings. P-trap, waste piping and tailpiece extensions for cup sinks, if required, shall be furnished and installed by Division 22. Comply with Division 22 requirements for piping and installation requirements.
  - 2. Pre-wire all electrical devices to junction box at top of hood. Provide wire terminal blocks and terminal identification. Comply with Division 26 requirements for electrical work. Lighting fixtures, electrical outlets, switches, wiring, terminal blocks, terminal boxes, safety alarms and other electrical devices mounted on or in fume hoods shall be approved for use in any Class 1, Division 2 locations indicated on the drawings.
  - 3. Work of this Section requires close coordination with Work of Divisions 22, 23, 25 and 26, as well as installation of BNL furnished components and Work specified in other Sections. Sequence all Work to ensure an orderly progress in the project without removal of previously installed Work and so as to prevent damage to finishes and products.

**1.5 REFERENCES**

- A. ASHRAE 110, latest edition, Method of Testing Performance of Fume Hoods.
- B. Work shall conform to the recommended practices of the Scientific Equipment and Furniture Association (SEFA), current version, except as superseded by this specification:
  - 1. SEFA 1 - Fume Hoods.
  - 2. SEFA 2 - Installation.
  - 3. SEFA 3 - Laboratory Work Surfaces.

4. SEFA 7 - Fixtures.
  5. SEFA 8 M - Laboratory Grade Metal Casework.
  6. SEFA 8 P - Laboratory Grade Polypropylene Casework.
- C. Occupational Safety and Health Administration, Federal Register 29 CFR Part 1910, "Occupational Exposures to Hazardous Chemicals in Laboratories."
  - D. American National Standards Institute/American Industrial Hygiene Association (ANSI/AIHA) Z9.5 "Standard for Laboratory Ventilation."
  - E. National Fire Protection Association (NFPA) 45 "Standard on Fire Protection for Laboratories Using Chemicals."
  - F. American Conference of Government Industrial Hygienists (ACGIH) "Industrial Ventilation."

## **1.6 SUBMITTALS WITH PROPOSAL**

- A. Description of hoods, including construction details, materials, gauges, sash lock and release procedure, hardware cut sheets, piping of equipment and description of re-lamping procedures.
- B. Statement giving face velocity, operating volume and pressure drop at operating sash position for each size hood.
- C. Description of proposed factory dynamic testing procedures.

## **1.7 SUBMITTALS**

- A. Submit as specified herein and under provisions of Section 01 33 00.
- B. Materials List/Product Data: Submit complete materials list, including catalog data of all materials, equipment, fan curves, test designs, performance charts, and products for Work specified in this Section.
- C. Shop Drawings:
  1. Submit complete shop fabrication and installation drawings, including plans, elevations, sections, dimensions, materials and metal gauge sizes, details, fittings, duct connections, schedules, and steam table piping and vents from cabinets below where applicable. Show relationship to adjoining materials and construction. Identify all connection points, locations and sizes to building services and systems. Provide clear identification where equipment requirements deviate from the service/utility provisions in the Construction Documents. Shop Drawings shall be in the form of reproducible or photocopies, not to exceed 11 IN by 17 IN in size. Blue line prints are not acceptable.
  2. Coordinate shop drawing submittals of both this Section and Section 12 35 53 so that each recognizes and incorporates each others products.
- D. Submit detailed anchorage and attachment drawings and calculations provided by a licensed Structural Engineer complying with the applicable Building Code seismic restraint requirements:
  1. Fume hoods shall be designed and anchored in accordance with IBC 2000 Seismic Design Category C requirements.
- E. Samples: Submit two (2) samples of each type of specified finish and color range available, or as identified in the Finish Schedule.
- F. Certification: Submit certification by an independent testing company stating that equipment is installed per applicable and referenced codes and standards, adjusted and balanced for design operations, and is complete and ready for intended function:
  1. Certify that fume hoods will not exceed design maximum at specified operating conditions.
- G. "As Manufactured" (AM) Fume Hood Testing in Manufacturing Facility: Provide certification that each type and size of fume hood has achieved an AM performance rating equal or better than 0.05 ppm with 4.0 Lpm tracer gas release rate when tested in accordance with ASHRAE 110-1995 at 60 fpm face velocity at operating sash opening.

- H. Fume Hood Sound Level Certification: Provide certification of fume hood compliance with design criteria for maximum allowable noise within laboratories:
  - 1. For fume hoods operating with a face velocity of 80 fpm, test data of octave band analysis verifying hood is capable of a 50 NC value when connected to a 50 NC HVAC source. Measurements shall be taken 36 IN in front of open sash, 60 IN above the floor, at 80 fpm face velocity.
- I. Informational Submittals:
  - 1. Provide piping, wiring, and/or control diagrams, including all connection points and sizes to building services and systems. Provide flow rates, pressure drops, voltage and amperage, etc.
- J. Closeout Submittals:
  - 1. Operations/Maintenance Manuals: Accompanying certification, submit for Architect's review and BNL's use, complete operating and maintenance manuals that describe proper operating procedures, maintenance and replacement schedules, component parts list, wiring diagrams, and closest factory representative for components and service.

## **1.8 QUALITY ASSURANCE**

- A. Coordinate work of this Section with Section 12 35 53 Laboratory Casework and Furnishings.
- B. Provide interface products of style, material, finish, and color in order to produce a homogenous installation.
- C. Fume Hoods shall be UL tested and labeled and conform to Class A requirements of ANSI Z9.5 Laboratory Ventilation.

## **1.9 QUALIFICATIONS**

- A. Fume Hood Manufacturer:
  - 1. Work in this Section shall be manufactured by a firm having a minimum eight years documented experience, and an established organization and production facilities including all tools, equipment and special machinery necessary for specializing in the fabrication and installation of the type of equipment required with skilled personnel, factory trained workmen and an experienced engineering department. Each shall have the demonstrated knowledge, ability and the proven capability to produce the specified equipment of the required quality and the proven capacity to complete an installation of this size and type within the required time limits.
  - 2. Manufacturer shall maintain a factory test facility which provides variable exhaust and make-up air control. Test facility shall contain, as permanent equipment, ANSI/ASHRAE 110 testing equipment as specified for performance testing.

## **PART 2 - PRODUCTS**

### **2.1 EXHAUST REQUIREMENTS**

- A. Refer to Exhaust Schedule for requirements.
- B. Fume hoods and exhaust devices shall be designed to operate safely within the values provided on the Exhaust Schedule. The airflow values provided on the Exhaust Schedule represent the total airflow through the fume hood or exhaust device, including the airflow through the sash or work opening, airfoil, bypass, and leakage, respectively, as they apply to particular devices. Exhaust devices shall operate at specified face velocity within total airflow scheduled.
- C. Proposed modifications or corrections shall be reviewed and approved by Laboratory Planner and Mechanical Engineer for any device that requires adjustment to operate within specified design requirements.

## 2.2 CHEMICAL FUME HOODS

- A. Manufacturers: Products complying with this specification may be provided by the following manufacturers. All chemical fume hoods shall be the product of a single manufacturer:
1. Hamilton Products, a part of Thermo Fisher Scientific, 1316 18th Street, Two Rivers, WI 54241 Tel: 920 793-1121. website: <http://www.hamiltonlab.com/>
  2. LabCrafters, 2085 Fifth Avenue, Ronkonkoma, NY 11779, [Tel:631 471-7755](http://www.lab-crafters.com/). website: <http://www.lab-crafters.com/>
  3. Mott Manufacturing Limited. 452 Hardy Road, P. O. Box 1120, Brantford, ON, Canada N3T 5T3 Tel: 519 752-7825. website: <http://www.mott.ca>
  4. Kewaunee Scientific Corporation, P O Box 1842, Statesville, NC 28687 Tel: 704 873-7202. - website: <http://www.kewaunee.com/>
  5. Advanced Lab Concepts, 15900 Bratton Lane, Austin, TX 78728, Tel: 800 711-5227. – website: <http://www.alc-corp.com>
  6. Bedcolab Limited, 2305 Francis-Hughes Avenue, Laval QC Canada H7S 1N5 Tel: 514 384-2820 website: [www.bedcolab.com](http://www.bedcolab.com)
  7. Substitutions are not permitted.
- B. Underwriters Laboratory Listing: Fume hoods shall be UL subject 1805 classified. Label shall be attached to the face of each fume hood indicating classification to the UL 1805 standard for Laboratory Fume Hoods.
- C. Materials: The following materials shall be provided, unless superseded by the requirements listed below for specific fume hood types:
1. Steel:
    - a. ASTM A366 high quality, cold rolled, mild steel, and free from rust, scale, scratches, buckles, ragged edges, and other defects.
    - b. Minimum Thickness: 18 gauge.
  2. Stainless Steel:
    - a. Type 304, ASTM 240, with exposed surfaces ground and polished to a No. 4 finish.
    - b. Minimum Thickness: 16 gauge.
    - c. Welding: All stainless steel welding material shall be of similar type to sheet material. Welds shall be made without discoloration, ground, polished, and passivated to blend with a No. 4 finish.
  3. Liner and Baffle:
    - a. Typical: Glass-reinforced polyester panel, flame-retardant and self-extinguishing with smooth finish and white color. Flexural strength: 14,000 psi. Flame spread: 15 or less per U.L. 723 and ASTM E84-80. Baffle shall be same material as liner. Liner thickness: 3/16 IN; baffle thickness: 1/4 IN, minimum. Liner performance characteristics shall be as specified below.
    - b. For Stainless Steel Hood Liner as noted on the drawings: 16 gauge Type 304 stainless steel. Continuously weld liner top to sides; grind welds smooth. Radius all vertical corners 1/2 IN.
  4. Glass: 7/32 IN laminated safety glass. Glass shall not be etched with manufacturer's name, logo, or any other permanent markings, other than to identify the glass as safety glass. Light fixture lens may be tempered safety glass. Safety glass shall be in compliance with ANSI Z97.1.
  5. Sash Guides: Extruded PVC.
  6. Sash pull: Full width corrosion-resistant steel with chemical resistant powder coating, stainless steel, or plastic.
  7. Gaskets: White 70 durometer PVC for interior access panels. Gasket interior access panels to eliminate air leakage and to retain liquids inside hood.
  8. Fasteners:
    - a. Exterior structural member attachments: Sheet metal screws, zinc plated.
    - b. Exposed exterior fastening devices shall be corrosion-resistant, non-metallic material; exposed screws are not acceptable.

- c. Interior fastening devices: Except where specifically allowed by this Specification, interior fastening devices shall be concealed; exposed screws are not acceptable. (Screw head "caps" not acceptable.)
- 9. Instruction Plate: Corrosion resistant or plastic plate attached to the fume hood exterior with condensed information addressing the recommended locations for apparatus and accessories, baffle settings, if adjustable, and use of sash.

D. Construction:

- 1. Superstructure: Rigid, self-supporting assembly of double wall construction, maximum 4 7/8 IN thick. Wall shall consist of a sheet steel outer shell and a corrosion resistant inner liner, and shall house and conceal steel framing members, piping, wiring, attaching brackets, and remote operating service fixture mechanisms and services. Panels shall be attached to a full frame construction, minimum 14 gauge galvanized members. Panels and brackets attached to eliminate screw heads and metallic bracketry from hood interior. Front panels shall be factory-punched for service fittings, electrical, control, and monitoring equipment. Provide stainless steel or epoxy- or urethane-coated plug buttons for holes not used.
- 2. Access Panel: Access to fixture valves and piping concealed in wall shall be through flush access panels on the inside liner walls, or through removable front posts. Panels shall be secured with fitted gasket, tamperproof, epoxy- or urethane-coated, countersunk, flat head screws, or similar method, providing a tight fit. Hook and loop type attachments and panels held by gravity are not acceptable.
- 3. Baffle Adjustment: In standard chemical fume hoods, if adjustable baffles are provided, the adjustment control shall be operable from outside the hood without exposing the user to the hood interior environment and, for ADA compliant hoods, shall be within the reach of a wheel chair bound operator. All baffles, supports, and brackets to be non-metallic. Baffles may be made fixed. Baffles shall be removable for cleaning.
- 4. Baffles: In high performance/low velocity fume hoods, baffles shall be fixed and non-adjustable. Baffles shall be removable for cleaning.
- 5. Ceiling Closure Panels: Provide 18 gauge steel paneled enclosure from top of hood to the ceiling. Enclosure shall include hinged door to access hood lighting fixture, and HEPA filter module where applicable. Finish shall match superstructure exterior. Panels shall terminate 1/4 IN below finished ceiling, where provided, or at 9'-0" above finished floor where there is no finished ceiling.
- 6. Vertical Sash Enclosure:
  - a. Fume hoods shall be provided with sash enclosures, gasketed or sealed penetrations and connections, as required, which limit air leakage to 1 percent of the design air flow quantities indicated on the Exhaust Schedule. Fume hood manufacturer shall remain responsible for achieving the required capture velocity at the specified operating sash height.
  - b. Provide sheet metal enclosure to completely encase vertically operated or combination sashes when sash is in the full open position.
  - c. Enclosure shall prevent air of fume leakage above the fume hood.
  - d. Enclosure shall be easily removed and replaceable to allow access to light fixture housing.
- 7. Trim and Side Panels: Provide matching steel trim and side panels, as required, to finish any openings around and between hoods. Finish shall match superstructure exterior.
- 8. Finished Back: Provide for any fume hood where back of hood is exposed to view. 18 gauge steel sheet. Finish shall match superstructure exterior.
- 9. Exhaust Collar:
  - a. Provide contoured 20 gauge exhaust collar and transition piece, if necessary, to receive circular exhaust duct connection by Division 23. Collar and transition piece shall receive urethane powder coating. Collar shall be stainless steel if hood has stainless steel liner.
  - b. Every hood to have combination exhaust collar 13-1/2 IN high.
- 10. Exhaust Filter Pack Assembly:

- a. All hoods designated as HEPA on the plans should be provided with HEPA filter pack assembly.
  - b. Provide access panel in ceiling enclosure panel to easily change out filter below ceiling.
  - c. Provide 99.99% efficient bagout HEPA filter.
11. Cup Sink:
- a. Oval with raised rim (CS-h), material and color to match work surface, sizes in accordance with drawings. Comply with Section 11 53 43 requirements.
  - b. Rectangular with raised rim (ES-h), color to match work surface, size in accordance with drawings. Comply with Section 11 53 43 requirements.
  - c. For floor-mounted hoods (CS-h), wall-mounted oval molded black epoxy resin complete with strainer, outlet and wall mounting bracket. Comply with Section 11 53 43 requirements.
  - d. Raised Rim Height: 1/4 IN.
12. Piping shall be as specified in Division 22 for respective system.
13. Service Fittings: As shown on Laboratory Furnishings Drawings and specified in Section 11 53 43, factory-installed and complete with all gaskets, grommets and sleeves.
14. Alarm and Controls: Coordinate cut outs for fume hood alarm and controls to be provided under Division 25. All cut outs for alarm and controls shall be made in the factory; field cutting is not acceptable.
15. Electrical Receptacles:
- a. Flush mounting, 120V/20A duplex type, single gang, NEMA 5-20R, 3-wire, grounding type receptacle, one per side, or as indicated on the Fume Hood Schedule, with brushed stainless steel cover plate.
  - b. Flush mounting, 208V/20A single gang, NEMA 6-20R, 3-wire, grounding type receptacle, as indicated on the Fume Hood Schedule, with brushed stainless steel cover plate.
  - c. Color: Receptacles shall be brown with hoods painted dark colors and white for hoods painted white, off white, grey, yellow, or similar colors.
  - d. Interior Receptacles: Factory install flush mount GFCI receptacles on the interior fume hood wall as noted on the Fume Hood Schedule. Receptacles must have a self closing cover plate. Receptacle must have a power kill switch mounted on the fume hood post and clearly labeled as such. This system must be included in the manufacturer's UL 1805 file and approved by UL.
16. Interior Hood Lighting:
- a. Lighting within hood shall be provided by a protected fluorescent lighting fixture with two lamps (32W T8, electronic ballast, rapid start) operated by an exterior switch with stainless steel cover plate located on the face of the fume hood. Lamp size shall not exceed 48 IN; provide multiple fixtures as required.
  - b. Provide safety glass panel cemented and vapor-tight sealed to the hood roof.
  - c. Light level: Average light level on the work surface shall be 80 footcandles, minimum.
  - d. Relamping shall be achieved from outside the hood enclosure.
  - e. Light fixture shall be U.L. listed.
  - f. Color: Switch shall be brown with hoods painted dark colors and white for hoods painted white, off white, grey, yellow, or similar colors.
17. Safety label: Provide self-adhesive polyester label, as described on the drawings. Labels shall indicate safe operating conditions with respect to fume hood sash position. Labels solely indicating 80 fpm face velocity sash position are not acceptable. Manufacturer: Lab Safety Supply Inc., P. O. Box 1368, Janesville, WI 53547 Tel: 800 356-0783, or approved substitution.
18. Hood Finish: Fume hood finish shall comply with SEFA 8 M Cabinet Surface Finish performance requirements.
19. Exterior Color: As selected by Architect from manufacturer's full color line and complying with finish requirements.
20. Through Port: 3 IN inside diameter (or as noted on drawings) threaded polypropylene or polyolefin sleeve with threaded pipe flanges and end caps. Provide rubber membrane inside each end cap with radiating cuts to allow for easy passage of cords and tubing.

21. Pass Thru: 12 IN by 12 IN pass thru sleeve between hoods as noted on drawing.
- E. High Performance/Low Velocity Chemical Fume Hoods:
1. Basis of Design: Hamilton Products, a part of Thermo Fisher Scientific, Concept Hood, or equal, as specified herein.
  2. Drawing Designations:
    - a. 4 FT benchtop: CFH48HV-xx.
    - b. 5 FT benchtop: CFH60HV-xx.
    - c. 6 FT benchtop: CFH72HV-xx.
  3. Depth: See hood schedule. 22 IN interior with 31-1/4 IN exterior, and 28 IN interior with 37-1/4 IN exterior.
  4. Design:
    - a. Restricted bypass fume hoods for variable air volume or constant volume exhaust systems with airfoil. Bypass shall be sufficient in size to allow 25 percent flow with sash closed. Bypass must be achieved through low resistance opening at top of front lintel panel. Bypass shall be designed to provide a smooth down flow effect.
    - b. Design fume hoods for consistent and safe air flow through the hood face. Negative variations of face velocity shall not exceed 20 percent of the average face velocity at any designated measuring point as defined in this section:
      - 1) Fume hoods shall be designed to operate safely at face velocities between 60 FT per minute and 80 FT per minute.
  5. Work Surface: 1-1/4 IN dished epoxy resin, as in compliance with Section 12 35 53 requirements. Color: Black.
  6. Downdraft bypass: Low resistant type, 18 gauge steel chamber; directional louvers are not acceptable. All bypass air shall enter top of bypass chamber and enter hood in a downflow direction. Chamber shall protect user from expelled particulate in the event of an adverse internal reaction.
  7. Airfoil: The airfoil shall allow ample room for electrical hospital grade cords to fit beneath the airfoil. Sill must pivot forward to provide cord and trough access. Bottom horizontal foil shall provide nominal 1 IN bypass when sash is in the closed position. Bottom foil shall not be removable without use of special tools. Airfoil shall be steel with urethane or epoxy powder coating:
    - a. Sill shall consist of a half-round bullnose on front edge. Air foil and sill to be flush with the height of the work surface; airfoil sills that are not flush with the top plane of the work surface dish are not acceptable. A secondary containment trough shall be located in front of the work surface and extend below the airfoil sill.
  8. Fume hood sash (Vertical): Full-view, frameless type with clear, unobstructed, side-to-side view of fume hood interior and service fixture connections. Sash to have a 35 IN, nominal, sight line and a 28-1/2 IN, nominal, vertical access height.
  9. Counter balance system: Single weight, sprocket and chain, counter balance system to prevent sash tilting and permit ease of operation at any point along full width pull. Maximum 7 pounds pull required to raise or lower sash throughout its full length of operating sash opening. Design system to hold sash at any position without creep and to prevent sash drop in the event of chain failure. Sash shall open and close against rubber bumper stops:
    - a. Sash shall have the capability to be raised to full 28-1/2 IN, nominal, vertical opening for loading or unloading of large apparatus.
    - b. Sash shall lower automatically to the operating position when released from any position above 18 IN.
  10. Automatic Sash Positioning System: All hoods to include Automatic Sash Positioning System – as specified within this section.
- F. High Performance/Low Velocity Floor-Mounted Fume Hoods:
1. Basis of Design: Hamilton Products, a part of Thermo Fisher Scientific, Concept Hood, or equal, as specified herein.
  2. Drawing Designations:

- a. 6 FT floor-mounted: FMFH72-xx.
  3. Depth: 28 IN interior, 37-1/4 IN exterior, nominal.
  4. Design:
    - a. Restricted bypass fume hoods for variable air volume or constant volume exhaust systems with airfoil. Bypass shall be sufficient in size to allow 25 percent flow with sash closed. Bypass must be achieved through low resistance opening at top of front lintel panel. Bypass shall be designed to provide a smooth down flow effect.
    - b. Design fume hoods for consistent and safe air flow through the hood face. Negative variations of face velocity shall not exceed 20 percent of the average face velocity at any designated measuring point as defined in this section:
      - 1) Fume hoods shall be designed to operate safely at face velocities between 60 FT per minute and 80 FT per minute.
  5. Downdraft bypass: Low resistant type, 18 gauge steel chamber; directional louvers are not acceptable. All bypass air shall enter top of bypass chamber and enter hood in a downflow direction. Chamber shall protect user from expelled particulate in the event of an adverse internal reaction.
  6. Fume hood (Vertical): Full-view, frameless type with clear, unobstructed, side-to-side view of fume hood interior and service fixture connections. Sash to have a 35 IN, nominal, sight line and a 28-1/2 IN, nominal, vertical access height.
  7. Counter balance system: Single weight, sprocket and chain, counter balance system to prevent sash tilting and permit ease of operation at any point along full width pull. Maximum 7 pounds pull required to raise or lower sash throughout its full length of operating sash opening. Design system to hold sash at any position without creep and to prevent sash drop in the event of chain failure. Sash shall open and close against rubber bumper stops:
    - a. Sash shall have the capability to be raised to full 77 IN, nominal, vertical opening for loading or unloading of large apparatus.
    - b. Sash shall lower automatically to the operating position when released from any position above 66-1/2 IN.
  8. Sash Stop: Rubber bumper stops to allow manual override with automatic reset for an 18 IN sash opening.
  9. Fume Hood Floor: Provide 14 gauge Type 316L stainless steel fume hood floor with raised lip at sash opening. Lip shall have chamfered corners. Stainless steel shall have a No. 4 finish.
  10. Automatic Sash Positioning System: All hoods to include Automatic Sash Positioning System – as specified within this section.
- G. Automatic Sash Positioning System:
1. The sash positioning system (sPs) shall consist of motion-presence sensor mounted on the front of the hood, a digital controller receiving signals from the motion-presence sensor, a 120 v.a.c power source and an electrical motor served and controlled by the controller that is connected to and causes a jack shaft with timing pulleys or sprockets for driving by imparting motion to the suspension chains of a fume hood which are in turn connected to the hood sash and counterweight:
    - a. When programmed to close the sash without user presence:
      - 1) sPs shall fully close the sash from any opening after an adjustable delay from 1 to 9999 seconds when the user exits the user presence zone.
      - 2) Opening of the sash shall be accomplished manually by the user.
    - b. Should the user re-enter the presence zone during closure, the sPs shall immediately disengage downward motion of the sash. When the user exits the presence zone, after a delay the sPs controller will again initiate downward sash motion until full sash closure is achieved.
    - c. Use of an Under Sash Pressure Sensitive Safety Switch attached to the bottom edge of the sash that, when activated by a contact force of 24 ounces or more disengages the downward motion of the sash. The sPs controller resets when the interference load is removed from the switch.

2. The sPs shall incorporate the following features:
  - a. Sash shall open when user walks into user detection area and push to open button is activated by user.
3. General:
  - a. Power supply and wiring to include 120 VAC, 60 Hz shall be provided by Division 26.
  - b. Low voltage power supplies, wiring, and other devices shall be furnished and installed as a part of the sPs.
4. Specific sPs Performance REQUIRED ELEMENTS and Features:
  - a. Electronic sPs controller, drive, and dc power supply.
  - b. The electronic sPs controller shall consist of a standalone digital programmable relay logic controller (PLR) complete with electric drive motor, motor drive controller and clutching mechanism:
    - 1) The sPs controller shall have:
      - a) Independently adjustable forward and reverse current limiter to motor.
      - b) Built in time delay ranging from 1 sec to 9999 sec.
      - c) Built in Real Time Clock for time of day resets.
      - d) Externally adjustable potentiometers for setting rate of sash opening and closing speed.
      - e) Externally adjustable open sash and close sash set points.
      - f) Connectivity for program changes.
    - 2) The electric drive motor shall be a variable speed dc driven with metal geared drive train complete with clutch that disengages the motor and allows the sash assembly to be free wheeling when the motor is not engaged.
  - c. The 24 vdc power supply shall be UL 60950 listed and approved.
  - d. Drive train and Motor Sub-Assembly:
    - 1) Motor sub-assembly shall consist of geared electric dc motor, clutching mechanism, primary belt drive, belt drive bearing supports, and sheet metal housing:
      - a) All belt drive timing pulleys material shall be aluminum or equivalent, no plastics allowed.
      - b) All timing belts shall have .200" pitch.
      - c) Primary belt drive bearing supports shall be oillite bronze bushings (SAE 660) or equivalent.
      - d) All sprockets shall be steel or cast iron with 3/8" pitch (#35).
    - 2) Motor Sub-Assembly with jack shaft assembly shall be attached to the top of the fume hood with drive sprockets in contact with counter weight suspension chains on both sides of the hood:
      - a) The motor sub-assembly, through a primary drive belt, shall apply clockwise or counter clockwise rotation with sufficient torque to turn jack shaft assembly via secondary belt drive or chain drive.
      - b) Motor sub-assembly jackshaft shall be supported by oillite bronze bushings (SAE 660).
      - c) The jackshaft assembly, having multiple bearing supports, through sprockets mounted on either end of it, provide linear motion to the chains that are attached to both the sash and to the slab counter weight causing controlled sash assembly movement.
  - e. Motion & Presence Sensor:
    - 1) Use a floor reflection method active infrared combination motion and presence detector.
    - 2) Have adjustable detection patterns and sensitivity.
    - 3) Have a minimum of four adjustable operating frequencies.
    - 4) Include an adjustable time delay on stationary object detection timer.
  - f. Under Sash Safety Sensor Switch shall attached to the bottom of the sash and incorporate the following:
    - 1) Active when subject to a force of 24oz to stop the sash from moving, with reset accomplished by removal of the obstruction.

- 2) A high durability PVC exterior covering for protection against chemicals splashes.
- 3) The under sash safety switch shall be wired to the sPs controller.
- g. Switches:
  - 1) All switches mounted on face of fume hood must have name plate or legend.
- h. Enclosure Protection:
  - 1) All controllers, low voltage transformers, and power supplies shall be in an enclosure to protect them from small falling objects, dust, and small leaks, splashes, or drips.
  - 2) Enclosure shall be located atop the fume hood or wall mounted adjacent to the top of the fume hood.
  - 3) Electrical devices not enclosed shall have all wire junction or termination points protected against grounding or shorting out due to local environment.
- i. Protective coatings applied to Metal Fabrication:
  - 1) All sheet metal parts that make up drive or motor box assembly must be coated to prevent rust. All finishes must be free of dirt or matter and have a uniform color drive train component additions to fume hood must be able to withstand chemical environment and mechanical loadings associated with daily fume hood usage.
  - 2) Protective Coating applied to metal parts shall be a polyester triglycidyl isocyanurate (TGIC) powder, applied via an electrostatic charged process to ensure a full and uniform powder coat coverage which is then baked to yield a thickness of 6 to 8 mils to producing a high gloss smooth a chemically resistant and durable finish.
- 5. Approved Manufacturers:
  - a. Accu\*Aire – Sash Positioning System, sPs.
  - b. Lab Crafters – Sash Positioning System.
- 6. Instrumentation:
  - a. Programmable Logic Relay Controller:
    - 1) Input Power: 20-28 Vdc, 150 Ma.
    - 2) Inputs:
      - a) 12ea, 24V/3.2 mA DC Digital Input.
      - b) 4 ea, 10 bit 0-10Vdc Analog Input .
    - 3) Outputs- 8ea, Resistive: 8A/point; Inductive: 4A/point.
    - 4) Real Time Clock with power failure back up.
    - 5) Retentive Flash Memory.
    - 6) Normal Operating Temperature: +32 °F to +104°.
  - b. Low Voltage DC Motor Drive:
    - 1) Input Power: 115/230 VAC +/- 10%.
    - 2) Output Voltage: 0-12 or 0-24 Vdc.
    - 3) Continuous Output Current: 4 A.
    - 4) Max Output Current: 7.5 A for 10 sec.
    - 5) Normal Operating Temperature: +50°F to +104°.
  - c. Spring loaded Recoil Reel, Sash Position Transmitter:
    - 1) Input Power: 10 V DC.
    - 2) Output Signal: 0-10V DC.
    - 3) Accuracy: ± 5%.
    - 4) Linearity: ± 0.1% across range.
    - 5) Normal Operating Temperature: +32 °F to +104°.
  - d. Presence Sensor:
    - 1) Input Power: AC/DC 12-24V, ±10%.
    - 2) Power Consumption: 2VA or 80mA max.
    - 3) Normal Operating Temperature: 32 °F to +104°F.
    - 4) Max Installation Height: 9ft.
    - 5) Presence Timer Setting: 2, 15, 60 sec & infinity.
    - 6) Response Time: 0.01 seconds.
  - e. Presence Sensor Matt Switch:
    - 1) Input Power: 24 vdc.

- 2) Force Actuation: 7 psi at any point.
- 3) Normal Operating Temperature: 32 °F to +104°F.
- f. Under Sash Pressure Sensitive Safety Switch:
  - 1) Input Power: 24 vdc.
  - 2) Force Actuation: 24 oz max.
  - 3) Normal Operating Temperature: 32 °F to +104°F.
- 7. Provide power wiring to the unit:
  - a. Check wiring before powering.
  - b. Cycle the controller to ensure free sash movement takes place.
- 8. Tune and test the functioning of the sPs controls to satisfy the Sequence of Control for the sPs:
  - a. Tune:
    - 1) Set close and open set points.
    - 2) Set rate of opening and closure.
    - 3) Set forward and reverse current limiter for drive motor.
    - 4) Set photo-eye limits and mode of operations.
  - b. Test and validate proper operation of :
    - 1) Photo-eye.
    - 2) Under sash safety switch.
    - 3) Pad switch if provided.
    - 4) Prove and validate connectivity to the BAS if Fieldbus Controller is provided.

H. Fume Hood Liner Test: Polyresin:

- 1. Test No. 1: Spills and Splashes:
  - a. Suspend a 42 IN by 12 IN panel (42 IN dimension horizontal) in a position to expose the surface to be tested in a vertical plane. Divide the panel vertically into 3/4 IN spaces.
  - b. Using an eyedropper, apply five drops of each reagent as listed.
  - c. Liquid reagents shall be applied at the top of the panel and permitted to flow down full panel height. (CAUTION! Flush away any reagent drops.)
- 2. Test No. 2: Fumes and Gases:
  - a. Prepare a panel 24 IN by 12 IN by dividing panel into 2 IN squares. Using 100 ml beakers, place 25 ml (approximately 1/2 IN of reagent) into each beaker. Place beakers in position so that test panel may be placed over beaker tops in the proper sequence. Place panel over beakers. Note: Beaker pouring lip permits atmospheric oxygen to enter and participate in the reaction of the reagent fumes.
  - b. After a 24 hour time period has elapsed, remove panel, flush off with water, clean with naphtha and detergent, rinse and wipe dry. Evaluate.
- 3. Evaluating Ratings:

|   |           |   |
|---|-----------|---|
| 0 | No effect | No detectable change in the material surface.   |
| 1 | Excellent | Slight detectable change in color or gloss but no change in function or life of the surface.  |
| 2 | Good      | A clearly discernable change in color or gloss but no significant impairment of surface life or function.   |
| 3 | Fair      | Objectionable change in appearance due to discoloration or etch, possibly resulting in deterioration of function over an extended period of time. |
| 4 | Failure   | Pitting, cratering, or erosion of the surface. Obvious and significant deterioration.   |

- 4. Performance: Test results shall equal or exceed the following:

| Reagent                                | % by wt. | Spills | Fumes |
|--|----------|--------|-------|
| Acetic acid, glacial                   |          | 0      | 0     |
| Acetone                                |          | 1      | 0     |
| Acid dichromate                        |          | 1      | 0     |
| Ammonium hydroxide                     | 28%      | 0      | 0     |
| Amyl acetate                           |          | 1      | 0     |
| Benzene                                |          | 1      | 0     |
| Butyl alcohol                          |          | 0      | 0     |
| Carbon tetrachloride                   |          | 0      | 0     |
| Chloroform                             |          | 1      | 0     |
| Chromic acid, saturated                |          | 2      | 0     |
| Cresol                                 |          | 1      | 0     |
| Dichloro acetic acid                   | 93%      | 1      | 1     |
| Dimethyl formamide                     |          | 1      | 0     |
| Dioxane                                |          | 0      | 0     |
| Ethyl acetate                          |          | 0      | 0     |
| Ethyl alcohol                          |          | 0      | 0     |
| Ethyl ether                            |          | 1      | 0     |
| Formaldehyde                           | 37%      | 0      | 0     |
| Formic Acid                            | 88%      | 0      | 0     |
| Furfural                               |          | 3      | 0     |
| Gasoline                               |          | 1      | 0     |
| Hydrochloric acid                      | 37%      | 0      | 1     |
| Hydrofluoric acid                      | 48%      | 0      | 4     |
| Hydrogen peroxide                      | 30%      | 0      | 0     |
| Methyl alcohol                         |          | 0      | 0     |
| Methyl ethyl ketone                    |          | 1      | 0     |
| Methylene chloride                     |          | 0      | 0     |
| Monochlorobenzene                      |          | 1      | 0     |
| Naphthalene                            |          | 1      | 0     |
| Nitric acid                            | 20%      | 1      | 0     |
| Nitric acid                            | 30%      | 1      | 0     |
| Nitric acid                            | 70%      | 1      | 0     |
| Phenol                                 | 85%      | 0      | 1     |
| Phosphoric acid                        | 85%      | 0      | 0     |
| Silver Nitrate                         | 10%      | 1      | 0     |
| Sodium Hydroxide                       | 10%      | 1      | 0     |
| Sodium Hydroxide                       | 20%      | 1      | 0     |
| Sodium Hydroxide                       | 40%      | 1      | 0     |
| Sodium Hydroxide Flake                 |          | 0      | 0     |
| Sodium Sulfide, saturated              |          | 2      | 0     |
| Sulfuric acid                          | 33%      | 0      | 0     |
| Sulfuric acid                          | 77%      | 1      | 0     |
| Sulfuric acid                          | 93%      | 2      | 0     |
| Sulfuric acid/Nitric acid, equal parts | 77%/70%  | 0      | 1     |
| Tincture of Iodine                     |          | 1      | 1     |
| Trichloroethylene                      |          | 1      | 0     |
| Toluene                                |          | 1      | 0     |
| Xylene                                 |          | 1      | 0     |
| Zinc Chloride                          |          | 0      | 0     |

Note: Maximum concentration is to be understood unless a lower concentration is shown in the table.

## 2.3 FUME EXTRACTOR ARMS (SNORKELS)

- A. Manufacturers: Products complying with this specification may be provided by the following manufacturers. All snorkel fume extractors shall be the product of a single manufacturer:
1. Nederman Inc., 39115 West Warren Road, Westland, MI 48185 Tel: 800-575-0609. website: <http://www.nederman.com/>
  2. Movex, Inc., 5966 Keystone Dr., Bath, PA 18014 Tel: 610-440-0478. website: <http://www.movexinc.com/>
  3. Plymovent Corporation, 375 Raritan Center Parkway, Edison, NJ 08837 Tel: 1-800-644-0911. - website: <http://www.plymovent.com/>
  4. Airflow Systems, Inc., 11370 Pagemill Road, Dallas, TX 75243 Tel: 214 503-8008. website: <http://www.airflowsystems.com/>
  5. Enviroflex International Inc., 1051 Clinton St., Buffalo, NY 14206 Tel: 716 883-2319. - website: <http://www.enviroflex.com/>
  6. Substitutions are permitted subject to Section 01 63 00.
- B. Basis of design: Nederman FX Original Extraction Arm 100. 4 IN hose diameter, hinged, self-supporting air extractor arm assembly, or equivalent (part no. 70570544):
1. Arm shall consist of 360 degree swivel elbow, support flange, internal support, pre-set joints with adjustable wear discs, anodized aluminum arm, hood, and flange for 4 IN exhaust duct.
  2. Fume extractor shall be constant volume device with manual damper.
  3. Mounting Bracket: Ceiling bracket. Use vibration secured fixing bolts and nuts suitable for structural ceiling mounting.
  4. Bracket Support: Provide extension arm or slotted channel framing as required to suspend and support ceiling bracket from structure above.
  5. Ceiling Cover Plate: Provide ceiling enclosure plate at ceiling.
  6. Mounting Height: Mount the Extraction Arm so that the lowest point of the assembly when retracted is 6 FT – 8 IN a.f.f.
  7. Arm Length: 94 IN.
  8. Silencer.
  9. Combination hood.
  10. No damper.

## 2.4 VENTILATED BALANCE SAFETY ENCLOSURE

- A. Manufacturers: Products complying with this specification may be provided by the following manufacturers. All ventilated balance safety enclosures shall be the provided by a single manufacturer:
1. Labconco Corporation, 8811 Prospect Avenue, Kansas City, MO 64132 Tel: 800 821-5525. website: <http://www.labconco.com>
  2. Flow Sciences, Inc., 2025 Mercantile Drive, Leland, NC 28451 Tel: 800 849-3429. website: <http://www.flowsciences.com>
  3. Rice Lake Weighing Systems, 230 West Coleman Street, Rice Lake, WI 54868 Tel: 800 472-6703. website: <http://www.ricelake.com>
  4. Substitutions are not permitted.
- B. Basis of Design: Labconco Corporation XPert Filtered Balance Station (4' and 5' models), or equal, as specified herein.
- C. Description: Enclosure specifically designed to provide maximum containment for balance applications. Enclosure opening shall be designed to allow turbulence-free airflow to prevent balance fluctuation. Enclosure shall have angled front for ergonomic design.
- D. Construction:
1. Enclosure shall be constructed of 1/4 IN thick tempered safety glass front sash and sides with air plenum mounted on rear of enclosure.
  2. Base shall be black, solid epoxy.

- E. Features:
1. Enclosure Dimensions: 48 IN wide x 29 IN deep x 49.6 IN tall. 5 FT model – 60 IN wide x 28.6 IN deep x 47.2 IN tall.
  2. Face velocity alarm, providing visual and audible alarm if flow is not maintained to the programmed parameters. Sensor shall have ability to be programmed to alarm between 30 and 150 feet per minute.
  3. Electrical: 115 Volts, 60 Hz
  4. Provide front mounted fluorescent lamp.
  5. Face velocity alarm, providing visual and audible alarm if flow is not maintained to the programmed parameters. Sensor shall have ability to be programmed to alarm between 30 and 150 FT per minute.
  6. 4 IN diameter, 8 FT long PVC flexible hose with spring steel wire helix. Hose shall be chemical and abrasion resistant and flame resistant to UL 94V-O standards.
  7. Stainless steel fan filter housing with 6 IN duct connections.
  8. 5 IN diameter waste chute mounted in enclosure side.
  9. Provide 5 IN diameter thimble connection for connection to 4 IN diameter building exhaust duct.
  10. Provide 99.99% efficient bagout HEPA filter.

## 2.5 CUSTOM VENTILATED ENCLOSURE

- A. Manufacturers: To be determined.
- B. Description: Floor mounted exhaust enclosure for ventilation of odors and heat from stacked box furnaces on carts. Enclosure should be designed to provide space for up to 4 box furnaces, and is attached to a 4" diameter point exhaust. This exhaust enclosure is to be located in room 137 Synthesis Lab.
- C. Construction:
1. Enclosure shall be constructed to withstand laboratory use, and will be designed in accordance to guidance from user.
- D. Features:
1. Dimensions: exterior dimensions to be 72 IN wide x 37-1/4 IN deep x 84 IN high.
  2. Attach to 4" diameter point exhaust.
  3. Electrical Receptacles:
    - a. 2 - 120V/20A duplex type, single gang, NEMA 5-20R, 3-wire, grounding type receptacle, one per side, with brushed stainless steel cover plate.
    - b. 4 - 208V/70A single gang, grounding type receptacles, with brushed stainless steel cover plate.
    - c. Color: Receptacles shall be white.

## PART 3 - EXECUTION

### 3.1 SITE CONDITIONS

- A. Prior to installation of the Work of this Section, carefully inspect the installed Work specified in other sections and verify that all such Work is complete to the point where this installation may properly commence.
- B. Verify that all Work has been installed in complete accordance with the original design, received submittals, and the manufacturer's recommendations.
- C. In the event of discrepancy, immediately notify the Architect. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

### **3.2 INSTALLATION**

- A. Work in this Section requires close coordination with Work specified in Divisions 22, 23, 25 and 26, as well as installation by BNL of BNL furnished components. Coordinate all Work to ensure an orderly process in the Project, without removal of previously installed Work, and so as to prevent damage to finishes and products.
- B. Coordinate location and alignment of fume hoods and cabinets for proper connection of all piping and duct work.
- C. Install all equipment in accordance with manufacturer's written instructions, applicable codes and regulations, accepted Shop Drawings, and as necessary for a complete operating system.
- D. Install equipment plumb, square, and straight with no distortion and securely anchored, as required.
- E. Coordinate with Section 12 35 53 for venting corrosives storage cabinets behind rear baffle of fume hood.

### **3.3 FIELD TESTING: CHEMICAL FUME HOODS**

- A. Provide two week advance notice of scheduled testing.
- B. Balance, test and certify each fume hood in accordance with ASHRAE 110-1995 (AI) for Flow Visualization, Face Velocity, and Tracer Gas Containment Testing Requirements.
- C. ASHRAE 110-1995 (AI) test to be performed at 60 FPM face velocity. Any hood that does not pass at 60 FPM should be retested at the specified 80 FPM face velocity.
- D. Fume hood field tests shall be performed by a qualified independent testing company on each hood to determine face velocity and air flow patterns.
- E. Fume hoods shall achieve an "As Installed" (AI) performance rating equal or better than 0.10 ppm with 4.0 Lpm tracer gas release rate when tested in accordance with ASHRAE 110-1995.
- F. Balancing of the system is in the scope of work of Division 23.
- G. Verify exhaust air quantity does not exceed design, plus allowable leakage.
- H. Verify hood pressure drop does not exceed design.
- I. Adjust and retest hoods that do not meet specified performance.
- J. Replace hoods which do not meet standards after repetitive testing.

### **3.4 ADJUSTING, CLEANING, AND PROTECTION**

- A. Repair or remove and replace defective work as approved by the Architect upon completion of installation.
- B. Adjust all moving or operating parts to function within their design parameters.
- C. Clean equipment, touch up as required.
- D. Protect all units before, during, and after installation. Damaged materials due to improper protection shall be cause for rejection.

**END OF SECTION**



**SECTION 11 53 33**  
**LASER SAFETY EQUIPMENT**

**PART 1 - GENERAL**

**1.1 SECTION INCLUDES**

- A. Laser Curtain and Track Assembly.

**1.2 UNDIVIDED RESPONSIBILITY**

- A. Unless specified otherwise, because of special coordination requirements, the scope of work described in this Section shall be provided by the supplier of the Section 12 35 53 scope of work.

**1.3 REFERENCES**

- A. ANSI Z136.1 Safe Use of Lasers, current edition.

**1.4 DESCRIPTION**

- A. Provide equipment complete with accessories as described herein and shown on Laboratory Furnishings drawings.
- B. Work of this Section requires close coordination with Work of Divisions 08, 09 and 26 as well as installation of BNL furnished components and Work specified in other Sections. Sequence all Work to ensure an orderly progress in the project without removal of previously installed Work and so as to prevent damage to finishes and products.
- C. Work includes, but is not limited to, furnishing to the project site for installation by Division 26, laser entry control system described herein and shown on the Laboratory Furnishings Drawings and Electrical Drawings.

**1.5 SUBMITTALS**

- A. Submit as specified herein and under provisions of Section 01 33 00.
- B. Materials List/Product Data: Submit complete materials list, including catalog data of all materials, equipment, fan curves, test designs, performance charts, and products for Work specified in this Section.
- C. Shop Drawings: Submit complete shop fabrication and installation drawings, including plans, elevations, sections, details, fittings, duct connections, and schedules. Show relationship to adjoining materials and construction. Shop Drawings shall be in the form of reproducible or photocopies, not to exceed 11 IN x 17 IN (A3) in size. Blue-line prints are not acceptable.
- D. Operations/Maintenance Manuals: Accompanying certification, submit for Architect's review and BNL's use, complete operating and maintenance manuals that describe proper operating procedures, maintenance and replacement schedules, component parts list, wiring diagrams, and closest factory representative for components and service.

## 1.6 QUALIFICATIONS

- A. Work in this Section shall be performed by a firm having a minimum five years documented experience, and an established organization and production facilities including all tools, equipment and special machinery necessary for specializing in the fabrication and installation of the type of equipment required with skilled personnel, factory trained workmen and an experienced engineering department. Each shall have the demonstrated knowledge, ability and the proven capability to produce the specified equipment of the required quality and the proven capacity to complete an installation of this size and type within the required time limits.

## PART 2 - PRODUCTS

### 2.1 LASER CURTAIN AND TRACK ASSEMBLY

- A. Manufacturers: Products complying with this specification may be provided by the following manufacturers. All products specified in this section shall be provided by a single manufacturer:
1. Rockwell Laser Industries, Inc., P.O. Box 43010, Cincinnati, OH 45243 Tel: 800 945-2737 website: <http://www.rli.com/>
  2. Kentek Corporation, 19 Depot Street, Pittsfield, NH 03263 Tel: 800 432-2323 website: <http://www.kentek-laser.com/>
  3. Control Optics Corporation, 1311 Brooks Drive, Suite J, Baldwin Park, CA 91706 Tel: 626 813-1991 website: <http://www.controloptics.com/>
  4. Wilson Laser Safety Products, Pomona, CA Tel: 909 468-3636 website: <http://www.wilsonindustries.com/>
  5. Substitutions are permitted subject to Section 01 63 00.
- B. Performance:
1. The laser curtain shall afford the required level of protection from direct and diffusely scattered laser light.
  2. The threshold limit for beam penetration through the curtain at the minimum distance indicated on the drawings shall not to be exceeded for an exposure time of 60 seconds.
  3. No part of the installation shall release toxic fumes following a laser exposure.
  4. Fabric:
    - a. Curtain must be flame-retardant or made of non-combustible materials. Fabric must pass the flame resistance requirements specified by the State of California test, and be in accordance with the National Fire Protection Association Standard No. 701-99 test methods 1 and 2. Submit certificate of passage to tests.
    - b. Curtain material shall be appropriate for the laser(s) to be used. Refer to Laser Curtain Schedule at the end of this Section.
    - c. The curtain material shall be fiberglass fabric impregnated with flame-retardant silicone rubber for use in laser protection areas. The curtain material shall be resistant to abrasion, flexing, tear, and puncture. In addition, the material shall be water and oil resistant.
  5. The curtain shall be sewn flat with 10% fullness. The seams shall be sewn French-style (no raw edges visible). The curtain top shall have brass grommets on 8 IN centers. Provide a heavy gauge fabric-reinforcing strip inserted in the top hem to provide addition strength for the insertion of grommets. The bottom edge shall be weighted and overlap the floor approximately 2 IN. All sewing shall be done in a manner so that fabric is not pierced in a way that will allow light through the needle holes.
  6. The outside vertical edges shall be supplied with "Velcro" quick-seal strips to facilitate "light-trap" overlaps for easy light-tight attachment to walls.

7. Curtain shall be supplied with minimum 11 IN high front and rear light-trap valances. The valances shall be made of the same black-out curtain materials, sewn flat (no fullness) with a sewn-on Velcro strip, and shall be mounted to the curtain track assembly using the "Light-Trap-Interface". Curtain shall be designed with a 2 IN floor overlap to maintain a light-proof environment.
  8. Magnets shall be sewn into hem or integrated into hardware to complete interlock circuit. Locations shall be coordinated with the Laser Access Control System requirements. If magnets are concealed, permanent visible markings shall be provided to indicate magnet locations. Wiring shall be the responsibility of the curtain supplier.
- C. Track Material and Assembly:
1. Construct of satin anodized extruded aluminum box-channel 1-3/8 IN x 3/4 IN slotted on the underside to receive two wheeled carriers designed for surface mounting to the underside of the ceiling. The track shall also serve as an integral part of the valance assembly; valance shall be fastened to track at not more than 18 IN on center. Supply with hook carriers, end-caps, snap-outs, and connectors, of the sleeve type. Hooks are formed of rustproof wire and bead chain riding on a carrier with non-wearing nylon wheels. Corners, where required, shall be one-piece, 12 IN radius 90 degree track sections.
  2. Curtain Supplier/Installer must provide any bracing necessary at ceiling. Coordinate with ceiling Manufacturer/Installer.

## **PART 3 - EXECUTION**

### **3.1 SITE CONDITIONS**

- A. Prior to installation of the Work of this Section, carefully inspect the installed Work specified in other sections and verify that all such Work is complete to the point where this installation may properly commence.
- B. Verify that all Work has been installed in complete accordance with the original design, received submittals, and the manufacturer's recommendations.
- C. In the event of discrepancy, immediately notify the Architect. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

### **3.2 LASER CURTAIN INSTALLATION**

- A. Installation of laser curtain shall be performed by installers experienced in the installation of the respective item as determined by the respective manufacturer.
- B. The laser curtain and track assembly shall be installed to prevent laser light from exiting the laser controlled area at levels above the applicable MPE level.
- C. Furnish each curtain with position contacts for connection to the laser safety system.
- D. Curtain Supplier/Installer must provide any bracing necessary at ceiling. Coordinate with ceiling Manufacturer/Installer.

### **3.3 DEMONSTRATION AND INSTRUCTION**

- A. Refer to Section 01 79 00.
- B. Test equipment prior to demonstration. Ensure equipment, including specified accessories, is operational.
- C. Provide demonstration of equipment operation and instruction of BNL's personnel.
- D. Demonstrate operating capability of equipment and systems. Include control and safety features, and service and maintenance procedures.

- E. Engage services of qualified instructor to instruct and train BNL's operating and maintenance personnel in operation, service, and maintenance of equipment. Provide at least four hours of instruction for each type of equipment.

#### **3.4 CLEANING AND PROTECTION**

- A. Repair or remove and replace defective work as approved by the Architect upon completion of installation.
- B. Adjust all moving or operating parts to function within their design parameters.
- C. Clean equipment, touch up as required.
- D. Protect all units before, during, and after installation. Damaged materials due to improper protection shall be cause for rejection.

| LASER CURTAIN SCHEDULE |          |  |         |                  |                |                        |                  |                    |                      |                     |                              |                        |                          |                      |   |  |
|------------------------|----------|--|---------|------------------|----------------|------------------------|------------------|--------------------|----------------------|---------------------|------------------------------|------------------------|--------------------------|----------------------|---|--|
| Curtain No.            | Room No. | Laser Parameters                           |         |                  |                |                        | Operation Mode   |                    |                      |                     | Delivery Optics              |                        |                          |                      | System Design & Geometry                          |  |
|                        |          | Laser Type                                 | Class   | Wave-length (μm) | Beam dia. (mm) | Beam divergence (mrad) | Pulsed           |                    |                      | Cont. Wave          | Beam Conduit                 |                        | Fiber Optics             |                      | Worse case viewing distance, diffuse targets (in) | Nominal distance(s) laser apperture to barrier: min./max. (ft) |
|                        |          |  |         |                  |                |                        | Pulse Energy (J) | Pulse Length (sec) | Repetition Rate (Hz) | Max. Ave. Power (W) | Beam dia. prior to lens (mm) | Lens Focal Length (mm) | Numerical Aperature (mm) | Cone Angle (degrees) |   |  |
| LC-1 & LC-2            | 184      | Fr. Doubled ND: YAG                        | 4       | 532 nm           | 2.25 mm        | <.5 mrad               |                  |                    |                      | <=18 W              |                              |                        |                          |                      | No Targets (pumps Ti:S)                           | .5-3 ft  |
| LC-1 & LC-2            | 184      | Ti: Sapphire (has femto pico and cw modes) | 4       | 700-900 nm       | .8 nom.        | 1.7 mrad               | 2.60E-08         | <3ps or <200 fs    | 76 MHz               | ~2 W                |                              |                        |                          |                      | ~1 ft   | 2-3 ft   |
| LC-3                   | 235      | Horizontal Open Beam, Helium-Neon          | 3R (3A) | 633nm            | ~3mm           |                        |                  |                    |                      | ~1.3W               |                              |                        |                          |                      | 12 in   |  |

**END OF SECTION**



**SECTION 11 53 43**  
**LABORATORY SERVICE FITTINGS AND FIXTURES**

**PART 1 - GENERAL**

**1.1 SECTION INCLUDES**

- A. Laboratory service fittings, valves, electrical pedestal boxes, and related components.
- B. Laboratory emergency plumbing fixtures.
- C. Laboratory sinks.

**1.2 UNDIVIDED RESPONSIBILITY**

- A. Unless specified otherwise, because of special coordination requirements, the scope of work described in this Section shall be provided by the supplier of the Section 12 35 53 scope of work.

**1.3 REFERENCES**

- A. Conform to the recommended practices for laboratory service fittings and fixtures published by the Scientific Equipment and Furniture Association (SEFA) 7-: Fixtures, current version.
- B. All emergency plumbing fixtures shall comply with requirements of ANSI Standard Z358.1-2004: American National Standard for Emergency Eyewash and Shower Equipment.
- C. Where identified, service fittings and sinks shall be accessible to the disabled in compliance with the requirements of the federal Americans with Disabilities Act (ADA), ADA Accessibility Guidelines (ADAAG), and state accessibility regulations.
- D. All emergency plumbing fixtures shall be accessible to the disabled in compliance with the requirements of the federal Americans with Disabilities Act (ADA), ADA Accessibility Guidelines (ADAAG), and state accessibility regulations.

**1.4 DESCRIPTION**

- A. Work includes but is not necessarily limited to furnishing to the project site for installation by Division 22, all laboratory fittings, emergency plumbing fixtures, and fixtures described herein and shown on the Laboratory Furnishings Drawings. When specified, Division 26 shall install associated electrical work associated with emergency equipment.

**1.5 SUBMITTALS**

- A. Submit as specified herein and under provisions of Section 01 33 00.
- B. Materials List/Product Data: Submit complete materials list, including catalogue data, of all materials, equipment, and products for Work in this Section.
- C. Shop Drawings: Submit complete shop fabrication and installation drawings, including plans, elevations, sections, dimensions, details and schedules. Show relationship to adjoining materials and construction. Shop Drawings shall be in the form of reproducible or photocopies, not to exceed 11IN by 17 IN in size. Blue line prints are not acceptable.
- D. Samples: Submit two (2) samples of each type of specified finish and color specified.
- E. Operations/Maintenance Manuals: Submit under provisions of Section 01 77 00 complete operating and maintenance manuals that describe proper operating procedures, maintenance and replacement schedules, components parts list, and nearest local factory representative for components and repairs.

## 1.6 QUALIFICATIONS

- A. Work of this Section shall be performed by an organization with five years documented experience specializing in the manufacture of the type of equipment specified, with demonstrated ability to produce the specified equipment of the required quality and quantity for complete installation in a project of this type and size within the required time limits.
- B. Work in this Section requires close coordination with Work in Section 12 35 53, Division 22 Plumbing, Division 23 HVAC and Division 26 Electrical. Coordinate all Work to assure an orderly progress in the Project, without removal of previously installed Work, and so as to prevent damage to finishes and products.
- C. Review conditions of installation, procedures and coordination with related Work.
- D. Carefully inspect the installed Work specified in other Sections and verify that all such Work is complete and ready for the installation of this Work to properly commence.
- E. Verify that all Work may be installed in complete accordance with the original design, reviewed submittals and manufacturer's recommendations.

## PART 2 - PRODUCTS

### 2.1 GENERAL

- A. All service fittings and emergency plumbing fixtures shall be specifically designed for laboratory use.
- B. All service fittings and emergency plumbing fixtures shall be factory pre-assembled including the assembly of valves to turrets, mounting shanks to turrets, etc., and individually factory tested.
- C. All laboratory service fittings shall be the product of one service fitting manufacturer to assure ease of replacement and maintenance.
- D. All emergency plumbing fixtures shall be the product of one manufacturer to assure ease of replacement and maintenance.
- E. All service valves, fittings, and accessories shall be of cast brass with a minimum copper content of 85 percent, except for items which are to be brass forging or bar stock, or are specifically specified to be of another material.
- F. Provide fittings as shown in laboratory fitting details for all laboratory equipment at locations shown on the Laboratory Furnishings drawings. Refer to Service Fitting Schedule.
- G. Assembly components and operating parts such as valve stems, renewable units, packing nuts, outlet nozzles and straight serrated hose ends shall be made from solid brass stock.
- H. Replaceable seats, needle cones, valve disc screws and other accessories shall be Monel or stainless steel alloys especially selected for use intended.
- I. Fittings shall be factory tested and shall be supplied with nipples, lock nuts, shanks, etc.
- J. Serrated tip fittings shall have 3/8 IN IPS thread with the hose end being tapered. Diameter of orifice in serrated tip shall be 1/8 IN, except where otherwise specified.
- K. Turrets shall be brass drop forging of design indicated in details shown elsewhere in the Section and shall be one or two-way, as required, with 3/8 IN IPS female inlet thread for connections. Units shall be furnished with brass shanks, brass locknuts, and washers.
- L. Fittings located on the same plane shall have their handles project the same distance from the plane of reference to present a uniform related appearance, regardless of valve type construction.
- M. Flanges shall be brass forging of approved design with 3/8 IN IPS female inlet and outlet.

- N. All goosenecks shall provide full thread for attachment of anti-splash outlet fittings, serrated tips, and filter pumps.
- O. Hot water/cold water gooseneck mixers and wall-mounted cold water goosenecks shall swivel. Swivel point shall be at turret or at valve level if wall mounted. Swing joints shall have heavy Teflon type packings; "O" rings will not be permitted. Cold water goosenecks at cup sinks shall be rigid.
- P. All fittings shall have plastic colored service index buttons as specified in this Section.
- Q. Provide plug and socket (2-piece) quick connect service fittings, as manufactured by Swagelok Company website: <http://www.swagelok.com/> tel: 440 248-4600., Hansen Manufacturing (Air-Oil Systems, Inc.) website: <http://www.airoil.com/> tel: 800 333-5520., or Tomco Products, Inc. website: <http://www.tomcoquickcouplers.com/> tel: 864 574-7966, or as manufactured by the remainder of the laboratory fittings, for all chilled water supply and return fittings and compressed air (AIR60) fittings and all other specialty gas fittings at ceiling service panel locations over the movable benches.
- R. Fittings and fixtures designated to be accessible to the disabled (ADA) with operable parts shall be operable with one hand and shall not require tight grasping, pinching, or twisting of the wrist. The force required to activate operable parts shall be 5 pounds, maximum.

## 2.2 LABORATORY SERVICE FITTINGS

- A. Manufacturers: Products, which comply with this specification section as judged and approved by the Architect, may be provided by the following manufacturers. All laboratory service fittings specified in this section shall be provided by a single manufacturer:
  1. Water Saver Faucet Co., 701 West Erie Street, Chicago, IL 60610 Tel: 312 666-5500. website: <http://www.wsflab.com/>.
  2. T&S Brass and Bronze Works, Inc., 2 Saddleback Cove, P. O. Box 1088, Travelers Rest, SC 29690 Tel: (800) 476-4103. - website: <http://www.tsbrass.com/> .
  3. The Chicago Faucet Company, 2100 S. Clearwater Dr., Des Plaines, IL 60018-5999 Tel: 847-803-5000. website: <http://www.chicagofaucets.com>
  4. Substitutions are not permitted.
- B. Body Style: All service fittings shall have traditional body profiles (cylindrical and tapered). Mushroom-profile body styles are not allowed. Turrets shall be provided without deck flanges.
- C. Handles:
  1. Faucets designated to be accessible to the disabled (ADA): provide "wrist-blade" handles with screw on index (identification) discs.
  2. Laboratory gas, air and vacuum valves at workstations indicated to be accessible to the disabled (ADA): Provide ball valves fitted with lever-type handles and screw on index (identification) discs.
  3. Other fittings shall be fitted with four arm handles.
- D. Finish: Polished chrome, with clear, acid-resistant (epoxy) coating.
- E. Water Valves:
  1. Water valves shall include a renewable unit containing all the working parts which are subject to wear, including stainless steel or monel seat, monel screw and heavy duty seat disk and Teflon packing, and an integral adjustable volume control.
  2. Unit shall be capable of being readily converted from compression to self-closing, and vice versa, without disturbing faucet body proper and shall also be capable of being readily converted from water construction to needle valve or steam valve construction having outside packing gland without disturbing faucet body.
  3. Unit shall be sealed in valve body with special composition gasket. Metal-to-metal or ground joint type of sealing is not acceptable.

4. All water service fixtures shall satisfy the requirements of ANSI/ASME A 112.18.1M-1989 and be certified by the Canadian Standards Association (CSA) under Standard CAN/CSA B.125.M89.
5. Water fixtures shall be fully assembled and factory tested at 80 psi water pressure.
6. See Fixture and Fitting Schedule on drawings for model and type of fixture.
7. LHCW-2: Bench-mounted, hot and cold water faucet: Water Saver L412AC-8-BH-PA128, or approved equal, as specified herein:
  - a. Exposed metal shall be finished as specified elsewhere in this Section.
  - b. Wrist blade handles with colored plastic index buttons.
  - c. Renewable water valves and deck-mounted valve body.
  - d. Swing gooseneck with 8 IN spread.
  - e. Removable aerator. Aerator should terminate approximately 3 IN above deck.
  - f. Threaded mounting with locknut, washer, and coupling nuts.
  - g. Adjustable volume control.
  - h. Accessible to the disabled.
8. LCW-1: Bench-mounted, single service faucet: Water Saver L611AC-BH, or approved equal, as specified herein:
  - a. Exposed metal shall be finished as specified elsewhere in this Section.
  - b. 4 IN wrist blade handle.
  - c. Renewable water valve and valve body.
  - d. Rigid gooseneck with 6 IN spread.
  - e. Serrated hose end. Hose end should be 5-5/8 IN above deck.
  - f. Threaded mounting with locknut, washer, and coupling nut.
  - g. Adjustable volume control.
9. LCW-5: Wall/panel-mounted, angle pattern water valve: Water Saver L3100-158-BO188, or approved equal, as specified herein:
  - a. Exposed metal shall be finished as specified elsewhere in this Section.
  - b. Four-arm handle with colored plastic index button.
  - c. Angle pattern water valve.
  - d. Quick connect fitting.
  - e. Wall flange.
  - f. Length of valve from wall to index button shall be 4-7/8 IN, nominal.
10. PCWS-5; PCWR-5; PCWS-s; PCWR-s: Wall/panel-mounted, 1/2 IN ball valve for equipment cooling water: Water Saver L4303-169WSA, or approved equal, as specified herein:
  - a. Exposed metal shall be finished as specified elsewhere in this Section.
  - b. Lever handle with colored plastic index button.
  - c. 1/2 IN IPS female inlet.
  - d. Quick connect fitting with 3/8 IN NPT male plug.
  - e. Wall flange.
  - f. Mounting shank.
  - g. Length of valve and quick connect fitting shall be 4-7/8 IN, nominal.
11. PCWS-1; PCWR-1: Deck-mounted, Turret base with 1/2 IN ball valve for equipment cooling water: WaterSaver L4303-121WSA, or approved equal as specified herein:
  - a. Exposed metal shall be finished as specified elsewhere in this Section.
  - b. Lever handle with colored plastic index button.
  - c. 1/2 IN IPS female inlet.
  - d. Quick connect fitting with 3/8 IN NPT male plug.
  - e. Mounting shank.
12. LCW-h: Fume hood-mounted, remote control, laboratory water valve for water service: Water Saver L740xW-L050WSA-BO358B, or approved equal, as specified herein:
  - a. Exposed metal shall be finished as specified elsewhere in this Section, unless noted otherwise.
  - b. Panel-mounted valve.
  - c. Four-arm handle with colored plastic index button.
  - d. Locking ring.

- e. Forged brass valve body located behind panel at front of hood.
  - f. Epoxy coated, panel-mounted turret base with serrated hose end.
  - g. Adjustable volume control fitting with hex wrench knob to be attached between turret base and serrated hose end.
  - h. Mounting shank.
  - i. End of serrated hose end shall be 2-1/4 IN, nominal, from turret centerline. Centerline of serrated hose end shall be 2-1/8 IN, nominal, from panel. Handle shall be 2-3/4 IN long from panel to index button.
13. PCWS-h; PCWR-h: Fume hood-mounted, remote control, laboratory ball valve for water service: Water Saver L4285B-L023WSA-BO358B, or approved equal, as specified herein:
- a. Exposed metal shall be finished as specified elsewhere in this Section, unless noted otherwise.
  - b. Rod-type remote control valve.
  - c. Lever handle with colored plastic index button.
  - d. Guide plate.
  - e. 3/8 inch (9.5 mm) aluminum rod with brass coupling.
  - f. Epoxy coated, panel-mounted turret base with quick connect fitting end.
  - g. Quick connect fitting with 3/8 inch (9.5 mm) NPT male plug
  - h. Adjustable volume control fitting with hex wrench knob to be attached between turret base and quick-connect end.
  - i. Mounting shank.
  - j. End of quick-connect shall be 3-1/8 inches (79mm), nominal, from panel. Lever handle shall be 2-7/16 inches (62 mm) from stem centerline to end.
  - k. Fixture shall satisfy requirements for accessibility of the disabled.
- F. High Purity Water Valves: Suitable for purified water and provided with polypropylene liner. Valve stem and bonnet shall be brass:
1. See Fixture and Fitting Schedule on drawings for model and type of fixture.
  2. ROW-1: Bench-mounted purified water fixture: Water Saver L7833SC, or approved equal, as specified herein:
    - a. Exposed metal shall be finished as specified elsewhere in this Section.
    - b. All components in contact with water shall be polypropylene.
    - c. Forged brass valve body and 8 IN spread riser with polypropylene interior and lining.
    - d. Self-closing lever that can also be turned to operate in a stay-open mode.
    - e. Polypropylene serrated hose end.
    - f. Deck mounting flange.
    - g. Mounting shank.
    - h. End of serrated hose end shall be 7-7/8 IN, nominal, above bench top.
  3. ROW-5: Wall-mounted purified water valve: Water Saver L3100F-PP-WSA, or approved equal, as specified herein:
    - a. All components in contact with water shall be polypropylene.
    - b. All-polypropylene angle pattern valve body, stem, and mounting shank.
    - c. Four-arm polypropylene handle with index button.
    - d. Serrated, polypropylene hose end.
    - e. Length of valve from wall to index button shall be 5-1/8 IN, nominal.
  4. DI-h; ROW-h: Fume hood-mounted, remote control, laboratory water valve for purified water service: Water Saver L740xW-L050WSA-BO358B, or approved equal, as specified herein:
    - a. Exposed metal shall be finished as specified elsewhere in this Section, unless noted otherwise.
    - b. All components in contact with water shall be polypropylene.
    - c. Panel-mounted valve.
    - d. Four-arm handle with colored plastic index button.
    - e. Locking ring.
    - f. Forged brass valve body located behind panel at front of hood.
    - g. Epoxy coated, panel-mounted turret base with serrated hose end.

- h. Adjustable volume control fitting with hex wrench knob to be attached between turret base and serrated hose end.
  - i. Mounting shank.
  - j. End of serrated hose end shall be 2-1/4 IN, nominal, from turret centerline. Centerline of serrated hose end shall be 2-1/8 IN, nominal, from panel. Handle shall be 2-3/4 IN long from panel to index button.
- G. Needle Valves: Fully assembled and factory tested at 225 psi air pressure. Gas, air, vacuum and steam needle valve fittings shall have stainless steel replaceable floating cone that is precision ground and self-centering which shall seat against a stainless steel or monel renewable valve seat. Valve shall be for standard control under pressure up to 150 psi and shall have subject-to-wear parts easily replaceable. Provide pressure regulators designed for use with the appropriate service at locations indicated on the Laboratory Furnishing drawings. Needle valves for natural (laboratory) gas service shall be certified for use with natural gas by the Canadian Standards Association under ANSI Z21.15-1997/CGA9.1-M97. Needle valves in fume hoods shall be mounted on the front panel of the fume hood, with all components subject to wear accessible from the exterior face of the hood:
1. See Fixture and Fitting Schedule on drawings for model and type of fixture.
  2. Ar-1; CDA-1; He-1; H2-1; HPN2-1; LA-1; SGx-1; UN2-1; VAC-1 : Bench-mounted, single straight pattern, needle valve: Water Saver L2880-131WSA, or approved equal, as specified herein:
    - a. Exposed metal shall be finished as specified elsewhere in this Section.
    - b. Four-arm handle with colored plastic index button.
    - c. Turret base.
    - d. Serrated hose end.
    - e. Mounting shank.
    - f. End of serrated hose end shall be 5-1/8 IN, nominal, from turret centerline. Centerline of serrated hose end shall be 2-1/16 IN, nominal, above bench top.
  3. Ar-5; CO2-5; CO-5; CDA-5; FGx-5; He-5; H2-5; HPN2-5; O2-5; SGx-5; UN2-5; VAC-5: Wall/panel-mounted, single angle pattern, needle valve: Water Saver L3180-158WSA, or approved equal, as specified herein:
    - a. Exposed metal shall be finished as specified elsewhere in this Section.
    - b. Four-arm handle with colored plastic index button.
    - c. Wall mounting flange. Flange shall be threaded in a manner to be installed tight to wall surface in wall mounted applications, and allow fitting to be installed straight.
    - d. Serrated hose end.
    - e. Mounting shank.
    - f. Length of valve from wall to index button shall be 5-1/2 IN, nominal.
  4. Ar-s; CDA-s; He-s; SGx-s; UN2-s; VAC-s: Overhead service carrier-mounted, dual angle pattern, needle valves, 180 degree straight alignment: Water Saver L3180-131SWSA, or approved equal, as specified herein:
    - a. Exposed metal shall be finished as specified elsewhere in this Section.
    - b. Four-arm handle with colored plastic index button.
    - c. Turret base.
    - d. Serrated hose end.
    - e. Mounting shank.
    - f. Length of valve from turret base to serrated hose end shall be 5-3/16 IN, nominal.
  5. Ar-h; CDA-h; FGx-h; He-h; HPN2-h; H2-h; SGx-h; UN2-h; VAC-h: Fume hood-mounted, remote control, laboratory needle valve for gas service: Water Saver L740N-022WSA, or approved equal, as specified herein:
    - a. Exposed metal shall be finished as specified elsewhere in this Section, unless noted otherwise.
    - b. Panel-mounted valve.
    - c. Four-arm handle with colored plastic index button.
    - d. Locking ring.
    - e. Valve body to be located behind panel at front of fume hood.

- f. Panel-mounted, color epoxy coated brass flange with angled serrated hose end.
  - g. Mounting shank.
  - h. End of serrated hose end shall be 2-5/8 IN, nominal, from panel. Handle shall be 2-3/4 IN long from panel to index button.
- H. Laboratory Ball Valves: Suitable for laboratory gas, air and vacuum and be supplied fully assembled and factory tested at 125 psi air pressure. Ball valves shall be of quarter-turn (closed to fully open) design, be fitted with lever handle requiring less than 5 lbf force to operate, and shall have subject-to-wear parts easily replaceable. Ball valves for natural (laboratory) gas service shall be certified for use with natural gas by the Canadian Standards Association under ANSI Z21.15-1997/CGA9.1-M97:
- 1. See Fixture and Fitting Schedule on drawings for model and type of fixture.
- I. Quick Connect Fittings: Provide plug and socket (2-piece) quick connect service fittings:
- 1. See Fixture and Fitting Schedule on drawings for model and type of fixture.
- J. Service Fitting Color Index: for colored plastic index buttons:

| Service Name          | Disc Color  | Letters      | Letter Color |
|-----------------------|-------------|--------------|--------------|
| Lab Air               | Orange      | AIR          | Black        |
| Compressed Air        | Orange      | AIR60,90,100 | White        |
| Gas                   | Dark Blue   | GAS          | White        |
| Vacuum                | Yellow      | VAC          | Black        |
| Industrial Cold Water | Dark Green  | ICW          | White        |
| Industrial Hot Water  | Red         | IHW          | White        |
| Cold Water (Potable)  | Dark Green  | CW           | White        |
| Hot Water (Potable)   | Red         | HW           | White        |
| High Purity Water     | White       | DI or RO     | Black        |
| Argon                 | Violet      | AR           | White        |
| Nitrogen              | Brown       | N2           | White        |
| Carbon Dioxide        | Pink        | CO2          | Black        |
| Helium                | Black       | HE           | White        |
| Oxygen                | Light Green | O2           | Black        |
| PCWS/R                | Green       | CWS/CWR      | Black        |
| Steam                 | Black       | STM          | White        |
| Cylinder Gas          | Light Blue  | SG           | Black        |

### 2.3 LABORATORY SAFETY EQUIPMENT

- A. Manufacturers: Products, which comply with this specification section as judged and approved by the Architect, may be provided by the following manufacturers. All laboratory safety fixtures specified in this section shall be provided by a single manufacturer:
- 1. Water Saver Faucet Co., 701 West Erie Street, Chicago, IL 60610 Tel: 312 666-5500. website: <http://www.wsflab.com/>.
  - 2. Haws Drinking Faucet Co., 1435 Fourth Street, PO Box 1999, Berkeley, CA 94701 Tel: 510 525-5801. website: <http://www.hawsc.com/>.
  - 3. Guardian Equipment, 660 N. Union St., Chicago, IL 60610 Tel: 312 733-2626. website: <http://www.gesafety.com/>.
  - 4. Substitutions are not permitted.
- B. General: Laboratory safety equipment shall be certified in accordance with ANSI Z358.1-2004.
- C. SSEW-1: Barrier-free safety station with swing-down eye/face wash and emergency shower actuation valve in stainless steel cabinet for recess mounting: Water Saver Model No. SSBF2150, or approved equal, with the following characteristics or modifications:

1. Ceiling-mounted exposed showerhead. Nipple length shall be as required for a complete installation; verify finished ceiling height.
  2. Exposed piping, showerhead, nipple, and escutcheon shall be stainless steel.
  3. Safety shower actuating arm shall be stainless steel.
  4. Showerhead shall have perforated stainless steel spreader.
  5. Eyewash heads shall be ABS plastic with flip-top dust covers.
  6. Eyewash flow shall be activated by swing-down actuation valve connected to eyewash piping.
  7. Eyewash components and safety shower actuating arm shall be mounted in a flanged, recessed-mounted 18 gauge stainless steel cabinet with No. 4 finish.
  8. Stay-open brass ball valves concealed behind stainless steel/access panel housing.
  9. Fixture shall be furnished with green plastic sign with graphic symbol for safety shower/eyewash.
- D. SSEW-2: Barrier-free safety station with swing-down eye/face wash and emergency shower actuation valve in stainless steel cabinet for surface mounting: Water Saver Model No. SSBF2173, or approved equal, with the following characteristics or modifications:
1. Wall-mounted exposed showerhead. Nipple length shall be as required for a complete installation; verify finished ceiling height.
  2. Exposed piping, showerhead, nipple, and escutcheon shall be stainless steel.
  3. Safety shower actuating arm shall be stainless steel.
  4. Showerhead shall have perforated stainless steel spreader.
  5. Eyewash heads shall be ABS plastic with flip-top dust covers.
  6. Eyewash flow shall be activated by swing-down actuation valve connected to eyewash piping.
  7. Eyewash components and safety shower actuating arm shall be mounted in a flanged, recessed-mounted 18 gauge stainless steel cabinet with No. 4 finish.
  8. Stay-open brass ball valves concealed behind stainless steel/access panel housing.
  9. Fixture shall be furnished with green plastic sign with graphic symbol for safety shower/eyewash.
- E. SSEW-3: Barrier-free safety station with swing-down eye/face wash, drain pan and emergency shower actuation valve in stainless steel cabinet for recessed mounting: Water Saver Model No. SSBF2170, or approved equal, with the following characteristics or modifications:
1. Wall-mounted exposed showerhead. Nipple length shall be as required for a complete installation; verify finished ceiling height.
  2. Exposed piping, showerhead, nipple, and escutcheon shall be stainless steel.
  3. Safety shower actuating arm shall be stainless steel.
  4. Showerhead shall have perforated stainless steel spreader.
  5. Eyewash heads shall be ABS plastic with flip-top dust covers.
  6. Eyewash flow shall be activated by swing-down actuation valve connected to eyewash piping.
  7. Eyewash components and safety shower actuating arm shall be mounted in a flanged, recessed-mounted 18 gauge (1.3mm) stainless steel cabinet with No. 4 finish. A stainless steel drain pan shall be integral with eyewash components and shall direct eyewash water to drain outlet in bottom of recessed mounting cabinet.
  8. Stay-open brass ball valves concealed behind stainless steel/access panel housing.
  9. Fixture shall be furnished with green plastic sign with graphic symbol for safety shower/eyewash.
- F. EW-1: Dual-purpose eye wash/drench hose, deck mounted: Water Saver Model No. EW1022-BP, or approved equal, with the following characteristics or modifications:
1. Dual-purpose eye wash/drench hose unit with dual gentle spray outlet heads and squeeze handle/valve with locking clip.
  2. Heads shall be equipped with flip top dust cover that automatically releases with water pressure.
  3. Flexible, reinforced PVC hose shall be furnished with swivel fitting at inlet end.

4. Furnish with in-line backflow preventer at the hose inlet.
5. Mounting flange and squeeze valve shall be chrome-plated brass with clear epoxy coating.
6. Mounting shank.

## 2.4 FINISHES

- A. Chrome finish with clear, acid-resistant coating:
  1. Applicable to:
    - a. All laboratory service fittings (except fittings inside fume hoods).
    - b. All laboratory service fittings mounted on stainless steel work surfaces, scullery sinks, hand or service sinks, or any other stainless steel laboratory furnishing item or equipment.
  2. Chrome finish: All exposed surfaces shall be polished and buffed, then electroplated with one layer of nickel and one layer of chrome. Each layer of plating shall completely cover all visible areas. Total plating thickness shall be not less than 0.4 mil. Finish:
    - a. Polished.
  3. Clear epoxy coating: Following plating, clear epoxy coating shall be applied to all exposed surfaces and then baked to permit curing. Surfaces shall have a minimum coating thickness of 2 mils.
- B. Colored coating:
  1. Applicable to:
    - a. Fume hood service fittings.
  2. Preparation: Surfaces to be coated shall be polished or sandblasted to produce a uniform fine-grained surface and immersed in a phosphoric acid cleaning solution to remove thoroughly all oil, grease and other foreign substances.
  3. Epoxy finish: Following cleaning, coating material shall be electrostatically applied to all exposed surfaces. After application, coating shall be fully baked to permit curing. Coating material shall be free-flowing epoxy powder with particle size of 1.4 to 2.8 mils. Surfaces shall have a minimum finished coating thickness of 2 mils.
  4. Color:
    - a. Fittings inside fume hoods shall have a colored finish color-coded to match the fitting service index color.
- C. Performance requirements for coated finishes:
  1. Chemical resistance:
    - a. Fume Test: Suspend coated samples in a container of at least 6 cu. ft. capacity, approximately 12 IN above open beakers, each containing 100 ml of 70 percent nitric acid, 94 percent sulfuric acid and 35 percent hydrochloric acid, respectively. After exposure to these fumes for 150 hours, the finish on the samples shall show no discoloration, disintegration or other effects.
    - b. Direct Application Test: Subject coated samples to the direct action of the following reagents and solvents at a temperature of 25 degrees C dropping from a burette at the rate of 60 drops per minute for ten minutes. Finish on samples shall not rupture, though slight discoloration or temporary softening is permissible.

| Reagent              | Concentration |
|----------------------|---------------|
| Acetic Acid          | 98%           |
| Acetone              |               |
| Ammonium Hydroxide   | 28%           |
| Amyl Acetate         |               |
| Amyl Alcohol         |               |
| Benzene              |               |
| Butyl Alcohol        |               |
| Calcium Hypochlorite |               |
| Carbon Disulfide     |               |
| Carbon Tetrachloride |               |

| Reagent               | Concentration |
|-----------------------|---------------|
| Chloroform            |               |
| Chromic Trioxide Acid |               |
| Cresol                |               |
| Crude Oil             |               |
| Dioxane               |               |
| Distilled Water       |               |
| Ether                 |               |
| Ethyl Acetate         |               |
| Ethyl Alcohol         |               |
| Ethyl Ether           |               |
| Formaldehyde          | 37%           |
| Formic Acid           | 90%           |
| Gasoline              |               |
| Glacial Acetic Acid   | 99.5%         |
| Glycerine             |               |
| Hydrochloric Acid     | 38%           |
| Hydrofluoric Acid     | 48%           |
| Hydrogen Peroxide     | 5%            |
| Isopropyl Alcohol     |               |
| Lactic Acid           | 10%           |
| Kerosene              |               |
| Methanol              |               |
| Methyl Alcohol        |               |
| Methyl Ethyl Ketone   |               |
| Methylene Chloride    |               |
| Mineral Oil           |               |
| Monochlor Benzene     |               |
| N-Hexane              |               |
| Naphthalene           |               |
| Nitric Acid           | 70%           |
| Perchloric Acid       | 70%           |
| Phenol                |               |
| Phosphoric Acid       | 75%           |
| Sea Water             |               |
| Silver Nitrate        | 30%           |
| Sodium Bichromate     | saturated     |
| Sodium Carbonate      | 10%           |
| Sodium Chloride       | 20%           |
| Sodium Hydroxide      | 50%           |
| Sodium Hypochlorite   |               |
| Sodium Sulfide        |               |
| Sulfuric Acid         | 87%           |
| Toluene               |               |
| Trichlorethylene      |               |
| Turpentine            |               |
| Urea                  | saturated     |
| Xylene                |               |
| Zinc Chloride         | saturated     |

2. Mar and abrasion resistance: Coating material shall have a pencil hardness of 2H – 4H with adhesion substantial enough to withstand both direct and reverse impacts of 160 IN-pounds. Coating shall have excellent mar resistance and be capable of withstanding scuffing, marring and other ordinary wear.
3. Repairability: Scratches and other localized surface damage shall be field-repairable.

## 2.5 LABORATORY SINKS

- A. Epoxy Resin:
  - 1. Manufacturer: Manufacturer shall be the manufacturer of the epoxy resin work surfaces specified in Section 12 35 53.
  - 2. Laboratory Sinks:
    - a. Drop-in Type: Drop-in installation by Division 11 in epoxy resin work surface. Color to match work surface.
    - b. Comply with the requirements of Section 12 35 53 for epoxy resin.
    - c. All exposed edges shall be radiused not less than 1/4 IN.
    - d. Drain grooves in top, when indicated on drawings: Sink shall be set 1/8 IN below the lowest drain groove level.
    - e. Tops without drain grooves: Sink shall be set 1/8 IN below the level of the adjacent surface.
    - f. Provide epoxy resin sink outlet with strainer, stopper and open-end overflow, and install in sink with continuous bead of silicone sealant.
    - g. Provide tailpiece compatible with waste piping system for all sinks unless otherwise specified. Refer to Division 22 for piping requirements.
  - 3. Cup Sinks:
    - a. Fume Hood Locations: Provide cup sinks at fume hoods as described in Section 11 53 13, and at wall locations (see drawings).
    - b. Laboratory Work Surface Installations:
      - 1) Raised rim, color to match work surface, sizes as indicated on drawings, with integral threaded tailpiece.
      - 2) Flush with work surface, color to match work surface, sizes as indicated on drawings, with integral outlet and threaded tailpiece. Tailpiece shall be compatible with waste piping system for all sinks unless otherwise specified. Refer to Division 22 for piping requirements.
    - c. Comply with the requirements of Section 12 35 53 for epoxy resin.
    - d. Provide strainer for all cup sinks.
    - e. Provide mounting bracket for wall-mounted cup sinks.

## PART 3 - EXECUTION

### 3.1 SITE CONDITIONS

- A. Inspection:
  - 1. Prior to installation of fixtures specified in Section 11 53 43, carefully inspect the installed Work specified in other Sections and verify that all such Work is complete to the point where this installation may properly commence.
  - 2. Verify that all Work has been installed in complete accordance with the original design, approved submittals, and the manufacturer's recommendations.
- B. Discrepancy:
  - 1. In the event of discrepancy, immediately notify the Architect.
- C. Installation:
  - 1. Rough-in fixture piping connections in accordance with minimum sizes indicated in fixture rough-in schedule for particular fixtures.
  - 2. Install fixtures plumb and level.
  - 3. Provide piping connections to fixtures with valves and escutcheons as specified in Division 22.
  - 4. Verify that fixtures and trim are tight, leak-free and function properly

### **3.2 PACKING AND DELIVERY**

- A. Deliver all fittings and fixtures to job site in recommended packaging, with each fitting individually packaged, marked, and scheduled for point of use.
- B. Inventory fittings, at job site, verify that type and quantity are correct, and re-package until installed.
- C. Store in clean, dry location.

### **3.3 INSTALLATION**

- A. Set internal volume control on all cup sink water fittings so water does not splash out of sink.
- B. Set sinks in chemical resistant sealing compound, secure and support, as recommended by the manufacturer.
- C. Emergency Showers:
  - 1. Emergency showers must be installed with a minimum of 16 IN of clearance from any obstruction to the center of the showerhead (eyewash or eye/face wash fixture is not considered an obstruction).
  - 2. In all cases, emergency showers shall be installed with showerhead positioned not lower than 82 IN or above 96 IN measured from the operational standing surface. Refer to drawings for mounting height within that range. If no range is provided, shower head shall be installed 96 IN above the operational standing surface.

**END OF SECTION**

**HDR**

**D I V I S I O N    1 2**  

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**FURNISHINGS**

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## **SECTION 12 24 14**

### **ROLLER SHADES**

#### **PART 1 - GENERAL**

##### **1.1 REFERENCES**

- A. ASTM-G21, Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.
- B. NFPA-70, National Electrical Code.
- C. NFPA-701-99, Fire Tests for Flame-Resistant Textiles and Films.

##### **1.2 SUBMITTALS**

- A. Shop Drawings:
  - 1. Plans, elevations, sections, product details, installation details, operational clearances, wiring diagrams and relationship to adjacent work.
  - 2. Prepare shop drawings on Autocad or Microstation format using base sheets provided electronically by the Architect.
- B. Product Data:
  - 1. Manufacturer's data sheets on each product to be used, including:
    - a. Preparation instructions and recommendations.
    - b. Styles, material descriptions, dimensions of individual components, profiles, features, finishes and operating instructions.
    - c. Storage and handling requirements and recommendations.
    - d. Mounting details and installation methods.
    - e. Window Treatment Schedule: For roller shades. Use same room designations as indicated on the Drawings and include opening sizes and key to typical mounting details.
- C. Samples:
  - 1. Selection Samples: For each finish product specified, one set of shade cloth options and aluminum finish color samples representing manufacturer's full range of available colors and patterns.
  - 2. Verification Samples: For each finish product specified, one complete set of shade components, unassembled, demonstrating compliance with specified requirements. Shadecloth sample and aluminum finish sample as selected. Mark face of material to indicate interior faces.
- D. Contract Closeout Information:
  - 1. Maintenance Data:
    - a. Methods for maintaining roller shades, precautions regarding cleaning materials and methods, instructions for operating hardware and controls.
  - 2. Warranty:
    - a. Roller shade and control systems: Manufacturer's standard non-depreciating 5-year warranty shall be provided.
  - 3. Interior finish fire performance data:
    - a. Provide for each finish material and type specified:
      - 1) Manufacturer's printed information including:
        - a) Fire class.
        - b) NFPA test number.
        - c) Photograph.
      - 2) Proof of purchase.

- E. LEED Information:
  - 1. LEED Credits MR 4.1 and 4.2, Recycled Content: Product data indicating percentages by weight of post-consumer and post-industrial recycled content for products having recycled content; include statement indicating costs for each product having recycled content.
  - 2. LEED Credits MR 5.1 and 5.2, Regional Materials: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.

### **1.3 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Obtain roller shades through one source from a single manufacturer with a minimum of twenty years experience in manufacturing products comparable to those specified in this section.
- B. Installer Qualifications: Installer trained and certified by the manufacturer with a minimum of ten years experience in installing products comparable to those specified in this section.
- C. Fire-Test-Response Characteristics: Passes NFPA-701-99 small and large-scale vertical burn. Materials tested shall be identical to products proposed for use.
- D. Anti-Microbial Characteristics: 'No Growth' per ASTM-G21 results for fungi ATCC 9642, ATCC 9644, and ATCC 9645.
- E. Mock-Up: Provide a mock-up (manual shades only) of one roller shade assembly for evaluation of mounting, appearance and accessories:
  - 1. Locate mock-up in window designated by Architect.
  - 2. Do not proceed with remaining work until, mock-up is accepted by Architect.

### **1.4 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver shades in factory-labeled packages, marked with manufacturer and product name, fire-test-response characteristics, and location of installation using same room designations indicated on Drawings and in the Window Treatment Schedule.

### **1.5 PROJECT CONDITIONS**

- A. Environmental Limitations: Install roller shades after finish work including painting is complete and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

### **1.6 EXTRA MATERIAL**

- A. Furnish extra materials that match products installed:
  - 1. Package extra materials with protective covering for storage and label to describe contents.
  - 2. Provide 5 percent additional shade cloth fabric of each type for BNL's attic stock.

### **1.7 WARRANTY**

- A. Roller Shade Hardware, Chain and Shadecloth: Manufacturer's standard non-depreciating twenty-five year limited warranty.

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS**

- A. Acceptable manufacturers:
  - 1. Roll shades:
    - a. MechoShade Systems:

- 1) Basis of Design, MechoShade V system.
- b. Silentgliss.
- c. Castec.

## **2.2 APPLICATIONS/SCOPE**

- A. Roller Shade Schedule:
  1. Shade Type SH-1: Manual operating, chain drive, sunscreen roller shades in exterior windows.
  2. Shade Type SH-2: Manual operating, chain drive, room darkening blackout roller shades, operating independently of each other, in exterior windows of Seminar Room 201, and in interior windows of Labs 137 and 138.

## **2.3 SHADE CLOTH**

- A. SH-1: Visually Transparent Single-Fabric Shadecloth: MechoShade Systems, Inc., EcoVeil group, 1550 series, extra dense basket-weave, 3 percent OF (openness factor).
- B. SH-2: Room Darkening Shadecloth (Single-Fabric): MechoShade Systems, Inc., EcoVeil group 1100 series 1 by 1 basket-weave, 1 percent OF.
- C. Color as indicated on Room Finish Schedule Key.

## **2.4 SHADE BAND**

- A. Shade Bands: Construction of shade band includes the fabric, the hem weight, hem-pocket, shade roller tube, and the attachment of the shade band to the roller tube. Sewn hems and open hem pockets are not acceptable:
  1. Hem Pockets and Hem Weights: Fabric hem pocket with RF-welded seams (including welded ends) and concealed hem weights. Hem weights shall be of appropriate size and weight for shade band. Hem weight shall be continuous inside a sealed hem pocket. Hem pocket construction and hem weights shall be similar, for shades within one room.
  2. Shade band and Shade Roller Attachment:
    - a. Use extruded aluminum shade roller tube of a diameter and wall thickness required to support shade fabric without excessive deflection. Roller tubes less than 1.55 inch (39.37 mm) in diameter for manual shades, and less than 2.55 inches (64.77 mm) for motorize shades are not acceptable.
    - b. Provide for positive mechanical engagement with drive / brake mechanism.
    - c. Provide for positive mechanical attachment of shade band to roller tube; shade band shall be made removable / replaceable with a "snap-on" snap-off" spline mounting, without having to remove shade roller from shade brackets.
    - d. Mounting spline shall not require use of adhesives, adhesive tapes, staples, and/or rivets.
    - e. Any method of attaching shade band to roller tube that requires the use of: adhesive, adhesive tapes, staples, and/or rivets are not acceptable.

## **2.5 SHADE FABRICATION**

- A. Fabricate units to completely fill existing openings from head to sill and jamb-to-jamb, unless specifically indicated otherwise.
- B. Fabricate shadecloth to hang flat without buckling or distortion. Fabricate with heat-sealed trimmed edges to hang straight without curling or raveling. Fabricate unguided shadecloth to roll true and straight without shifting sideways more than 1/8 inch (3.18 mm) in either direction per 8 feet (2438 mm) of shade height due to warp distortion or weave design. Fabricate hem as follows:
  1. Bottom hem weights for concealed hem tube.

## 2.6 COMPONENTS

- A. Access and Material Requirements:
  - 1. Provide shade hardware allowing for the removal of shade roller tube from brackets without removing hardware from opening and without requiring end or center supports to be removed.
- B. Manual Operated Chain Drive Hardware and Brackets:
  - 1. Provide for universal, regular and offset drive capacity, allowing drive chain to fall at front, rear or non-offset for shade drive end brackets. Universal offset shall be adjustable for future change.
  - 2. Provide hardware capable for installation of a removable fascia, for both regular and/or reverse roll, which shall be installed without exposed fastening devices of any kind.
  - 3. Provide shade hardware system that allows for removable regular and/or reverse roll fascias to be mounted continuously across two or more shade bands without requiring exposed fasteners of any kind.
  - 4. Provide shade hardware system that allows for operation of multiple shade bands (multi-banded shades) by a single chain operator, subject to manufacturer's design criteria. Connectors shall be offset to assure alignment from the first to the last shade band.
  - 5. Provide shade hardware system that allows multi-banded manually operated shades to be capable of smooth operation when the axis is offset a maximum of 6 degrees on each side of the plane perpendicular to the radial line of the curve, for a 12 degrees total offset.
  - 6. Provide positive mechanical engagement of drive mechanism to shade roller tube. Friction fit connectors for drive mechanism connection to shade roller tube are not acceptable
  - 7. Provide shade hardware constructed of minimum 1/8-inch (3.18 mm) thick plated steel or heavier as required to support 150 percent of the full weight of each shade.
  - 8. Drive Bracket / Brake Assembly:
    - a. MechoShade Drive Bracket model M5 shall be fully integrated with MechoShade accessories, including, but not limited to: SnapLoc fascia, center supports and connectors for multi-banded shades.
    - b. M5 drive sprocket and brake assembly shall rotate and be supported on a welded 3/8 inch (9.525 mm) steel pin.
    - c. The brake shall be an over running clutch design which disengages to 90 percent during the raising and lowering of a shade. The brake shall withstand a pull force of 50 lbs. (22 kg) in the stopped position.
    - d. The braking mechanism shall be applied to an oil-impregnated hub on to which the brake system is mounted. The oil impregnated hub design includes an articulated brake assembly, which assures a smooth, non-jerky operation in raising and lowering the shades. The assembly shall be permanently lubricated. Products that require externally applied lubrication and or not permanently lubricated are not acceptable.
    - e. The entire M5 assembly shall be fully mounted on the steel support bracket, and fully independent of the shade tube assembly, which may be removed and reinstalled without effecting the roller shade limit adjustments.

## 2.7 ACCESSORIES

- A. Fascia for Shade Type SH-1 and SH-2:
  - 1. Continuous removable extruded aluminum fascia that attaches to shade mounting brackets without the use of adhesives, magnetic strips, or exposed fasteners.
  - 2. Fascia shall be able to be installed across two or more shade bands in one piece.
  - 3. Fascia shall fully conceal brackets, shade roller and fabric on the tube.
  - 4. Provide bracket / fascia end caps where mounting conditions expose outside of roller shade brackets.
  - 5. Notching of Fascia for manual chain shall not be acceptable.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Do not begin installation until substrates have been properly prepared.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

### **3.2 PREPARATION**

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

### **3.3 INSTALLATION**

- A. Install roller shades level, plumb, square, and true according to manufacturer's written instructions, and located so shade band is not closer than 2 inches (50 mm) to interior face of glass. Allow proper clearances for window operation hardware.
- B. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.
- C. Clean roller shade surfaces after installation, according to manufacturer's written instructions.
- D. Engage Installer to train BNL's maintenance personnel to adjust, operate and maintain roller shade systems.

### **3.4 PROTECTION**

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Substantial Completion.

**END OF SECTION**



**SECTION 12 34 00**  
**FORMALDEHYDE-FREE ARCHITECTURAL CASEWORK (AC)**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. Work includes:
  - 1. Furnish labor, materials, tools, equipment, and services for laminate faced architectural casework (AC) as indicated on drawings, plans and elevations, both plastic laminate and wood veneer-faced, standard and custom configurations as indicated.
  - 2. Completely coordinate with work of other trades.
  - 3. Although such work is not specifically indicated, provide supplementary or miscellaneous items, appurtenances and devices incidental to or necessary for a sound, secure and complete installation, including, but not limited to accompanying countertops and brackets, and other surrounds.
  - 4. See Division 01 for General Requirements.
  - 5. Architectural casework (AC) elevations as indicated on Drawings in Contract Documents are covered in this section.
- B. See drawings for types of countertops required.
- C. Definitions:
  - 1. Refer to Fabrication requirements in Part II of this specification.
    - a. Exposed surfaces: Surfaces visible after installation.
    - b. Concealed surfaces: Surfaces not visible after installation.
    - c. Semi exposed surfaces: Surfaces not meeting the definition of exposed or concealed, including the interiors of drawer and door components.

**1.2 QUALITY ASSURANCE**

- A. Installer qualifications: Manufacturer, or manufacturer's authorized representative.
- B. Construction details, fastening, tolerances and workmanship:
  - 1. Comply with 8<sup>th</sup> Edition (or most current) of "Architectural Woodwork Quality Standards" by AWI.
  - 2. Architectural Woodworking Institute (AWI) Premium grade standards, with exceptions indicated.

**1.3 SUBMITTALS**

- A. Shop Drawings:
  - 1. Plans and elevations:
    - a. Plans of casework at 1/8 IN = 12 IN or larger.
    - b. Elevations of casework at 1/4 IN = 1 FT or larger.
    - c. Cross reference shop drawings to Construction Drawing casework elevation reference numbers.
- B. Samples:
  - 1. Sealant colors for selection.
  - 2. Hardwood veneer.
  - 3. Hardware.
- C. Contract Closeout Information:
  - 1. Operating and maintenance data.
  - 2. Warranty.

D. LEED Information:

1. LEED Credits MR 4.1 and 4.2, Recycled Content: Product data indicating percentages by weight of post-consumer and post-industrial recycled content for products having recycled content; include statement indicating costs for each product having recycled content.
2. LEED Credits MR 5.1 and 5.2, Regional Materials: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional
3. LEED Credit MR 7, Certified Wood: Certification by Forest Stewardship Council for lumber furnished from certified sustainable forest.
4. LEED Credit EQ 4.1, Low-Emitting Materials, Adhesives and Sealants: Manufacturer's product data for adhesives, including printed statement of VOC content.
5. LEED Credit EQ 4.4, Low-Emitting Materials, Composite Wood and Agrifiber Products: Composite wood manufacturer's product data for each composite wood product used indicating that the bonding agent used contains no urea formaldehyde.

**1.4 JOB CONDITIONS**

- A. Verify dimensions at site.
- B. Verify locations of items furnished in other sections.
- C. If necessary to vary from arrangement indicated because of structural, mechanical, electrical or other considerations, make such variations only after approval of LT.

**1.5 PRODUCT DELIVERY, STORAGE AND HANDLING**

- A. Store in dry, weathertight, ventilated, temperature and humidity controlled spaces.
- B. Stack to provide air circulation.
- C. Time delivery and installation to avoid delaying progress of other work.

**1.6 WARRANTY**

- A. Manufacturer to provide 5-year warranty against defects in materials and workmanship, such as but not limited to delamination, swelling, or warping.

**PART 2 - PRODUCTS**

**2.1 GENERAL**

- A. Acceptable manufacturers:
  1. Plastic Laminate-faced Architectural Casework:
    - a. Base:
      - 1) TMI Systems Design.
      - 2) LSI of America.
      - 3) Calmar Manufacturing (Tru-Bilt).
    - b. The apparent successful bidder shall provide the following prior to submittal of Shop Drawings:
      - 1) Sample of finished base cabinet unit, 18 IN wide minimum, with one drawer, door and shelf, complete with hardware conforming to requirements.
      - 2) Catalog of standard units (detailing construction and assembly of components.
      - 3) If not acceptable, construct additional sample cabinets.
      - 4) Sample cabinet constitutes standard of quality for actual construction.
      - 5) Maintain sample at job office during construction, as a basis for Architect's acceptance of the remainder of the work.

2. Formaldehyde-free particleboard:
  - a. Base:
    - 1) PureKor Formaldehyde-free Plus.
    - 2) SkyBlend Formaldehyde-free.
3. Agrifiber Composite Board:
  - a. Base:
    - 1) Primeboard.
    - 2) BioFiber Wheat.
4. Medium Density Fiberboard:
  - a. Base:
    - 1) Sierra Pine.
5. Plastic Laminate:
  - a. Base:
    - 1) Formica.
    - 2) Nevamar.
    - 3) Wilsonart.
6. Contact Adhesive:
  - a. Base:
    - 1) Conbond.
7. Plastic Overlay Panel products:
  - a. Base:
    - 1) Simpson Timber.; Shelton, WA.
    - 2) Selply.; White City, OR.
    - 3) Casework Manufacturer.
8. Cabinet Hardware:
  - a. Base:
    - 1) Accuride.
    - 2) EpcO; Flint, MI.
    - 3) Hafele.
    - 4) Blum.
    - 5) Knappe & Vogt.
    - 6) Grant; West Hyack, NY.
    - 7) National Lock; Mauldin, SC.
    - 8) Ilco Unican Corporation.
    - 9) Stanley Hardware.
    - 10) Stylmark; Minneapolis, MN.
    - 11) HEWI.
    - 12) LSI America.
    - 13) TMI Systems Design.
    - 14) Rockford Process Control; Rockford, IL.
    - 15) U.S. Futaba; Santa Ana, CA.
    - 16) Rohm & Haas.
    - 17) Weber Knapp Company, Jamestown, NY.
    - 18) Corbin Cabinet Lock Div.
    - 19) Schlage Lock.
    - 20) Olympus Lock; Seattle, WA.
    - 21) Sugatsune America, (Lamp); Carson, CA.
    - 22) Bull Dog Lock.; Chicago, IL.
    - 23) Colson Caster Corporation; Jonesboro, AR.
    - 24) PX Industries; Farmingdale, NY.
9. Stains and Varnishes:
  - a. Base:
    - 1) Pratt and Lambert.
  - b. Optional:
    - 1) Sherwin-Williams.
    - 2) Glidden Paint.

- 3) Fuller-O'Brien Paints.
- 10. Plastic Laminate-faced Countertops:
  - a. Base:
    - 1) VT Industries.; Holstein, IA.
- 11. Wood Moulding:
  - a. Base:
    - 1) Southern Architectural Woodwork, Columbia, SC.
    - 2) Custom Woodworks Limited, Sioux City, IA.
- 12. Sealant:
  - a. Base:
    - 1) Color Rite.
- 13. Other miscellaneous items:
  - a. Base: Products and Manufacturers as listed.

## 2.2 MATERIALS - GENERAL

- A. Plastic Laminate-Faced Casework:
  - 1. Fixed factory built formaldehyde-free core casework finished on exterior with high pressure laminate. Interior of plastic laminate faced units with plastic overlay. Provide units complete with hardware, countertops and subbases, in sizes and configurations indicated. Refer to Fabrication requirements in Part II of this specification.
    - a. Style:
      - 1) Reveal overlay, with square cornered doors and drawer fronts overlapping case front with minimum reveal at plastic laminate casework.
      - 2) Plastic laminate doors and drawer fronts shall be edged with 3mm ABS banding, machine applied using waterproof hot melt adhesive. Machine profile exposed edges with 1/8 IN radius.
    - b. Jointing:
      - 1) Cabinet body construction shall be 3/4 IN thick formaldehyde-free core joined with 10mm diameter industrial grade hardwood dowels, securely glued and clamped under pressure during assembly.
- B. Plastic Laminate Facings:
  - 1. Standard: NEMA LD3-1991 high-pressure decorative laminate (HPDL).
  - 2. Thickness and Grade:
    - a. Countertops and backsplashes, and their edges: Grade-GP50, 0.050 IN thick.
    - b. Formed surfaces: Post form Grade-PF42.
    - c. Other exposed surfaces: Grade-GP28, 0.028 IN thick.
  - 3. Backer Sheets for laminated items.
    - a. Semi-exposed cabinet liner: Grade-CL20, 0.020 IN thick; color to match plastic overlay.
    - b. Concealed backer sheet: Grade-BK20, 0.020 IN thick.
  - 4. Laminate Color(s): as selected by Architect from laminate manufacturer's full line.
    - a. See Finish Schedule for selections.
    - b. Allow for 5 different cabinet face colors for project; no more than 1 color per each elevation.
    - c. Allow for 5 different countertop colors.
    - d. Color of laminate on countertop edges: Same as surface of the item.
    - e. Color of other plastic laminate edges: Black or to match plastic overlay, as selected by BNL.
  - 5. See "Fabrication-Case Components" for components requiring plastic laminate finish.
- C. Contact Adhesive:
  - 1. Comply with South Coast Air Quality Management District Rule 1168 for VOC content of not more than 80 g/L.
- D. Plastic Overlay:
  - 1. Resin impregnated 80 gram paper overlay, glued and press cured onto substrate.

2. Conform to NEMA LD3.3 wear resistance Grade-GP28 requirements for "General Purpose" decorative board (not "Light Duty" liner type).
  3. Finish: Satin.
  4. Color: As selected by BNL from manufacturer's standard color line of dove gray, frosty white and light beige.
  5. Material: Polyester or Melamine; phenolic resin may be used on concealed surfaces.
  6. Substrates: As indicated below; see "Fabrication- Case Components" for components requiring plastic overlay finish.
- E. Wood veneer laminate-faced:
1. Refer to Finish Key for specification.
- F. Formaldehyde-free particleboard:
1. ANSI-A208.1, mat formed.
  2. Density: 45 PCF.
  3. Type 1-M-3 for general use.
- G. Adhesives:
1. No greater than 80 g/L in accord with SCAQMD Rule 1168.
- H. Medium Density Fiberboard (MDF):
1. Meet or exceed ANSI 1037-87.
  2. Exterior grade, 48 PCF density, formaldehyde free.
  3. Base: Medite Corporation "MEDEX"; Medford, OR. (800/ 676-3339).
  4. Core material for counters, backsplash, and sidesplashes with sinks.
  5. Core material for p-lam faced window sills where indicated.
- I. ABS edge banding (all shelves in plastic laminate clad units):
1. Machine applied with waterproof hot-melt adhesive.
  2. Shelves: Apply to 4 edges.
  3. Thickness: 1mm.
  4. Color: To match case, as selected by BNL.
- J. ABS Edge-banding for doors and drawer fronts and removable panels:
1. Machine applied with waterproof hot-melt adhesive.
  2. Thickness: 3mm.
  3. See color schedule for selections (Section 09 06 10).
  4. Color: As selected by BNL, to match laminate.
    - a. Allow for 5 different colors.
- K. Sealant:
1. Base Product: "Poly-Sil" by Color Rite.
  2. Description:
    - a. Polymers suspended in 100% Silicone.
    - b. Specifically formulated for applications indicated, including wet areas.
    - c. Mold/Mildew-resistant.
    - d. Elastomeric.
    - e. Shore A Hardness: 25.
    - f. Compatible with Gypsum wallboard, Painting, Plastic Laminate, Stone, Wood, Solid Polymer Materials (SPM), and other materials specified in this section.
  3. Colors:
    - a. Colors as required to match Plastic Laminate, Stone, Wood, Solid Polymer Materials (SPM) specified for casework bodies, countertops and splashes.
    - b. BNL to select from no less than 450 standard color choices.
    - c. Number of different colors required for project shall not be limited.
    - d. Sealants shall have a VOC content no more than 250 g/L in accord with SCAQMD Rule #1168.

## 2.3 CABINET DOOR HARDWARE

- A. 5-knuckle Hinges:
  - 1. Institutional (hospital tip), 5 knuckle, wrap around type (screwed to back of door and side of divider/end), with barrel only projecting beyond face of cabinet. (used on plastic laminated faced units).
  - 2. Not less than 2-3/4 IN long.
  - 3. Minimum 8 screws per hinge.
  - 4. Shall pass ANSI/BHMA-A156.9 Grade-1 requirements.
  - 5. Hinge Quantities per leaf:
    - a. For doors up to 48 IN high: 2 hinges.
    - b. For doors over 48 IN high: 3 hinges.
  - 6. Finish: Epoxy Powder Coat.
  - 7. Color: BNL to select.
- B. Wire Pulls:
  - 1. Wire type (for use on plastic laminate-faced doors).
  - 2. 4 IN centers.
  - 3. Finish: Epoxy Powder Coat.
  - 4. Color: BNL to select.
- C. Catches:
  - 1. Magnetic, adjustable, 6-7 LB pull; or Roller type; provide 40 LB unit on doors over 4 FT<sup>2</sup>.
- D. Locks:
  - 1. Provide as noted on Q-Drawings.
- E. Elbow Catch:
  - 1. Provide at doors with locks.
- F. Door Stops:
  - 1. Metal slide type with positive stop.
- G. Door Bumpers:
  - 1. Provide on backside of add doors.

## 2.4 CABINET DRAWER HARDWARE

- A. Drawer Slides:
  - 1. Nylon wheels/rollers, stainless steel or polymer ball bearings, positive closing and pull out stops, drawer removable without use of tools; file drawers.
  - 2. Full extension (all capacities).
  - 3. Capacity:
    - a. Standard Drawers (other than types listed below): 100 LBS.
    - b. File Drawers: 150 LBS.
    - c. Lateral Files:
      - 1) Less than 42 IN wide: 200 LBS.
      - 2) 42 to 48 IN wide: 400 LBS.
  - 4. Optional Product:
    - a. "Metabox System" by Blum, is acceptable where capacities (listed above) can be met.
- B. Wire Pulls:
  - 1. Wire type (for use on plastic laminate faced-drawers).
  - 2. 4 IN centers.
  - 3. Finish: Epoxy Powder Coat.
  - 4. Color: BNL to select.
- C. Locks:
  - 1. Provide as noted on Q-Drawings.

- D. Suspension Rails (file drawers):
  1. Description: 14 GA steel pendaflex file suspension rails, epoxy coated in dove gray, frosty white or light beige to match drawer body color.
  2. Provide one pair of such rails at file drawers.
- E. Drawer bumpers:
  1. Provide on backside of drawer faces.

## **2.5 HARDWARE FOR SLIDING FORMALDEHYDE-FREE CORE DOORS**

- A. General:
  1. Hardware in this article is intended for formaldehyde-free core sliding cabinet doors.
- B. Tracks:
  1. Mortised bottom sheaves:
    - a. Base Product: "582 STL" by Knape & Vogt.
    - b. Minimum of 2 per door but not more than 18 IN.
  2. Mortised bottom guide rail:
    - a. Base Product: "469 ZC" by Knape & Vogt.
    - b. Let into bottom panel of cabinet.
  3. Upper guide mortised in door:
    - a. Base Product: "2409 Nylon" by Knape & Vogt.
    - b. Requires dado groove in top panel of cabinet.
    - c. Minimum of 2 per door but not more than 18 IN.
  4. Flush pulls:
    - a. Base Product: "542 recessed" by HEWI.
  5. Locks:
    - a. Base Product: "SC-180" by Sugatsune (LAMP).
    - b. Provide as indicated ("L") on AC elevations for sliding doors.

## **2.6 LOCKS**

- A. Locks (typical type):
  1. Small-pin tumbler with heavy-duty deadbolt.
    - a. Disc-tumbler type locks will not be accepted.
    - b. Cam locks will not be accepted.
  2. Keyway: D4292 (5-pin).
  3. ANSI/BHMA Standard: E07121.
    - a. Cycle Tested per ANSI/BHMA A156.11 Grade 1.
  4. Base Products:
    - a. Door Locks: "#100DR" by Olympus Lock.
    - b. Drawer Locks: "#200DW" by Olympus Lock.
  5. Finish: Satin Chrome US26D (BHMA 626).
  6. Include spacers, adapters, fasteners and strikes.
  7. Barrel Length: As appropriate for conditions.
  8. Provide 2 keys for each lock.
  9. Master key and grand master key as directed.
  10. Finish: As selected by BNL.
  11. Provide 20 extra locks.

## **2.7 SUPPORTS AND BRACKETS**

- A. Adjustable Shelf Supports (drilled hole type):
  1. Description: Friction fit into cabinet end panels and vertical dividers, readily adjustable on 1 1/4 IN centers.
  2. Material: Injection molded polycarbonate.
  3. Color: Clear to blend with selected interior finish.
  4. Provide non-tip feature and allow for field fixing of shelf if desired

5. Capacity: Structural test shall indicate loading of shelf to 1500 LBS ( 375 LBS per support device).
  6. No substitutions.
- B. Wall Shelf Supports:
1. Provide for shelves mounted to walls (not within cabinets).
  2. Finish: Enamel, Anochrome or anodized aluminum.
  3. Standards: Heavy duty slotted steel.
  4. Shelf brackets: Boltless, steel or aluminum, shelf depths as indicated.
  5. Shelf rests: Anchor shelf to bracket.

## **2.8 HARDWARE FOR REMOVABLE PANELS**

- A. Catches (for removable panels):
1. "Flush Recessed Catch" by Bull Dog.
  2. Provide 4 per panel.
- B. Electrical access panel below counters:
1. Heavy duty concealed hinges (2 per panel).
  2. Key lock at strike side - no pulls.

## **2.9 GROMMETS**

- A. Grommets for cords:
1. Base Product: "XG-3" by Doug Mockett & Company.
  2. Finish: Black or putty as selected by BNL.
  3. Provide cap with 5/8 IN cord slot.
  4. Provide as indicated on Drawings and at each location with undercounter electrical or systems outlet, cord drop location, and keyboard drawer location.
- B. Grommets for paper slots:
1. Base Product: "CP-1, with "nubber" paper retainer" by Doug Mockett & Company.
  2. Finish: Black or putty as selected by BNL.
  3. Provide as indicated on Drawings.

## **2.10 MISCELLANEOUS CABINET HARDWARE**

- A. Hinged lid stay:
1. Base Manufacturer: Hafele.
  2. Finish: Satin chrome.
  3. Provide with metal construction and spring loaded adjustable brake mechanism.
- B. Hinge, continuous:
1. Base Product: "0351.04.039" by Hafele.
  2. Finish: Chrome finish.

## **2.11 COUNTERTOP MATERIALS & FABRICATIONS**

- A. Engineered Quartz Fabrication Countertops (SSF): Specified in Section 12 36 65.

## **2.12 FABRICATION - DEFINITIONS**

- A. Definitions:
1. Exposed surfaces: Surfaces visible when doors and drawers are closed:
    - a. Door and drawer fronts, and their edges.
    - b. Exposed ends.
    - c. Bottom of wall case.
    - d. Countertop and backsplash and their exposed edges.
    - e. Face of cabinet body not covered by doors or drawer fronts.
    - f. Toe strip not to be covered by separate base.
    - g. Wall mounted adjustable shelves and their edges.

- h. Interior of open cabinets, including shelving.
- i. Interior of cabinets with glass doors.
- 2. Concealed surfaces: Surfaces not visible after installation:
  - a. Solid top panels.
  - b. Security panels.
  - c. Locking rails.
- 3. Semi-exposed surfaces: Other surfaces not exposed or concealed, and:
  - a. Interior of closed cabinets.
  - b. Top of wall and tall cases.
  - c. Drawers.

## **2.13 CASE COMPONENTS (FOR PLASTIC LAMINATE-FACED CABINETS)**

- A. General Finishes for non-fire-rated cabinets:
  - 1. Exposed surfaces: Plastic Laminate.
  - 2. Semi-exposed surfaces: Plastic Overlay.
  - 3. Edges of Doors and Drawer Fronts: 3mm ABS edge banding.
  - 4. Edges of Case Body members: 1mm ABS edge banding.
  - 5. Edges of Shelves: 1mm ABS edge banding (4-sides).
- B. Case Body Members:
  - 1. Sides: 3/4 IN Formaldehyde-free core with Plastic Overlay (1-side).
  - 2. Top Panels: 3/4 IN Formaldehyde-free core with Plastic Overlay (2-sides).
  - 3. Backs: 1/2 IN Formaldehyde-free core with Plastic Overlay (1-side).
    - a. Exception: Where back face is exposed to view: Upgrade to 3/4 IN Formaldehyde-free core; Plastic Overlay on inside face; Plastic Laminate (color matching sides and fronts) on exposed back face.
  - 4. Semi-exposed Members: 3/4 IN Formaldehyde-free core with Plastic Overlay (2-sides).
  - 5. Exposed edges of Formaldehyde-free core: 1mm ABS edge banding.
  - 6. Security Panels: 1/2 IN Formaldehyde-free core with Plastic Overlay (2-sides).
  - 7. Drawer Lock Rails: 3/4 IN Formaldehyde-free core with Plastic Overlay (2-sides).
  - 8. Base: 3/4 IN Formaldehyde-free core, with intermediate reinforcing at 24 IN on O.C. (maximum).
- C. Shelves:
  - 1. Semi-exposed Shelves: 3/4 IN Formaldehyde-free core with Plastic Overlay (2-sides).
    - a. Exception: Increase thickness to 1 IN for spans exceeding 30 IN.
  - 2. Exposed Shelves: Shelves: 3/4 IN Formaldehyde-free core with Plastic Laminate (2-sides).
    - a. Exception: Increase thickness 1 IN for spans exceeding 30 IN.
- D. Doors:
  - 1. 3/4 IN Formaldehyde-free core with Plastic Laminate on exposed faces, Plastic Overlay on semi-exposed faces.
  - 2. Edges: 3mm ABS edge banding on laminate-faced doors.
  - 3. Doors not to exceed 25 IN in width.
- E. Drawers:
  - 1. Drawer Fronts:
    - a. 3/4 IN Formaldehyde-free core with Plastic Laminate on exposed faces, Plastic Overlay on semi-exposed faces.
    - b. Edges: 3mm ABS edge banding on laminate-faced drawer fronts.
  - 2. Sub-fronts, Sides and Backs:
    - a. 1/2 IN Formaldehyde-free core with Plastic Overlay (2-sides).
    - b. Exposed top edges finished with 1mm ABS banding.
  - 3. Bottoms:
    - a. 1/2 IN Formaldehyde-free core with Plastic Overlay (2-side).
    - b. Include intermediate reinforcing rails where drawer width exceeds 18 IN.
- F. Case Base: Integral or separate base for each unit.

- G. Small Compartment Dividers: 1/4 IN Clear acrylic panel.
- H. Filler Panels and Scribe Pieces: 3/4 IN Formaldehyde-free core with Plastic Laminate exposed surfaces; Plastic Overlay on semi-exposed or fully concealed surfaces,
- I. Grain Direction (where laminate has a predominate grain direction): Vertical grain at all frames, cases, doors faces, drawer faces and all other vertical surfaces.

## **2.14 FABRICATION - CONVENTIONAL JOINTING**

- A. Case body:
  - 1. Sides, dividers, bottom, and tops members:
    - a. Dowel with 10mm fluted hardwood dowels. Provide minimum of 6 dowels at each joint for 24 IN deep cabinets and a minimum of 4 dowels for 12 IN deep cabinets.
    - b. Glue joints.
  - 2. Back:
    - a. Dado into sides, bottom, and top. Locate dado 3/4 IN in from back face of cabinet or on-set type, lead in at finished ends, screwed at the top and bottom, stapled at the sides.
    - b. Glue joints.
  - 3. Compartment dividers & lock rails:
    - a. Doweled.
  - 4. Base:
    - a. Integral or separate, to receive base material to match adjacent walls, unless noted otherwise.
  - 5. Blind-fasten to bottom of case body when separate.
- B. Drawers with subfront:
  - 1. Sub-front, sides and back:
    - a. Doweled corners.
    - b. Glue joints.
  - 2. Bottom: Dado into 4 sides and glued or screwed to the bottom with the use of bottom supporting drawer slide hardware.
  - 3. Front:
    - a. Secured from subfront side with no less than four screws after adjustments.
- C. Use no blocking or fasteners in exposed or Semi-exposed locations.

## **2.15 FABRICATION - MECHANICAL FASTENERS**

- A. Countertop joints:
  - 1. Provide joint connectors every 6 IN OC.
- B. Pre-drill and countersink screw holes before installation.
- C. Do not use mechanical fasteners or blocking in exposed locations. When fasteners are required on exposed surfaces color, materials and finish to be approved by BNL.

## **2.16 FABRICATION - CASE CONFIGURATION**

- A. Plastic Laminate-Faced Units:
  - 1. Provide reveal, approximately 1/8 IN, at top of doors and drawer fronts, and between doors and drawer fronts in same unit; reveal approximately 7/16 IN at sides.
- B. Provide reveal 1/8 IN x 1/8 IN (black) in upper edge of exposed sides of wall case when plastic laminate soffits provided.
- C. Toe space:
  - 1. 4 IN high by approximately 3 IN deep; provide on front of each base unit unless noted on architectural drawings.
- D. Pairs of sliding doors:
  - 1. Equal width; overlap approximately 1 IN.

- E. Countertop:
  - 1. Plastic laminate units:
    - a. Overhang 3/4 IN beyond doors, drawer fronts and exposed ends.
- F. Hardware mounting:
  - 1. Drawers:
    - a. Center pull in front, horizontally.
    - b. No more than 4 IN from top.
  - 2. Drawers with 2 pulls:
    - a. Set pulls at 1/4 points.
    - b. No more than 4 IN from top.
  - 3. Swinging doors:
    - a. Set pull in swing side corner, vertically; at top of base units; at bottom of wall units.
- G. Exposed adjustable shelves:
  - 1. Use drilled hole supports only (32mm centers).
- H. Semi-exposed adjustable shelves:
  - 1. Use drilled hole supports (32mm centers).
    - a. Depth: 1/2 IN less than inside cabinet depth.
    - b. Width: 1/8 IN, maximum, less than inside cabinet width.
- I. Provide doors at locations requiring access to electrical devices, as indicated on drawings.

## **PART 3 - EXECUTION**

### **3.1 INSPECTION**

- A. Verify suitability of substrate to accept installation.
- B. Insure that adequate Wall Backing has been installed.
  - 1. Metal Wall Backing: Specified in Section 09 22 16.
  - 2. Coordinate and direct installation of backing where required.
- C. Correct unsatisfactory conditions.
- D. Installation constitutes acceptance of responsibility for performance.

### **3.2 INSTALLATION**

- A. Manufacturer to provide printed instructions or drawings on wall blocking locations and type required to Contractor.
- B. Use manufacturer's printed instructions or drawings in cases where items or details are not indicated.
- C. Provide trim, fillers, closures, stands, supports, sleeves, collars, escutcheons, ferrules, brackets, braces or other miscellaneous items required for complete installation.
- D. Provide cutouts for mechanical and electrical items.
- E. Seal sink cutouts.
- F. Install extra locks as directed; deliver unused locks to BNL.

### **3.3 SEALING OF JOINTS**

- A. Seal casework, countertops and splashes to walls, to seal joints.
  - 1. Sealant color to match countertop color.
- B. Seal perimeter of counter-mounted sink fixtures.
  - 1. Sealant color to match countertop or sink color(s).

- C. Seal window sills to walls and window frames to seal joints.
  - 1. Sealant color to match color(s) of sill material specified.

#### **3.4 ADJUSTMENTS AND CLEANING**

- A. Test and adjust items of equipment for satisfactory operation.
- B. Adjust hinges for proper door alignment.
- C. Adjust drawer guides for proper drawer front alignment and operation.
- D. Adjust countertops to a level position and align to adjacent unit.
- E. Repair damage to casework or countertops to appear in original new condition.
- F. Repair damage to premises as a result of installation.
- G. Remove debris left by this installation.
- H. Clean casework and countertops after above items have been completed.

**END OF SECTION**

**SECTION 12 35 53**  
**LABORATORY CASEWORK AND OTHER FURNISHINGS**

**PART 1 - GENERAL**

**1.1 SECTION INCLUDES**

- A. Metal Laboratory Casework, Tables, and Casework Systems:
  - 1. Metal Laboratory Casework.
- B. Cabinet Hardware.
- C. Laboratory Work Surfaces.
- D. Mobile Base Cabinets.
- E. Balance Tables.
- F. Shelving Assemblies.
- G. Cylinder & Dewar Restraint Assembly.
- H. Overhead Service Carriers.
- I. Drying Rack.
- J. Cable / Vacuum Line Through Port.
- K. Blackout Curtain and Track Assembly.
- L. Metal Fabrications and Finish Requirements.
- M. Stainless Steel Fabrications:
  - 1. Work Surfaces.
  - 2. Canopy Hoods.
- N. Gowning Bench.
- O. Clean Room Garment and Supplies Storage.
- P. Slotted Channel Framing (Strut).
- Q. Sealant.

**1.2 UNDIVIDED RESPONSIBILITY**

- A. Unless specified otherwise, because of special coordination requirements, the supplier of the scope of work described in this Section shall also provide the scope of work described in the following Sections:
  - 1. Section 11 53 00 - Laboratory Equipment.
  - 2. Section 11 53 13 - Fume Hoods and Exhaust Devices.
  - 3. Section 11 53 33 - Laser Safety Equipment.
  - 4. Section 11 53 43 - Laboratory Service Fittings and Fixtures.

**1.3 REFERENCES**

- A. Work shall conform to the recommended practices of the Scientific Equipment and Furniture Association (SEFA), current version, except as superseded by this specification:
  - 1. SEFA 2 - Installation.
  - 2. SEFA 3 - Work Surfaces.
  - 3. SEFA 7 - Fixtures.
  - 4. SEFA 8 M - Laboratory Grade Metal Casework.

5. SEFA 8 PL – Laboratory Grade Plastic Laminate Casework.
- B. American Woodwork Institute (AWI): Architectural Woodwork Quality Standards Illustrated, Eighth Edition, 2003..
- C. American National Standards Institute:
  1. ANSI A208.1-1999 – Particleboard Plywood.
  2. ANSI A208.2-1999 – MDF Plywood.
  3. ANSI/HVPA HP-1 2004 – American National Standard for Hardwood and Decorative Plywood, with the Hardwood Veneer Plywood Association.

#### 1.4 SUBMITTALS

- A. Submit as specified herein and under provisions of Section 01 33 00.
- B. Materials List/Product Data: Submit complete materials list, including catalogue data, of all materials, equipment, and products for work in this section.
- C. Shop Drawings: Submit complete shop fabrication and installation drawings, including plans, elevations, sections, details and schedules. Show relationship to adjoining materials and construction. Shop Drawings shall be in the form of reproducibles or photocopies, not to exceed 11 IN by 17 IN in size. Blue line prints are not acceptable.
- D. Submit detailed anchorage and attachment drawings and calculations provided by a licensed Structural Engineer complying with the applicable Building Code seismic restraint requirements:
  1. Casework shall be designed and anchored in accordance with IBC 2000 Seismic Design Category C requirements.
- E. Samples: Accompanying Materials List, submit two (2) samples of each of the following items for Architect's approval:
  1. 4 IN by 4 IN sample of each laboratory work surface specified.
  2. 3 IN by 5 IN sample of each available standard paint color, stain with finish, or laminate, as is applicable.
  3. Hardware: pulls, locks, hinges, padlock latches, label holders, as specified.
  4. One (1) sample of each casework type specified, standing height or suspended height cabinet, respectively, 24 IN wide, with one drawer on top with door and adjustable shelf below.
- F. Operations/Maintenance Manuals: Accompanying certification, submit for Architect's review and BNL's use, complete operating and maintenance manuals that describe proper operating procedures, maintenance and replacement schedules, components parts list, and closest factory representative for components and service.
- G. Informational Submittals:
  1. Statement of Installer Qualifications.
  2. Load Tests: Provide on request, load test results certified by an independent testing laboratory for cabinet box, drawers, doors, suspensions slides, and unit shelving as identified in SEFA 8.
  3. Certificates:
    - a. Certify that factory tests specified for mechanical service fixtures have been performed and that products or systems meet or exceed specified requirements.
    - b. As a condition of acceptance, submit certification stating that equipment is complete and ready for intended function.
- H. LEED Information:
  1. LEED Credits MR 4.1 and 4.2, Recycled Content: Product data indicating percentages by weight of post-consumer and post-industrial recycled content for products having recycled content; include statement indicating costs for each product having recycled content.

2. LEED Credits MR 5.1 and 5.2, Regional Materials: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.

## 1.5 PRODUCT HANDLING

- A. Contractor shall schedule the delivery of casework and furnishings when spaces are sufficiently complete so materials can be installed immediately following delivery.
- B. Protection: Use all means necessary to protect work of this section before, during and after installation including installed work and materials of other trades.
- C. Replacement: Any damaged work shall be replaced, repaired and restored to original condition to the approval of the Architect at no additional cost or inconvenience to BNL.

## 1.6 QUALIFICATIONS

- A. Work in this section shall be performed by a company having a minimum of eight years documented experience, and an established organization and production facilities including all tools, equipment and special machinery necessary for specializing in the fabrication and installation of the type of equipment required, with skilled personnel, factory trained workmen and an experienced engineering department. Each shall have the demonstrated knowledge, ability and the proven capability to produce the specified equipment of the required quality and the proven capacity to complete an installation of this size and type within the required time limits.
- B. Casework installers shall be approved in writing by the casework manufacturer for the installation of specified products.

## 1.7 DESIGN AND PERFORMANCE CRITERIA

- A. Dimensions: Cabinets may be manufacturer's standard depth, provided such standard is not more or less than 1 IN of the depth indicated on the Drawings.

## PART 2 - PRODUCTS

### 2.1 METAL LABORATORY CASEWORK, TABLES AND CASEWORK SYSTEMS

- A. Manufacturers: Products complying with this specification may be provided by the following manufacturers. All painted metal laboratory casework, tables, and casework systems shall be provided by a single manufacturer:
  1. Laboratory Casework:
    - a. Hamilton Products, a part of Thermo Fisher Scientific, 1316 18th Street, Two Rivers, WI 54241, Tel: 920 793-1121. website: <http://www.hamiltonlab.com/>
    - b. LabCrafters, 2085 Fifth Avenue, Ronkonkoma, NY 11779, Tel:631 471-7755. website: <http://www.lab-crafters.com/>
    - c. Advanced Lab Concepts, 15900 Bratton Lane, Austin, TX 78728, Tel: 800 711-5227. website: <http://www.alc-corp.com>
    - d. Bedcolab, 2305 Francis-Hughes Avenue, Laval, QC H7S 1N5, Canada Tel: 800 461-6414. website: <http://www.bedcolab.com/>
    - e. Mott Manufacturing Limited., 452 Hardy Road, P. O. Box 1120, Brantford, ON, Canada N3T 5T3, Tel: 519 752-7825. website: <http://www.mott.com/>
    - f. Kewaunee Scientific Corporation, P O Box 1842, Statesville, NC 28687, Tel: 704 873-7202. website: <http://www.kewaunee.com/>
    - g. Substitutions are not permitted.
  2. Corrosives and Flammable Liquid/Solvent Storage Cabinets:

- a. Manufacturers of metal laboratory casework.
  - b. Justrite Manufacturing Company, 2454 Dempster St., Suite 300, Des Plaines, IL 60016  
Tel: 800 798-9250. website: <http://www.justritemfg.com/>
  - c. Eagle Manufacturing Company, 2400 Charles St., Wellsburg, WV 26070 Tel: 304  
737-3171. website: <http://www.eagle-mfg.com/>
  - d. Substitutions are not permitted.
- B. Design Requirements:
- 1. Door and drawer front design: Full flush overlay, construction with metal door and drawer fronts overlaying the case unit ends, top and bottom rails. Provide applied panels in areas such as sink cabinets and knee spaces with apron panels to provide a full flush overlay appearance.
  - 2. Pulls on doors shall be mounted vertically and on drawers horizontally.
  - 3. All tall cases shall be provided with toe space to match base units.
  - 4. All cabinets shall be constructed and finished to be suitable for use as stand-alone units and to permit future rearrangement without the need for additional parts or finish.
  - 5. Widths of drawers in knee opening rails shall not be less than 24 IN or the width of the rail whichever is the lesser.
  - 6. Structural Requirements: Work shall conform to the recommended structural requirements and testing of Scientific Equipment and Furniture Association, except as superseded by this specification.
- C. Materials:
- 1. Environmental Compliance:
    - a. All steel used in the product fabrication shall comply with the LEED II (Leadership in Energy and Environmental Design) Green Building Rating System.
    - b. The manufacturer shall submit documentation (i.e., "Source of Materials", Invoices, Third Party Validation, etc.) for steel purchased for this project providing recycled content. Such documentation shall be submitted to the Architect for approval - prior to award of contract.
  - 2. Cold rolled sheet steel:
    - a. Sheet Steel: All "Cold Rolled" sheet steel used in the fabrication of laboratory cabinets, fume hoods and modular laboratory systems shall have a minimum of 20 percent recycled steel content.
    - b. Recycled Steel Content: The 20 percent minimum recycled content shall consist of the sum of post-consumer recycled content plus 50 percent of the pre-consumer content.
    - c. Fabricators Scrap: Fabricators shall provide documentation that manufacturing fall-off is recycled to respective steel mills and neither enters the solid waste system nor becomes a product of landfill space.
    - d. Prime grade, roller leveled, and treated at the mill to be free of scale, ragged edges, deep scratches or other injurious effects. Thickness of metal used in construction of cases shall be 18 gauge, except as follows:
      - 1) 20 gauge: Solid door interior panels, drawer fronts, scribe strips, filler panels, enclosures, drawer bodies, shelves, security panels, and sloping tops.
      - 2) 16 gauge: Top front rails, top rear gussets, intermediate horizontal rails, table legs and frames, leg rails and stretchers.
      - 3) 14 gauge: Drawer suspensions, door and case hinge reinforcements, and front corner reinforcements.
      - 4) 12 gauge: Table leg corner brackets and gussets for leveling screws.
  - 3. Glass: Framed glass doors:
    - a. 7/32 IN nominal laminated glass with 0.060 IN clear vinyl interlayer, ANSI Z97.1, ASTM C1036 or C1048.
    - b. Without imperfections or marred surfaces.
    - c. Cut or drill to receive hardware.

D. Construction:

1. General:
  - a. All units shall have a cleanable smooth interior. Front and rear posts, reinforcing members or channel uprights shall be enclosed full heights on all cabinet openings.
  - b. Exterior corners: shall be spot and arc welded with gussets at exterior corners. All face joints shall be arc welded and ground smooth to provide a continuous flat plane.
  - c. Units less than 49 IN tall: Provide internal reinforcing and rear posts for end panels and cabinet backs.
  - d. Units 49 IN tall and greater: Provide formed end panels with front and rear reinforcing posts. Back shall be formed steel panel, recessed 3/4 IN for mounting purposes.
  - e. Posts: Front post fully closed with full height reinforcing upright to facilitate cleaning.
  - f. Shelf adjustment posts shall be perfectly aligned for level setting, with holes for shelf adjustment at 1/2 IN on center.
  - g. The front edge shall be formed to provide a strike for doors and drawers, and shall be pre-drilled for intermediate rails and hinge screws.
  - h. Intermediate Vertical Uprights: shall be furnished to enclose cabinets when used in a unit in combination with a half width bank of drawers. However, to allow storage of large or bulky objects, no upright of any type shall be used at the center of double door cupboard units.
  - i. The inside front of the upright shall be further reinforced with a full height 14 gauge hinge reinforcement angle.
  - j. Wall and Tall Case Top: One-piece, with front edge formed into front rail.
  - k. Provide filler panels where required between cabinets, at corner intersections of cabinets, between cabinets and walls and wherever else required for a complete finished installation. For tall cabinets, filler panels shall be provided for vertical face and top. For wall cabinets, filler panels shall be provided for vertical face, top and bottom. When wall hung cabinets are installed to ceiling, provide continuous metal filler between top of cabinet and ceiling, to permit door to swing clear of ceiling. Maximum filler panel width is 1-1/2 IN, and should be balanced on each end of wall-to-wall elevations.
  - l. Exposed fasteners are not allowed without prior approval of the Architect.
2. Base, Wall, Upper, and Tall Cabinets:
  - a. Cabinet Base:
    - 1) Case bottom and bottom rail shall be formed of one piece of metal except in corner units and shall have both sides and back formed up or down and shall be rabbeted in front for drawers and swinging doors.
    - 2) Toe Space Rail: Provide 3 IN deep and 4 IN high formed steel base with corner gussets. Whenever the base is omitted for units to be set on building bases or separate metal bases, the toe space rail shall extend back 4-1/2 IN. Provide 3/8 IN diameter leveling screw with integral bottom flange of minimum 0.56 in<sup>2</sup> area at each corner, accessible through openings in toe space.
  - b. Removable Cabinet Back, Unexposed: Cabinet back shall consist of a top and bottom rail, channel formed for maximum strength and welded to back and top flange of end uprights, with space between left open for access to plumbing lines. All units shall be provided with removable back panels.
  - c. Knee Space Service Chase Cover Panels where specified, shall be of the same finish as cabinets, and shall be furnished at open spaces under counter top where no cabinets occur. They shall be easily removable and shall cover piping from underside of top of service ledge to floor.
  - d. Shelves: shall be full depth formed down 3/4 IN, back 7/8 IN and up 1/4 IN at front and rear and formed down at ends 3/4 IN. Shelves over 36 IN in length shall be additionally reinforced by a flanged channel shaped member electro-welded to underside of shelf. Shelves shall be adjustable.
  - e. Pull-Out Shelves: Provide pull-out shelves in cabinet or locations indicated.

- f. Doors and Drawer Heads (Flush Overlay Steel):
  - g. Doors: Doors shall be readily removable and hinges easily replaceable. Hinges shall be applied to the case and door with screws. Welding of hinges to either case or door will not be acceptable:
    - 1) Door and Drawer Heads (metal): shall be a two-piece sheet steel assembly of 3/4 IN overall thickness to consist of an inner pan, an outer pan having a channel formation on all four sides welded and ground to eliminate exposure of sharp raw edges, and the interior space filled with sound deadening at the time of assembly. Welds shall be ground smooth. Door Pans and Drawer Heads shall be painted inside and out prior to assembly.
    - 2) Framed Glazed Doors: Framed glazed door construction shall match construction and quality of solid panel doors. Inner head shall include top, bottom, and side framing members which are removable for installation and replacement of glass. Continuous vinyl retainer shall be provided to receive glass.
    - 3) Framed Sliding Doors: Design for tilt-out removal after removal of bottom guide. Doors shall be hung with nylon-tired sleeve bearing rollers in formed steel top track and shall close against rubber bumpers.
  - h. Drawer Construction:
    - 1) Drawer bodies shall be made in one-piece construction including the bottom, two sides, back and inner front, or one piece center section with bottom and coved sides, with formed top edges. Front and back faces should be spot welded to sides or center section. Sides shall be full height with 1/2 IN clearance to frame opening. Drawers shall be a minimum of 18 IN front to back. Drawers shall be easily removable in the field without the use of special tools. Drawers shall be sized on a modular basis for interchange to satisfy varying storage requirements:
      - a) Drawer Suspension: Refer to Drawer Slides under Hardware section.
      - b) Drawer stops: Rubber bumpers shall be provided to insure smooth, quiet operation at point of contact with cabinet front.
  - i. Rails:
    - 1) Top Horizontal Rail: Provide on base cabinets such that rail shall interlock within the flange at top of end panels for strength, but shall be flush at face of unit. Reinforcements shall be provided at all front corners for additional welded strength between vertical and horizontal case members.
    - 2) Intermediate Rails: Provide on base cabinets such that rails shall be provided between doors and drawers, but shall not be provided between drawers unless made necessary by locks in drawers. When required, intermediate rails shall be recessed behind doors and drawer fronts, and designed so that security panels may be added as required.
  - j. Security Panels: Provide security panels where keyed different locks are specified.
3. Metal-Framed Laboratory Tables:
- a. Tops: Refer to Laboratory Furnishing drawings for worktop materials, described in the Laboratory Work Surfaces section of this specification.
  - b. Leveling Glide and Leg Shoe: Each leg, other than those fitted with casters, shall have a recessed leveling screw and a black, coved vinyl or rubber leg shoe, 2 IN in height.
  - c. Aprons and Rails: Not less than 1-1/2 IN by 4-1/2 IN 16 gauge channel steel sections, reinforced as necessary for leg attachment. Provide 1-1/2 IN by 2 IN 16 gauge channel steel sections, reinforced as necessary for leg attachment, where no drawers are required.
  - d. Legs: Not less than 2 IN by 2 IN 16 gauge square tubular steel sections with welded leg brackets:
    - 1) Table legs shall be telescoping to allow vertical height adjustment of work surface in 1 IN increments from 30 IN to 37 IN above finished floor.
  - e. Leg rails and spreader rail: Not less than 1-1/4 IN by 2-1/2 IN 16 gauge steel sections, reinforced as necessary for leg attachment.

4. Leg assemblies:
  - a. Legs: Not less than 2 IN by 2 IN by 16 gauge square tubular steel sections. Each leg shall have a recessed leveling screw and a black, coved vinyl or rubber leg shoe, 2 IN in height.
  - b. Leg rails, where required: Not less than 1-1/4 IN by 2-1/2 IN by 16 gauge steel sections, reinforced as necessary for leg attachment.
5. Apron: Not less than 1-1/2 IN by 4-1/2 IN 16 gauge channel steel sections, reinforced as necessary for leg or panel attachment. Provide 1-1/2 IN by 2 IN 16 gauge channel steel sections, reinforced as necessary for leg attachment, below work surfaces set at 32 IN above finished floor, or less. Apron panel shall align with plane of adjacent doors and drawers for full flush overlay appearance.
6. Apron drawers: Where indicated on the Laboratory Furnishing drawings, provide support rails; drawer unit, hardware and suspension as specified for base unit drawers. Widths of drawers in knee opening rails shall not be less than 24 IN or the width of the rail whichever is the lesser.
7. Width of drawer heads shall match width of knee opening in flush overlay applications
8. Fume Hood Cabinets: Purpose-designed metal cabinet with fixed panel above door to conceal cup sink and plumbing.
9. Corrosives Storage Cabinets:
  - a. Purpose-designed metal cabinet completely lined with a polypropylene liner with sealed or seamless intersections between panels.
  - b. Shelf: Removable, polypropylene shelf.
  - c. Label: "CORROSIVES" in conspicuous silk-screened lettering. Stick-on decals are not acceptable. Size and style of lettering shall match the Flammable Liquid/Solvent Storage Cabinet label.
  - d. Locks: Provide key locks for cabinet doors.
  - e. Venting:
    - 1) Cabinets below or adjacent to fume hoods: Provide and install 2 IN polypropylene vent pipe to extend 4 IN above dished worktop, behind baffle in hood. Seal gap around penetration with clear sealant.
    - 2) Cabinets not below or adjacent to fume hoods: Provide and install 2 IN polypropylene vent pipe to run horizontally in the chase space behind the casework to nearest pipe drop enclosure and rise vertically to 6 IN above ceiling level. Connection to exhaust duct system shall be by Division 23.
  - f. Provide hole through fume hood work surface above the corrosives storage cabinet to accommodate 2 IN diameter vent pipe.
10. Flammable Liquid/Solvent Storage Cabinets:
  - a. Purpose-designed double-walled metal cabinet for the storage of flammable, combustible and solvent liquids.
  - b. Cabinet doors: Well fitting, self-closing and self-latching
  - c. Label: "FLAMMABLE - KEEP FIRE AWAY" in conspicuous silk-screened lettering. Stick-on decals are not acceptable. Size and style of lettering shall match that of the Corrosives Storage Cabinet label.
  - d. Locks: Provide key locks for cabinet doors.
  - e. Floor pan: Provide a 2 IN deep liquid tight pan to cover the entire bottom of the cabinet to contain liquid leaks and spills.
  - f. Shelves: Provide heavy-duty shelf (shelves) with reinforced edges and underside.
  - g. Casters: Provide cabinets with locking casters where indicated on the Laboratory Furnishing drawings or specifications and as specified under Cabinet Hardware.
  - h. Standards:
    - 1) Cabinet shall be in compliance with the requirements of:
      - a) OSHA: 29 CFR 1910.106.
      - b) NFPA 1 (latest edition): Uniform Fire Code.
      - c) NFPA 30 (latest edition): Flammable and Combustible Liquids Code.

- 2) Cabinets shall be Factory Mutual (FM) Approved or Underwriters Laboratories (UL) Listed.
  - i. Flammable liquid/solvent storage cabinets shall not be vented. Seal vent openings with bungs as provided by manufacturer.
  - j. Electrical grounding:
    - 1) Provide each flammable liquid/solvent storage cabinet with an externally mounted grounding conductor screw terminal for up to #8 AWG conductor, mounted at the top of the cabinet.
    - 2) Connection from the equipment grounding bus at the lab branch circuit panel to the storage cabinet terminal shall be by Division 26.
11. Vacuum Pump Cabinets:
- a. Purpose-designed metal cabinet with interior top, sides, rear, and door lined with sound absorbing material:
    - 1) Cabinet shall have no bottom, and shall have specially fabricated door to extend to 1/8 IN above floor with integral toe kick to match the profile of the toe kick of adjacent cabinets. Provide louvers in toe kick to allow for airflow; openings shall continue through soundproofing material. Door shall swing open 165 degrees.
    - 2) Provide separate mobile platform or trolley capable of supporting 300 lbs. Platform shall be 1/2 IN solid phenolic (Trespa Athlon, Pionite Thick Phenolic Core, or approved substitution) with 1/2 IN by 1 IN high shelf edge to contain spills.. Platform shall be mounted on casters; the front casters shall be locking swivel type. Platform shall be 3 IN less than the exterior width of the cabinet and 18 IN in depth.
    - 3) Sound Absorbing Material: Closed-cell soundproofing foam:
      - a) Thickness: 1 IN flat sheet.
      - b) Insulating mat shall be fire retardant, mold resistant, and designed to block and absorb sound. Material shall be HCFC- and CFC-free.
      - c) Color: Black.
  - b. Electrical: Provide NEMA 5-20R receptacle mounted to inside back of cabinet and activated by a remote pilot light toggle switch with stainless cover plate mounted on front blank panel of cabinet. Switch shall be hard wired to receptacle. Power to cabinet shall be provided under Electrical scope of work.
  - c. Venting: Cabinets below or adjacent to fume hoods:
    - 1) Provide and install 2 IN polyolefin or polypropylene vent pipe to extend 2 IN above dished worktop, behind baffle in hood. Seal gap around penetration with clear sealant. In cabinet, pipe shall terminate with open end. Also within cabinet, pipe shall have a 1 IN 'tee' for connection pump discharge connection by BNL and a drip leg with threaded cap. Provide flange to secure pipe to cabinet.
  - d. Venting: Cabinets not below or adjacent to fume hoods and exhausted to fume exhaust system:
    - 1) Provide and install 2 IN polyolefin or polypropylene vent pipe through rear of cabinet for connection under the scope of work of Division 23. In cabinet, pipe shall terminate with open end. Also within cabinet, pipe shall have a 1 IN 'tee' for connection pump discharge connection by BNL and a drip leg with threaded cap. Provide flange to secure pipe to cabinet.
- E. Hardware: As specified elsewhere in this Section.
- F. Metal Casework Finish Requirements: Refer to Painted Metal Finish Performance Requirements elsewhere in this Section.

## 2.2 CABINET HARDWARE

- A. General: Special metal cabinets, such as corrosives storage, flammable liquid and solvent storage, rock storage, map storage, museum storage, radioisotope storage, and narcotics locker, may be provided with the manufacturer's standard hardware, except that all door and drawer pulls shall match, regardless of type of casework, except for polypropylene casework.
- B. Hinges:
1. Five Knuckle Hinges, Stainless Steel:
    - a. Manufacturers: Products complying with this specification may be provided by the following manufacturers:
      - 1) Rockford Process Control, Inc. 202 Seventh St., Rockford, IL 61104, Tel: 815 966-2000.
      - 2) Substitutions are permitted subject to Section 01 63 00.
  2. Concealed Hinges:
    - a. Manufacturers: Products complying with this specification may be provided by the following manufacturers:
      - 1) Grass America Inc., P. O. Box 1019, 1202 Highway 66 South, Kernersville, NC 27284, Tel: 800 334-3512.
      - 2) Julius Blum, Inc. 7733 Old Plank Rd., Stanley, NC 28164, Tel: 800 438-6788.
      - 3) Salice America Inc., 2123 Crown Centre Dr., Charlotte, NC 28227, Tel: 800 222-9652.
      - 4) Substitutions are permitted subject to Section 01 63 00.
  3. General: Hinges shall be attached to both door and case with three screws through each leaf. Provide two hinges for doors up to 48 IN high; three hinges for doors over 48 IN high.
  4. Type: Concealed, self-closing, 165° opening Grass 3903 attached with sheet metal screws. Notch for proper fit.
  5. Type: Institutional with a five-knuckle bullet-type barrel. Characteristics:
    - a. Height: 2-1/2 IN, nominal.
    - b. Material:
      - 1) Type 302 or 304 stainless steel with stainless steel screws.
- C. Shelving Standards and Clips:
1. Manufacturers: Products complying with this specification may be provided by the following manufacturers:
    - a. Knappe & Vogt Manufacturing Co., 2700 Oak Industrial Dr. NE, Grand Rapids, MI 49505, Tel: 616 459-7620.
    - b. Fixture Hardware Manufacturing, 4116 First Avenue, Brooklyn, NY 11232, Tel: 718 499-9422.
    - c. The Engineered Products Company (Epc), P. O. Box 108, Flint, MI 48501, Tel: 313 767-2050.
    - d. Sugatsune America, Inc. 221 East Selandia Lane, Carson, CA 90746, Tel: 310 329-6373.
    - e. Bainbridge Manufacturing, Inc., P. O. Box 487, 237 W 3<sup>rd</sup>, Waterville, WA 98858, Tel: 800 255-4702.
    - f. Substitutions are permitted subject to Section 01 63 00.
  2. Adjustable shelf supports: 13 gauge steel angle with 5mm diameter by 3/8 IN long pin, bright zinc-plated finish, and all edges rounded, with slotted standard.
- D. Ball Bearing Drawer Slides:
1. Manufacturers: Products complying with this specification may be provided by the following manufacturers:
    - a. Accuride, 12311 Shoemaker Ave., Santa Fe Springs, CA 90670, Tel: 562 903-0200. website: [www.accuride.com/](http://www.accuride.com/)
    - b. Waterloo Furniture Components Inc., 501 Manitou Dr., Kitchener, Ontario, Canada N2C 1L2, Tel: 519 748-5060.

- c. Fulterer USA, 542 Townsend Ave., High Point, NC 27263, Tel: 800 395-4646.
    - d. Substitutions are permitted subject to Section 01 63 00.
  - 2. Full extension, 100 lb/pr. capacity: Accuride 3832, or equal.
  - 3. File drawers shall be equipped with rail mounted with overtravel, 150 lb/pr. capacity: Accuride 4034, or equal.
  - 4. Pull-out shelf suspension: 100 lb/pr. capacity pull-out shelf slide: Accuride 322, or equal.
  - 5. Base Metal:
    - a. Clear, zinc-coated steel.
- E. Hanging File Suspension System:
  - 1. Manufacturers: Products complying with this specification may be provided by the following manufacturers:
    - a. Julius Blum, Inc. 7733 Old Plank Rd., Stanley, NC 28164, Tel: 800 438-6788.
    - b. Hettich America L. P., 6225 Shiloh Rd., Alapartta, GA 30005, Tel: 800 438-8424.
    - c. Substitutions are permitted subject to Section 01 63 00.
  - 2. Blum Metafile, Hettich MultiTech Hanging File Frame Kit, or equal. File hangers shall be fastened and secured to drawer construction and shall not be freestanding units set inside the drawer. Provide in all file drawers.
- F. Sliding Door Hardware:
  - 1. Framed Glass and Solid Doors:
    - a. Manufacturers: Products complying with this specification may be provided by the following manufacturers:
      - 1) Hettich America L. P., 6225 Shiloh Rd., Alapartta, GA 30005, Tel: 800 438-8424.
      - 2) Substitutions are permitted subject to Section 01 63 00.
    - b. Sliding framed glazed doors shall have extruded aluminum track with top hung nylon rollers. Hardware shall be designed so doors cannot 'jump' track. Rocker arm carriers shall insure constant track contact: Hettich (Grant) 73-034, or equal.
- G. Locks:
  - 1. Swinging Doors and Drawers:
    - a. Manufacturers: Products complying with this specification may be provided by the following manufacturers:
      - 1) National Cabinet Lock, 200 Old Mill Rd., P. O. Box 200, Mauldin, South Carolina 29662, Tel: 864-297-6655.
      - 2) Illinois Lock Company, 301 West Hintz Rd., Wheeling, IL 60090, Tel: 847 537-1800.
      - 3) Substitutions are permitted subject to Section 01 63 00.
  - 2. General: Provide locks on all file cabinet drawers. Provide locks at other locations as indicated on the drawings. Provide chain bolts 3 IN long, with an 18 IN pull and an angle strike to secure inactive door on cabinets over 72 IN in height. Five (5) or eight (8) tumbler locks are acceptable. Locks shall have be provided with removable cores and stamped with identifying numbers. Locks shall have satin nickel or satin chrome finish.
  - 3. Keys: Stamped brass keys available from manufacturer or locksmith and supplied in the following quantities, unless otherwise specified:
    - a. Provide two (2) keys for each different lock.
    - b. Provide three (3) keys for each group keyed alike locks.
    - c. Provide two (2) keys for each master key system.
  - 4. Keying:
    - a. Keyed differently with up to 2000 primary key changes. Master key one level with built in flexibility to accommodate, if required, three levels, one grandmaster, 59 master groups, and 70 sub-master groups with 13 primary changes under each.
  - 5. Framed sliding door locks shall be plunger type.

- H. Roller Catch:
1. Manufacturers: Products complying with this specification may be provided by the following manufacturers:
    - a. The Engineered Products Company (Epc), P. O. Box 108, Flint, MI 48501, Tel: 313 767-2050.
    - b. Amerock, 6350 Stevens Forest Road, Suite 200, Columbia, MD 21046, Tel: 800 435 6959.
    - c. Ives, 2720 Tobey Drive, Indianapolis, IN 46219, Tel: 877 613-8766.
    - d. Substitutions are permitted subject to Section 01 63 00.
  2. Roller Catches: Roller catches shall be adjustable, spring-loaded polyethylene roller with a steel strike plate.
- I. Casters:
1. Manufacturers: Products complying with this specification may be provided by the following manufacturers:
    - a. Algood Casters Limited, 605 Fenmar Drive, Toronto, Canada, M9L 2R6, Tel: 800 254-6633.
    - b. Caster Technology Corporation, 3265 Whipple Rd., Union City, CA 94587, Tel: 510 429-6727.
    - c. Acorn Industrial Products Co., 7 Union Hill Dr., W. Conshohocken, PA 19428, Tel: 800 523-5474.
    - d. Hamilton Caster & Mfg. Co., 1637 Dixie Highway, Hamilton, OH 45011, Tel: 888 699-7164.
    - e. Substitutions are permitted subject to Section 01 63 00.
  2. Where indicated on Laboratory Furnishing drawings or specifications, provide sets of 4 IN diameter wheels with self-lubricating precision roller- or ball-bearings. Casters shall be swivel, locking type on front and swivel, non-locking type on rear, rated to carry 250 pounds minimum each. Casters shall be equal to Algood Model S5033-SRG, soft rubber wheeled casters. The entire assembly shall be reinforced to permit mobility without twisting. Casters shall be through-bolted through bottom of cabinet at all four bolts and interior bolt heads shall be countersunk to conceal bolt heads. Caster Housing: Casters shall be heavy gauge cold rolled steel with bright zinc plating. Each caster must swivel and have a total locking brake. Wheel shall be of solid polyurethane or molded polyurethane tread mechanically locked to a polyolefin core:
    - a. Caster Housing: Casters shall be heavy gauge cold rolled steel with bright zinc plating.
- J. Pulls:
1. Drawer and hinged door: Drawer and door pulls shall attach to door or drawer with machine screws. Two (2) pulls shall be furnished on drawers wider than 28 IN. Plastic pulls or other types subject to breakage are not acceptable:
    - a. Type:
      - 1) Pulls shall be round "wire."
    - b. Material and Finish:
      - 1) Stainless steel with US32D satin finish.
    - c. Length: 4 IN center to center of screw holes.
    - d. Diameter: 1/4 IN.
  2. Sliding door pulls: Rectangular or oval, flush (recessed) design stainless steel pulls with recessed finger pull.
- K. Drawer Stops: All regular drawers shall be equipped with integral stops or drawer bumpers on each side of drawer body to prevent drawer head impact with cabinet body.

- L. Cabinet Door Bumper Pads: Non-staining, non-marring, clear polyurethane pads with pressure-sensitive, adhesive backing for sound and vibration dampening, preventing direct contact between door and cabinet. Pad should have raised tip in middle of pad. Provide at top and bottom corners along pull edge of doors 36 IN and less in height. Provide at top and bottom corners and at an intermediate location along pull edge of doors greater than 36 IN in height.
- M. Door Stops: Provide chain door stops for any tall cabinet door, which will strike an obstruction when opened between 90° and 135°:
  - 1. Provide #30 zinc-plated steel sash chains; cut to length to allow door to open 1-1/2 IN from obstruction.
  - 2. Provide zinc chromate wire screw eyes. Open eye as required to attach chain. Through-bolting not allowed.
- N. Glides: Non-marring material, 1 IN diameter, minimum, with at least 5/8 vertical adjustment. Provide on movable tables, unless otherwise indicated.
- O. Leveling devices: Provide each table leg with 3/8 IN minimum diameter leveling bolt and floor clip.
- P. Leg shoes: Leg shoes shall be provided on all legs and table legs to conceal leveling devices, except for tables with casters. Shoes shall be 2-1/2 IN high and of black rubber or pliable black vinyl material. Use of a leg shoe which does not conceal leveling device is not acceptable.
- Q. Floor clips: Provide leg assemblies and fixed table legs with floor clips securely fastened to the floor after shimming.

### 2.3 LABORATORY WORK SURFACES

- A. Epoxy Resin:
  - 1. Manufacturers: Products complying with this specification may be provided by the following manufacturers. All epoxy resin work surfaces shall be provided by a single manufacturer:
    - a. Durcon Inc., 206 Alison Drive, Taylor, TX 76574, Tel: 512 595-8000. website: <http://www.dltinc.com>
    - b. Epoxyn Products, 500 E. 16<sup>th</sup> Street, Mountain Home, AR 72653, Tel: 870 425-4321. website: <http://www.epoxyn.com/>
    - c. Kewaunee Scientific Corporation, P O Box 1842, Statesville, NC 28687, Tel: 704 873-7202. website: <http://www.kewaunee.com/>
    - d. Substitutions are not permitted.
  - 2. Thickness:
    - a. Typical work surface: 1 IN.
    - b. Fume hood work surfaces: Tops shall be 1-1/4 IN thick at outer edge, indented 1/4 IN to provide a raised rim around all exposed edges 1 IN wide, minimum, or as to allow for the fume hood sash. The front top edge of the raised rim and exposed vertical corners of the top shall be rounded or chamfered to a 1/8 IN radius. The juncture between the raised rim and the top surface shall be coved or chamfered to a 1/4 IN radius.
  - 3. Color:
    - a. Black.
    - b. Color sample shall be submitted for approved by Architect.
  - 4. Provide the following:
    - a. Drip Grooves: Provide under all work surface exposed edges, unless noted otherwise on the Laboratory Furnishing Drawings. Drip grooves shall be 1/2 IN from the front edge where the top overhangs 1 IN and 1/4 IN from the edge where the edge overhangs 1/2 IN.
    - b. Edge profile: All exposed upper edges and corners shall have 1/8 IN bevel.

- c. Marine edges: Where indicated on the Laboratory Furnishing Drawings, shall be 1 IN wide and 1/4 IN high with chamfered or radiused transition to and be an integral part of the work surface.
  - d. Indented areas: Where indicated on the Laboratory Furnishing Drawings, shall be 1/4 IN deep with chamfered or radiused sides. Internal and external corners shall have 1/4 IN to 1/2 IN radius. Marine edges formed around indented areas shall not be less than 1 IN wide.
  - e. Sink Mounting:
    - 1) Drop-in Sink Cutouts: Cutouts shall be profiled to provide support for the sink, and to ensure that the rim of the installed sink is 1/8 IN below the surrounding work surface level or bottom of drain grooves, if present. The top edge of the cutout shall have 1/8 IN bevel. Ensure that there shall be no gaps between the installed sink rim and work surface.
  - f. Curbs and Splashes:
    - 1) Curbs and Splashes: 1 IN thick.
    - 2) Height: 4 IN, unless noted otherwise on Laboratory Furnishing Drawings.
    - 3) Bonded to the surface of the top to form a square joint.
  - g. Provide all holes and cutouts as required for built-in equipment and mechanical and electrical service fixtures. Verify size of opening with actual size of equipment to be used prior to making openings. Form inside corners to a radius of not less than 1/8 IN. After sawing, rout and file cutouts to ensure smooth, crack-free edges. Seal exposed edges after cutting with a waterproofing material recommended by the manufacturer.
5. Physical Properties:
- a. Chemical resistance:
    - 1) Organic solvents: A cotton ball, saturated with the test chemical, is placed in a one ounce bottle with a reservoir of liquid above the ball. The container is inverted on the test material surface for a period of 24 hours. Test temperature: 23°C ±2°C.
    - 2) Other test chemicals: Five drops (1/4 cc) of the test chemical are placed on the test material surface. The chemical is covered with a 1 IN diameter watch glass for a period of 24 hours. Test temperature: 23°C ±2°C.
    - 3) Evaluation: After 24 hours exposure, exposed areas are washed with water, then a detergent solution, finally with naphtha, then rinsed with distilled water, dried with a cloth, and rated as follows:

|   |           |   |
|---|-----------|---|
| 0 | No effect | No detectable change in the material surface.   |
| 1 | Excellent | Slight detectable change in color or gloss but no change in function or life of the surface.  |
| 2 | Good      | A clearly discernable change in color or gloss but no significant impairment of surface life or function.   |
| 3 | Fair      | Objectionable change in appearance due to discoloration or etch, possibly resulting in deterioration of function over an extended period of time. |
| 4 | Failure   | Pitting, cratering, or erosion of the surface. Obvious and significant deterioration.   |

4) Test results:

| Test chemical             | Concentration | Black | Dark gray | Light gray | Beige |
|---------------------------|---------------|-------|-----------|------------|-------|
| Chromic acid              | 40%           | 3     | 2         | 2          | 2     |
| Hydrochloric acid         | 10%           | 0     | 0         | 0          | 0     |
| Hydrochloric acid (conc.) | 37%           | 0     | 0         | 0          | 0     |
| Nitric acid               | 40%           | 0     | 0         | 0          | 0     |
| Nitric acid (conc.)       | 70%           | 0     | 0         | 0          | 0     |
| Sulfuric acid             | 60%           | 0     | 0         | 0          | 0     |
| Sulfuric acid (conc.)     | 96%           | 4     | 4         | 4          | 4     |
| Acetic acid               | 5%            | 0     | 0         | 0          | 0     |
| Acetic acid (glacial)     |               | 0     | 0         | 0          | 0     |
| Citric acid               | 1%            | 0     | 0         | 0          | 0     |
| Oleic acid                |               | 0     | 0         | 0          | 0     |
| Phenol solution           | 5%            | 0     | 0         | 0          | 0     |
| Ammonium hydroxide        | 10%           | 0     | 0         | 0          | 0     |
| Sodium carbonate sol.     | 20%           | 0     | 0         | 0          | 0     |
| Sodium hydroxide sol.     | 60%           | 0     | 0         | 0          | 0     |
| Sodium hypochlorite sol.  | 4%            | 0     | 0         | 0          | 0     |
| Acetone                   |               | 1     | 1         | 1          | 1     |
| Benzene                   |               | 1     | 1         | 1          | 1     |
| Carbon tetrachloride      |               | 1     | 1         | 0          | 0     |
| Diethyl ether             |               | 0     | 0         | 1          | 1     |
| Dimethyl formamide        |               | 0     | 0         | 0          | 0     |
| Ethyl acetate             |               | 0     | 1         | 1          | 0     |
| Ethyl alcohol             | 95%           | 0     | 0         | 0          | 0     |
| Ethylene dichloride       |               | 0     | 0         | 0          | 0     |
| Heptane                   |               | 0     | 0         | 1          | 0     |
| Isooctane                 |               | 0     | 0         | 0          | 0     |
| Kerosene                  |               | 0     | 0         | 0          | 0     |
| Methyl alcohol            |               | 0     | 0         | 0          | 0     |
| Toluene                   |               | 0     | 0         | 0          | 0     |
| Aniline                   |               | 0     | 0         | 0          | 0     |
| Mineral oil               |               | 0     | 0         | 0          | 0     |
| Olive oil                 |               | 0     | 0         | 0          | 0     |
| Soap solution             | 1%            | 0     | 0         | 0          | 0     |
| Transformer oil           |               | 0     | 0         | 0          | 0     |
| Turpentine                |               | 0     | 0         | 0          | 0     |

b. Heat resistance:

- 1) High temperature test: A porcelain crucible is heated to a dull red color, placed on the test material, and allowed to cool to ambient temperature. Result: No observable surface deformation.
- 2) Flame test: A 3/8 IN Bunsen burner is adjusted to a quiet flame with a 1-1/2 IN inner cone, overturned on the test material, and allowed to stay for 5 minutes. Result: no observable surface deformation.

c. Physical properties:

|                           |           |                          |
|---------------------------|-----------|--------------------------|
| Compressive strength      | ASTM D695 | 31,400 psi               |
| Tensile strength          | ASTM D638 | 8,000 psi                |
| Flexural strength         | ASTM D790 | 11,700 psi               |
| Rockwell hardness "M"     | ASTM D785 | 122                      |
| Specific density          | ASTM D792 | 122.4 lb/ft <sup>3</sup> |
| Water absorption          | ASTM D570 | 0.01%                    |
| Fire Resistance           | ASTM D635 | ATB (sec)=0              |
| Heat deflection @ 264 psi | ASTM D648 | 342°F                    |

B. Chemical Resistant High-Pressure Decorative (Plastic) Laminate Tops:

1. Manufacturers/Facing material: Products complying with this specification may be provided by the following manufacturers. All chemical resistant plastic laminate worksurfaces shall be the product of a single manufacturer:
  - a. Wilsonart International, 2400 Wilson Place, P. O. Box 6110, Temple, TX, 76503 Tel: 800 433-3222.
  - b. Approved substitution (no known equal).
2. Basis of Design: Wilsonart Chemsurf, or equal (no known equal).
3. Substrate Thickness:
  - a. Typical work surface: 1 IN.
  - b. Curbs and Splashes: 3/4 IN.
4. Color: To be selected by Architect.
5. Description:
  - a. High-pressure decorative laminate consisting of a resin formulation applied over the decorative surface paper to achieve chemical resistance. The decorative paper shall be treated with melamine resin, and the core shall consist of kraft papers impregnated with phenolic resin. Sheets shall be bonded under high temperature and pressure. Product shall be developed for casework, work surface, and shelving surfaces in laboratories.
  - b. Finish: Fine beaded "crystal" texture to minimize smudges and finger marks, and to provide optimum scratch resistance.
  - c. Core material:
    - 1) M3 Particleboard (NAF: No Added Urea Formaldehyde):
      - a) Description: 3-ply, FSC Certified, 100 percent recycled wood fiber particleboard with no urea formaldehyde added during the manufacturing process.
      - b) Formaldehyde Emissions: 0.00 to 0.01 ppm.
      - c) Reference Standards: Average density of 47 pounds per cubic FT, meeting or exceeding ANSI Standard A208.1-1999 M3 PB Standard specifications.
      - d) Resin: Panels shall be manufactured with Phenol formaldehyde resin. Resin shall be urea formaldehyde-free and produce no Volatile Organic Compounds (VOC's).
      - e) Thickness: 3/4 IN.
      - f) Moisture Content: less than 8 percent.
      - g) Modulus of Rupture: 2,393 psf .
      - h) Modulus of Elasticity: 398,900 psf.
      - i) Internal Bond: 80 psi.
      - j) Face Screw Holding Strength: 247 lbf.
      - k) Edge Screw Holding Strength: 225 lbf.
      - l) Hardness: 500 lbf.
      - m) Thickness Tolerance: ±0.005 IN from panel average.
      - n) Flame spread: ASTM E84 Class 3 or C.
  - d. Backing sheets: High-pressure phenolic meeting or exceeding NEMA Standard LD3-2000 Grade BKL.

- e. Plastic laminate adhesive: High-pressure decorative laminate shall be bonded to core with thermosetting resorcinol, phenol-resorcinol, or urea formaldehyde adhesive, or as recommended by the manufacturer for the application, at temperature above 65 degrees F at a pressure no less than 15 pounds per square IN. Laminate core is not to exceed 10 percent moisture content and is to be laminated and cured in a controlled environment between 45 percent and 60 percent RH.
- f. Edging: Tops shall be edged with 3mm PVC edge banding set in hot melt adhesive. Adhesive shall have a minimum softening point of 150 degrees F. Apply primer to substrate when recommended by adhesive manufacturer.
- g. Provide all holes and cutouts as required for built-in equipment and mechanical and electrical service fixtures. Verify size of opening with actual size of equipment to be used prior to making openings. Form inside corners to a radius of not less than 1/8 IN. After sawing, rout and file cutouts to ensure smooth, crack-free edges. Seal exposed edges after cutting with a waterproofing material recommended by the manufacturer.
- h. Sinks:
  - 1) Cutouts for top-mounted sinks shall be routed and sanded to form smooth edged openings.
- i. Curbs and Splashes:
  - 1) Height: 4 IN, unless noted otherwise on Laboratory Furnishing Drawings.
  - 2) Fabricate similar to top with PVC edge band along exposed ends.
  - 3) Splash shall be set in a thin bead of sealant to prevent moisture migration through the joint.
- j. Grommets:
  - 1) Manufacturers: Products complying with this specification may be provided by the following manufacturers:
    - a) Doug Mockett & Company, Inc., Box 3333, Manhattan Beach, CA 90266, Tel: 800 523-1269.
    - b) Häfele America Inc., 3901 Cheyenne Dr., P. O. Box 4000, Archdale, NC 27263, Tel: 336 889-2322.
  - 2) Provide 2-3/8 IN O.D. plastic grommets, Doug Mockett and Co., Inc. Model No. TG-3, or equal, complete with removable slotted plastic cover. Color to be selected by Architect. Refer to plans for location.
- k. Physical Properties:
  - 1) Reference Standard: Plastic laminates shall meet or exceed ANSI/NEMA Specification LD3-2000 as specified herein.
  - 2) Minimum Thickness: 0.038 IN  $\pm$  0.005 IN.
  - 3) Cleanability: 10 cycles (NEMA LD3 test method 3.4).
  - 4) Boiling Water Resistance: No effect (NEMA LD3 test method 3.5).
  - 5) High Temperature Resistance: Slight effect (NEMA LD3 test method 3.6).
  - 6) Scratch Resistance: 4.5 Newtons (NEMA LD3 test method 3.7).
  - 7) Ball Impact Resistance: 60 IN (NEMA LD3 test method 3.8).
  - 8) Radiant Heat Resistance: 200 sec (NEMA LD3 test method 3.10).
  - 9) Dimensional change:
    - a) Machine direction: 0.50 percent (NEMA LD3 test method 3.11).
    - b) Cross direction: 0.80 percent (NEMA LD3 test method 3.11).
  - 10) Wear resistance: 1,500 cycles, min. (black); 700 cycles, min. (other colors) (NEMA LD3 test method 3.13).
  - 11) Blister Resistance: 70 sec (NEMA LD3 test method 3.15).
  - 12) Stain Resistance Performance Test Results: The surface shall show essentially no effect on Black (Lab grade) plastic laminate when left in contact for 16 hours either when reagents were kept covered or allowed to evaporate.

|   |           |   |
|---|-----------|---|
| 0 | No effect | No detectable change in the material surface.   |
| 1 | Excellent | Slight detectable change in color or gloss but no change in function or life of the surface.  |
| 2 | Good      | A clearly discernable change in color or gloss but no significant impairment of surface life or function.   |
| 3 | Fair      | Objectionable change in appearance due to discoloration or etch, possibly resulting in deterioration of function over an extended period of time. |
| 4 | Failure   | Pitting, cratering, or erosion of the surface. Obvious and significant deterioration.   |

|   | Concentration | Rating |
|---|---------------|--------|
| <b>Acids</b>                                      |               |        |
| Acetic acid                                       | All           | 0      |
| Aqua regia  |               | 0      |
| Chromic trioxide (Chromic acid cleaning solution) |               | 1      |
| Glacial acetic acid                               | 99%           | 0      |
| Hydrochloric acid                                 | All           | 0      |
| Hydrofluoric acid                                 | 48%           | 0      |
| Formic acid                                       | All           | 0      |
| Nitric acid                                       | All           | 3      |
| Sulfuric acid                                     | All           | 0      |
| Perchloric acid (concentrated)                    |               | 0      |
| Phosphoric acid                                   | All           | 0      |
| Picric acid                                       | 1.2%          | 0      |
| Tannic acid (saturated)                           |               | 0      |
| Uric acid (saturated)                             |               | 0      |
| <b>Alkalis</b>                                    |               |        |
| Ammonium hydroxide                                | All           | 0      |
| Sodium hydroxide                                  | All           | 3      |
| Sodium sulfide                                    | 15%           | 0      |
| <b>Solvents</b>                                   |               |        |
| Acetone   |               | 0      |
| Amyl acetate                                      |               | 0      |
| Amyl alcohol                                      |               | 0      |
| Butyl alcohol                                     |               | 0      |
| Carbon disulfide                                  |               | 0      |
| Carbon tetrachloride                              |               | 0      |
| Chlorobenzene                                     |               | 0      |
| Chloroform  |               | 0      |
| Cresol  |               | 0      |
| Dimethylformamide                                 |               | 0      |
| Dioxane   |               | 0      |

|                                       |     |   |
|---------------------------------------|-----|---|
| Solvents                              |     |   |
| EDTA                                  |     | 0 |
| Ethyl acetate                         |     | 0 |
| Ethyl alcohol                         |     | 0 |
| Formaldehyde                          |     | 0 |
| Methanol                              |     | 0 |
| Methyl ethyl ketone                   |     | 0 |
| Methylene chloride                    |     | 0 |
| n-Hexane                              |     | 0 |
| Naphthalene                           |     | 0 |
| Phenol                                |     | 0 |
| Tetrahydrofuran                       |     | 0 |
| Toluene                               |     | 0 |
| Trichlorethane                        |     | 0 |
| Xylene                                |     | 0 |
| General Reagents                      |     |   |
| Alconox (lab detergent)               |     | 0 |
| Aluminon                              |     | 0 |
| Ammonium phosphate                    |     | 0 |
| Aromatic ammonia                      |     | 0 |
| Benedicts solution                    |     | 0 |
| Calcium hypochlorite (concentrated)   |     | 0 |
| Camphorated parachlorophenol          |     | 1 |
| Cellosolve                            |     | 0 |
| Copper sulfate                        |     | 0 |
| Ethylene glycol                       |     | 0 |
| Eucalyptol                            |     | 0 |
| Formalin                              |     | 0 |
| Gasoline                              |     | 0 |
| Hydrogen peroxide                     | 3%  | 0 |
| Iodine                                |     | 0 |
| Karl Fisher Reagent                   |     | 0 |
| Kerosene                              |     | 0 |
| Lactated ringers                      |     | 0 |
| Lysol                                 |     | 0 |
| Methyl methacrylate                   |     | 0 |
| Mineral Oil                           |     | 0 |
| Monsel's solution (Ferric subsulfate) |     | 0 |
| Naphtha                               |     | 0 |
| Petroleum jelly                       |     | 0 |
| Phosphate buffered saline (PBS)       |     | 0 |
| Pine oil                              |     | 0 |
| Potassium permanganate                |     | 0 |
| Povidone iodine                       |     | 0 |
| Procaine                              |     | 0 |
| Quaternary ammonia compounds          |     | 0 |
| Silver nitrate                        |     | 0 |
| Sodium azide                          |     | 0 |
| Sodium chromate                       |     | 0 |
| Sodium hypochlorite                   | 5%  | 0 |
| Sodium thiocyanate                    |     | 0 |
| Sucrose                               | 50% | 0 |

|                               |     |   |
|-------------------------------|-----|---|
| General Reagents              |     |   |
| Thymol & Alcohol              |     | 0 |
| Tincture of Iodine            |     | 0 |
| Tincture of Mercurochrome     |     | 0 |
| Tincture of Merthiolate       |     | 0 |
| Trisodium phosphate           | 30% | 0 |
| Urea                          |     | 0 |
| Vegetable oils                |     | 0 |
| Water                         |     | 0 |
| Zephiran chloride             |     | 0 |
| Zinc chloride                 |     | 0 |
| Zinc oxide ointment           |     | 0 |
| <hr/>                         |     |   |
| Stains and Indicators         |     |   |
| Ag Eosin Bluish 5% in Alcohol |     | 0 |
| Bromothymol Blue              |     | 0 |
| Cresol Red                    |     | 0 |
| Crystal Violet                |     | 0 |
| Gentian Violet                | 1%  | 0 |
| Gram Stains                   |     | 0 |
| Malachite Green               |     | 0 |
| Methyl Orange                 |     | 0 |
| Methyl Red                    |     | 0 |
| Methylene Blue                |     | 0 |
| Nigrosine                     |     | 0 |
| Safranin O                    |     | 0 |
| Sudan III                     |     | 0 |
| Thymol Blue                   |     | 0 |
| Wright's Blood Stain          |     | 0 |

C. Stainless Steel: Refer to Stainless Steel Fabrications section of this specification.

## 2.4 MOBILE BASE CABINETS

- A. Mobile Base Cabinets: Cabinets with casters shall be constructed without toe spaces. The cabinet shall be constructed with a reinforced base capable of supporting a 4" high caster assembly in each corner. Casters shall be swivel locking type and rated for minimum 250 pounds load each. Cabinets with casters shall be completely finished on four sides and top since surfaces are considered visible.
- B. The entire cabinet assembly shall be reinforced to permit mobility without twisting and achieve an industry standard height of 31" or 37" including the flush 1" counter top. Top of the base cabinet shall be chemical resistant laminate.
- C. Base cabinets shall, except as noted, incorporate a flush overlay design in which the cabinet body is completely concealed.
- D. Drawer units must be equipped with an anti-tip/anti-trick mechanism that shall include an interlock in the lower cabinet so that only one drawer in a vertical stack can be opened at one time. Base cabinets shall have a finished 12 gauge metal plate across the full bottom face of the cabinet to which casters shall be attached.

## 2.5 BALANCE TABLES

- A. Metal-Framed Balance Tables:
  - 1. Rails: Not less than 1-1/2 IN by 4-1/2 IN by 16 gauge channel steel sections, reinforced as

- necessary for leg attachment.
2. Legs: Not less than 2 IN by 2 IN by 16 gauge square tubular steel sections.
  3. Leg rails and spreader rail: Not less than 1-1/4 IN by 2-1/2 IN by 16 gauge steel sections, reinforced as necessary for leg attachment.
  4. Materials and Finish: Refer to Metal Fabrications specifications in this Section for material and finish requirements.
  5. Tops: 2-1/2 IN thick epoxy resin work surface, as described in the Laboratory Work Surfaces section of this specification, mounted on shock and vibration absorbing insulators:
    - a. Top Width: 35 IN.
    - b. Top Depth: 24 IN.
    - c. Edge Treatment: Edges shall be eased.
  6. Table Height: 30 to 31 IN.
  7. Leveling Glide and Leg Shoe: Provide each balance table leg with 3/8 IN minimum diameter recessed leveling glide. Provide 2 IN high black rubber or vinyl leg shoes.
- B. Stone Balance Tables:
1. Stone: White marble.
  2. Slab Thickness: 3 IN.
  3. Table Width: 35 IN.
  4. Table Depth: 24 IN.
  5. Table Height: 31 IN.
  6. Edge Treatment: Stone edges shall be eased.
  7. Provide galvanized or stainless steel tube stabilizing bar anchored to stone uprights by three bolts on each side.
  8. Stone top shall be set on uprights with two isolation pads on each upright. Upright shall have setting pads to rest on floor.

## 2.6 SHELVING ASSEMBLIES

- A. Provide 18 gauge steel shelves with integral seismic lip and hat-section stiffener with 16 gauge bookend brackets. Rear of bracket shall be profiled to fit into slots of shelf standards as described below. Refer to details on Laboratory Furnishings Drawings.
- B. High-Pressure Decorative (Plastic) Laminate Shelving:
  1. Chemical Resistant High-Pressure Decorative Laminate:
    - a. Manufacturers/Facing material: Products complying with this specification may be provided by the following manufacturers. All chemical resistant plastic laminate shall be the provided by a single manufacturer:
      - 1) Wilsonart International, 2400 Wilson Place, P. O. Box 6110, Temple, TX 76503  
Tel: 800 433-3222.
      - 2) Approved substitution (no known equal).
    - b. Basis of Design: Wilsonart Chemsurf, or equal (no known equal).
    - c. Description: High-pressure decorative laminate consisting of a resin formulation applied over the decorative surface paper to achieve chemical resistance. The decorative paper shall be treated with melamine resin, and the core shall consist of kraft papers impregnated with phenolic resin. Sheets shall be bonded under high temperature and pressure. Product shall be developed for casework, work surface, and shelving surfaces in laboratories:
      - 1) Laminate shall be applied to top and bottom surfaces.
      - 2) Finish: Fine beaded "crystal" texture to minimize smudges and finger marks, and to provide optimum scratch resistance.
      - 3) Color: To be selected by the Architect.
    - d. Physical Properties:
      - 1) Reference Standard: Plastic laminates shall meet or exceed ANSI/NEMA Specification LD3-2000 as specified herein.
      - 2) Minimum Thickness: 0.038 IN ± 0.005 IN.

- 3) Cleanability: 10 cycles (NEMA LD3 test method 3.4).
- 4) Boiling Water Resistance: No effect (NEMA LD3 test method 3.5).
- 5) High Temperature Resistance: Slight effect (NEMA LD3 test method 3.6).
- 6) Scratch Resistance: 4.5 Newtons (NEMA LD3 test method 3.7).
- 7) Ball Impact Resistance: 60 IN (NEMA LD3 test method 3.8).
- 8) Radiant Heat Resistance: 200 sec (NEMA LD3 test method 3.10).
- 9) Dimensional change:
  - a) Machine direction: 0.50 percent (NEMA LD3 test method 3.11).
  - b) Cross direction: 0.80 percent (NEMA LD3 test method 3.11).
- 10) Wear resistance: 1,500 cycles, min. (black); 700 cycles, min. (other colors) (NEMA LD3 test method 3.13).
- 11) Blister Resistance: 70 sec (NEMA LD3 test method 3.15).
- 12) Stain Resistance Performance Test Results: The surface shall show essentially no effect on Black (Lab grade) plastic laminate when left in contact for 16 hours either when reagents were kept covered or allowed to evaporate.

|   |           |   |
|---|-----------|---|
| 0 | No effect | No detectable change in the material surface.   |
| 1 | Excellent | Slight detectable change in color or gloss but no change in function or life of the surface.  |
| 2 | Good      | A clearly discernable change in color or gloss but no significant impairment of surface life or function.   |
| 3 | Fair      | Objectionable change in appearance due to discoloration or etch, possibly resulting in deterioration of function over an extended period of time. |
| 4 | Failure   | Pitting, cratering, or erosion of the surface. Obvious and significant deterioration.   |

|   | Concentration | Rating |
|---|---------------|--------|
| <b>Acids</b>                                      |               |        |
| Acetic acid                                       | All           | 0      |
| Aqua regia  |               | 0      |
| Chromic trioxide (Chromic acid cleaning solution) |               | 1      |
| Glacial acetic acid                               | 99%           | 0      |
| Hydrochloric acid                                 | All           | 0      |
| Hydrofluoric acid                                 | 48%           | 0      |
| Formic acid                                       | All           | 0      |
| Nitric acid                                       | All           | 3      |
| Sulfuric acid                                     | All           | 0      |
| Perchloric acid (concentrated)                    |               | 0      |
| Phosphoric acid                                   | All           | 0      |
| Picric acid                                       | 1.2%          | 0      |
| Tannic acid (saturated)                           |               | 0      |
| Uric acid (saturated)                             |               | 0      |
| <b>Alkalis</b>                                    |               |        |
| Ammonium hydroxide                                | All           | 0      |
| Sodium hydroxide                                  | All           | 3      |
| Sodium sulfide                                    | 15%           | 0      |

|                                       |    |   |
|---------------------------------------|----|---|
| Solvents                              |    |   |
| Acetone                               |    | 0 |
| Amyl acetate                          |    | 0 |
| Amyl alcohol                          |    | 0 |
| Butyl alcohol                         |    | 0 |
| Carbon disulfide                      |    | 0 |
| Carbon tetrachloride                  |    | 0 |
| Chlorobenzene                         |    | 0 |
| Chloroform                            |    | 0 |
| Cresol                                |    | 0 |
| Dimethylformamide                     |    | 0 |
| Dioxane                               |    | 0 |
| EDTA                                  |    | 0 |
| Ethyl acetate                         |    | 0 |
| Ethyl alcohol                         |    | 0 |
| Formaldehyde                          |    | 0 |
| Methanol                              |    | 0 |
| Methyl ethyl ketone                   |    | 0 |
| Methylene chloride                    |    | 0 |
| n-Hexane                              |    | 0 |
| Naphthalene                           |    | 0 |
| Phenol                                |    | 0 |
| Tetrahydrofuran                       |    | 0 |
| Toluene                               |    | 0 |
| Trichlorethane                        |    | 0 |
| Xylene                                |    | 0 |
| General Reagents                      |    |   |
| Alconox (lab detergent)               |    | 0 |
| Aluminon                              |    | 0 |
| Ammonium phosphate                    |    | 0 |
| Aromatic ammonia                      |    | 0 |
| Benedicts solution                    |    | 0 |
| Calcium hypochlorite (concentrated)   |    | 0 |
| Camphorated parachlorophenol          |    | 1 |
| Cellosolve                            |    | 0 |
| Copper sulfate                        |    | 0 |
| Ethylene glycol                       |    | 0 |
| Eucalyptol                            |    | 0 |
| Formalin                              |    | 0 |
| Gasoline                              |    | 0 |
| Hydrogen peroxide                     | 3% | 0 |
| Iodine                                |    | 0 |
| Karl Fisher Reagent                   |    | 0 |
| Kerosene                              |    | 0 |
| Lactated ringers                      |    | 0 |
| Lysol                                 |    | 0 |
| Methyl methacrylate                   |    | 0 |
| Mineral Oil                           |    | 0 |
| Monsel's solution (Ferric subsulfate) |    | 0 |
| Naphtha                               |    | 0 |
| Petroleum jelly                       |    | 0 |

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|                                 |     |   |
|---------------------------------|-----|---|
| General Reagents                |     |   |
| Phosphate buffered saline (PBS) |     | 0 |
| Pine oil                        |     | 0 |
| Potassium permanganate          |     | 0 |
| Povidone iodine                 |     | 0 |
| Procaine                        |     | 0 |
| Quaternary ammonia compounds    |     | 0 |
| Silver nitrate                  |     | 0 |
| Sodium azide                    |     | 0 |
| Sodium chromate                 |     | 0 |
| Sodium hypochlorite             | 5%  | 0 |
| Sodium thiocyanate              |     | 0 |
| Sucrose                         | 50% | 0 |
| Thymol & Alcohol                |     | 0 |
| Tincture of Iodine              |     | 0 |
| Tincture of Mercurochrome       |     | 0 |
| Tincture of Merthiolate         |     | 0 |
| Trisodium phosphate             | 30% | 0 |
| Urea                            |     | 0 |
| Vegetable oils                  |     | 0 |
| Water                           |     | 0 |
| Zephiran chloride               |     | 0 |
| Zinc chloride                   |     | 0 |
| Zinc oxide ointment             |     | 0 |

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|                               |    |   |
|-------------------------------|----|---|
| Stains and Indicators         |    |   |
| Ag Eosin Bluish 5% in Alcohol |    | 0 |
| Bromothymol Blue              |    | 0 |
| Cresol Red                    |    | 0 |
| Crystal Violet                |    | 0 |
| Gentian Violet                | 1% | 0 |
| Gram Stains                   |    | 0 |
| Malachite Green               |    | 0 |
| Methyl Orange                 |    | 0 |
| Methyl Red                    |    | 0 |
| Methylene Blue                |    | 0 |
| Nigrosine                     |    | 0 |
| Safranin O                    |    | 0 |
| Sudan III                     |    | 0 |
| Thymol Blue                   |    | 0 |
| Wright's Blood Stain          |    | 0 |

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2. Plastic laminate adhesive: High-pressure decorative laminate shall be bonded to core with thermosetting resorcinol, phenol-resorcinol, or urea formaldehyde adhesive, or as recommended by the manufacturer for the application, at temperature above 65 degrees F at a pressure no less than 15 pounds per square inch. Laminate core is not to exceed 10 percent moisture content and is to be laminated and cured in a controlled environment between 45 percent and 60 percent RH.
3. Core material: 9-ply hardwood plywood manufactured in accordance with ANSI/HVPA HP-1 with K+ face veneers, 1 IN thick. Product shall consist of FSC certified veneers.
4. Safety Edging and Edge Banding:
  - a. All edge banding shall be set in hot melt adhesive with a minimum softening point of 150 degrees F. Apply primer to substrate when recommended by adhesive manufacturer. Contact cement is not acceptable.

- b. Safety Edging and Edge Band Materials:
    - 1) PVC: 3mm PVC edge banding.
    - 2) Retainer Rail: 1/4 IN diameter stainless steel retainer rail, as indicated on the drawings
  - c. Adjustable wall shelving:
    - 1) Front edges: Retainer rail. Rear edges: 2 IN high PVC band. Side edges: PVC band; height to match finished shelf thickness.
  - d. Adjustable reagent shelving on a steel tube support system:
    - 1) Front edges: Retainer rail. Rear edges: 2 IN high PVC band. Side edges: PVC band; height to match finished shelf thickness.
  - e. Heavy-duty adjustable shelving: Similar to adjustable wall shelving above.
- C. Adjustable Wall Shelves:
- 1. Shelving: High-Pressure Decorative Laminate shelving as specified above.
  - 2. Double Slot Shelf Standards:
    - a. Manufacturers: Products complying with this specification may be provided by the following manufacturers. All adjustable shelf standards shall be the product of a single manufacturer:
      - 1) Knapé & Vogt Manufacturing Co., 2700 Oak Industrial Drive NE, Grand Rapids, MI 49505 Tel: 616 459-3311. website: <http://www.knapandvogt.com/>
      - 2) Fixture Hardware Manufacturing, 4116 First Avenue, Brooklyn, NY 11232 Tel: 718 499-9422.
      - 3) Substitutions are permitted subject to Section 01 63 00.
    - b. Basis of Design: Knapé & Vogt 85 ANO series uprights, or equal. Length as indicated on the drawings.
  - 3. Shelf standards shall be slotted channel framing as specified elsewhere in this Section.
  - 4. Shelf Brackets: 16 gauge bookend type, as detailed on drawings.
  - 5. Finish: Factory finish standards and brackets with epoxy powder coating. Color to be selected by the Architect.

## 2.7 CYLINDER AND DEWAR RESTRAINT ASSEMBLY

- A. Cylinder Rack Assembly (Steel Tube Assembly):
- 1. Manufacturers: Products complying with this specification may be provided by the following manufacturers:
    - a. Safe-T-Rack Systems, Inc., 4325 Dominguez Rd., Suite A, Rocklin, CA 95677, Tel: 800 344-0619. website: <http://www.safe-t-racksystems.com>
    - b. Spectra Gases, Inc., 3434 Route 22 West, Branchburg, NJ 08876, Tel: 800 932-0624. web site: [www.spectragases.com](http://www.spectragases.com)
    - c. Matheson Tri-Gas, 166 Keystone Drive, Montgomeryville, PA 18936, Tel: 215 648-4000. web site: [www.matheson-trigas.com](http://www.matheson-trigas.com)
    - d. Scott Specialty Gases, Inc., 6141 Easton Road Box 310, Plumsteadville, PA, 18949 Tel: 215 766-8861. web site: [www.scottgas.com](http://www.scottgas.com)
    - e. Substitutions are permitted subject to Section 01 63 00.
  - 2. Frame members: 2 IN by 2 IN by 1/8 IN square steel tube.
  - 3. Construction: All welded. Weld cover plates to close exposed tube ends. Grind and polish all welds to produce smooth surface with no visible evidence of welding when painted.
  - 4. Chain: Provide restrainers of 1/4 IN diameter, Type 304 stainless steel welded chain fitted one threaded connector chain link at one end and one harness clip at the other end; two chains per cylinder at high and low points. Frame shall have welded chain link or similar hardware for attachment for each end of chain.
  - 5. Cylinder racks components shall be factory-finished. Color to be selected by the Architect.

- B. Cylinder and Dewar Restraint Assembly:
  - 1. Slotted Framing Channel, Fittings, Swivel Hangers, and End Caps: Slotted channel framing as specified elsewhere on this Section. Provide two swivel hangers per cylinder or dewar per wall bracket. Slotted framing channel and associated components shall be factory-finished. Color to be selected by the Architect
  - 2. Chain and Associated Hardware: Provide 1/4 IN diameter welded chain fitted with one threaded connector chain link at each end, and one harness clip; McMaster-Carr Supply Company, Suncor Stainless, Inc., or approved substitution. All chain and hardware shall be Type 304 or 316 stainless steel. Chain shall be long enough to secure 9 IN cylinder or 20 IN dewar, as indicated on drawings.
  - 3. Provide two assemblies per cylinder or dewar to anchor at a high and low point.
  - 4. Cylinder restraint components shall be factory-finish. Color to be selected by Architect.

## **2.8 OVERHEAD SERVICE CARRIERS**

- A. Description:
  - 1. Overhead Service Carriers (OSC) are structurally supported frames constructed of steel framing members as delineated on the drawings. OSC are designed as a means to distribute utilities to movable tables/benches in the laboratory and to provide support for adjustable shelving. Power, data, voice, air, vacuum, and other specialty gasses are utilities commonly found on these carriers. These utilities will be brought to an umbilical assembly and then connected to the carrier.
  - 2. Option for height adjustability from 4 FT – 8 IN a.f.f. to 6 FT – 8IN a.f.f. may also be considered.
- B. Basis of Design:
  - 1. Fisher Scientific Nautilus Overhead Service Carrier.
  - 2. Carrier Bodies – 21 IN wide x 72 IN long - product number V2172LPLD.
  - 3. Lights on bottom surface.
  - 4. Umbilical Assembly – 8 IN x 15-1/2 IN.
- C. Fabrication:
  - 1. Fabricate and assemble components as detailed on the drawings.
  - 2. The entire OSC assembly, including vertical and horizontal supports and diagonal braces, shall be securely and rigidly fastened to structural slab above or to a structural grid where provided. All OSC's and components shall be designed to local seismic design standards.
  - 3. The Laboratory Furniture Contractor shall supply final shop drawings along with structural design drawings and structural calculations which are stamped and wet-signed, and use structural engineer who is registered in the State where the building is constructed.
- D. Coordination: Carefully coordinate location of supports with the work of other Sections.
- E. Finish: Paint assembly with color selected by the Architect.

## **2.9 LASER SHELF**

- A. Framing System: Slotted channel framing as specified elsewhere in this Section and as detailed on the drawings.
- B. Shelf:
  - 1. 1 IN plastic laminate shelving as specified above for adjustable wall shelving.
  - 2. Safety Edging: 2 IN by 3mm thick PVC band applied to all sides with hot melt glue. Contact cement is not acceptable.

## **2.10 DRYING RACK**

- A. Stainless Steel Drying Rack with White Polypropylene Pegs:

1. Manufacturers: Products complying with this specification may be provided by the following manufacturers. All stainless steel drying racks shall be the product of a single manufacturer:
  - a. Inter Dyne Systems, Inc., 676 Ellis Rd., Norton Shores, MI 49441, Tel: 231 799-8760. website: <http://www.interdynesystems.com/>
  - b. Substitutions are permitted subject to Section 01 63 00 (no known equal).
2. Basis of Design: Inter Dyne Systems "V" Victoria Series, modified as indicated on the drawings:
  - a. Drying rack bodies shall be of one-piece design and of not less than 20 gauge Type 304 stainless steel with a No. 4 finish. The top shall have two 90-degree bends, and sides to have one 90 degree bend.
  - b. Each rack shall have an integral full-width 20 gauge, Type 304 stainless steel drip trough with stainless steel drain tube. Drip trough shall be continuously welded.
  - c. The trough shall have a full-length, Type 304 stainless steel wire mesh screen insert. Screen insert shall be turned down on all four sides to provide a clean and finished appearance.
  - d. Each rack front shall be dimensioned and punched with T-shaped holes to accommodate the peg arrangement shown on the drawings.
3. Pegs shall fit into the punched holes in the rack front. A T-shaped protrusion on the base of the pegs shall allow easy removal and replacement without the need for tools. The T-shaped holes shall be designed to fit the protrusion on support pegs for holding single or multiple utensil drip trays, drain shelves, funnel racks or pipette holders. Pegs shall be of injection-molded white polypropylene.
4. Provide wall hangers for each rack, designed to enable the removal and replacement of the entire rack for cleaning without the need for tools.
5. Provide stainless steel fixing screws of appropriate type for attachment to support structure.
6. Provide clear, tight-fitting hose to drain from drip trough drain tube into sink.
7. Provide finished stainless steel back panel when any portion of the back of drying rack is exposed.

## **2.11 CABLE/VACUUM LINE THROUGH PORT**

- A. Provide 1-3 IN diameter threaded pipe sleeve wire or cable access through ports of Type 304 stainless steel with No. 4 finish at bench tops as located and detailed on the Laboratory Furnishings drawings. Provide threaded pipe flanges and caps.

## **2.12 BLACKOUT CURTAIN AND TRACK ASSEMBLY**

- A. Manufacturers: Products complying with this specification may be provided by the following manufacturers. All blackout curtains and tracks shall be provided by a single manufacturer:
  1. Darkrooms USA, Inc. 193 Rocky Point Landing Road, Rocky Point, NY 11778 Tel: 631 821-5948.
  2. Blackout Curtains, 8527 Westmoreland, Suite 111, Minneapolis, MN 55426 Tel: 866 252-2568.
  3. Cubicle Curtain Factory, 2956 Jog Road, Greenacres, FL 33467 Tel: 1-800-588-9296. website: <http://www.cubiclecurtainfactory.com/>
  4. Substitutions are permitted subject to Section 01 63 00.
- B. Curtain Materials and Fabrication:
  1. The blackout curtain material shall be of the following fabric composition: 38 percent SEF Modacrylic, 30 percent Saran Flat Monofilament, 26 percent Viscose Rayon and 6 percent Polyester. Material shall have a double-vinyl black color laminated back for opacity (samples must be submitted).

2. The curtain shall be sewn flat with 10% fullness. The seams shall be sewn French-style (no raw edges visible). The curtain top shall have brass grommets on 8 IN centers. Provide a heavy gauge fabric-reinforcing strip inserted in the top hem to provide addition strength for the insertion of grommets. The bottom edge shall be weighted and overlap the floor approximately 2 IN. All sewing shall be done in a manner so that fabric is not pierced in a way that will allow light through the needle holes.
  3. Double curtain installation: Where two separate curtain panels meet they shall overlap each other approximately 24 IN.
  4. The outside vertical edges shall be supplied with "Velcro" quick-seal strips to facilitate "light-trap" overlaps for easy light-tight attachment to walls.
  5. Curtain shall be supplied with minimum 11 IN high front and rear light-trap valances. The valances shall be made of the same black-out curtain materials, sewn flat (no fullness) with a sewn-on Velcro strip, and shall be mounted to the curtain track assembly using the "Light-Trap-Interface". Curtain shall be designed with a 2 IN floor overlap to maintain a light-proof environment.
  6. Blackout curtain must be flame-retardant or made of non-combustible materials. Fabric must pass the flame resistance requirements specified by the State of California test, and be in accordance with the National Fire Protection Association Standard No. 701-99 test methods 1 and 2. Submit certificate of passage to tests.
- C. Track Material and Assembly:
1. Construct of satin anodized extruded aluminum box-channel 1-3/8 IN by 3/4 IN slotted on the underside to receive two wheeled carriers designed for surface mounting to the underside of the ceiling. The track shall also serve as an integral part of the valance assembly; valance shall be fastened to track at not more than 18 IN on center. Supply with hook carriers, end-caps, snap-outs, and connectors, of the sleeve type. Hooks are formed of rustproof wire and bead chain riding on a carrier with non-wearing nylon wheels. Corners, where required, shall be one-piece, 12 IN radius 90 degree track sections.
  2. Double curtain installations: Provide two parallel tracks for double curtain installations.
  3. Curtain Supplier/Installer must provide any bracing necessary at ceiling. Coordinate with ceiling Manufacturer/Installer.

## 2.13 METAL FABRICATIONS AND FINISH REQUIREMENTS

- A. Applicability: This section applies to metal fabrications, including, but not limited to, pipe drop enclosures, radioisotope storage cabinets, shelving support systems, metal-framed laboratory tables, metal-framed balance tables, cylinder racks, and other miscellaneous brake-formed and shop fabricated components and trim, such as required for overhead service carriers.
- B. Materials:
1. All steel used in the product fabrication shall comply with the LEED II (Leadership in Energy and Environmental Design) Green Building Rating System.
  2. The manufacturer shall submit documentation (i.e., "Source of Materials", Invoices, Third Party Validation, etc.) for steel purchased for this project providing recycled content. Such documentation shall be submitted to the Architect for approval - prior to award of contract.
  3. Cold rolled sheet steel:
    - a. Sheet Steel: All "Cold Rolled" sheet steel used in the fabrication of laboratory cabinets, fume hoods and modular laboratory systems shall have a minimum of 20% recycled steel content.
    - b. Recycled Steel Content: Of this 20 percent recycled content, 60 percent shall be purchased scrap (i.e., old cars, appliances) with the remaining 40 percent from generated in-house scrap and manufacturing fall-off.
    - c. Fabricators Scrap: Fabricators shall provide documentation that manufacturing fall-off is recycled to respective steel mills and neither enters the solid waste system nor becomes a product of landfill space.

- d. Prime grade, roller leveled, and treated at the mill to be free of scale, ragged edges, deep scratches or other injurious effects.
- C. Finish Requirements:
1. Chemical Resistant Finish: Painted finish shall be chemical resistant, dry powder coated finish complying with SEFA 8 M casework specifications for chemical and durability resistance. A letter from a third-party validator, verifying independent test results, shall be submitted to the Architect for approval at time of bid submittal.
  2. Operator Protection: Paint application shall be convenient and easily mastered through robotic application plus manual detailing. The painting process shall be contained and have no solvent odor and be performed in an air conditioned room.
  3. Overspray: Powder overspray shall be captured and resprayed. Efficiency shall be 99 percent effective in coating usage, reducing waste generated. A closed collection system shall be used for overspray that is not reused. Powder overspray, which cannot escape the facility, shall be collected in bulk, eliminating the need for daily replacement/disposal of filter media.
  4. VOC Emissions: Powder paint shall be sprayed and baked with a near zero (0.29 lbs. per gallon maximum) VOC (Volatile Organic Compounds) emissions. All powder coats shall comply with the GS (Green Seal Standard) 11 allowable emissions.
  5. Offgassing: After all steel powder coated parts have cooled from the curing ovens, the coating shall be firm and stable. No further emissions or "Offgasing/Decomposition" vapors shall occur at room temperature.
- D. Metal Casework Color: As selected by the Architect from manufacturer's full color line and complying with finish requirements described above.

## 2.14 STAINLESS STEEL FABRICATIONS

- A. Material: Unless otherwise noted stainless steel for work surfaces, canopy hoods, low slotted exhaust, drying racks, shelves, sinks and scullery sinks shall be Type 304 and shall be of gauge indicated on Laboratory Furnishing drawings or this specification.
- B. Finish: All fabrications shall have exposed surfaces ground and polished to a No. 4 satin finish.
- C. All stainless steel nuts, screws, bolts, and rivets, etc., shall be of the same type stainless as in the sheet material and shall have a tumbled finish closely resembling that of a No. 4 finish.
- D. All stainless steel welding material shall be of type similar to the sheet material or a richer quality. All welds shall be made without discoloration and shall be ground, polished, and passivated to blend harmoniously with a Number 4 satin finish. All joints in stainless steel tops and work surfaces shall be welded.
- E. Work Surfaces:
  1. Thickness: 16 gauge.
  2. Fabrication:
    - a. Edges: Flanged down the same dimension as the adjacent non-stainless top, if any, with 1 inch being a minimum and returned over a 16 gauge perimeter metal frame to simplify securing top material to cabinet or structural frame, insure rigidity and prevent buckling, warping, or oil canning.
    - b. Reinforcement: Under-surface shall be reinforced with full length 16 gauge structural metal channels at rear and middle top to insure rigidity and prevent buckling, warping, or oil canning. Where bench-mounted fittings are indicated on the drawings, provide top reinforcement to allow for rigid, secure mounting of fittings.
    - c. Undercoating: Underside of top shall have a heavy mastic agent coating providing sound deadening.
    - d. Stainless steel sides and back-splashes, where indicated, shall be integrally welded to top and finish as indicated above. The back side of exposed backsplashes shall be finished to match front and sides.

- e. Provide all holes and cutouts as required for built-in equipment and mechanical and electrical service fixtures. Verify size of opening with actual size of equipment to be used prior to making openings. Form inside corners to a radius of not less than 1/8 IN. After sawing, rout and file cutouts to ensure smooth, crack-free edges with no burrs.
  - f. Marine edges: Where indicated on the Laboratory Furnishing Drawings, shall be 1 IN wide and 1/4 IN high with chamfered or radiused transition to and be an integral part of the work surface. Marine edges shall be seamless die-formed.
3. Flat Stainless Steel Work Surfaces (without marine edge or sink): Provide an integrally coved back splash and bull-nose at front of work surface.
- F. Canopy Hood: Provide stainless steel canopy with all hangers and miscellaneous hardware at locations and sizes as indicated on the Laboratory Furnishing drawings:
1. Thickness: 18 gauge.
  2. Construction: Provide reinforcing necessary to prevent "oil canning" or deflection of panel between supports. All corners and joints shall be welded, ground smooth and free of all defects. Welded joints with visible burn marks will not be accepted. Form with condensation gutter. Provide welded exhaust collar with no open seams.
  3. Accessories: Provide stainless steel hangers and miscellaneous support hardware as required for a complete installation.
  4. Light fixtures and wiring shall be provided under Division 26. Holes for electrical work shall be made by canopy hood fabricator.
  5. Provide exhaust duct transition piece for mechanical connection above the ceiling. Refer to Exhaust Schedule for exhaust rate and size.

## 2.15 GOWNING BENCH

- A. Manufacturers: Products complying with this specification may be provided by the following manufacturers:
1. Terra Universal Inc., 800 S. Raymond Avenue, Fullerton, CA 92831, Tel: 714 578-6000 [www.terrauniversal.com](http://www.terrauniversal.com).
  2. Innotech Products Inc., 1045 10<sup>th</sup> Avenue SE Minneapolis, MN 55414, Tel: 888 270-0458 [www.innotechprod.com](http://www.innotechprod.com).
  3. Substitutions are permitted subject to Section 01 63 00.
- B. Basis of Design: Terra Universal Inc. Model: Freestanding Tubular Gowning Bench.
- C. Description:
1. Top: 3/8 IN solid rod on 1 IN centers.
  2. Bootie Rack: 1/4 IN solid rod on 2 IN centers.
  3. Type 304 stainless steel construction, electropolished square or round tube.
  4. Class 1 environment design.
  5. Leveling glides.

## 2.16 CLEAN ROOM GARMENT AND SUPPLIES STORAGE

- A. Manufacturers: Products complying with this specification may be provided by the following manufacturers:
1. Terra Universal Inc., 800 S. Raymond Avenue, Fullerton, CA 92831 Tel: 714 578-6000 [www.terrauniversal.com](http://www.terrauniversal.com).
  2. Clean Air Products, 8605 Wyoming Ave. No., Minneapolis, MN, Tel: 612 425-9122.
  3. Liberty Industries, Inc., 133 Commerce St., East Berlin, CT 06023, Tel: 800 828-5656.
  4. Substitutions are permitted subject to Section 01 63 00.
- B. Basis of Design: Terra Universal Model 4101 Type B cabinet, or equivalent, as specified herein.
- C. Description:
1. Dimensions: 48 IN wide by 24 IN deep by 90 IN tall, nominal.

2. 16 gauge cold rolled steel with baked enamel coating storage cabinet:
  - a. Cabinet shall be divided internally into garment and adjustable shelf storage areas.
  - b. Provide garment pole and four stainless steel hangers.
  - c. Provide four perforated or stainless steel wire shelves.
3. Doors: 3/8 IN clear acrylic.
4. Blower with HEPA filter rated at 99.99 percent effective at 0.3 µm particles.

## 2.17 SLOTTED CHANNEL FRAMING

- A. Manufacturers: Products complying with this specification may be provided by the following manufacturers. All slotted channel framing components shall be the product of a single manufacturer:
  1. Unistrut, 35660 Clinton Street, Wayne, MI 48184, Tel: 800 521-7730. website: <http://www.unistrut.com/>
  2. Power Engineering Co. (Powerstrut), 420 Boston Turnpike, Shrewsbury, MA, Tel: 800 274-1303. website: <http://www.powerstrut.com/>
  3. Kumar Industries, 4881 Chino Ave., Chino, CA 91710, Tel: (909) 591-0722.
  4. Cooper B-Line Inc. (B-Line), 509 West Monroe St., Highland, IL 62249, Tel: (618) 654-2184.
  5. Substitutions are permitted subject to Section 01 63 00.
- B. Materials: Channel and framing members shall be fabricated from steel conforming to the following requirements:
  1. Framing Members:
    - a. Concealed Framing Members and Fittings: ASTM A570 GR 33.
    - b. Exposed Framing Members and Fittings: ASTM A446 GR A with zinc coating conforming to ASTM A525.
    - c. Stainless Steel Framing Members and Fittings: ASTM A240 (Type 304), where indicated.
  2. Fittings:
    - a. Concealed Fittings: Fabricate from steel satisfying the requirements of ASTM A570 GR 33, and conform to the following ASTM specifications: A575, A576, A36, or A635. Nuts shall conform to ASTM A576 GR 1015 and screws shall conform to SAE J429 GR 2 and ASTM A307.
    - b. Exposed Fittings: Fabricate from steel satisfying the requirements of ASTM A570 GR 33, and conform to the following ASTM specifications: A575, A576, A36, or A635. Nuts shall conform to ASTM A576 GR 1015 and screws shall conform to SAE J429 GR 2 and ASTM A307. Exposed fittings shall receive zinc coating conforming to ASTM A525.
    - c. Stainless Steel Fittings and Hardware: Sintered Nuts shall be of ASTM B783 (Type 316N2-33) stainless steel and fittings shall be of ASTM A240 (Type 304) stainless steel. Stainless steel fittings and hardware shall be used with stainless steel framing members, or where indicated.
  3. Thickness: 12 gauge, unless noted otherwise.
  4. Size: 1 5/8 IN by 1 5/8 IN cross-section, unless noted otherwise.
- C. Components:
  1. The following components shall be provided, unless otherwise noted:
    - a. Framing Channel: 1 5/8 IN by 1 5/8 IN by 12 gauge: Unistrut P1000, Powerstrut PS 200, Kumar Industries N-200, B-Line Systems, Inc. B22, or equal.
    - b. Suspended Framing Channel, 3-1/4 IN by 1-5/8 IN by 12 gauge: Unistrut P5000, Powerstrut PS 100, Kumar Industries N-150, B-Line Systems, Inc. B11, or equal.
    - c. Slotted Hole Framing Channel, 1-5/8 IN by 1-5/8 IN by 12 gauge framing channel with 13/32 IN by 3 IN slotted holes, 4 IN on center: Unistrut P1000 SL, Powerstrut P 200 S, Kumar Industries N-200-SL, B-Line Systems, Inc. B22S.

- d. Slotted Framing Channel for installation in Chemical Fume Hoods, 1 5/8 IN by 13/16 IN by 16 gauge Type 316 stainless steel framing channel: Unistrut P4000 SS, Powerstrut PS 560 SS, Kumar Industries, B-Line Systems, Inc:
  - 1) Attach channel to side of fume hood with 2-5/8 IN by 1-7/8 IN by 1/8 IN, 4 hole, stainless steel 90 degree fitting: Unistrut P6325 SS, Powerstrut, Kumar Industries, B-Line Systems, Inc.
- e. Vertical Posts: 3-1/4 IN by 1-5/8 IN by 12 gauge, double channel section: Unistrut P1001, Powerstrut PS 200 2T3, Kumar Industries N-200-A, B-Line Systems, Inc. B22A, or equal.
- f. Horizontal Support Members: 1-5/8 IN by 1-5/8 IN by 12 gauge framing channel with 13/32 IN by 3 IN slotted holes, 4 IN on center: Unistrut P1000 SL, Powerstrut P 200 S, Kumar Industries N-200-SL, B-Line Systems, Inc. B22S, or equal.
- g. Diagonal Brace Supports: Framing Channel, 1-5/8 IN by 1-5/8 IN by 12 gauge: Unistrut P1000, Powerstrut PS 200, Kumar Industries N-200, B-Line Systems, Inc. B22, or equal.
- h. 90 Degree Angle Fitting: 4-1/8 IN by 3-1/2 IN by 1/4 IN with two holes, each leg: Unistrut P1325, Powerstrut PS 607, Kumar Industries N-1123, B-Line Systems, Inc. B104, or equal.
- i. 135 Degree Angle Fitting: 3 IN by 2-5/16 IN by 1/4 IN with one hole, each leg: Unistrut P1546, Powerstrut PS 633-45°, Kumar Industries N-1425, B-Line Systems, Inc. B154, or equal.
- j. T-Shaped Flat Plate Fitting: 5-3/8 IN by 3-1/2 IN by 1/4 IN plate, T-shaped, with four holes: Unistrut P1031, Powerstrut PS 714, Kumar Industries N-1022, B-Line Systems, Inc. B133, or equal.
- k. Wing Shape Fitting, 9-5/32 IN by 3-7/8 IN ten holes, two holes in each wing section and two holes in each of three channel section sides: Unistrut P2347, Powerstrut PS 913, B-Line Systems, Inc. B273.
- l. Closure Strip: 0.04 IN thick snap-in cover for framing channel: Unistrut P3184, Powerstrut PS 6152, Kumar Industries N-1920, B-Line Systems, Inc. B217-24, or equal. Provide closure strips over all exposed vertical post sections.
- m. End Caps: 0.06 IN thick for framing channel: Unistrut P1280, Powerstrut PS 707, Kumar Industries N-2500, B-Line Systems, Inc. B205, or equal. Provide end caps for all exposed horizontal framing channels.
- n. Ceiling Escutcheon: Provide 18 gauge steel, finished to match framing members, as indicated on the Laboratory Furnishing drawings, at ceiling penetrations.
- o. Other components, hardware, and fasteners, as required for a complete assembly and as indicated on the drawings.
- p. Service Struts and Ledinging:
- q. 16 gauge, 13/16 IN by 1-5/8 IN cold-formed framing uprights: Unistrut P4000, Powerstrut PS 560, Kumar Industries N-400, B-Line Systems, Inc. B56, or equal. Uprights shall be provided at 48 IN, maximum, and fastened top and bottom by two adjustable U-shaped spreaders.
- r. U-shaped spreaders: 12 gauge by 1-1/2 IN wide by length required, galvanized steel.
- s. Locations:
  - 1) Provide to support tops at pipe service chase space, support drain troughs, under fume hood superstructures, and other abnormal loads.
  - 2) Support struts with U-shaped spreaders shall be provided at 48 IN on center below island and peninsula benches, as indicated on drawings. Support struts shall be provided along wall 48 IN on center below island and peninsula benches. Struts will be used to support piped and electrical services installed under Divisions 23 and 26. Provide all bolts, expansion sleeves, and fastening devices for a complete assembly. Pipe and conduit hangers shall be provided by Division 23 and 26 installers.

## 3.2 INSTALLATION

- A. Installation of items specified in this Section shall be performed by installers experienced in the installation of the respective item as determined by the respective manufacturer.
- B. Coordinate work with any BNL furnished and/or installed components indicated on drawings.
- C. Set casework items plumb, level, and true. Shim as required, using concealed shims for a plumb, level, true and straight installation. All items shall be securely anchored.
- D. Where required, assemble units into one integral unit with joints flush, tight, and uniform. Align similar adjoining units to a tolerance of 1/16 IN.
- E. Provide matching filler pieces where casework abuts walls or columns, or should be closed off.
- F. Field weld joints in stainless steel tight, without open seams. Finish material to match adjacent to weld.
- G. Adjust doors, drawers, hardware, fixtures and other moving or operating parts to function smoothly and correctly.
- H. Suspended Casework, Wall Cabinets, and Shelving:
  - 1. Securely fasten to solid supporting material; not plaster, lath, or wallboard. Anchor, adjust, and align suspended casework, wall cabinets, and shelving supports as specified for base cabinets.
  - 2. Blocking and backing in cavity wall construction for suspended casework, wall cabinets, and shelving shall be as specified under Division 09, and shall be installed under the scope of work of other Sections. General Contractor shall coordinate the location of in-wall blocking and backing using the shop drawings provided under this Section. Verify that all required backing and reinforcement necessary to support wall-mounted units is in place, secure, and accurately located.
- I. Laboratory Tops:
  - 1. Scribe tops as necessary for close and accurate fit.
  - 2. Field Joints: Factory-prepared and identical to factory joints, locate only where indicated on approved Shop Drawings. Field processing of top and edge surfaces is not acceptable, except as described by manufacturer in approved Submittal Data. Provide full length, one-piece tops and backsplashes wherever possible, and keep field joints to an absolute minimum.
  - 3. Abut top and edge surface in one true plane, with internal supports placed to prevent any deflection. Joints in top units shall be flush and the narrowest for the respective materials of construction. Cement joint in accordance with the manufacturers' specifications.
- J. Laboratory Sinks: Sinks shall be set in work surface with chemical-resisting sealing compound, secured and supported in accordance with manufacturer's instructions.
- K. Miscellaneous Furnishings and Accessories: Install in accordance with manufacturer's instructions. Tighten screws to seal flat; do not drive.
- L. Sealant:
  - 1. Caulk edges of tops, backsplashes and side splashes to adjacent wall surface, and around all work surface penetrations, with sealant.
  - 2. Sealant application shall be in accordance with manufacturer's published recommendations.
- M. Repair or remove and replace defective work as approved by the Architect at no additional cost to BNL.
- N. Adjustable Laboratory Furniture System:
  - 1. Support system locations shall be established from approved shop drawings so that mechanical and electrical work can be installed without interfering with installation.

2. Installation of support system shall be coordinated with the trades to maintain the integrity of the installed system.
3. Support system assemblies, ancillary components and accessories shall be installed with the supervision of the manufacturer's authorized representative and according to manufacturer's recommendations.

### **3.3 CLEANING AND PROTECTION**

- A. Clean finished units, touch up as required, and remove and refinish damaged or soiled areas.
- B. Cover tops with Kraft paper or polyethylene sheeting after installation for protection against scratching, soiling, and deterioration during remainder of construction period. Remove protection prior to final cleaning.
- C. Clean counter tops with diluted dishwashing liquid and water leaving tops free of all grease and streaks. Use no wax or oils.

### **END OF SECTION**

**SECTION 12 36 65**  
**ENGINEERED QUARTZ FABRICATIONS (EQF)**

**PART 1 - GENERAL**

**1.1 QUALITY ASSURANCE**

- A. Applicable standards:
  - 1. Standards of the following, as referenced herein:
    - a. American National Standards Institute (ANSI).
    - b. American Society for Testing and Materials (ASTM).
    - c. National Electrical Manufacturers Association (NEMA).
    - d. NSF International.
- B. NSF/ANSI standards:
  - 1. Refer to [www.nsf.org](http://www.nsf.org) for the latest compliance to NSF/ANSI Standard 51 for food zone — all food types.
- C. Fabricator/Installer Qualifications:
  - 1. Firm that employs skilled workers who custom fabricate products similar to those required for this project and whose products have a record of successful in-service performance.
- D. Source Limitations: Obtain materials and products from single source.

**1.2 DELIVERY, STORAGE AND HANDLING**

- A. Deliver components to project site in a timely manner, when areas are ready for installation.
  - 1. Store components indoors prior to installation.
  - 2. Deliver fabrications appropriately wrapped in protective materials.
- B. Protect stored material and fabrications from damage.
- C. Handle materials to prevent damage to finished surfaces.
  - 1. Provide protective coverings to prevent physical damage or staining following installation for duration of project.

**1.3 WARRANTY**

- A. Provide 10-year manufacturer's warranty including colorfastness and material defects.
  - 1. Warranty shall provide material and labor to repair or replace defective materials.

**1.4 SUBMITTALS**

- A. Shop Drawings:
  - 1. Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices and other components.
  - 2. Show full-size details, edge details, thermoforming requirements, attachments, etc.
  - 3. Show locations and sizes of furring, blocking, including concealed blocking and reinforcement.
  - 4. Show locations and sizes of cutouts and holes for plumbing fixtures, faucets, soap dispensers, waste receptacle and other items installed in surface.
  - 5. Indicate dimensions, component sizes, fabrication details, attachment provisions and coordination requirements with adjacent work.
- B. Samples:
  - 1. For each EQF color selected:
    - a. Minimum 6 IN x 6 IN sample in specified gloss.
    - b. Cut sample and seam together for representation of inconspicuous seam.

- c. Indicate full range of color and pattern variation.
  - 2. Sealant colors for selection.
  - 3. Approved samples will be retained as a standard for work.
- C. Contract Closeout Information:
- 1. Maintenance data.
  - 2. Warranty.
- D. LEED Information:
- 1. LEED Credits MR 4.1 and 4.2, Recycled Content: Product data indicating percentages by weight of post-consumer and post-industrial recycled content for products having recycled content; include statement indicating costs for each product having recycled content.
  - 2. LEED Credits MR 5.1 and 5.2, Regional Materials: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.

## 1.5 JOB CONDITIONS

- A. Site-verify dimensions.
- B. Coordinate installation with work of all trades.
- C. Environmental Conditions:
  - 1. Maintain relative humidity planned for building occupants for 48 hours prior to and during installation.
  - 2. Maintain ambient temperature between 65 Deg F and 75 Deg F for 48 hours prior to and during installation.
  - 3. After installation, maintain relative humidity and ambient temperature planned for building occupants.
- D. Jobsite Tooling:
  - 1. Protect adjacent materials from damage caused by water-cooled tools.
  - 2. Protect adjacent materials from dust contamination caused by tooling operations.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Acceptable manufacturers:
  - 1. Engineered Quartz Fabrications (EQF):
    - a. Base:
      - 1) DuPont de Nemours, (Zodiaq).
    - b. Optional:
      - 1) US Quartz Products Inc. (CaesarStone).
      - 2) Cambria.
      - 3) Techistone USA.
      - 4) Cosentino USA (Silestone Quartz).
  - 2. Sealant (elastomeric):
    - a. Base:
      - 1) Color Rite.
      - 2) Other products approved by EQF manufacturer.

### 2.2 ENGINEERED QUARTZ FABRICATIONS (EQF)

- A. Material Description:
  - 1. Homogeneous, uncoated, engineered stone matrix.
    - a. Composition: 93% quartz and 7% resin binders and pigments.

- b. Free of fissures and cracks, and impervious to water, moisture, or bacteria.
2. Base Product: “Zodiaq” by DuPont de Nemours.
3. Physical properties:

| Minimum Physical Properties                     |                           |                                   |
|---|---------------------------|-----------------------------------|
| Property  | Method                    | Value                             |
| Flexural Strength                               | ASTM-D790                 | >5300 PSI                         |
| Flexural Elongation                             |                           | > 0.1 %                           |
| Compression Strength (Dry)                      | ASTM-C170                 | >27,000 PSI                       |
| Compression Strength (Wet)                      |                           | >24,000 PSI                       |
| Hardness  | Mohs Hardness Scale       | 6.5 to 7.5                        |
| Thermal Expansion                               | ASTM-D696                 | 1.4 x 10 <sup>-3</sup> IN/IN/DegF |
| Gloss (60 –degree Gardner)                      | ANSI-Z124                 | 45-50                             |
| Colorfastness                                   | ANSI-Z124.6.5.1.          | Pass                              |
| Wear and Cleanability                           | ANSI-Z124.6.5.3.          | Pass                              |
| Stain Resistance                                | ANSI-Z124.6.5.2           | Pass                              |
| Chemical Stain Resistance                       | ANSI-Z124.6.5.5           | Pass                              |
| Cigarette Stain Resistance                      | ANSI-Z124.6.5.4           | Pass                              |
| Fungal and Bacterial Resistance                 | ASTM-G21                  | No Growth                         |
| High Temperature Resistance (365 Deg.F)         | NEMA-LD 3.3.6             | None to slight effect             |
| Boiling Water Resistance                        | NEMA-LD 3.3.5             | None to slight effect             |
| Freeze-Thaw Cycling                             | ASTM-C1026                | Unaffected                        |
| Point Impact                                    | ANSI-Z124.6.4.2           | Pass                              |
| Ball Impact                                     | NEMA-LD 3.3.8             | 164 IN drop                       |
| Slip Resistance (textured models)               | --                        | Above 0.80                        |
| Static Coefficient of Friction (as received)    | --                        | 0.89 wet / 0.61 dry               |
| Static Coefficient of Friction (with renovator) | --                        | 0.87 wet / 0.65 dry               |
| Abrasion Resistance                             | ASTM-C501                 | 139                               |
| Specific Gravity                                | ASTM-D792                 | 2.44                              |
| Density   | --                        | 150 PCF                           |
| Water Absorption                                | ASTM-C373                 | 0.12%                             |
| Moisture Expansion on average                   | ASTM-D370                 | <0.01%                            |
| Toxicity Passes                                 | Pittsburgh Protocol       | LC50 = 68-128                     |
| Flammability                                    | ASTM-E84 and NFPA–<br>255 | Class I / Class A                 |
| Flame Spread Index                              |                           | 0 for 3 cm / 5 for 2 cm           |
| Smoked Developed Index                          |                           | 40 for 3 cm and 75 for 2 cm       |

## 2.3 MISCELLANEOUS MATERIALS

- A. Joint Adhesive:
  1. Manufacturer’s standard polyester or epoxy adhesive as required for inconspicuous, non-porous joints.
- B. Sealant (elastomeric):
  1. Description:
    - a. Mildew-resistant, FDA-compliant, NSF 51-compliant (food zone — any type), UL-listed silicone sealant in colors matching components.
    - b. Specifically formulated for applications indicated, including wet areas.
    - c. Elastomeric.
    - d. Shore A Hardness: 25.
    - e. Compatible with Engineered Quartz specified.
    - f. Compatible with Gypsum wallboard, Painting, Solid Surfacing and other materials being sealed.
    - g. Sealants shall have a VOC content no greater than 250 g/L in accord with SCAQMD Rule #1168.
  2. Colors:
    - a. Colors as required to match various EQF colors specified.

- b. Architect to select from no less than 450 standard color choices.
- c. Number of different colors required for project shall not be limited.
- 3. Base Product(s):
  - a. Color as indicated in Finish Key on Drawings.

## 2.4 SHOP FABRICATION - GENERAL

- A. Shop assembly
  - 1. Fabricate components to greatest extent practical to sizes and shapes indicated, in accordance with approved shop drawings and manufacturer's instructions.
  - 2. Fabricated per manufacturer's instructions, the Dimension Stone Manual (by MIA) and using techniques consistent with fabrication of natural stone.
  - 3. Fabricate with water-cooled tools with hardened tips.
  - 4. Form joints between components using color-matched Joint Adhesive in an inconspicuous manner.
    - a. Reinforce joint as recommended by manufacturer.
    - b. Locate seams directly over supports; do not locate seams in the midspan region.
  - 5. Provide factory cutouts for plumbing fittings and bath accessories as indicated.
    - a. Radius all inside corners of cutouts as large as but not less than 3/8 IN.
    - b. Reinforce as required to avoid stress cracking.
    - c. Tool edges and corners smooth and free of chips or nicks.
  - 6. Rout and finish component edges with clean, sharp returns.
    - a. Rout cutouts, radii and contours to template.
    - b. Smooth edges.
    - c. Repair or reject defective and inaccurate work.
  - 7. Fabricate coved splashes where indicated.
  - 8. Reinforce inside corners, narrow pieces, cantilevered overhangs, and stress points against breakage by laminating an additional thickness of EQF on concealed face.
  - 9. Laminate additional thicknesses of EQF and tool edge profiles indicated.
  - 10. Finishing: Ensure that completed pieces are uniformly finished according to the Finish Schedule and Key.

## 2.5 FABRICATIONS

- A. EQF Countertops:
  - 1. Configurations as indicated on the Q Drawings.
  - 2. Thickness: Minimum 2 cm 3/4 IN (unless otherwise indicated).
  - 3. Provide plywood backing material as required for added strength.
  - 4. Backsplashes and Sidesplashes:
    - a. Provide where indicated.
    - b. Thickness: Minimum 3/4 IN (unless otherwise indicated).
    - c. Height: As indicated.
    - d. Fabricate from same material and color as top.
    - e. Seal to Countertops with color-matched elastomeric sealant.
  - 5. Front overhang of Tops: 1-1/2 IN.
  - 6. Edge Treatments: As indicated on the drawings.
  - 7. Polish exposed faces.
  - 8. EQF Color / Pattern / Finish: Per Finish Schedule and Key.
- B. Sinks (specified elsewhere):
  - 1. Porcelain, enameled steel and/or stainless steel bowls: Specified in Section 22 42 00.
- C. Faucets and Trim: Specified in Section 22 42 00.

## 2.6 SCHEDULE OF EQF FINISHES

- A. Schedule of EQF Finishes:
  - 1. Utilize the colors, patterns, and finishes and shown on the Finish Key in locations indicated on the Finish Schedule.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Examine substrates and conditions, with fabricator present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.
  - 1. Verify measurements, dimensions and drawing details before proceeding.
  - 2. Coordinate location of furring, nailers, blocking, grounds and similar supports for attached work.
  - 3. Examine conditions under which work is to be installed.
  - 4. Correct unsatisfactory conditions.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
- C. Installation constitutes acceptance of responsibility for performance.

### **3.2 INSTALLATION**

- A. General:
  - 1. Install components plumb, level and rigid, scribed to adjacent finishes, in accordance with approved shop drawings and product data.
  - 2. Provide product in the largest pieces available.
  - 3. Form field joints using manufacturer's recommended adhesive, with joints inconspicuous in finished work.
    - a. Exposed joints/seams will not be allowed.
  - 4. Reinforce field joints with EQF strips extending a minimum of 1 to 2 IN on either side of the seam with the strip being the same thickness as the top.
  - 5. Cut and finish component edges with clean, sharp returns.
  - 6. Rout radii and contours to template.
  - 7. Anchor securely to base cabinets or other supports.
  - 8. Align adjacent countertops and form seams to comply with manufacturer's written recommendations using adhesive in color to match countertop.
  - 9. Carefully dress joints smooth, remove surface scratches and clean entire surface.
  - 10. Install countertops with no more than 1/8 IN sag, bow or other variation from a straight line.
- B. Countertops:
  - 1. Install plumb, level, true and straight.
    - a. Shim as necessary using concealed shims.
  - 2. Adhere tops to base cabinets with dabs of a clear silicone sealant at 10 to 12 IN apart.
  - 3. Attach top securely to base unit or support brackets in accordance with manufacturer's instructions.
    - a. Supply additional wood supports, spaced no more than 12 IN apart or as otherwise required for adequate strength.
    - b. Restrict unsupported overhangs to 12 IN.
  - 4. Where tops are abutted by walls at both ends: All 1/8 IN expansion gaps at both ends for every of 10 FT countertop.
    - a. Seal gaps with elastomeric sealant.
- C. Backsplashes and Sidesplashes:
  - 1. Applied Splashes:
    - a. Join "adhered" items to substrate using color-matched, elastomeric sealant.
    - b. Adhere to walls and other substrates with clear silicone sealant.
    - c. Seal to walls and adjacent cabinets with color-matched, elastomeric sealant.
- D. Sinks (specified elsewhere):
  - 1. Install sinks per Section 22 42 00.
  - 2. Seal to Countertop with elastomeric sealant and mounting hardware provided.
  - 3. Drain and overflow connections: Specified in Section 22 42 00.

- E. Faucets and Trim:
  - 1. Install faucets and trim per Section 22 42 00.
  - 2. Plumbing connections: Specified in Section 22 42 00.
  - 3. Seal to Countertop with elastomeric sealant.

### **3.3 CLEANING AND PROTECTION**

- A. Keep components clean during installation.
- B. Protect finished surfaces from damage.
- C. Remove adhesives, sealants and other stains.

### **3.4 REPAIR**

- A. Repair damaged work.
- B. Replace damaged work which cannot be repaired to Architect's satisfaction.

**END OF SECTION**

**SECTION 12 48 13**  
**ENTRANCE MATS (EM)**

**PART 1 - GENERAL**

**1.1 QUALITY ASSURANCE**

A. Minimum Performance Standard Compliance:

| <b>Minimum Physical Properties</b> |                    |                            |
|------------------------------------|--------------------|----------------------------|
| <b>Property</b>                    | <b>Test Method</b> | <b>Required Value</b>      |
| Flammability                       | ASTM-E648          | Class I                    |
| Critical Radiant Flux              | ASTM-E648          | 0.45 Watts/M <sup>2</sup>  |
| Slip-Resistance                    | ASTM-D2047         | Wet and Dry $\mu \geq 0.6$ |

B. Single Source Responsibility:

1. Obtain mats and frames from one source.

C. Reference Standards:

1. American Society for Testing and Materials (ASTM)
2. The Aluminum Association
3. The Carpet and Rug Institute (CRI)
4. The National Floor Safety Institute (NFSI).

D. Dissimilar materials protection:

1. Where aluminum materials will be in contact with concrete or other incompatible materials:  
Provide a suitable protective coating.

E. Splices:

1. General:
  - a. Manufacturer shall be capable of producing Tread Rails in lengths of at least 12 FT.
  - b. Show proposed splice locations on Shop Drawings for Architect approval.
2. Where Entrance Mats on project are less than 12 FT wide:
  - a. No splices will be permitted.
3. Where Entrance Mats on project are greater than 12 FT:
  - a. Locate splices away from primary pathways.
  - b. Utilize maximum practical lengths of Tread Rails.

**1.2 SUBMITTALS**

A. Shop Drawings:

1. Showing layout of mat and frame specified including details indicating construction relative to materials, direction of traffic, splices, spline locations, profiles, anchors and accessories.

B. Product Data:

1. Manufacturer's specifications for each type of floor mat and frame specified.

C. Samples:

1. Materials, finishes and colors for final selection and approval.

D. Project Information:

1. Manufacturer's installation instructions for each type of floor mat and frame specified.
2. Certification of Slip-Resistance rating.

E. Contract Closeout Information:

1. Maintenance data.

2. Warranty.
  3. Interior finish fire performance data:
    - a. Provide for each finish material and type specified:
      - 1) Manufacturer's printed information including:
        - a) Fire class.
        - b) NFPA test number.
        - c) Photograph.
      - 2) Proof of purchase.
- F. LEED Information:
1. LEED Credits MR 4.1 and 4.2, Recycled Content: Product data indicating percentages by weight of post-consumer and post-industrial recycled content for products having recycled content; include statement indicating costs for each product having recycled content.
  2. LEED Credits MR 5.1 and 5.2, Regional Materials: For products and materials required to comply with requirements for regional materials indicating location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include statement indicating cost for each regional material and the fraction by weight that is considered regional.

### **1.3 DELIVERY, STORAGE AND HANDLING**

- A. Deliver embedded anchorage items in time for installation.
- B. Deliver materials to the project site ready for use and fabricated in as large sections and assemblies as practical, in unopened original factory packaging clearly labeled to identify manufacturer.

### **1.4 PROJECT CONDITIONS**

- A. Field measurements:
  1. Check actual openings for mats by accurate field measurements before fabrication.
  2. Record actual measurements on final Shop Drawings.
  3. Coordinate fabrication schedule with construction progress to avoid delay of work.
- B. For recessed applications:
  1. Coordinate frame installation with concrete construction to ensure recess and frame anchorage are accurate and that the base is level and flat.
  2. Defer frame installation until building enclosure is complete and related interior finish work is in progress.
- C. Deviations from Specified Thicknesses:
  1. Units proposed by Optional Manufacturers, where the nominal thickness of their products differ from that of the Base Product:
    - a. Seek prior approval of thickness deviation from Architect.
    - b. Notify Contractor/CM so that compensation in substrate and abutting finishes can be coordinated.

### **1.5 WARRANTY**

- A. Manufacturer's standard 2-year warranty.

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS**

- A. Acceptable manufacturers:
  1. Entrance Mats:
    - a. Base:
      - 1) C/S Group.

- b. Optional:
  - 1) Balco Inc.
  - 2) JL Industries.
  - 3) Mats Inc.
  - 4) Arden Architectural Specialties.
  - 5) Reese Enterprises.

## 2.2 ENTRANCE MAT – TYPE EM-2

- A. Description:
  - 1. Aluminum tread rails and inserts, joined by combination hinge and cushions.
  - 2. Nominal Unit Depth: 1/2 IN.
  - 3. Base Product: “G3 PediTred LP” by C/S Group.
  - 4. Capacity Rating: Standard rolling load performance: 750 LBS wheel load.
    - a. 5 IN x 2 IN wide polyurethane wheel.
    - b. 1000 passes without damage.
- B. Tread Rail Extrusions:
  - 1. Material: ASTM-B221 aluminum alloy 6105-T5.
  - 2. Finish:
    - a. Clear Anodized.
- C. Hinge/cushion extrusions:
  - 1. Flexible prime PVC.
  - 2. Perforated between each tread rail for drainage.
- D. Tread Inserts:
  - 1. Heavy Duty Monotuft Carpet Inserts:
    - a. Complying with Carpet and Rug Institute’s standard for indoor air quality.
    - b. Colorfast, solution dyed 100% nylon.
    - c. Carpet weight: 33 OZ/YD<sup>2</sup>.
    - d. Color: To be selected by Architect from 25 standard colors.
    - e. Fibers and monofilaments:
      - 1) Fibers including not less 100 monofilament fibers per square Inch.
      - 2) Anti-static, containing antimicrobial additive and treated with Scotchgard.
      - 3) Fusion-bonded to rigid two-ply backing and supplied in continuous splice-free lengths.
- E. Perimeter Frames:
  - 1. General:
    - a. Materials: 6063-T5/T6 alloy aluminum with finishes matching those specified for visible portions of Tread Rails.
    - b. Include extruded vinyl fillers at leading and trailing edges.
    - c. Include required fillers, inserts fasteners and other accessories.
    - d. Dissimilar materials protection: Where raw aluminum will be in contact with concrete: Provide a suitable protective coating.
  - 2. Profiles: Select Frame types and profiles as appropriate for project conditions.
    - a. Refer to Drawings.
  - 3. Frame transitions to abutting materials shall comply with ADA.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Clean substrate prior to installation of mat.

- B. Verification of conditions:
  - 1. Examine areas and conditions under which work is to be performed and identify conditions detrimental to proper or timely completion.
  - 2. Do not proceed until unsatisfactory conditions have been corrected.
- C. Verify suitability of substrate to accept frame and mat.
- D. Installation constitutes acceptance of responsibility for performance.

### **3.2 PREPARATION**

- A. Manufacturer shall offer assistance and guidance to provide a template of irregular shaped mat assemblies to ensure a proper installation.

### **3.3 INSTALLATION**

- A. Install the work of this section in accordance with the manufacturer's recommendations.
- B. Set mat at height recommended by manufacturer for most effective cleaning action.
- C. Utilize latex screed to ensure level base.
  - 1. Product to be approved by manufacturer of Entrance Mat.
- D. Coordinate top of mat surfaces with bottom of doors that swing across to provide clearance between door and mat.

### **3.4 PROTECTION**

- A. After completing required frame installation and concrete work, defer installation of Tread Rails until time of substantial completion of project.
  - 1. In meantime: Provide temporary filler plywood or fiberboard in recess, and cover frames with plywood protective flooring.
  - 2. Maintain protection until construction traffic has ended and project is near time of substantial completion.

### **3.5 CLEANING & REPAIRS**

- A. Adjust and clean prior to final acceptance.
- B. Train BNL's maintenance personnel of proper cleaning/maintenance procedures.

**END OF SECTION**

**HDR**

**D I V I S I O N    1 3**  

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**SPECIAL CONSTRUCTION**

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**SECTION 13 34 39**  
**ACOUSTICAL SHIELDED ROOMS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section includes requirements for pre-engineered, pre-fabricated acoustic shielded rooms.

**1.2 PERFORMANCE REQUIREMENTS**

- A. Provide manufacturer's standard or custom system of products, materials, equipment, and components adapted to the application indicated:
1. System will comply with performance requirements specified, demonstrated by the test methods indicated.
  2. Manufacturer shall provide manufacturer's standard system to the extent that such system complies with design and performance criteria.
- B. Performance Responsibility:
1. Manufacturer shall provide design and engineering required for acoustic shielding system required to meet the specified performance requirements within physical and other requirements established by the Contract Documents.
  2. Manufacturer shall be responsible for complete fabrication and installation of the system utilizing certified field service technicians.
- C. Contract Documents provide an outline of criteria and performance requirements for acoustic shielded rooms, but requirements shall not be construed as engineered design:
1. Requirements indicated by details are intended to establish basic aspects of the system, and connection to other construction.
- D. Structural Requirements: Design, engineer, fabricate, and install acoustic shielded room to withstand loads indicated within limits and under conditions indicated, without material failure or permanent deformation of structural members.
- E. Design Limitations: Conditions that are not indicated shall be developed to the same level of design as intended by the Contract Documents. Architect retains sole responsibility for determining compliance.
- F. Function:
1. Acoustics:
    - a. Enclosure manufacturer shall successfully demonstrate ability to effectively reduce the sound transmissions from surrounding areas into the chamber, by laboratory results and the completion of at least 10 successful installations involving noise reduction design packages.
    - b. Noise reduction values shall be measured at 100 Hz and 500 Hz.
    - c. Tests shall be performed in accordance with ISO standards 140/717 by a certified third party.
    - d. Minimum Performance Levels when tested in accordance with ASTM E90-99:
      - 1) Walls: Minimum noise reduction of STC 59.
      - 2) Ceiling: Minimum noise reduction of STC 59.
      - 3) Door: Certified minimum sound attenuation level of STC 64.
      - 4) Ceiling Hatch: STC 59.

### 1.3 SUBMITTALS

- A. Shop Drawings:
  - 1. Submit complete fabrication and erection drawings, consisting of floor and ceiling plans, elevations, details, and schedules that include locations of miscellaneous penetrations.
  - 2. Provide details for other trades that interface with enclosure, including mechanical, electrical and plumbing, and any other conditions that will affect acoustic enclosure performance.
- B. Product Data:
  - 1. Submit manufacturer's technical data, installation instructions, and recommendations for each product specified.
  - 2. Include data substantiating the materials and performance comply with requirements.
- C. Project Information:
  - 1. Warranty: Submit sample copy of manufacturer's extended warranty, stating obligations, remedies, limitations, and exclusions.
- D. Contract Closeout Information:
  - 1. Field Test Certification Reports: Submit written report of testing and inspection complying with Field Quality Control requirements, which includes, but is not limited to, the following:
    - a. Testing and inspection performed.
    - b. Findings of the testing and inspections.
    - c. Statement that the testing and inspections were performed in accordance with the specified test requirements.
    - d. Indication whether shielding enclosure has passed or failed the test or inspection.
  - 2. Operation and Maintenance Data: Submit manufacturer's written instructions for maintenance of installed Work:
    - a. Include precautions against cleaning materials and methods which may be detrimental to finishes and performance.
    - b. Data shall include parts list for spare parts recommended by manufacturer to ensure efficient operation of the enclosure for 1-year normal operation following expiration of the warranty period.
  - 3. Warranty: Manufacturer's fully executed written warranty.

### 1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications:
  - 1. Single manufacturer shall produce products provided under this section.
  - 2. Firm shall be experienced in manufacturing products, materials, equipment for acoustical shielding systems similar to those indicated for this Project, with not less than 5 years experience, and having completed not less than 10 similar installations within the previous 5 years.
- B. Regulatory Requirements for Accessibility: Door unit shall comply with Americans with Disabilities Act (ADA), ANSI A117.1, and state and local handicapped accessibility standards.

### 1.5 PROJECT CONDITIONS

- A. Space Enclosure and Environmental Limitations:
  - 1. Comply with shielding manufacturer's recommendations for optimum temperature and humidity conditions for the storage and installation of shielding enclosure.
  - 2. Store and install products, materials and equipment only after optimum conditions have been attained and stabilized, so that temperature and humidity will be within plus or minus 1.0 percent of optimum moisture content from date of installation through remainder of construction period.
- B. Deliver, store and install shielding enclosure only after possibility of water damage from weather no longer exists:

1. Building shall be fully enclosed, with exterior walls and roof complete.

## 1.6 WARRANTY

- A. Manufacturer shall warrant installation against defective materials and workmanship, and that the installed shielded enclosure, including doors, windows and power filters, shall retain the specified shielding characteristics for a period of 5 years from date of acceptance test.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Acceptable manufacturers:
  1. Prefabricated acoustically shielded rooms:
    - a. Base:
      - 1) Quiet Star Industries (Industrial Acoustics Corp).
    - b. Optional:
      - 1) ETS-Lindgren/Acoustic Systems.
- B. Panels Specification based on IAC Noise Lock VII:
  1. 4 IN thick, sandwich panel.
  2. Panel Face: Cold rolled steel.
  3. Finish: Powder coated, manufacturer's standard white
- C. Doors and frames: Specification based on IAC 64 door:
  2. Finish and color to harmonize with panel facing.
  3. Frames: Acoustic seal in steel channel with overlap to door opening.
  4. Provide pre-hung and adjusted doors and frames.
  5. Install and test hardware before packaging.
- D. Hardware:
  1. Hinges as required by door size/weight.
  2. Push/Pulls on active leaf.
  3. Surface mounted slide bolts inactive leaf.
  4. Sill plate and acoustic compression seal.
- E. Roof deck:
  1. Match wall panel construction.
  2. Design for 50 psf loading in addition to panel load.
  3. Top Hatch: Construction of material matching wall panels. Provide "key hole" configuration with two sliding panels which will mate to provide acoustic seal. Split panels to rest on horizontal industrial quality slides with angle seals at all 4 edges to seal to roof deck panels.
- F. Removable Cryopit Cover Floor Panel:
  1. 4 IN thick sandwich panel.
  2. Panel face: 11 GA minimum cold rolled steel.
  3. Design for 50 PSF live loading in addition to panel load.
- G. Electrical and lighting:
  1. Surface mounted, 3/4 IN EMT zinc plate steel, with zinc plated handiboxes and steel faceplates.
  2. (8) 120V, 20A duplex receptacles (4 ckt).
  3. (1) light switch.
  4. (8) 100 watt, 120V incandescent fixtures in surface mounted fixtures.
  5. Ground Bar Kit: Storm Copper Components, SCGB-2KT, 2 IN x 24 IN ground bar.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Manufacturer shall provide the Contractor with a listing of minimum site requirements and acceptable conditions necessary to begin enclosure installation.
- B. Insure that proper conditions have been confirmed prior to work commencement.
- C. Do not proceed until unsatisfactory conditions have been corrected in a manner acceptable to the Installer.
- D. Starting of work within a particular area will be construed as installers' acceptance of conditions.

### **3.2 INSTALLATION**

- A. Install in accordance with manufacturer's requirements and instructions, approved submittals, and Contract Documents.
- B. Coordinate installation with other trades that connect to shielding system enclosure.

### **3.3 FIELD QUALITY CONTROL**

- A. Testing:
  - 1. Upon completion of acoustic enclosure, installer shall test the effectiveness of acoustical shielding.
  - 2. BNL, Architect and room equipment manufacturers shall witness tests.
  - 3. Perform qualification test after interior room construction is complete and equipment is in place:
    - a. Test method ASTM E90-99.
    - b. Test shall be performed before equipment is energized.

### **3.4 ADJUSTING**

- A. Adjust and leave shielding enclosure in proper operating order.

### **3.5 CLEANING**

- A. Immediately remove spots, smears, stains, residues, adhesives, etc., resulting from enclosure areas and surfaces, and from adjacent areas or surfaces that have resulted from this work.
- B. Remove damaged items, elements, units or materials and replace with new, undamaged items, elements, units or materials, to the satisfaction of BNL and Architect.

### **3.6 PROTECTION**

- A. Upon completing work, institute procedures for surveillance and protection of acoustic enclosure during remainder of construction period.

**END OF SECTION**

**SECTION 13 48 13**  
**ELECTRO-PNEUMATIC CONTROLLED AIR-SPRING VIBRATION ISOLATION**  
**SYSTEM**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. Electro-pneumatic controlled air-springs are used as supports for a vibration isolated concrete inertia mass.
- B. Electro-Pneumatic Controlled Air Vibration Isolation System shall include air spring isolator units and precision electronic controller for precise height positioning and leveling of all isolator units.

**1.2 QUALITY ASSURANCE**

- A. Warranty: The isolation system and controls shall be guaranteed against all defects for one year from the date of acceptance. In the event of a failure, provide a replacement component at no charge. If the vibration isolation provided by the system should decrease noticeably during the one year warranty period (without any obvious failure) determine the reason for the decrease and adjust or repair the system as required at no charge providing the problem is due to the performance of the system. If the problem is determined to be caused by a something other than the system, standard service rates would apply.
- B. The isolator's natural frequency in a single degree of freedom system shall be guaranteed to be within 15 percent of the values specified. Friction and vibration transmitted by the electro-pneumatic servo valves shall be guaranteed to be less than 1 percent.

**1.3 SUBMITTALS**

- A. Shop drawings: Installation drawings including spring layout and control piping, wiring, and location. Include details for mounting control devices in service module.
- B. Product data: Manufacturer's published information of the systems to be provided.
- C. Samples: Not required.
- D. Project information:
  - 1. Review of construction drawings: Review the drawings for the floor being supported and the supports for the springs with regard to possible incompatibilities between springs and the attachment points. Notify Architect of incompatibilities that are found.
- E. Contract closeout information:
  - 1. Maintenance and operating information.
  - 2. Warranty.
  - 3. Acceptance test report.
  - 4. Computer diskettes containing all acceptance test data gathered.

**1.4 PRODUCT DELIVERY**

- A. Deliver material to jobsite in cartons and crates.
- B. Inspect for damage prior to installation.

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS**

- A. Acceptable manufacturers:
  - 1. Base:
    - a. Technical Manufacturing Corporation, High Capacity Isolators and PEPS precision height control system.
  - 2. Other manufacturer's desiring approval comply with Section 01 25 13.

### **2.2 ELECTRO-PNEUMATIC AIR-SPRING WITH HEIGHT CONTROL**

- A. Technical Manufacturing Corporation PEPS System or equivalent.
- B. The performance of the vibration isolation system will approximate the following:
  - 1. Vertical natural frequency:
    - a. 1.5 Hz at maximum rated load.
    - b. 1.75 Hz at 50 percent of maximum rated load.
    - c. 2.0 Hz at 25 percent of maximum rated load.
  - 2. Horizontal natural frequency 2.5 Hz.
  - 3. Damping - 10 percent of critical, with damping adjustment capability.
- C. Vertical to horizontal stiffness ratio - 0.4:1.

### **2.3 PRODUCT CONSTRUCTION**

- A. The isolator body will include a metal housing consisting of a spring chamber and damping chamber in one unit.
- B. All tubing shall be color coded plastic with an operating pressure rating of greater than 690 kPa at temperatures of 38 degC or less.
- C. Valve to provide damping adjustment capability.
- D. Provide variable external orifices with isolators to allow adjustment of vertical natural frequency to 1.3 Hz or less.
- E. Provide an oil fog lubricator at the air supply to the system for each vibration isolator system.

### **2.4 OPERATING CHARACTERISTICS**

- A. Operating capacity: 30,000 LBS per isolator.
- B. Operating height: As indicated.
- C. Internal pressure: 550 kPa at maximum rated load.
- D. Over travel protection: An internal safety valve will vent air to protect the isolator from the sudden change in weight.
- E. Minimum height: The height of the isolator shall decrease when deflated to permit the isolator to be installed under the ledge of the concrete inertia mass.
- F. The isolators shall be useable in either of the following configurations:
  - 1. Height control by three mechanical height sensing servo valves.
  - 2. Height control by an electro-pneumatic height control system.
- G. Provide electro-pneumatic height control.
- H. When used with mechanical height sensing valves or with electro-pneumatic height control systems, the isolators shall be divided into three sets with the internal pressure and height of each set controlled by one of the servo valves. The height control at each of the three sensing points will be as follows:
  - 1. High-accuracy electro-pneumatic height control system, with an accuracy of 0.005 mm.

- 2. Provide hall effect non-contacting sensors. Height sensing potentiometers will not be permitted.
- I. The isolation system shall be provided with the number of isolators indicated. The system shall support the total anticipated load of slab weight plus 1.9 kPa with an internal pressure of less than 550 kPa except that system at slab mark M shall support the slab weight plus 9 metric tons.
- J. A control panel shall be furnished with an air filter, pressure regulator and four (4) pressure gauges to indicate the regulated pressure and the pressure in each set of isolators. The panel shall be recess mountable within service module.
- K. The distance from the top of the retaining ring to the roll plane of the isolators shall not exceed 20 mm.

## **2.5 INTERFACE TO BUILDING**

- A. The isolation with electro-pneumatic servo valves shall be able to work with a continuous source of shop air or nitrogen at pressure between 590 kPa and 860 kPa (875 PSI to 125 PSI). The maximum air consumption for the complete isolation system with electro-pneumatic servo valves shall not exceed 28 L/min. (1 CFM) under static conditions to 550 L/min. (19.5 CFM) for a few seconds when correcting for large shifts in weight.

## **PART 3 - PART 3 - EXECUTION**

### **3.1 INSPECTION**

- A. Examine structure, substrates and conditions under which work is to be installed for conditions detrimental to correct and timely completion.
- B. Installation constitutes acceptance of responsibility for performance.

### **3.2 INSTALLATION**

- A. Provide and grout in setting plates such that the distance from the top of the setting plate to the underside of the slab is equal for all isolators (to plus or minus 0.1 mm).
- B. Level and align upon completion of installation.
- C. Leave work complete and in proper operating condition.
- D. Remove and replace defective work.
- E. Manufacturer shall provide a field engineer to supervise installation and testing of the isolation systems.

### **3.3 ACCEPTANCE TESTING**

- A. Acceptance testing shall be performed upon completion of the installation compensation and optimization of the system. The natural frequency shall be determined by measuring the transmissibility between the foundation and the top of the mass.
  - 1. Passive test procedure apply to all isolation systems.
  - 2. Active test procedure apply to all isolation systems with active control.
  - 3. These tests shall be performed to indicate the natural frequency and isolation.
  - 4. Additional testing shall be performed by BNL.
  - 5. Prior to testing, adjust damping of isolators so that isolators for each mass are balanced and tuned to the configuration of the masses and isolation system.
- B. Test procedures:
  - 1. Passive test:

- a. Place two seismic vibration sensors on top of the concrete inertia mass near the center. Using a two channel FFT Spectrum analyzer measure the transfer function between the two signals to verify that the two triaxial sensors have the same calibration and response characteristics. The transfer function should be flat. Repeat for the longitudinal and lateral axes. Relocate one of the triaxial velocity sensors to the top of the pit wall. Where active system is installed set system in STANDBY measure the transfer function (transmissibility) between the inertia mass and the top of the pit wall from 0.5 Hz to 100 Hz in the vertical axis. The transfer function should be the result of 800 line analysis (frequency range 0 to 100 Hz) and at least 50 averages without overlap. This will establish the isolation provided by the passive isolation system.
  - b. Repeat step b., in the longitudinal axis.
  - c. Repeat step b., in the lateral axis.
  - d. At conclusion record and store FFT spectrum data including magnitude, phase and coherence.
2. Active test:
    - a. Reset the active controller to OPERATE. Measure the transfer function in the vertical, longitudinal and lateral axes using the same procedure used in step 1.b., above.
    - b. Compare the transfer functions obtained in each axis with the controller in STANDBY with the transfer function for the same axis with the controller in OPERATE. The difference in the two transfer functions is the result of the active vibration control.
    - c. At conclusion, record and store FFT spectrum data including magnitude, phase and coherence.
  3. Height sensing system test:
    - a. Install a dial indicator between the floor and the isolated mass at each height sensor for the isolation system. Adjust the dial indicators to mid stroke and set it to 0.
    - b. Observe the dial indicator readings for 10 minutes. Note and record the highest and lowest reading.
    - c. Add a weight of about 450 N to the top of the mass, note and record the dial indicator readings after the isolation system has corrected for the change in load.
    - d. Remove the 450 N weight from the top of the mass, note and record the dial indicator readings after the isolation system has corrected for the change in load.
- C. Data reduction and plotting:
1. Describe methods and formats.
- D. Report:
1. Describe test conditions.
  2. Describe test activities.
  3. Present data, including a copy of the test procedure, data sheets, FFT spectra, transfer function plots, and any other applicable information.

**END OF SECTION**

**SECTION 13 49 57**  
**RADIO FREQUENCY SHIELD ENCLOSURE**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. Design, engineer, fabricate, install and test radio frequency (RF) shielded enclosure, with shielding constructed of fully annealed pure copper, galvanized steel sheet, plate steel, or aluminum sheet for the Laboratories indicated in the drawings:
  - 1. RF shielding system may be prefabricated modular panel or field fabricated panel.
  - 2. Include opening protection systems such as RF doors, wave guides, and filters as necessary for mechanical, electrical, and plumbing penetrations.
  - 3. Provide custom details and installation for the following and as shown in the drawings:
    - a. Ceiling (floor) hatch.
    - b. Closet in each RF enclosure for connection of RF filters on electrical and controls systems.
    - c. Structural supports for floor grating where shown on drawings for 250 LBS per linear foot.
- B. Coordinate design of RF enclosure with construction drawings and stated requirements.
- C. The work to be performed under this Section consists of all labor, materials, appliances and equipment necessary in performing all operations in connection with the design, furnishing and installation of a RF Shielding System, and as specified in Architectural and Structural drawings for the facility.

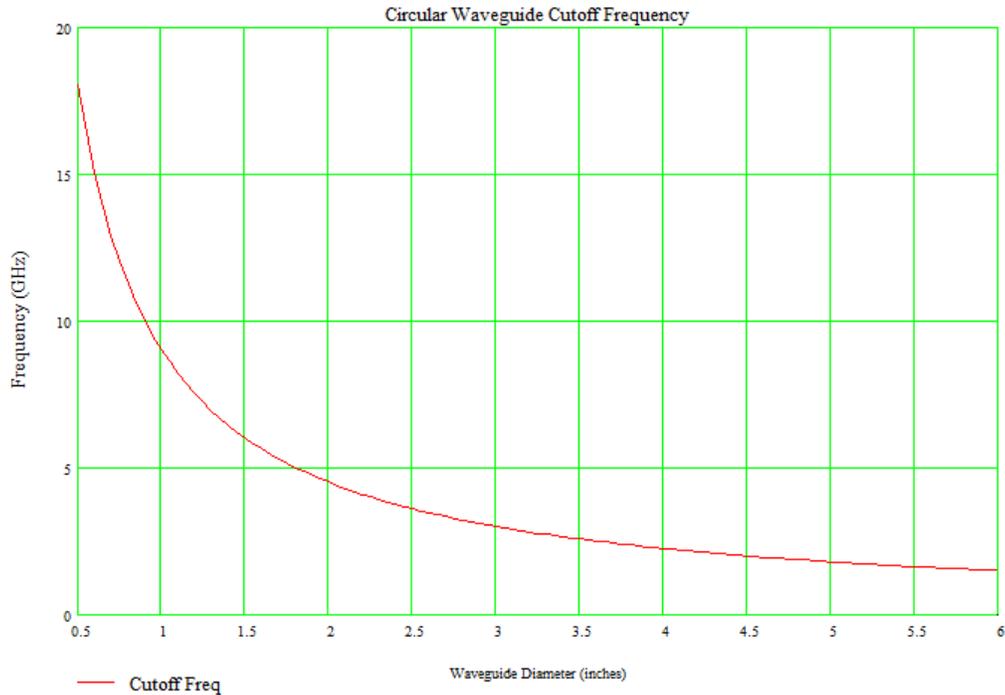
**1.2 SYSTEM DESCRIPTION**

- A. Design Requirements:
  - 1. Required RF Shielding Performance Objective:

| RF Attenuation Rating of Enclosure when Tested in Accordance with IEEE 299 |                 |             |
|--|-----------------|-------------|
| Category   | Frequency Range | Attenuation |
| Microwave  | 5 GHz           | 100 dB      |

- 2. After the RF Shielding Systems have been completely installed as specified in this Section, perform a performance test of the rooms. The final performance testing must comply with Shielding Performance Objectives stated in Item 1 above. All testing shall be performed by a qualified EMF Consultant with at least 10 years RF testing experience.
  - 3. Performance of RF Shielded door and ceiling hatch shall meet or exceed the performance of the RF Shielding.
- B. Shield shall be six sided, including floor and ceiling:
  - 1. In no case shall the shielding system wall panels exceed 4 IN from face of concrete substructure at walls or ceiling.
  - 2. Shielding system floor material shall be installed directly over the concrete floor substrate.
  - 3. Shielding system floor will be continuous copper, aluminum, or steel sheet with welded seams:
    - a. Shielding system floor material shall be capable of supporting 7000 PSF when installed:
    - b. Floor material will be subjected to the load of the concrete isolation block (shown in the drawings) which is approximately 100 tons, bearing on 8 support blocks each.
  - 4. Shielding system ceiling panels shall be suspended from the concrete floor structure above the chamber, and shall be self supporting between suspension points.

- C. RF pipe penetrations wave guides shall be appropriately sized by the shielding vendor per the following size/cutoff frequency chart:



- D. Construct installed enclosure so that, without connections to earthing terminal, resistance of enclosure relative to earth ground shall be equal to or greater than 1,000 Ohms.

### 1.3 SUBMITTALS

- A. Manufacturer Qualifications (see Article 1.4 below):
1. Statement demonstrating manufacturer's experience
  2. ISO 9001 Certification
  3. Welders certifications
- B. Shop Drawings:
1. Include floor plan of each space, interior enclosure elevations, typical construction, and cross sections drawn at 1/4 IN equals 1 FT scale:
    - a. Indicate locations and types of all RF shielding penetrations.
  2. Provide details of RF shielding components installation including joints, attachments between components, and connections to building systems such as grounding..
  3. Provide construction details showing interface with adjacent construction, including structural supports.
  4. Provide details of attachment of RF shielding to structure.
  5. Provide full set of Shop Drawings in AutoCAD drawing format on a CD.
- C. Product Data:
1. RF Shielding material specifications.
  2. Panel fabrication data.
  3. Product data for all accessories, including wave guides, line filters, and power filters.
  4. Product data for RF shielded door:
    - a. Test Data: Door system life cycle test.
- D. Contract Closeout Information:
1. Record documents of as-built drawings for the RF Shielding Systems (3 hard copies and one CD).
  2. Test Reports:

- a. Qualification Test.
  - b. Acceptance Test.
  - c. Ground Isolation monitoring Test.
3. Warranties.

#### **1.4 QUALITY ASSURANCE**

- A. Supplier of RF Shielding shall be ISO 9001 Certified for "RF Shielded Enclosures":
  1. A copy of the ISO certificate is to be submitted.
- B. Manufacturer Qualifications:
  1. Engaged in manufacture and installation of RF-shielded enclosures of like size and complexity to that required for this Project for a period of not less than 10 years.
  2. Directly employ experienced and properly equipped engineering, drafting, and project management personnel.
  3. Directly employ qualified installers and field supervisory personnel.
  4. All welders shall be AWS D1.1 Certified. Welder qualifications to be submitted prior to commencement of work.
- C. Use of Dissimilar Metals:
  1. Do not place dissimilar metals in direct contact without appropriate protection:
    - a. RF shielding medium shall display an anodic voltage differential index of less than 0.40 Volts and a cathodic group number of 1 to 9 (0.00 to 0.40 Volts).
    - b. Construct shielding system with proper materials so that ionic conduction across joints and RF seams shall be less than 0.10 Volts.
  2. Bronze or brass flame sprayed treatments of steel or aluminum RF contact surfaces are acceptable.
- D. Corrosion Protection of Shielding Materials:
  1. RF Shielding system will be installed over concrete substructure. Provide corrosion protection as required for the shielding material supplied, and to provide isolation of minimum 1000 Ohms resistance to ground. Backing materials are acceptable provided the system will support floor loads.

#### **1.5 REFERENCES**

- A. Standards:
  1. IEEE 299-2006 Standard Method for Measuring the Effectiveness of Electromagnetic Shielding Enclosures..
  2. MIL-STD-220C - Standard Method of Insertion Loss Measurement.
  3. ASTM Standards:
    - a. ASTM-E84, "Surface Burning Characteristics".
    - b. ASTM-F1869, "Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride".

#### **1.6 WARRANTY**

- A. Warrant the system to be free of defects in materials and workmanship as evidenced by retention of specified RF shielding characteristics for periods as follows:
  1. Basic Enclosure: 5 years.
  2. EMI Electrical Filters, RF Shielded Doors, Pipe Penetrations, and Air Vent RF Filters: 2 years.
- B. Pass-through warranties provided by subcontractors to manufacturer shall not be allowed.

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS**

- A. Acceptable manufacturers:
  - 1. Radio Frequency Shielded Enclosure:
    - a. Braden Shielding Systems, Inc.
    - b. ETS-Lindgren, Inc.
    - c. Global Partners in Shielding, Inc.
    - d. Universal Shielding Corporation.

### **2.2 MATERIALS AND COMPONENTS**

- A. Shielding Material:
  - 1. One of the following or a combination of the following meeting the specified Performance Requirements:
    - a. Annealed pure copper sheet with a conductivity rating of 1 or greater, and conforming to the galvanic requirements specified.
    - b. Galvanized steel sheet, G60 Grade.
    - c. Aluminum sheet, AA1100-H14.
    - d. Steel sheet, ASTM A36.
- B. RF Shielded Floor System:
  - 1. General:
    - a. Provide monolithic, continuous RF floor membrane.
    - b. Provide electrical isolation of enclosure and RF floor system with minimum resistance to ground of 1000 Ohms:
      - 1) Use of Masonite, other pressed wood materials, plastic sheet or other sheet goods for electrical isolation or as a moisture barrier is not permitted.
    - c. Where substrate is in direct contact with soil (slab-on-grade): Refer to Part 3 for limitations on substrate vapor pressure.
  - 2. Water Resistance:
    - a. No porous products (including wood particleboards, plywood, wafer board, Masonite or other pressed paper products, etc.) utilized within the flooring system.
    - b. RF floor assembly must resist fluid absorption from any fluid source within the RF enclosure and any fluid source originating outside of the RF enclosure.
- C. Primary Enclosure:
  - 1. Vertical Walls and Ceiling:
    - a. Integrated with RF floor system.
    - b. Support RF shielding materials on the concrete structural system.
    - c. Do not exceed 4 IN depth from face of concrete wall structure.
    - d. Bolt or weld RF panels together to provide continuous, constant, and uniform RF seams:
      - 1) Fasteners:
        - a) Material: Non-oxidizing.
        - b) Minimum Spacing: 1N centers or of a distance equal to or less than the quarter wavelength of the highest frequency specified.
    - e. Wood Frames are not acceptable.
- D. RF-shielded Door Assembly:
  - 1. General:
    - a. Factory assembled, pre-hung door and frame..
    - b. RF Performance:
      - 1) Utilize a proven RF seal design that is easily maintained and serviced.
      - 2) Maintain a shielding effectiveness equal to that of shielded enclosure.
    - c. Life cycle test rating:
      - 1) Minimum 10,000 operational cycles without loss of specified RF attenuation.

- 2) Minimum 50,000 cycles with planned maintenance without loss of specified RF attenuation.
  - 2. Frame:
    - a. Manufacturer's standard metal finish, paintable.
  - 3. Threshold:
    - a. Manufacturer's standard providing RF shield continuity to meet specified performance:
      - 1) Capable of withstanding daily pedestrian traffic without damage.
      - 2) Vendor to provide a temporary, removable ramp to be used when dewars, equipment or other heavy objects are moved across the threshold to prevent damage. Load capacity minimum 250 LBS/SF.
  - 4. Hardware:
    - a. General:
      - 1) Manually operated two point or three point latching system with cam driven hardware.
    - b. Hinges:
      - 1) Brass, aluminum, or stainless steel swing clear, with minimum of two needle-bearings and one thrust bearing per hinge.
      - 2) Provide minimum of three hinges per leaf.
  - 5. RF sealing system:
    - a. Manufacturers standard system of beryllium copper finger stock:
      - 1) Easily repaired and /or replaced without the use of special tools or training.
      - 2) Spring type RF contact fingers are acceptable.
      - 3) Continuous monolithic contact fingers.
- E. RF-shielded Hatch Assembly at Chamber Ceiling:
  - 1. General:
    - a. Factory assembled, pre-hung hatch and frame.
    - b. RF Performance:
      - 1) Utilize a proven RF seal design that is easily maintained and serviced.
      - 2) Maintain a shielding effectiveness equal to that of shielded enclosure.
    - c. Life cycle test rating:
      - 1) Minimum 10,000 operational cycles without loss of specified RF attenuation.
      - 2) Minimum 50,000 cycles with planned maintenance without loss of specified RF attenuation.
  - 2. Frame:
    - a. Four sided frame with RF seal.
    - b. Prime painted.
  - 3. Hardware:
    - a. General:
      - 1) Two point latching system with cam driven hardware, manual actuation on both sides of door.
    - b. Hinges:
      - 1) Brass, aluminum, or stainless steel, swing clear, with minimum of two needle-bearings and one thrust bearing assembly per hinge.
      - 2) Provide minimum of two hinges per leaf.
  - 4. RF sealing system:
    - a. Manufacturer's standard system of beryllium copper finger stock:
      - 1) Easily repaired and /or replaced without the use of special tools or training.
      - 2) Spring type RF contact fingers are acceptable.
      - 3) Continuous monolithic contact fingers.
- F. Heating, Ventilation and Air Conditioning:
  - 1. General:
    - a. Design RF shielded air vents to maintain a shielding effectiveness equal to that of shielded enclosure.
  - 2. Vent Type:

- a. Wave-guide below cutoff type, 3/16 IN brass hex cells, and minimum 1 IN in thickness.
  - 3. HVAC Services feeding or entering the RF enclosure:
    - a. Specified by Mechanical Specification Divisions, and installed by mechanical installer.
    - b. Notify installer of RF shielding suppliers approved techniques.
- G. Mechanical Pipe Penetrations:
  - 1. Wave-guide below cutoff type, size as required for penetrating element.
  - 2. Construct pipe penetrations of a material suitable to conditions of service on which it is installed, and to maintain shielding effectiveness equal to that of the shielded enclosure.
  - 3. Mechanical Piping Services feeding or entering the RF enclosure:
    - a. Specified by Mechanical Specification Divisions, and installed by mechanical installer.
    - b. Notify installer of RF suppliers/magnet manufacturers approved techniques.
- H. EMI Rated Power Line and Signal Electrical Filters:
  - 1. RF-shielded electrical filters:
    - a. Insertion loss as specified within MIL-STD 220C and maintain the shielding effectiveness equal to that of the shielded enclosure.
    - b. Provide an EMI filter for each electrical conductor that penetrates the enclosure, including neutral conductors.
    - c. UL certification will be required for power line filters.
  - 2. Refer to Electrical Drawings for indication of specific electrical characteristics of and the total number of conductors required for lighting and power circuits, communication devices, environmental control devices, data transmission devices, and fire alarm devices that will be utilized within the RF enclosure.
  - 3. Electrical Services feeding or entering the RF enclosure:
    - a. Specified by Electrical Specification Divisions, and installed by electrical installer.
    - b. Notify installer of RF shielding suppliers approved techniques.
- I. Grounding Conductor Terminal:
  - 1. Provide a single point ground conductor terminal using a brass stud and copper bus bar, common to both interior and exterior of enclosure:
    - a. Locate terminal as close as possible to EMI power line filters.
  - 2. Ground Conductors feeding or entering the RF enclosure:
    - a. Specified by Electrical Specification Divisions, and installed by electrical installer.
    - b. Notify installer of RF shielding suppliers approved techniques.
- J. Interior Painting:
  - 1. Specified in Section 09 91 13.
- K. Other finishes: Specified in Division 09 as applicable.
- L. Suspension System as required to support RF ceiling panels:
  - 1. Modular Steel Channels and hangers (a.k.a. "Unistrut"): Specified in Section 05 45 23.
  - 2. Final design, location and spacing as directed by RF Enclosure designer and coordinated with concrete structural inserts above RF shielded rooms..
  - 3. Design to support weight of RF Ceiling panels and finished ceiling.
- M. Related Mechanical and Plumbing items:
  - 1. Specified in Mechanical Specification Divisions:
    - a. Connections of ductwork to wave-guides:
    - b. Dielectric connections to the exterior side of each mechanical pipe penetration of a suitable material to maintain a minimum of 1,000 Ohms DC resistance to earth ground, construct of material suitable to conditions of service on which it is installed.
    - c. Pipe connections to or from the installed wave guide beyond cutoff pipe penetration.
- N. Related Electrical items:
  - 1. Specified in Electrical Specification Divisions:
    - a. Electrical connection to the installed RF power and/or signal filters, either internally or externally to the enclosure.

## **PART 3 - EXECUTION**

### **3.1 JOB CONDITIONS**

- A. Construction Facilities and Temporary Controls and Utilities: Specified in Section 01 50 00.
- B. Maintain installation site at a minimum of 68 DegF for a period of 24 hours prior to, during, and after enclosure installation.

### **3.2 PREPARATION**

- A. Substrate Quality Requirements:
  - 1. Notify slab installer of the physical requirements of the substrate in time for incorporating into work including but not limited to:
    - a. Level within 0.16mm in any 3 M 1/4 IN in any 10 FT section.
    - b. Concrete allowed to cure for minimum 28 days prior to start of enclosure installation.
    - c. Maximum allowable water vapor transmission through the substrate determined to receive epoxy coatings is 3 LBS per ASTM-F1869:
      - 1) Where slabs exceed the above value, delay installation of flooring until equilibrium <3 LBS is reached OR stabilize vapor pressure with topical treatment system specified in Section 09 60 05.
- B. Ensure that installation site has been properly weatherproofed:
  - 1. Protect RF Shielded Room from moisture, standing water, and running water prior to, during, and following enclosure installation to ensure enclosure integrity and specified earth ground isolation.
- C. Field verify dimensions and prepare Shop Drawings based on actual values.
- D. Obtain coordination drawings from Contractor/Construction Manager for all items to be installed on or within the RF enclosure and design enclosure system to support them.

### **3.3 INSTALLATION**

- A. Assemble enclosure wall and ceiling RF panels into straight, level and plumb surfaces:
  - 1. Align and secure RF joints.
- B. Perform installation under manufacturer's direct supervision.
- C. Install per approved Shop Drawings.
- D. Coordinate installation of RF enclosure with installation of other trades.
- E. SAFETY NOTE: RF shield must be permanently and properly grounded prior to connection of RF power filters to the electrical service, or Death or Serious Injury may occur to personnel working on or around the shielding enclosure. At this time, the grounding isolation monitoring will be redundant and should be removed. Timing of this phase of construction should be agreed with BNL, Construction Manager/Contractor and Shielding Vendor.

### **3.4 TESTING**

- A. Test enclosure in accordance with IEEE 299-2006:
  - 1. Demonstrate the specified attenuation values.
- B. Qualification Testing:
  - 1. Perform immediately after completion of the enclosure and prior to installation of architectural surfaces within or outside the enclosure.
  - 2. Make no trade connections to enclosure until successful completion of test process.
  - 3. Witness: Notify BNL Representative, and Contractor/Construction Manager, in advance, of on-site testing.
  - 4. Furnish a written test report to Contactor/Construction Manager and to BNL.

- C. Acceptance Testing:
  - 1. Perform after installation of the Acoustical Chamber, completion of mechanical, electrical, and plumbing connections and closure of the RF entrance panel.
  - 2. Witness: Notify BNL Representative, and Contractor/Construction Manager, in advance, of on-site testing.
  - 3. Furnish a written test report to Contactor/Construction Manager and to BNL.
- D. Ground Isolation Monitoring:
  - 1. Monitor ground isolation during entire phase of construction for a minimum of 1,000 Ohms above earth potential:
    - a. Immediately correct deficiencies.
  - 2. Provide an adjustable audio and visual ground isolation device for continuous monitoring of the RF enclosures ground isolation:
    - a. Device is to remain with the enclosure for follow up monitoring by the Contractor/Construction Manager.
  - 3. Furnish a written test report to Contactor/Construction Manager and to BNL.

**END OF SECTION**

**SECTION 13 60 13**  
**SPECIAL CLEAN ZONE REQUIREMENTS**

**PART 1 - GENERAL**

**1.1 WORK INCLUDED**

- A. Maintain and enforce requirements for every person who performs any work or function within the defined boundaries of the Clean Zone.
- B. Completed construction of the scheduled cleanroom areas for the Project are defined with the air cleanliness classification required in accordance with International Organization for Standardization ISO 14644. Federal Standard 209 E Classifications are included for cross-reference.
- C. A controlled clean environment shall be provided within which all mechanical, electrical and cleanroom systems, and process piping, will be installed.
  - 1. Clean environment shall be maintained from the initial construction stage through final cleanroom certification.
  - 2. Products brought into the Clean Zone shall comply with minimum cleanliness standards on both interior and exterior surfaces.
  - 3. Personnel cleanliness levels and construction protocol standards shall be established and monitored for each construction stage.
  - 4. Active contamination controls shall be enforced consistent with each construction stage.
  - 5. Required level of cleanliness shall be monitored using spot checks at prescribed locations.

**1.2 DESCRIPTION**

- A. Cleanrooms shall be constructed by a qualified Cleanroom Contractor responsible for compliance with the documents.
  - 1. Cleanroom Contractor qualifications:
    - a. Minimum 5 years experience in Cleanroom construction.
    - b. Minimum of 3 ISO Class 5 or FED-STD-209E Class 100 Cleanroom projects, with at least one successful operational Cleanroom facility completed in the last 12 months similar in size and function to that required for this project.
    - c. Staff of on-site personnel with similar experience.
  - 2. Provide a Clean Zone Director for the duration of Clean Zone construction and start-up activities.
    - a. Clean Zone Director shall have a minimum ten years experience in the construction of cleanrooms.
    - b. Clean Zone Director shall have completed a minimum of two projects dealing with submicron wafer technology under ISO 14644 Class 5 or better, or previous FED-STD-209E Class 100 or better.
    - c. Clean Zone Director shall have full authority over all construction procedures and personnel in the Clean Zone Area.
    - d. Clean Zone Director shall initiate weekly meetings to be attended by representatives of each trade installing equipment in the Clean Zone.
      - 1) Clean Zone Director shall keep minutes of the meetings, establish the agenda and maintain coordination between trades working in the Clean Zone.
    - e. Clean Zone Director shall record and document all staged construction events.
    - f. Clean Zone Director shall organize and lead protocol training sessions required to assure compliance with the documents and construction requirements.
    - g. Clean Zone Director shall coordinate all cleaning procedures, testing and balancing, and commissioning procedures.

3. Employ and pay for the services of a qualified Cleanroom Testing and Certification Agency to perform services specified in Section 13 60 19.
  - a. Cleanroom Testing and Certification Agency shall be independent from the Cleanroom Contractor, system manufacturer and installer.

### **1.3 CLEAN ZONE BOUNDARIES**

- A. Clean Zone includes cleanrooms as indicated on the Drawings, and remote rooms for cleanroom support equipment, bounded by and inclusive of:
  1. The Clean Zone is located on the First Floor Level and Interstitial Area above the ceiling, bounded by Column Lines '13.5' to '17' and Column Lines 'E' to 'G'. It includes the Gown Room 139.
  2. Top of recessed concrete floor slab below.
  3. Bottom of Second Floor Level floor structure above.
  4. Perimeter walls on all sides.
  5. The Clean Zone includes the interstitial space above the cleanroom ceiling, and the space below the cleanroom access floor.

### **1.4 CLEAN ZONE CONSTRUCTION STAGES**

- A. Milestones for scheduling construction stages include:
  1. Stage 1: Building shell enclosed.
  2. Stage 2: Clean Zone perimeter boundaries enclosed.
  3. Stage 3: Cleanroom walls, floors, and ceiling assembly completed.
  4. Stage 4: Ceiling HEPA filters installed.
  5. Stage 5: Certification tests completed.

### **1.5 DEFINITIONS**

- A. General definitions applicable to Cleanrooms shall comply with Federal Standard 209E.
- B. As-Built Facility: Cleanroom which is complete and ready for operation, with all services connected and functional, but without production equipment or personnel within the room.
- C. At-Rest Facility: Cleanroom which is complete and has production equipment installed and operating, but without personnel within the room.
- D. Certifying Agency: The Cleanroom Testing and Certification Agency responsible to verify acceptance and performance of all cleanroom systems.
- E. Classes of Cleanliness: Statistically allowable number of particles of a given size per cubic foot volume of air:
  1. Gown Room: ISO 6 (Class 1000)
  2. Cleanroom - Bays, Main Clean Aisle: ISO 6 (Class 1000)
  3. Cleanroom – Lithography Bay: ISO 5 (Class 100)
  4. For this project, the concentration and size of particles shall meet the requirements of ISO 14644, measured at 0.5 micrometers.
- F. Cleanroom: A defined clean area or room in which the concentration of airborne particles is controlled to specified limits.
  1. For this project, Cleanroom shall be the space bounded by the cleanroom structural floor slab below, the cleanroom filtered ceiling grid above, and the perimeter cleanroom walls on all sides, including all spaces, products, and utilities within.
- G. Clean Zone: A defined clean area in which the concentration of airborne particles is controlled to specified limits.

1. For this project, Clean Zone shall be the building space bounded by and inclusive of top of concrete floor slab below, bottom of structural deck construction above, and the perimeter walls on all sides, which encompass any and all cleanrooms of any cleanliness classification, as well as any remote special rooms for cleanroom support equipment, including all spaces, products, and utilities within.
- H. Clean Zone Director: The person vested with authority by the Cleanroom Contractor to supervise all construction personnel working within the Clean Zone and ensure requirements of the Contract Documents are met in completion of the Clean Zone construction, inclusive of all spaces, products, and utilities within.
- I. Clean Room Mechanical Room: A defined area housing the air handling and other support equipment for the cleanroom, and bounded by the top of the second floor structure and the bottom of the building roof membrane above, and the perimeter walls on all sides, inclusive of all spaces, products, and utilities within.
- J. Interstitial: A defined clean area bounded by the plane of the cleanroom filtered ceiling below, the bottom of the second floor Clean Room Mechanical Room above, and the perimeter walls on all sides, inclusive of all spaces, products, and utilities within.
- K. Office Clean: A standard of cleanliness expected to be maintained in finished commercial office spaces, with no visible residues of dirt, dust, oil, grease or debris on the floor, walls, or work stations, as normally achieved by cleaning, wiping, and vacuuming.
- L. Operating Facility: Cleanroom in normal operation with all services functioning and with production equipment and personnel present and performing their normal work functions within the room.
- M. Products: Materials, equipment, physical items, and packaged systems.
- N. Stage: The phase or degree of construction completion that mandates specific activities, training, security clearance, dress and work protocol, cleaning procedures, work habits and system performance, all as prescribed in Section 13 60 16. Also referred to as the Clean Zone Construction Stage.
- O. Staging area: Controlled room or defined area in the building, including enclosed access routes to the Clean Zone, where products to be installed during a workday are unpackaged, cleaned and otherwise made ready for installation that same day in the cleanroom.

## **1.6 DESIGN CRITERIA**

- A. Design criteria:
  1. International Organization for Standardization ISO 14644, International Standards for Cleanrooms and associated controlled environments:
    - a. ISO 14644-1, Part 1: Classification of air cleanliness.
    - b. ISO 14644-2, Part 2: Specifications for testing and monitoring to prove continued compliance with ISO 14644-1.
    - c. ISO 14644-4, Part 4: Design, Construction, and Start-up of Cleanroom Facilities.
  2. ASHRAE Handbook: Fundamentals.
  3. Institute of Environmental Sciences and Technology (IEST) recommended practices:
    - a. IEST-RP-CC001.3: HEPA and ULPA Filters.
    - b. IEST-RP-CC006.2: Testing Cleanrooms.
  4. NFPA 318: Standard for the Protection of Semiconductor Fabrication Facilities.

## **1.7 SUBMITTALS**

- A. Shop drawings:
  1. Complete shop drawings indicating construction limits and details of Clean Zone.
- B. Project information:
  1. Cleanroom Contractor qualifications.

2. Qualifications and references for proposed Clean Zone Director.
3. Checklists of requirements for reviewing procedures and work performed.

## **1.8 PRE-INSTALLATION MEETING**

- A. Pre-installation meeting, directed by Clean Zone Director, shall be held prior to beginning of Cleanroom installations.
- B. Meeting agenda shall include, but not be limited to:
  1. Contract Document requirements.
  2. Scheduling.
  3. Cleanroom drawings.
  4. Partition manufacturer's specifications and details.
  5. Ceiling manufacturer's specifications and details.
  6. Access floor system manufacturer's specifications and details.
  7. HVAC system manufacturer's specifications and details.
  8. Piping and plumbing requirements.
  9. Life safety requirements.
  10. Available on site storage.
  11. Protection from damage by other trades.
  12. Testing, balancing and commission protocol.
  13. Installation drawings.
  14. Manufacturer product data.
  15. Samples of proposed materials.
  16. Warranties.
  17. Project schedule.
  18. Other information deemed pertinent for sound and secure installation.
- C. Attendance is required for:
  1. BNL.
  2. Contractor's superintendent.
  3. Cleanroom Installer's Clean Zone Director.
  4. Cleanroom wall manufacturer's representative.
  5. Cleanroom wall installation supervisor.
  6. Ceiling manufacturer's representative.
  7. Ceiling installation supervisor.
  8. Access floor system manufacturer's representative.
  9. Access floor system installation supervisor.
  10. HEPA filter manufacturer.
  11. Mechanical installation supervisor.
  12. Sheet metal installation supervisor performing ductwork.
  13. Sprinkler installation supervisor.
  14. Electrical installation supervisor.
  15. Plumbing and piping installation supervisors.
  16. Other trades working within the Clean Zone or whose work may effect cleanroom construction.
- D. Include review of specifications, details, application requirements and preparatory work.

## **1.9 PRE-ENCLOSURE CONFERENCE**

- A. Prior to construction of Clean Zone areas, Clean Zone Director shall hold a meeting to coordinate and clarify all requirements for the staging area.
- B. Attendance is required for all participants of the pre-installation meeting.

## **1.10 DELIVERY, STORAGE, AND HANDLING**

- A. Clean Zone components shall be delivered with an approved protective coverings in original unopened sealed packages to prevent transit and construction dust from contaminating the surfaces.
  - 1. Return any material or equipment to the manufacturer for recleaning and repackaging where the original shipping protective wrap is torn or defective.
  - 2. Stripping of packaging shall be done inside the designated equipment staging room outside the cleanroom.
- B. Open ends of all ducts and pipes shall be sealed with moisture-proof barrier until product is being connected during installation.
- C. Products and components shall be handled and stored in such manner as to prevent damage or intrusion of foreign matter.
  - 1. Conspicuously mark "Rejected" on any materials which have been damaged, and remove them from the job site.
- D. Products shall be stored within the building in controlled space designated by the Cleanroom Contractor.
- E. Products shall not be stored in the staging area in excess of that used in one day's work.
- F. Contaminated materials shall not be stored in the staging areas or Clean Zone.

## **1.11 QUALITY ASSURANCE**

- A. Review the procedures and work performed on a continuous basis to verify compliance with requirements.
  - 1. Prepare checklists of requirements as basis for reviewing procedures and work performed.
- B. Provide training for new personnel during construction before they are allowed to work in Clean Zone.
- C. Provide weekly status reports of the following activities:
  - 1. Cleanup crew operations for the previous week.
  - 2. Clean Zone particle counts for each workday of the previous week.
  - 3. Updated list of visitors entering the Clean Zone for the previous week.
  - 4. Inventory list of tools, equipment, materials, and other items entering the Clean Zone for the previous week.
  - 5. Updated list of construction workers authorized and cleared for entry into the Clean Zone for the upcoming week.
- D. Factory test logs shall be submitted for all equipment and products used within the Clean Zone.
  - 1. Test logs shall include the name of the quality control inspector, test date, original performance and test data logs, corrective action required, and final certified performance and test data logs.
  - 2. Test data logs shall be provided with each shipment for each item included, enclosed inside waterproof clear plastic jackets suitable for placing in a standard three-ring binder.
- E. Every product shall include a permanent nameplate, decal or sticker that prominently displays the final certified performance and test data information.
- F. A qualified technical supervisor shall be furnished by each manufacturer whose Clean Zone products require field application, assembly, or installation by workers who are not direct employees of the manufacturer.
  - 1. Technical supervisor shall observe field conditions, quality of surface finishes, and other field conditions essential to acceptance and use of the finished product.
  - 2. During subsequent work activities by the installing workers, the manufacturer's technical supervisor shall provide periodic, timely inspection and counseling to ensure system complies with factory requirements.

3. Technical supervisor shall submit a written report to the Cleanroom Contractor listing tasks performed, observations, and finished results.
- G. Particle counts shall be taken within the Clean Zone on a random schedule at least once each workday.
1. Maintain particle count records and submit as part of the weekly status reports to BNL.

## **PART 2 - PRODUCTS**

### **2.1 CLEANROOM SYSTEMS**

- A. Architectural elements:
1. Cleanroom partition system (CRPS): Prefinished panels, with integral structural framing and supports, doors, windows, gaskets, sealants and accessories, as specified in Section 13 61 16.
  2. Cleanroom raised access floor (CRCS): Raised access flooring system as specified in Section 13 63 13.
  3. Cleanroom ceiling system (CRCS): Grid ceiling system, with HEPA and ULPA filter assemblies, as specified in Section 13 62 17.
  4. Equipment Support System of slotted channel framing for support of cleanroom ceiling as specified in Section 05 45 23.
  5. Equipment installed in the Clean Zone.
- B. Mechanical elements specified in Mechanical Specification Divisions:
1. HVAC systems:
    - a. Recirculating air handling system including ductwork, plenums, piping, dampers, coils, sound attenuators, mounting, connection to filters and connection to make-up air handling unit system.
    - b. Recirculating Air Handling Units.
    - c. Make-up Air Handling Units.
    - d. Grilles, registers, floor panels and HEPA filters in addition to those included in the partitions, access floor and grid ceiling system.
  2. Piping systems:
    - a. Process cooling water supply and return system.
    - b. Ultrapure water supply and return system.
    - c. Gaseous nitrogen system.
    - d. Process vacuum system.
  3. Plumbing systems:
    - a. Safety shower/eye wash station supply.
    - b. Drain system.
  4. Fire Suppression systems:
    - a. Sprinkler heads and run-out from branches.
    - b. Branches from cross mains.
- C. Electrical elements specified in Electrical Specification Divisions:
1. Lighting in addition to fixtures included in the grid ceiling system.
  2. Grounding of raised floor system.
  3. Installation of branch circuits including wiring, conduit and devices in cleanroom and chases.
  4. Panelboards in chases.

## **PART 3 - EXECUTION**

### **3.1 JOB CONDITIONS**

- A. Provide and maintain a temporary envelope around the cleanroom construction.

- B. Continuous and uninterrupted staging areas and enclosed access routes shall be provided to the Clean Zone.
- C. Temporary gowning areas shall be provided for all personnel involved in cleanroom construction.
  - 1. Gowning areas shall be upgraded for each stage of operations as construction proceeds.
- D. Separate temporary staging area shall be provided for equipment and equipment storage.
- E. Temporary cleanroom complying with ISO 14644 Class 6 standards shall be required for field fabrication, storage, cleaning, and assembly of cleanroom walls, ceilings and floors, and for storage of HEPA filters prior to installation.
  - 1. Temporary cleanroom shall be provided and maintained by Cleanroom Contractor.

### **3.2 TEMPORARY CLIMATE CONTROL**

- A. Positive pressure within Clean Zone shall be maintained at 0.012 kPa 0.25 PSF continuously until permanent makeup air system is activated and specified cleanroom conditions have been achieved.
- B. Temporary fans shall be provided with 30 percent prefilters and 99.99 percent HEPA filters operating with 100 percent outside air.
  - 1. Provide sufficient fans for minimum six air changes per hour.
  - 2. Replace prefilters and HEPA filters every 30 days minimum.
  - 3. Assure that emergency backup power is available to maintain Clean Zone climate control.
- C. Temporary flooring, partitions and doors shall be water resistant, sealed against particle gathering or release, airtight and suitable for the function intended. Wood construction is not acceptable.
  - 1. Doors shall be provided with sufficient weatherstripping to prevent passage of air outside of the Clean Zone.

**END OF SECTION**



## **SECTION 13 60 16**

### **CLEANROOM PROTOCOL**

#### **PART 1 - GENERAL**

##### **1.1 SUMMARY**

- A. This Section describes the requirements for maintaining Clean Zone conditions during construction.
  - 1. Additional Clean Zone General Requirements are specified in Section 13 60 13.
- B. Special cleanroom cleaning specified in this section shall be provided in addition to cleaning specified elsewhere.
- C. Clean all materials, systems components, and equipment for placement into cleanroom areas. Maintain clean environmental conditions during construction. All procedures shall be on-going and continuous throughout the course of the Project.
- D. Cleanroom areas are identified on the Drawings and include all environmentally controlled areas with mechanical air circulation/filter bank arrangements designed to reduce airborne particulate levels.
- E. Types of provisions include specific requirements for:
  - 1. On-going cleaning procedures.
  - 2. Precleaning of tools and equipment.
  - 3. "Dedicated" equipment handling devices and tools.
  - 4. Cutting, patching, sawing, drilling, grinding.
  - 5. Final clean-up.
- F. Cleanroom areas shall include rooms and associated spaces identified in the Schedule of Required Classifications in Section 13 60 19.

##### **1.2 RELATED WORK**

- A. Refer to other Sections for the following.
  - 1. Section 01 50 13, General Clean Zone Construction Procedures.
  - 2. Section 13 60 13, Special Clean Zone Requirements; including definitions of clean zone areas and construction stages.
- B. Requirements for fabrication and installation of cleanroom process and mechanical service, including high purity systems, are provided in Mechanical Specification Divisions.

##### **1.3 QUALITY ASSURANCE**

- A. Provide a Cleanroom Cleaning Supervisor to supervise cleaning procedures, and provide competent technicians to conduct the work.
- B. Cleanroom cleaning supervisor shall have a minimum of 3 years experience, devoted exclusively to cleaning of cleanroom facilities.
- C. Cleaning products shall be compatible with surface to be cleaned, and shall cause no damage to adjacent materials.
- D. Maintain, during the entire course of construction, an on-going and continuous housekeeping program designed to facilitate final certification of the cleanliness of the various cleanroom spaces defined by the documents.
  - 1. Actual daily procedures for continued cleaning and maintenance shall be established by Contractor.
  - 2. Procedures shall be communicated to all tradesmen involved, and noticeably posted.

3. Cleanroom cleaning supervisor shall have the responsibility of assuring that construction is free of trapped dirt and debris through regular and thorough inspection of the work.
4. Cleaning products used inside of cleanroom areas shall be only products specifically designed for use within cleanrooms, and approved for use in the Clean Zone by BNL and Architect.

#### **1.4 SUBMITTALS**

- A. Project information:
  1. Cleanroom Contractor's detailed construction protocol program, including clean-build requirements for each stage and each discipline, and control and enforcement measures.
  2. Qualifications and references for proposed Cleanroom Cleaning Supervisor.
  3. Product data for cleaning materials and program of cleaning procedures.

### **PART 2 - PRODUCTS**

#### **2.1 CLEANING MATERIALS**

- A. Wipe-down fabric:
  1. Lint-free "Anticon 100" or "Texwipe Alphawipe" woven cleanroom wipers.
- B. Wipe-down liquid:
  1. EKC "Lab Clean".
  2. "Floor Clean".
  3. "Glass Clean".
  4. Allied Chemical "WRS-200".
  5. "Texclean 100".
  6. "TechniPure".

### **PART 3 - EXECUTION**

#### **3.1 INITIAL CLEANROOM AREA PREPARATION**

- A. At the first available time following completion of interior cleanroom enclosure, entire area shall be cleaned as follows:
  1. All dirt and debris, etc. shall be removed from the cleanroom areas.
  2. The entire interior of the work area, including structural steel, ductwork, piping, return air chase area, walls and floor areas, shall be cleaned to remove all dust and particulate matter likely to cause contamination of the cleanroom.
  3. All areas shall be prepainted, including structural steel, ductwork, piping, return air chase area, walls and floor, after thorough cleaning and before installation of any cleanroom material or equipment.

#### **3.2 GENERAL CLEANROOM CLEANING**

- A. Vacuum spaces which will be concealed by subsequent construction as the work progresses.
- B. Clean dirt and dust from structural members, decking and components before proceeding with other construction.
- C. Operate recirculating fan units, without HEPA filters installed, for at least 24 hours continuously before final cleaning.
- D. Remove construction debris promptly.
- E. Shovels, brooms, dustpans, mops and buckets may be used during Stage 1 cleaning.
  1. Minimize need for brooms and sweeping tools during Stage 2 cleaning, and primarily use wet mopping and vacuum cleaning for floor cleaning.

2. Where surfactants are needed, use only non-ionic type.
- F. Beginning during Stage 2 cleaning, provide positive pressurization to prevent infiltration of contamination from surrounding areas.
  1. During welding, grinding and other construction operations requiring additional measures to remove contaminants, provide negative pressure ducted smoke removal fans.
- G. Use 99.99 percent HEPA filtered vacuum cleaner during Stage 3 and later cleaning.
  1. Output filter shall be tested at least weekly with a particle counter to assure minimum ISO 14644 Class 5 performance.
- H. The following materials shall not be used in cleanroom construction:
  1. Masking tape.
  2. Duct tape.
  3. Lubricants, pastes and fluxes containing ionic contaminants.
  4. Freons, aerosols and spray products.
  5. Salt, soap and other materials containing sodium, potassium or other heavy metals.
  6. Any kind of wood.
  7. Silicone based sealants, except those approved for the Project.
- I. Cleanroom Contractor and each subcontractor performing work shall be responsible for cleaning their own tools, cleaning their construction materials, and removing their construction debris.
  1. Contractor and each subcontractor provide at least one cleaning person for every ten or less of their workers on the job.

### **3.3 BASIC CLEANROOM PROTOCOL**

- A. On-going installation and cleaning procedures: Institute procedures for the fabrication and placement of specified materials which will preclude the entrapment of construction soils, refuse, dust and other debris in the finished work.
  1. Ensure that each installer shall carefully inspect the substrate over which succeeding work is to be installed and shall perform such cleaning activities as required to maintain "clean conditions".
  2. Cleaning activities shall include daily broom cleaning of exposed floor surfaces and wipe down or vacuuming, as appropriate, of other substrates.
  3. Additionally, the following procedures shall be followed, beginning with the first installation of filter modules:
    - a. Work operations scheduled within the cleanroom involving processes likely to create dusting shall be carried out within a remote fabrication area.
      - 1) Demountable wall panels, ceiling materials, and like constructions shall be removed to this dedicated area for cutting, drilling, sanding, grinding and similar operations.
    - b. Operations of similar nature, where removal to remote fabrication area is not possible shall be carried out under the following guidelines:
      - 1) Only those tools, fixtures, test equipment required for current workloads will be kept in the cleanroom area.
      - 2) Work shall be sheltered from other areas of the cleanroom by the erection of polyethylene vapor barriers surrounding immediate work area.
      - 3) Air circulating systems shall be "shut-down".
      - 4) Any and all ceiling gel to be protected from any contamination.
      - 5) Filter banks at ceiling shall be covered with polyethylene.
      - 6) Tools shall be equipped with auxiliary HEPA vacuum for continual removal of dust before release to the air.
      - 7) Wiping and general vacuum procedures shall be employed to insure final construction will be free of trapped debris and particulate contaminants.
  4. Maintain a complete set of tools, ladders and material handling devices for use only within the confines of cleanroom areas.

- a. Equipment shall remain in the cleanroom during construction to avoid unnecessary transfer of contamination.
  5. No smoking or chewing of any tobacco products, or eating shall take place within cleanroom areas at any time.
  6. Materials and equipment entering cleanroom area shall be solvent wiped and HEPA vacuumed to remove loose particles.
  7. Visitors: Permission for visitors to enter cleanroom areas will be strongly discouraged and held to an absolute minimum.
    - a. No one will be permitted to enter the cleanroom areas without first receiving training on cleanroom protocol.
    - b. Training shall be conducted by the Cleanroom Contractor, with visitors undergoing the entire cleanup process and donning a full set of dust-preventive clothing furnished by the Cleanroom Contractor.
    - c. Access to and from the cleanroom areas shall be only through one designated door that serves as both entrance and exit.
    - d. "Sign In" and "Sign Out" log shall be maintained at the single point of access.
    - e. Log shall register visitor's name, company represented, time "In", time "Out" and purpose of entry, i.e. work, construction observation, visitor, etc.
  8. Beginning with first continuous operation of air filtration system and initial stages of process piping fit-up and process equipment installation, the following procedures shall be implemented in addition to general installation procedures with cleanrooms:
    - a. Precleaning of tools and equipment.
    - b. Dedicated tools.
    - c. Gowning.
  9. Procedures shall be approved by the Cleanroom Director.
- B. Precleaning procedures: All items shall be unwrapped, unboxed or uncrated before moving to preparation area.
1. All exposed surfaces shall be thoroughly cleaned of all dirt, grease, oil lint and other contaminants by wiping with sterile, nonshedding, lint-free cloths, then HEPA vacuumed prior to transfer onto dedicated material handling devices for carrying into cleanroom.
  2. No raw material to be installed or brought into cleanroom area.
  3. Portable test equipment, jigs, fixtures, parts and subassemblies that cannot be normally cleaned due to size, material composition, or critical finishes shall be thoroughly HEPA vacuumed.
    - a. All wheels and other tire surfaces on portable equipment shall be covered with cleanroom tape.
      - 1) Duct tape is not an approved tape material.
    - b. Entry of these materials into a cleanroom area shall be accomplished through an equipment airlock.
  4. All assembly tools used in the cleanroom shall be cleaned daily.
    - a. Tool cleaning shall be accomplished at the beginning of the work shift.
    - b. Each cleanroom worker shall clean tools and bench area to insure cleanliness.
    - c. Workers shall continually inspect and clean their work-in-progress in accordance with the technical instructions for that item.
  5. Workers, inspectors and visitors shall remove lint, dust and loose dirt from clothing and shoes, prior to initiating gowning procedure and entry into cleanroom as follows:
    - a. Topcoats, raincoats, overshoes, umbrellas, lunches, street shoes, and other such personal articles will be removed and covered with plastic film or other lint-free, nondust generating materials, and placed in an outer cloak room.
    - b. Personnel working in cleanroom areas will use liquid soap and lukewarm water to wash hands thoroughly to remove dust, cigarette ashes, loose skin flakes, loose hair, skin oils and cosmetics.
      - 1) After washing, dry surfaces with a hot air blower or lint-free cloth.
      - 2) Cosmetics will not be worn or carried into a cleanroom at any time.

- c. Special contamination preventive clothing furnished by Contractor shall be worn by all personnel.
  - 6. Procedures shall be approved by the Cleanroom Director.
- C. Contaminants: No smoking materials, hygiene sprays, cosmetics, paints, lubricants, exhaust-producing equipment or similar contaminants shall be allowed to enter either the preparation area or any cleanroom area.
  - 1. Personnel leaving the cleanroom for any reason will remove smocks and all other dust preventive clothing and leave these garments in the clean personnel change room.
  - 2. Upon re-entry into the change room, the entire clean-up procedure will be carefully and completely repeated.
  - 3. Snacking and eating is absolutely forbidden in cleanrooms and in areas provided for clean-up of personnel or material preparatory to entering the cleanroom.
  - 4. No edibles, including candy, chewing gum, or soft drinks, and no personal articles shall be taken into the cleanroom except as otherwise indicated.
  - 5. If considered necessary, personnel may be permitted to keep billfolds, valuables such as keys, coins, knives and watches, and personal articles such as handkerchiefs, tissues and combs on their person, but these items shall be kept in pockets under dust preventive clothing and shall not be removed in the cleanroom.
  - 6. Jewelry, such as necklaces, locketts, earrings, bracelets, and large rings shall not be worn in the cleanroom.
    - a. Small rings, such as wedding bands, may be permitted if they present no work hazard.
    - b. Pins and brooches may be permitted provided they are covered and remain covered by dust preventive clothing.
  - 7. Personal clothing that tend to produce lint, such as angora sweaters or linty stockings, shall not be worn in the cleanroom areas.
  - 8. Abrasives such as steel wool, emery cloth and sandpaper shall not be permitted in the cleanroom areas.
    - a. Corrosive materials and cleaning solvents are prohibited except those specifically authorized for use in the cleanroom area.
  - 9. Ordinary paper pads, notebooks, manuals and writing paper of any description shall not be permitted.
    - a. Ordinary writing pencils, pens, erasers, crayons and chalk shall not be permitted.
    - b. Notes and records shall be kept on lint-free paper or plastic sheet, using ball point pens or other suitable nondust generating materials.
    - c. Drawings, specifications and other instructions shall be covered with plastic film or other lint-free, nondust generating material.
  - 10. Dedicated Items: Maintain a complete set of tools, ladders, and material handling devices for use only within the confines of cleanroom areas.
    - a. Equipment shall remain in the cleanroom to avoid transfer of contamination.
    - b. Material Handling Devices: Provide hand trucks, dollies and other rolling devices that are equipped with non-lubricated bearings for use within the cleanroom.
      - 1) Wheels and tire surfaces shall be covered with cleanroom tape.
  - 11. Gowning: All personnel shall wear cleanroom gowns while within the confines of the cleanroom.
    - a. Gowns and gowning procedures shall be approved by the Clean Zone Director, BNL and Architect.
- D. Function of the building shall be considered during entire course of construction, with particular regard to on-going cleaning procedures to be employed.
  - 1. Walls, floors, ceilings, and air handling equipment shall be cleaned prior to conducting tests.
  - 2. Sheet vinyl floors in cleanroom areas shall be cleaned as specified by the manufacturer but shall not be waxed.
  - 3. Cleaning shall be performed by HEPA vacuuming, and wiping with knitted cleanroom wiper or cleanroom sponge with deionized wiper and approved cleanroom cleaner.
  - 4. Exercise due care and consideration for cleanliness of entire facility.

5. Specific cleaning procedures shall be carried out as directed by the Cleanroom Cleaning Supervisor, and as approved by the Clean Zone Director.

### **3.4 FINAL CLEANROOM CLEANING**

- A. Prior to certification, perform following final cleaning:
  1. Clean cleanroom areas as follows, with the vacuuming and wiping down of ceiling surfaces first, walls second, and floors last.
  2. Vacuum light fixtures inside and out, HEPA filter protective grids, ceiling channels and angles, automatic fire sprinklers, trim and escutcheons, and ceiling tiles and panels, using a portable or central vacuum system with discharge to the building exterior.
  3. Vacuum wall surfaces, including furnishings, doors, hardware, and other wall attachments and accessories.
  4. Vacuum exposed surfaces of process piping, drain lines, interior and exterior of ductwork, electrical raceways, including interior, utility rack framing, and all connections to process equipment.
  5. Vacuum floors, including integral coved base and reducer strips, floor penetration coverings, and other floor attachments and accessories.
  6. Final wipe-down: After vacuuming of cleanroom areas has been completed, wipe down hard surfaces, including glazing, using wipe-down fabric soaked in wipe-down liquid.
  7. Complete cleaning by repeating steps 3, 4 and 5.
- B. Completed work areas shall be subjected to certification testing to confirm conformance to specified cleanliness standards.
  1. Reclean areas not conforming to the extent necessary for certification.

### **3.5 CLEANROOM PROTOCOL SUMMARY**

- A. Stage 1:
  1. Step 1-A for Cleanroom, Cleanroom Mechanical Room, and Interstitial:
    - a. Work: Dirty; concrete, structural steel, grinding, welding, gas torch cutting, heavy piping, insulation piping and ductwork, interstitial sprinkler piping, ductwork, plumbing and air handlers.
    - b. Garments: No special requirements.
    - c. Cleaning: Remove trash daily and sweep floors daily.
    - d. Maintain an "office-clean" environment.
  2. Step 1-B for Cleanroom, Cleanroom Mechanical Room, and Interstitial:
    - a. Work: After completion of Step 1-A, provide initial wipe down and vacuum from top structure down.
    - b. Remove trash daily and vacuum floors daily.
    - c. Smoking, spitting, eating, or drinking shall not be allowed.
    - d. Gas powered or fume and particulate-emitting equipment shall not be allowed.
    - e. Maintain an "office-clean" environment.
- B. Stage 2:
  1. Step 2-A for Cleanroom, Cleanroom Mechanical Room, and Interstitial:
    - a. Work: Semi-clean; cleanroom perimeter established, firewalls constructed, controlled staging area and entry area erected, and rough-in of clean supply and return ductwork, electrical, ceiling support steel, utility racks, and sprinkler pipe.
    - b. Garments: Clean construction boots.
    - c. Cleaning: Continuously remove trash and continuously remove floor debris.
    - d. Maintain an "Office Clean" environment.
  2. Step 2-B for Cleanroom, Cleanroom Mechanical Room, and Interstitial:
    - a. Work: After completion of Step 2-A, vacuum and "coarse clean" all building elements from structure down.
    - b. Garments: Clean booties.
  3. Step 2-C for Cleanroom, Cleanroom Mechanical Room, and Interstitial:

- a. Work: After completion of Step 2-B, begin 24 hour per day pressurization with makeup air handler, and recirculation air handler blowdown.
  - 4. Step 2-D for Cleanroom and Cleanroom Mechanical Room:
    - a. Work: After initiating pressurization and blowdown, provide a "final" coarse cleaning from structure down for those areas not complying with "office clean" environment.
    - b. Garments: Clean booties.
    - c. Cleaning: Damp mopping daily.
- C. Stage 3:
  - 1. Step 3-A for Cleanroom, Cleanroom Mechanical Room, and Interstitial:
    - a. Work: Clean; complete controlled gowning area, access flooring, ceiling grid, cleanroom wall partitions, and utility and service connections.
    - b. Garments: Clean smock jacket, clean booties, gloves, hair covers, facial hair covers, and safety glasses.
    - c. Cleaning: Continuously remove trash and debris, and vacuum and wipe down of all surfaces.
  - 2. Step 3-B for Cleanroom:
    - a. Work: After completion of Step 3-A, provide clean zone initial washdown from interstitial elevation down.
    - b. Garments: Full-length suit, clean booties, gloves, hair covers, facial hair covers, and safety glasses.
- D. Stage 4:
  - 1. Step 4-A for Cleanroom:
    - a. Work: Clean; Clean HEPA filter materials and provide continuous cleaning, including wipedown, vacuuming and trash removal.
    - b. Garments: Clean smock jackets, clean booties, gloves, hair covers, full-face hood headgear, and safety glasses.
    - c. Clean equipment, tools and delivered materials before entering.
  - 2. Step 4-B for Cleanroom:
    - a. Work: After Step 4-A, provide a final washdown of all surfaces within cleanroom, followed by a successful black and white felt rubdown test when complete.
    - b. Garments: Full-length suit, knee-high boots, gloves, hair covers, full-face hood headgear, and safety glasses.
- E. Stage 5:
  - 1. Cleanroom:
    - a. Work: Test and certification.
    - b. Garments: Full-length suit, knee-high boots, gloves, hair covers, full-face hood headgear, and safety glasses.
    - c. Clean equipment, tools, and delivered materials before entering.

**END OF SECTION**



**SECTION 13 60 19**  
**CLEANROOM CERTIFICATION**

**PART 1 - GENERAL**

**1.1 CONDITIONS AND REQUIREMENTS**

- A. Clean Zone construction requirements are specified in Sections 01 50 13 and 13 60 13.
- B. Cleanroom cleaning procedures are specified in Section 13 60 16.
- C. Testing and balancing of mechanical systems are specified in Mechanical Specification Sections.

**1.2 DESCRIPTION**

- A. Employ and pay for the services of a qualified Cleanroom Testing and Certification Agency, as a subcontractor to perform specified services:
  - 1. The Cleanroom Testing and Certification Agency shall be independent from the Cleanroom Contractor, system manufacturers and installers.
  - 2. Cleanroom testing and certification shall be a separate activity from other services which may be offered by the Cleanroom Testing and Certification Agency.
  - 3. The Cleanroom Testing and Certification Agency and the Cleanroom Air Systems Testing and Balancing Agency shall be different companies.
  - 4. Employment of the independent subcontractor shall in no way relieve the Contractor's obligation to perform the Contract work.
- B. Certification shall certify that the completed construction of the scheduled cleanroom areas complies with the air cleanliness classification required in accordance with International Organization for Standardization (ISO) 14644.
- C. Test methods used for characterizing the performance of cleanrooms shall be in accordance with ISO 14644:
  - 1. Specific tests and the acceptance criteria shall comply as specified.
  - 2. Institute of Environmental Sciences and Technology IEST-RP-CC006.3, "Testing Cleanrooms", is also an acceptable standard if the Certification Agency requests in writing to BNL. Request shall include the following minimum information:
    - a. Desired test(s) substitution(s).
    - b. Reasons for the substitutions.
    - c. Verification that test substitutions are equal to or more stringent than' the specified ISO Test.

**1.3 REFERENCES**

- A. ISO 1644-4 Cleanrooms and Associated Controlled Environments and ISO 14644, Cleanrooms and Associated Controlled Environments Parts 1 through 4.  
  
International Organization for Standardization  
Geneva, Switzerland  
[www.iso.org](http://www.iso.org)
- B. IES-RP-CC-006, Testing Cleanrooms and IES-RP-CC-001, HEPA and ULPA Filters.  
  
Institute of Environmental Sciences  
940 East Northwest Highway  
Mount Prospect, IL 60056
- C. NEBB Procedural Standards for Certified Testing of Cleanrooms.  
  
National Environmental Balancing Bureau (NEBB)

8575 Grovemont Circle  
Gaithersburg, MD 20877

D. Federal Standard 209E, Airborne Particulate Cleanliness Class for Cleanrooms and Clean Zones:

General Services Administration  
Specifications Activity  
Printed Materials Supply  
Bldg. 197, Naval Weapons Plant  
Washington, DC 20407

E. ESD Association Standards.

Electrostatic Discharge Association  
200 Liberty Plaza  
Rome, NY 13440

F. NEBB, Procedural Standards for Measuring Sound and Vibration.

National Environmental Balancing Bureau (NEBB)  
8575 Grovemont Circle  
Gaithersburg, MD 20877

#### 1.4 QUALITY ASSURANCE

A. Certification Agency shall be N.E.B.B. (National Environmental Balancing Bureau) Certified.

B. The Certification Agency shall have been in business a minimum of 15 years specializing in cleanroom testing and certifying work.

C. Cleanroom Testing and Certification Agency shall supervise all tests and shall provide competent test technicians to conduct all tests in the presence of BNL's authorized representative:

1. Test technicians shall have a minimum of four years uninterrupted service, devoted exclusively to the Testing and Certification of Cleanroom Facilities, or shall be directly supervised by a test technician with these qualifications.

D. Tests shall be performed after initial operating and balancing adjustments have been satisfactorily completed:

1. A copy of the Air Balancing Report shall be provided by the Contractor to the Testing and Certification Agency, and this report shall satisfy requirements that the facility is ready for "Cleanroom Certification" testing.

E. Instrumentation to be used shall be in accordance with the descriptions given in each test procedure, and shall have a demonstrated accuracy and sensitivity suitable for the test procedure:

1. Instruments shall be properly calibrated according to the manufacturer's recommendations, and shall be so certified by Cleanroom Testing and Certification Agency at the time of the test.

F. No certification testing shall be initiated or conducted without notifying BNL's authorized representative.

#### 1.5 SUBMITTALS

A. Information to be submitted with Bid or Work Proposals:

1. Submit qualifications and references of the proposed Testing and Certification Agency, supervisor, and personnel.
2. Submit a list of cleanroom projects similar in size, general scope, and cleanliness classes to this Project.
3. Submit program of test procedures and specimen copy of each of the typical report forms and charts proposed for use for the Project.

4. Submit complete list of instruments proposed to be used, organized in appropriate categories, with data sheets for each indicating:
    - a. Manufacturer and model number.
    - b. Size, capacity, and sensitivity range.
    - c. Serial number.
    - d. Latest calibration date and method of calibration employed.
- B. Certification Testing Submittals:
1. Submit a schedule for performing all tests specified, indicating the duration of the testing period for each room identified in the Schedule of Required Classifications.
  2. After completion and acceptance of all required tests, the Cleanroom Testing and Certification Agency shall compile all of the test and certification data and shall submit three copies of the completed report to BNL and Architect for approval:
    - a. The report shall include a signed and dated certificate, stating compliance with the specified performance criteria.
    - b. The report submitted shall include signatures and seal of the Supervisor.
    - c. Contents of completed report shall be in accordance with the NEBB *Procedural Standards for Certified Testing of Cleanrooms*. The Cleanroom Certification report shall include, but is not limited to the following items:
      - 1) Tabulate all test data on 8-1/2 inch by 11 inch sheets bound in a report. Identify all test data by grid location. Grids shall be reviewed with BNL and Architect prior to award of Contract.
      - 2) Drawings: Include prints of the Cleanroom Floor Plans and Reflected Ceiling Plans made from the contract drawings with testing and certification locations shown on the drawings. (Sample Test Report Forms may be found in Chapter 13--*Sample Test Report Forms* in the NEBB *Procedural Standards for Certified Testing of Cleanrooms*).
      - 3) Test Equipment: Furnish a complete list of all test equipment used in performing the work with serial numbers and verification of the latest calibration dates. All equipment will be reviewed with BNL and Architect prior to commencement of certification test work.
      - 4) Furnish in the report, a written statement, signed by the Supervisor, stating that all work has been performed in accordance with the requirements of this section unless specifically noted otherwise in the report.
      - 5) Include a description of all tests performed, including the purpose, instrumentation, procedures, results, and analysis of the data. Data shall be presented and graphically displayed on NEBB forms to permit full understanding of all tests by BNL and Architect.
  3. Submit reports of all initial tests and retesting required after corrective measures have been taken.

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS**

- A. The certification Agency shall provide all materials and testing equipment and instruments to perform the certification work and required submittals.
- B. Refer to Sections 13 60 13 and 13 60 16 for Clean Zone and Protocol requirements for working in the clean zones.
- C. The Contractor shall supply the Certification Agency with any required protocol requirements such as apparel and cleaning materials.

## **PART 3 - EXECUTION**

### **3.1 INSPECTION AND PREPARATION**

- A. Prior to the start of Cleanroom Certification Testing, the Testing and Certification Agency shall verify that the work of the Air and Water Balancing Subcontractor has been completed:
  - 1. In addition, the Testing and Certification Agency shall verify that all construction Contract work has been completed within the clean space.
  - 2. Prior to the start of Airborne Particle Monitoring, the Cleanroom shall be cleaned to the satisfaction of the Testing and Certification Agency:
    - a. All Pre-Certification requirements and procedures have been completed and the Certification Agency has provided BNL and the Architect written notification that pre-testing procedures have been completed and the testing schedule is ready to be initiated.
    - b. Final Cleanroom Cleaning and Project Commissioning shall be completed prior to start of Certification Activities.

### **3.2 TEST PROCEDURES - GENERAL**

- A. The Testing and Certification Agency shall report the location of all sample points on an accurate grid diagram which represents the actual ceiling layout.
- B. Discrepancies with acceptance criteria shall be promptly reported to BNL's authorized representative, who shall approve the Cleanroom Contractor's defect resolution strategy.
- C. The Testing and Certification Agency shall observe all temperature and humidity sequencing testing by the Air Balancing Subcontractor.
- D. All work shall be scheduled and coordinated to accommodate phased completion.

### **3.3 ON-SITE PRE-INSTALLATION TESTING OF HEPA FILTERS**

- A. This Testing Requirement is based on IEST Recommended Practices.
- B. A random selection of 1 out of 10 HEPA filters shall be tested individually for leaks by full Polystyrene Latex Spheres ( PSL ) challenge and scan with an aerosol photometer of either linear or logarithmic readout type.
  - 1. Testing shall be performed in a suitably isolated and clean area.
- C. Each filter to be tested shall be clamped into a holding fixture which provides complete access to the downstream face of the filters and upstream plenum for supplying the air and test smoke mixture to the filter.
  - 1. The upstream plenum shall have two sample ports, one on each side and the 100 percent reading shall be taken at the lower of the two to assure sufficient concentration.
- D. Filter shall be tested at an average flow rate equal to operating design flow rate within +20 percent.
  - 1. A shielded hot-wire anemometer ( 0.43 fps-4.9 fps) face velocity profile, 12 IN downstream of filter face shall establish the average velocity across the face of the filter pack.
  - 2. Velocity shall be uniform within these limits without evidence of "dead spots".
- E. Aerosol Test challenge shall be PSL 'smoke' generated by an aerosol generator.
  - 1. The aerosol light scattering droplet size distribution shall be listed in IES-RP-CC006.3.
  - 2. Aerosol Generator Criteria:
    - a. PSL size range 0.1 to 0.5  $\mu$ m
    - b. PSL output 7.2x10<sup>10</sup> per minute
    - c. Output flow rate 8.0 cfm
    - d. Dry compressed air or N<sub>2</sub> 8 cfm@ 80 - 100 psig
    - e. Remote control option 115 VAC, 2A

- F. Upstream concentration to the test filter shall be 0.0001 above the minimum sensitivity of the logarithmic readout photometer, or shall produce 100 percent reading which will allow the linear readout photometer to be stray-light adjusted to zero on the lowest scale.
  - 1. Measurement shall be taken in the plenum immediately ahead of the test filter.
  - 2. Prolonged exposure of filter to DOP shall be avoided.
  - 3. The least amount of DOP necessary to perform testing shall be introduced.
- G. The test instrument shall be an aerosol photometer of sufficient sensitivity to indicate a test smoke concentration of not less than 3.53 micrograms/ft<sup>3</sup> and a threshold sensitivity of not less than 0.000035 micrograms/ft<sup>3</sup>.
  - 1. Minimum sample flow rate shall be 0.0177 ft<sup>3</sup>/s.
  - 2. Probe size shall be dependent upon the actual filter velocity and shall be such that the air flow velocity through the probe is 1.48 fps +20 percent ( 0.945 IN diameter for 0.0085 ft<sup>3</sup>/s sample flow rate and 1-1/2 IN diameter for 0.0212 ft<sup>3</sup>/s sample flow rate).
- H. Scanning shall be accomplished by passing the probe over the filter in slightly overlapping strokes so that the entire area of the filter is scanned.
  - 1. A separate pass shall be made around the periphery of the filter and the adhesive bond between the filter pack and the rigid frame.
  - 2. Factory repair patches shall be double checked.
  - 3. Probe shall be a maximum of 1 IN from the filter face.
  - 4. Scanning method shall conform to IEST-RP-CC006.
- I. A leak indicated by a repeatable steady photometer (linear readout type) reading greater than 0.01 percent of the upstream concentration is defined as a significant leak.
  - 1. For a logarithmic readout photometer, a reading of 0.01 percent of upstream on the instrument logarithmic calibration chart is defined as a significant leak.
- J. Filters that are found to have leaks after floor testing shall be repaired providing:
  - 1. The size of the repair(s) is less than 5 percent of the filter face area.
  - 2. One dimension of any repair is limited to 1-1/2 IN maximum.
- K. The Testing and Certification Agency shall keep a daily record of the defective filters found during on-site testing.
  - 1. Defective filters shall be re-boxed immediately, before being repaired, until such time that the problem is identified.
  - 2. The integrity of the filters is the responsibility of the Contractor.

### **3.4 CLEANROOM PERFORMANCE TESTING**

- A. The following tests in Section 3.5 shall be required for rooms listed in the Schedule of Classifications Section 3.6.
- B. Certified Tester may use ISO or IEST Testing Criteria, using the stringent testing procedure providing acceptability of the requirements.
- C. All Testing shall be applicable to 'As-Built' 'At-Rest' or 'Operational' Operational State; and 'Non-unidirectional' or 'Unidirectional' Airflow. Refer to Section 3.6 for required criteria.

### **3.5 SCHEDULE OF ACCEPTANCE CRITERIA**

- A. In addition to the general basic cleanliness requirements in ISO 14644, comply with the following criteria:

| ISO TEST NO. | CERTIFICATION TEST                              | <u>Main Clean Aisle, Clean Bays 1, 2 Room No's 141, 145, 147</u><br>Ref. Section 3.6 | <u>Gownroom Room No. 139.</u><br>Ref. Section 3.6 | <u>Litho Bay Room No. 143.</u><br>Ref. Section 3.6 |
|--------------|---|--|---|--|
|              | <b>CLASS</b>                                    | ISO-6<br>(CL1000<br>Fed. 209)  | ISO-6<br>(CL1000<br>Fed. 209)                     | ISO-5<br>(CL100<br>Fed. 209)                       |
| <b>B.1</b>   | <b>Airborne Particle Count Test</b>             | ISO-Class 6  | ISO-Class 6                                       | ISO-Class 5  |
|              |   | ISO 14644-1  | ISO 14644-1                                       | ISO 14644-1  |
| <b>B.4</b>   | <b>Airflow Test</b>                             | 210 Air Changes / Hr.  | 210 Air Changes / Hr.                             | 420 Air Changes / Hr.                              |
|              |   | ISO 14644-1, -2  | ISO 14644-1, -2                                   | ISO 14644-1, -2                                    |
| <b>B.5</b>   | <b>Air Pressure Difference Test</b>             | Refer Mechanical Drawings – Airflow Diagrams   | Refer Mechanical Drawings – Airflow Diagrams      | Refer Mechanical Drawings – Airflow Diagrams       |
|              |   | ISO 14644-1, -2  | ISO 14644-1, -2                                   | ISO 14644-1, -2                                    |
| <b>B.6</b>   | <b>Installed Filter System Leakage Test</b>     | B.6.1.3  | B.6.1.3   | B.6.1.3  |
| <b>B.7</b>   | <b>Airflow Direction Test and Visualization</b> | Unidirectional   | Non-unidirectional                                | Unidirectional                                     |
|              |   | ISO 14644-2  | ISO 14644-2                                       | ISO 14644-2  |
| <b>B.8</b>   | <b>Temperature Test</b>                         | Refer Mechanical Drawings – Airflow Diagrams   | Refer Mechanical Drawings – Airflow Diagrams      | Refer Mechanical Drawings – Airflow Diagrams       |
|              |   | 68° ± 1° F   | 68° ± 1° F  | 68° ± 1° F   |
|              |   | ISO 7726   | ISO 7726  | ISO 7726   |
| <b>B.9</b>   | <b>Humidity Test</b>                            | Refer to Mechanical Drawings – Airflow Diagrams                                      | Refer to Mechanical Drawings – Airflow Diagrams   | Refer to Mechanical Drawings – Airflow Diagrams    |
|              |   | 40% ± 5%   | 40% ± 5%  | 40% ± 2%   |
|              |   | ISO 7726   | ISO 7726  | ISO 7726   |
| <b>B.10</b>  | <b>Electrostatic Test</b>                       | Wall System<br>Floor System  | Wall System<br>Floor System                       | Wall System<br>Floor System                        |
|              |   | B.10.2.1.1<br>B.10.2.1.2   | B.10.2.1.1<br>B.10.2.1.2                          | B.10.2.1.1<br>B.10.2.1.2                           |
| <b>B.11</b>  | <b>Particle Deposition Test</b>                 | NR   | NR  | NR   |

| ISO TEST NO. | CERTIFICATION TEST    | Main Clean Aisle, Clean Bays 1, 2 Room No's 141, 145, 147<br>Ref. Section 3.6 | Gownroom Room No. 139.<br>Ref. Section 3.6 | Litho Bay Room No. 143.<br>Ref. Section 3.6 |
|--------------|-----------------------|---|--|---|
|              | CLASS                 | ISO-6 (CL1000 Fed. 209)   | ISO-6 (CL1000 Fed. 209)                    | ISO-5 (CL100 Fed. 209)                      |
| B.12         | Recovery Test         | NR  | NR   | NR  |
|              |                       | ISO 14644-2   | ISO 14644-2                                | ISO 14644-2                                 |
| B.13         | Containment Leak Test | NR  | NR   | NR  |
|              |                       | ISO 14644-1, -2   | ISO 14644-1, -2                            | ISO 14644-1, -2                             |
| --           | Vibration             | VC-E  | VC-NR                                      | VC-E  |
|              |                       | IEST 6.11   | IEST 6.11                                  | IEST 6.11                                   |
| --           | Noise Level Test      | NC-50-60  | NC-50-60                                   | NC-50-60                                    |
|              |                       | IEST 6.7.2.c.   | IEST 6.7.2.c.                              | IEST 6.7.2.c.                               |
|              |                       | IEST 6.7.3.a.   | IEST 6.7.3.a.                              | IEST 6.7.3.a.                               |

### 3.6 SCHEDULE OF REQUIRED CLASSIFICATIONS

| ISO CLASS ISO CLASSIFICATIONS IIFICATIONS |                  |            |                 |                 |
|---|------------------|------------|-----------------|-----------------|
| ROOM NUMBER                               | ROOM NAME        | CLASS      | OCCUPANCY STATE | UNI-DIRECTIONAL |
| 147                                       | Bay 1            | ISO-6/1000 | As-Built        | Yes             |
| 145                                       | Bay 2            | ISO-6/1000 | As-Built        | Yes             |
| 143                                       | Litho Bay        | ISO-5/100  | As-Built        | Yes             |
| 141                                       | Main Clean Aisle | ISO-6/1000 | As-Built        | No              |
| 139                                       | Gownroom         | ISO-6/1000 | As-Built        | No              |

### 3.7 FINAL GASKETING LEAKAGE TEST

- A. While performing Final HEPA Filter Installation Leak Test, scan ceiling grids for leakage at gasketing, perimeter ceiling angle condition, and at any fixture mounted through the HEPA filters, with particle counter using the same procedures as in the Final HEPA Filter Installation Leak Test.
1. Notify BNL and Architect in advance of this Work and allow BNL's authorized representative to witness test.
  2. Report all locations of ceiling grid leakage to Clean Zone Director for immediate defect resolution.
- B. Retest all locations of leaks after defects have been corrected.

**END OF SECTION**



**SECTION 13 61 16**  
**CLEANROOM PARTITION SYSTEMS (CRPS)**

**PART 1 - GENERAL**

**1.1 QUALITY ASSURANCE**

- A. International Standard ISO 146644D, "Cleanrooms and Associated Controlled Environments", parts 1 through 4.
  - 1. Classifications are scheduled in Section 13 60 19.
- B. Manufacturer's qualifications: Fabricator of cleanroom wall systems for minimum five years.
  - 1. Provide proof of at least five similar installations of equal or greater size.
  - 2. Install under supervision of representative certified by manufacturer.
- C. AWS-D1.2, "Code for Welding Aluminum".
- D. Structural requirements for partition system:
  - 1. Lateral stability: System shall support lateral seismic force equal to minimum 11.25 percent of weight of wall.
  - 2. Seismic Design Criteria: 'B'; I-1.0.
  - 3. Vertical Loading: dead load = component weight plus 15 plf.
  - 4. Bending Design Pressure: 1 psf for bending stress.
  - 5. Stiffness: L/120 at 5 psf, L/600 at 1 psf.
- E. Coordinate with related or potentially conflicting work of other sections to result in certified cleanroom assemblies.

**1.2 TOLERANCES**

- A. Dimensional tolerance:
  - 1. Aluminum wall panel width shall not vary more than 0.06 IN.
  - 2. Wall panel height:  $\pm 0.06$
  - 3. Panel squareness: Within 0.063 IN when measured diagonally from corner to corner.
  - 4. Panel thickness:  $\pm 0.012$  IN
- B. Flatness:
  - 1. In installed conditions, aluminum wall panel surface shall not vary more than  $\pm 0.004$  IN.

**1.3 SUBMITTALS**

- A. Submit the following in addition to the standard requirements with the bid:
  - 1. Manufacturer's literature, specifications, and installation instructions for each cleanroom partition component proposed for use, including certification and other data as may be required to show compliance with the specifications.
  - 2. Three samples of partition system components with specified finish, gasketing, and connectors, Also any other component as necessary to illustrate a completed wall assembly.
  - 3. Three sets of samples for each finish and color required. Submit sample finishes on aluminum having the specified alloy, temper, finish coating treatment, and thickness of metal required for the work. Provide 12 IN square samples. Samples will be reviewed for color and finish only.
  - 4. Installer's License Certificate: Copy of "Certificate of License" issued to system installer by manufacturer.
- B. Submit the following within 4 weeks of Subcontract award:
  - 1. Design Calculations: provide structural calculations for the cleanroom partition panel system by a structural engineer for review prior to fabrication and erection.

2. Shop Drawings and erection diagrams: shop drawings shall give all pertinent information of construction method proposed, including connections, together with all required dimensions for the proper fitting for the connection with other work and materials, together with all special conditions as may be required to complete installation. Show elevations of all partition types, indicating components dimensions, wall penetrations, joint locations, and intended closures at joints.
  3. Submit assembled and bound parts list and specifications describing the materials, devices, and procedures to be followed in cleaning and maintaining the cleanroom partition system. Include manufacturer's brochures describing the actual materials used in the work, including metal alloys, finishes, sealants, gaskets, and all other major components, as well as methods of disassembly and reassembly.
- C. Contract closeout information:
1. Manufacturer's product warranty.
  2. Maintenance data including cleaning instructions.

#### **1.4 DELIVERY, STORAGE AND HANDLING**

- A. Delivery:
1. Deliver materials only after factory work has been finished.
  2. Deliver thoroughly cleaned panels and other system components in original, unopened packages providing full protection from damage and contamination.
- B. Store materials where directed by Cleanroom Contractor's Clean Zone Director.
- C. Handling: Protect materials from impact, moisture and other deleterious effects.

#### **1.5 PRE-INSTALLATION MEETING**

- A. Conduct pre-installation meeting prior to beginning of wall system installation to discuss following:
1. Contract Document requirements.
  2. Cleanroom drawings.
  3. Wall system manufacturer's specifications and details.
  4. Available on-site storage and protection from damage by other trades.
  5. Coordination with cleanroom ceiling installation.
- B. Attendance is recommended for:
1. Contractor's project manager or superintendent.
  2. Cleanroom installer's Clean Zone Director.
  3. Wall system manufacturer's field supervisor.
  4. Mechanical field supervisor.
  5. Electrical field supervisor.
  6. Other trades whose work may affect wall system.
  7. BNL's authorized representative.
- C. Meeting agenda may include, but not be limited to:
1. Installation drawings.
  2. Coordination with cleanroom ceiling installation and cleanroom access floor installation.
  3. Manufacturer product data.
  4. Samples of proposed materials.
  5. Sample warranty.
  6. Project schedule.
  7. Other information deemed pertinent for sound and secure application.
- D. Include review of specifications, details, application requirements and preliminary work.

## 1.6 EXTRA MATERIAL

- A. Provide 1 percent full-sized panels of each partition type for use by BNL as maintenance stock for each type of panel at each cleanroom area of the Building. Panels shall be packaged for storage.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Acceptable manufacturers:
  - 1. Cleanroom Partition Systems, including doors:
    - a. Base:
      - 1) Porta-Fab; FabLine Framed 250 and Furred 250 Systems.
        - a) 1/4 IN panels typical.
        - b) 1.88 IN panels where indicated.
    - b. Optional:
      - 1) Webb Core.
      - 2) CleanPak International.
      - 3) Plascore.
      - 4) Gordon Cleanroom Products.
  - 2. Other manufacturers desiring approval comply with Section 01 25 13.

### 2.2 COMPONENTS

- A. Provide components through a single firm for undivided responsibility to produce cleanroom wall systems complete with structural framing and accessories.
  - 1. Prefinished aluminum non-progressive framing system including but not limited to batten strip clips, anchors, screws, attachments and supports.
  - 2. Prefinished demountable wall panels.
  - 3. Reinforcing, bracing, blocking, finishing trim, gaskets and seals.
- B. Cleanroom Partition System:
  - 1. General: 2 IN (nominal thickness) partition system with aluminum honeycomb core and aluminum face finished on both sides. Partition hardware includes all "floating" headtrack, floortrack, corner struts, and appurtenances, the load bearing, 48 IN-on-center repetitive partition panel shall be completely demountable, non-progressive, with framing studs. Single partition segments shall originate at finish floor and terminate at ceiling.
    - a. Cleanroom Partition System 1 (CRPS-1): 1/4 IN panel on 1-side only; Cleanroom side.
    - b. Cleanroom Partition System 2 (CRPS-2): 1/4 IN panels on both sides (or a 2 IN nominal panel).
    - c. Cleanroom Partition System 3 (CRPS-3): 1/4 IN 'Furred' system mounted to gypsum board and metal stud wall, or concrete wall.
  - 2. Construction:
    - a. Headtrack: Anodized extruded aluminum, predrilled, for connection to the ceiling grid at 12 IN-on-center minimum, headtrack to provide vibration isolation between CRPS and ceiling system, allow 1/2 IN minimum vertical movement, 2 IN wide maximum track width.
    - b. Aluminum Honeycomb Partition Panel: Nominal 48 IN wide by scheduled ceiling height by 1/4 IN thick, aluminum skins over aluminum honeycomb core continuously bonded.
    - c. Floortrack: Anodized extruded aluminum, predrilled for connection to cleanroom floor at 18 IN on-center minimum.
    - d. Panel Post: Anodized extruded aluminum strut, nominal 2 IN. Mounting block hardware on bottom of post to be t-bolted, into the floor track on both sides at every connection.

- e. Batten: Anodized extruded aluminum batten, continuous full height of partiion, screwed to front face of strut to secure panels in place. Provide removable vinyl cover continuous over fasteners on the battens.
  - f. Miscellaneous Components – Corners, Door Frames, Bulkhead Frames, Glazing Frames: Anodized extruded aluminum sizes compatible with the panel thickness.
  - g. Electrical Outlet Box Block Outs (if applicable): Provide cut outs in panels or as indicated for the fixtures scheduled on the Electrical drawings.
3. Framing System Finish:
    - a. Aluminum Headtrack and Floortrack. Finish to be clear anodized.
    - b. Aluminum Glazing and Joint Battens. Finish to be clear anodized.
    - c. Aluminum Corner Posts and Exposed Wall Surface Components. Finish to be clear anodized.
  4. Glazed Partition Panels: Where shown, provide 1/4 IN glazing in CRPS with panels separated by horizontal posts with battens on both sides.
    - a. Clear Glazing: 1/4 IN thick acrylic plastic plate.
      - 1) StatiCon Technologies; StatiCon AC-300, clear.
  5. UV Glazing: Provide for wall system and doors of Lithography Bay.
    - a. 1/4 IN thick, Capable of eliminating 99.995% of UV light, between 250 nm-450 nm wavelengths (yellow) or 250 nm-550 nm wavelengths (amber).
    - b. Glazing Manufacturers:
      - 1) Base: StatiCon Technologies; StatiCon AC-300, Amber.
      - 2) Optional: Other manufacturers are acceptable if matching manufacturer properties of the Base Products.
- C. Doors:
1. Partition manufacturer’s standard; aluminum, extruded tube frame, medium stile with intermediate crossrail.
  2. 1 3/4 IN thick.
  3. Perimeter seals with jamb frames and head frame.
  4. Include glass panels in doors.
    - a. Glaze doors with 1/4 IN thick laminated glass.
  5. Finish: Clear Anodized
  6. See item “CLEANROOM DOOR HARDWARE SETS” below for Door Hardware Sets.
- D. Sealants and glazing compounds:
1. Comply with Section 01 35 34.
  2. Acceptable Products:
    - a. Sika Sikaflex-1a.
    - b. Dow Corning 6-1125.
  3. Non-sag, non-staining type, cleanroom classified.
  4. Pigmented to match frame or adjacent units not requiring painting.
  5. Compatible with adjacent surfaces.
- E. Gaskets:
1. Wall system manufacturer’s standard for use in ISO-5 Cleanrooms.
    - a. Adhesion to aluminum: Minimum 40 OZ/IN.
    - b. Service temperature range: -63 degF to 149 degF.
  2. Comply with Section 01 35 34.
- F. Miscellaneous materials:
1. Silicone rope: Silicone tubing complying with AMS-3196F, low compression set, and of size and shape to provide secondary seal.
    - a. Comply with Section 01 35 34.
    - b. Nonabsorbent to water and gas.
    - c. Remains resilient to -103 degF.
  2. Clips: Plastic, removable without causing damage to panel.
  3. Slotted channel framing: Refer to Section 05 45 23.

4. Fittings: ASTM-A36 or ASTM-A635.
5. Hex head bolts with hex nuts: Stainless steel, ASTM-A193 and ANSI-B18.2.1.
6. Channel nuts: ASTM-A575, Grade M1015; threads complying with ANSI-B1.1 UNC-2B.
  - a. Rectangular with rounded ends.
  - b. Toothed grooves.
  - c. Spring tension.
7. Washer: ANSI-B18.22.1, Type A-W.
8. Sleeve type concrete anchors: FS FF-S-325, Group II, Type 3, Class 3, stainless steel.
9. Galvanized metal flat strapping for furred system anchoring attachment to gypsum board and metal stud walls.

## 2.3 FABRICATION

- A. Partition panel:
  1. Width: 48 IN, unless otherwise indicated on drawings.
  2. Face and back sheets adhered to honeycomb by heat and pressure applied adhesive.
  3. System height 10 FT with a horizontal mullion break at 8 FT.
- B. Doors and frames:
  1. 6063-T5 extruded aluminum framed doors.
    - a. Plain unpatterned architectural quality 5005 alloy aluminum face sheets, minimum 0.047 IN thick.
    - b. Cores shall be foamed-in place urethane at 2 PSF density and free of CFC's.
  2. All screws and miscellaneous fasteners shall be aluminum.
  3. Corners mitered, welded and ground smooth.
  4. Integral closers in head of frame.
  5. Finish: Clear anodized.
- C. Finish:
  1. Conductive Roll coating on panels.
    - a. Factory applied.
    - b. Chemically pretreat surfaces to remove oil and grease.
    - c. Chemically etch surfaces to be treated.
    - d. Apply coatings for uniform coverage, free of voids, variations in density or color, flaking and other defects.
  2. Panel Color:
    - a. Partition Panels: Selected from manufacturer's standard colors.

## PART 3 - EXECUTION

### 3.1 PARTITION ERECTION

- A. Verify dimensions of supporting structure by field measurements so that cleanroom wall will be accurately designed, fabricated, and fitted to the structure.
- B. Lay out partitions.
  1. Correct substrate defects.
  2. Wipe off studs and panels prior to moving into cleanroom.
- C. Erect all component parts of the cleanroom partitions in accordance with the manufacturer's written instructions and recommendations.
  1. Use HEPA vacuum during drilling processes.
  2. Provide additional framing for air returns, windows, doors and other pass-throughs.
  3. Install panels into framing without bending or otherwise damaging panels.
- D. Erection Tolerances – erect all component parts within the following tolerances.
  1. Variations from plumb or angle shown: 1/8 IN maximum variation in height or 10 foot run noncumulative.

2. Offsets in end-to-end or edge-to-edge alignment of consecutive members: none allowed.
- E. Cutting and Trimming Component Parts.
    1. Cut and trim component parts of the cleanroom partition during erection only with the approval of the manufacturer or fabricator, and in accordance with his recommendations. Perform operations outside the cleanroom in separate clean fabrication area.
    2. Restore finish completely to protect material and remove all evidence of cutting and trimming. All cutting and trimming to be done outside the cleanroom in a designated area.
    3. Field cutting shall conform to fire safety requirements.
  - F. Do not erect members which are observed to be warped, bowed, deformed, or otherwise damaged or defaced to such extent as to impair strength or appearance. Remove and replace members damaged in the process of erection.
  - G. Set units level, plumb, and true to line, with uniform joints. Support and secure in place by bolting to clip angles and similar supports anchored to supporting structure.
  - H. Paint concealed contact surfaces of dissimilar materials with a heavy coating of isolation paint, or provide other separations as per manufacturer's recommendations.
  - I. Conceal connections to walls, floors, ceilings, cornice sections, and connections between panels.
    1. Seal penetrations.
  - J. Coordinate partition erection with Cleanroom Raised Access Floor (CRAF) installation specified in Section 13 63 13.
    1. Install partitions only after access floor installation is complete.
    2. Protect finished floor installation from damage during partition installation.
    3. Install partition floor track anchored to access floor with j-bolts or thru bolts.
  - K. Coordinate partition erection with equipment support systems specified in Section 05 45 23.
  - L. Coordinate partition erection with automatic sliding doors specified in Section 08 42 30. Include jamb and head reinforcing struts to support automatic sliding door.
  - M. Coordinate partition erection with Cleanroom Ceiling System (CRCS) specified in Section 13 62 17.
  - N. Adjust hardware to proper working order.
  - O. Do not allow construction dust or debris to contaminate installed units, and clean panels in accordance with manufacturer's written post-installation instructions.

### **3.2 ELECTRICAL WORK**

- A. Allow access to system for installation of electric items in accordance with Electrical Specification Divisions.
- B. Wiring shall comply with requirements specified in Electrical Specification Divisions.

### **3.3 FIELD QUALITY CONTROL**

- A. Bright Light Test: Panel joints, ceiling joints and sill joints shall be tested for air and light leaks in the following manner:
  1. Darken room (clean area side of partition) to a state of less than 0.5 footcandles general illumination.
  2. On opposite side of wall shine 100 watt flood light at vertical and horizontal joints.
  3. Light source shall not be greater than 16 IN from wall surface, angle of light source to joint in wall shall not be greater than 30 degrees from perpendicular.
  4. Observe corresponding joints from darkened side of wall.
  5. Any visible light through joint shall constitute a leak and shall be sealed.
    - a. Repair gasket seal as required to achieve proper seal.
      - 1) Liquid sealants shall not be used.

### **3.4 CLEANROOM DOOR HARDWARE SETS**

- A. HW-CR01: Single Cleanroom Door, End of Bays and Chases; Passage Set
  - 1. Door Type: ¼” Laminated Glass upper, CRPS panel infill lower.
  - 2. Pivots: Jackson J30 Modified, top, center, bottom pivots.
  - 3. Passage Set - F75: Best; 9K Series - 15C.
  - 4. Concealed Closer: LCN 3134.
  - 5. Stop: Manufacturer to provide in jamb.
  - 6. Seals: By cleanroom door manufacture (Bayer Corp.; Texin 285, thermoplastic polyurethane).

**END OF SECTION**



**SECTION 13 62 17**  
**CLEANROOM CEILING SYSTEMS (CRCS)**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. Cleanroom Ceiling System (CRCS): Extruded aluminum 'T-bar' gasketed grid system, high stem, bolt-together, ceiling grid support system, filters, filter housings and lighting.
- B. System installation shall include sealing of all penetrations including, but not limited to fire sprinklers, electrical lines, light fixtures, etc.
- C. Related Sections:
  - 1. Product Outgassing Requirements for Cleanroom Construction: Section 01 35 34.
  - 2. General Clean Zone Construction Procedures: Section 01 50 13.
  - 3. Equipment Support System: Section 05 45 23.
  - 4. Special Clean Zone Requirements: Section 13 60 13.
  - 5. Cleanroom Protocol: Section 13 60 16.
  - 6. Cleanroom Certification: Section 13 60 19.
  - 7. Cleanroom Wall Systems: Section 13 61 16.
  - 8. Lighting: Electrical Specification Divisions.
  - 9. HEPA Filter Modules: Section 23 31 13.

**1.2 QUALITY ASSURANCE**

- A. ASTM Standards:
  - 1. ASTM-A193 for stainless steel bolting materials.
  - 2. ASTM-A307 for carbon steel bolts.
  - 3. ASTM-A563 for carbon steel nuts.
  - 4. ASTM-B209 for aluminum sheet and plate.
  - 5. ASTM-B221 for aluminum extrusions.
- B. American Welding Society (AWS):
  - 1. D1.2 for welding aluminum.
- C. International Standardization Organization:
  - 1. ISO 14644.
- D. ASHRAE Standards:
  - 1. Test Standard 52-76.
- E. Seismic Design:
  - 1. System shall be designed and installed in accordance with the applicable Building Code, for the applicable Seismic Design Criteria for the Project location: Criteria 'B'; I-1.0.

**1.3 PERFORMANCE**

- A. The resultant ceiling system (framing and HEPA/ULPA filters) shall be capable of providing clean room class conditions indicated for the specific area installed.

**1.4 SUBMITTALS**

- A. Shop drawings:
  - 1. Cleanroom ceiling system plans and details:
    - a. Framing and support details.
    - b. Indicate location of ceiling units and other items requiring coordination with ceiling.
    - c. Indicate structural classification of system.

- B. Product data:
  - 1. Lighting fixture data including photometric, ballast, lamp and U.V. filter sleeve data.
- C. Samples:
  - 1. Materials and components proposed for use.
  - 2. Color and texture of exposed surfaces.
- D. Contract closeout information:
  - 1. Maintenance data.
  - 2. Required after execution of Contract: Shop drawings shall be submitted within two weeks of purchase order acceptance, and they shall include: complete specifications, descriptive drawings, catalog cuts, and descriptive literature on all components used in the ceiling system, with make, model, dimensions, capacity, weight, and electrical schematics. Manufacturer's information for HEPA filters shall be included.

## **1.5 JOB CONDITIONS**

- A. Verify suitability of structure to accept installation.
- B. Carefully coordinate ceiling layout with other work penetrating the system.
- C. Provide structural bridging to span ducts and other obstructions, and provide structural headers to reinforce and support deck units at holes through deck.

## **1.6 DESIGN REQUIREMENTS**

- A. The work supplied pursuant to this Section shall be in conformance with the following, except as modified here:
  - 1. ISO 14644, latest editions.
  - 2. IEEE Test Procedure 112A.
  - 3. ASHRAE Test Standard 52-76.
- B. All electrical components shall be UL listed and labeled.

## **1.7 PRODUCT DELIVERY, STORAGE AND HANDLING**

- A. Filters shall be individually double-bagged and shall be packaged one per carton:
  - 1. Flat face of carton where HEPA/ULPA filter face could be exposed to shipping damage shall be covered with hardboard material.
  - 2. Filter cartons and hardboard protection shall be shrink wrapped to pallet.
  - 3. Pallets shall not be stacked at any time.
- B. For individually ducted HEPA/ULPA filters, cap collar on all terminal HEPA/ULPA filters prior to shipment to job:
  - 1. Cap shall remain intact until connection of flexible duct.

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS**

- A. Acceptable manufacturer:
  - 1. Cleanroom ceiling system:
    - a. Base:
      - 1) Gordon Inc.; DS Gasket Seal Grid DS-38.
    - b. Optional:
      - 1) Hunt Air, Inc.
      - 2) Clean Rooms International, Inc.
  - 2. Other manufacturers desiring approval comply with Section 01 25 13.

## 2.2 GASKETED CEILING GRID SYSTEM

- A. Grid System:
  - 1. 2 IN wide extruded aluminum "T" grid system: 48 x 24 IN grid, unless otherwise indicated on Drawings:
    - a. Main tee spacing: Maximum 24 IN OC.
    - b. Hanger spacing: Maximum 48 IN OC each way.
  - 2. Include grid connector, rod-hung suspension, factory-applied gaskets, filters, filter housing, lighting and accessories, and extrusions for furred perimeter walls.
  - 3. Structural criteria:
    - a. Maximum deflection with 77 PSF uniform applied load:  $L/360$ .
    - b. Maximum deflection at mid-span with 621 LB point load: 1/8 IN.
  - 4. Aluminum: ASTM-B221, 6063-T5 alloy.
  - 5. Suspension system: Minimum 3/8 IN zinc plated steel rod and turn buckles.
  - 6. Grid system shall be level overall within 0.10 IN and within 0.062 IN in 10 FT.
  - 7. Finish: Clear anodized aluminum finish.
- B. Gaskets:
  - 1. Factory applied, closed cell PVC structure with small cells.
  - 2. Size: 1/4 x 5/8 IN.
  - 3. Shore hardness: ASTM-D2240: 21 on the OO scale.
  - 4. Density: Nominally 7 LB/SF.
  - 5. 25 percent compression deflection of 2.5.
- C. Sealants:
  - 1. Sealants complying with the requirements of Section 01 35 34.
- D. Blank ceiling panels:
  - 1. Cleanroom ceiling blank-off panels shall be of aluminum honeycomb core sandwich design, with aluminum skins on the face and back for lay-in installation in the finished ceiling grid:
    - a. Panel skins shall be aluminum alloy 5052-H32 with a smooth, non-shedding roll coat finish suitable for cleanroom applications.
    - b. Panels shall meet minimum requirements of 5 for smoke generation and 0 for flamespread when tested to ASTM E84.
  - 2. Manufacturers Option: Cleanroom ceiling blank-off panels may be of 0.032 IN thick aluminum with 1/2 IN edge returns and sealed corners.
  - 3. Size: 48 x 24 IN or as indicated.
  - 4. Secure panels in place with hold down clips.
  - 5. Finish: Powder coat enamel - white.
- E. Egg Crate Grille:
  - 1. Panels shall be 24 IN x 48 IN x 1 IN grid OC aluminum grille finished to match ceiling panels.
- F. Sprinkler Adapter Panels:
  - 1. Same panel type as blank ceiling panels.
  - 2. Size: 24 x 4 IN.
  - 3. Secure panels in place with hold down clips.
  - 4. Finish: Powder coat enamel - white.
  - 5. Sprinkler layout: Reference drawings.
- G. Light Fixtures: Refer to Electrical Lighting Drawings and Specifications.

H. HEPA Filter Modules: Refer to Spec Section 23 31 13.

### **PART 3 - EXECUTION**

#### **3.1 PREPARATION**

- A. Examine subsurfaces to receive work, and correct any defects.
- B. Provide all support members with attachments with special dimension closure strips at walls and where otherwise required.

#### **3.2 ERECTION**

- A. Install grid ceiling system in accordance with manufacturer's recommendations.
- B. Accurately support grid ceiling system from supporting framework.
- C. Extend ceiling grid without ceiling tile infill where indicated.
- D. Level, align and adjust to final position prior to permanent fastening and connections.

**END OF SECTION**

**SECTION 13 63 13**  
**CLEANROOM RAISED ACCESS FLOORING (CRAF)**

**PART 1 - GENERAL**

**1.1 QUALITY CONTROL**

- A. Provide system tested in accordance with CISCA (Ceiling & Interior Systems Construction Association) test procedures capable of supporting following minimum loads, with no permanent set:
1. Concentrated load of 1750 LBS for round-hole perforated panels, or 1500 LBS for grated panels, on any 1 SQIN with maximum deflection of 0.08 IN.
  2. Meet lateral design requirements without the use of diagonal bracing whenever possible to achieve a clear unobstructed area below the floor panels.
  3. Design system for lateral stability in all directions, with or without panels in place.
  4. Completed floor systems shall be rigid and free from rocking panels.
  5. Underfloor support structure design shall be stamped and signed by an engineer licensed to provide structural design and calculations in the State of New York.
  6. Seismic Design: Provide applicable Seismic Design Criteria Code Requirements for the Project for the applicable Project location:
    - a. Criteria 'B': I-1.0.
    - b. Pedestals shall meet the requirements of the IBC, 2006 edition, for the applicable seismic criteria of the project site.
- B. Tolerances:
1. Squareness tolerance of 0.008 IN measured on diagonal on top of panel.
  2. Flatness tolerance of + 0.020 IN/-0.015 IN measured on diagonal on top of panel.
  3. Tolerances apply before edging is applied.
- C. Electrical grounding and conductance:
1. Provide solid copper grounding jumper clamp for 10% of all the pedestal bases.
  2. Provide floor covering material meeting requirements of NFPA 99 for static-dissipative flooring.
  3. Maximum electrical resistance shall be 1 ohm from the top of the panel, less wear surface, to the pedestal base.
  4. Electrical grounding of installed access floor system provided by copper bonding strap connected to floor system pedestals and grounding system components under Division 16.
  5. Bonding strap furnished and installed under Division 16.
  6. Pedestal-to-Pedestal Resistivity: Frame grid and panel assembly shall have an installed dc resistance of less than 1 ohm when measured across the diagonal of a 24 by 24 foot grid.
  7. Conductivity Test: Point-to-Groundable point and Point-to-Point Resistance per ESD STM 7.1 2001 with an open circuit voltage of 100 volts  $\pm$  -10%:  $1 \times 10^6$  to  $1 \times 10^9$  ohms.
  8. Installed floor shall pass anti-static tests ( $10E^6$  ohms to  $10E^9$  ohms) as described in Section 13 60 19 Cleanroom Testing and Certification.
- D. Grate panel epoxy paint finish shall meet standards for surface abrasion, adhesion, and anti-static per the below test procedures. Supplier shall provide certified test reports from a recognized testing lab demonstrating compliance.
1. ANSI Z124.6 Abrasion test using a Gardner abrasion tester. Cut an 8" by 18" sample section out of each full tile. Subject to abrasion using a 1.5 pound puck and 600 grit wet/dry sandpaper. Test 3 sections on each sample. Record readings at 250, 500, and 100 cycles to determine the hardness of the coating material.
    - a. SPEC range = 250 cycles = no change, 500 cycles = no change, 1000 cycles = no change.
    - b. SGS Testing Company, 5555 Telegraph RD, Los Angeles, CA 90040, 1-323-838-1600.

2. ASTM D3359-97 Adhesion Test, "Standard Test Methods for Measuring Adhesion by Tape Test".
  - a. SPEC Range – 4B-5B.
3. Madrel Bend: ASTM D522.
  - a. Spec = Pass 0.125 inch test

E. Floor panels shall conform to CISCA test procedures.

## 1.2 SUBMITTALS (SEE DIVISION 1)

A. Shop drawings:

1. Plan showing grid and panel layout.
2. Sections and details showing dimensional relationship to adjacent work.
3. Details with descriptive notes indicating materials, finishes, fasteners, typical and special edge conditions, accessories and other data to permit full evaluation of system submitted.

B. Project Information:

1. Manufacturer's standard technical data for materials and systems furnished.
2. Test reports, by independent laboratory, certifying that component parts specified meet all requirements.
3. Installer qualifications.
4. Certified report indicating pressure drops in grating and perforated panels with or without dampers at various flow rates.

C. Samples:

1. Floor panels and support system components, all indicating finishes and colors.
2. System finish samples including paints, coatings, and vinyl flooring.

D. Contract closeout information:

1. Maintenance data.
2. Warranty.
3. Certificates:
  - a. Manufacturer's certification that product has been tested and meets or exceeds the specified design strength and electrical resistance requirements.

## 1.3 JOB CONDITIONS

A. Verify field dimensions.

B. Verify conditions and levelness of subfloor and applied finishes.

C. Coordinate with other trades.

D. Do not deliver material until the building is completely weathertight.

E. Do not install raised access flooring until concrete subfloor epoxy coating has completely set in accordance epoxy flooring manufacturer's recommendations.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

A. Acceptable manufacturers:

1. Access flooring (die-cast aluminum floor panels):
  - a. Base:
    - 1) Maxcess Aluminum Floors; phone: 843-824-1225.
  - b. Optional:
    - 1) Tate Access Floors; phone: 800-231-7788

B. Pedestals:

1. Manufacturer's standard aluminum construction.

2. Base not less than 4 IN x 4 IN.
  3. Steel or aluminum head.
  4. Vertical adjustment by threaded column with positive locking elevating nut.
  5. Capable of supporting 5000 LBS without deformation.
  6. Height as required.
  7. Provide wider base flanges for pedestals in areas exceeding normal heights, as recommended by manufacturer to maintain lateral stability.
  8. Seal around pedestal base plates with Cleanroom sealant to prohibit liquids from seeping under bases.
- C. Grid systems:
1. Aluminum stringers, interlocking with pedestal heads to form grid pattern supporting edge of each floor panel, with pedestal under each panel corner.
  2. Removable grid with stringers bolted to pedestal heads to create stable grid without fasteners.
- D. Aluminum floor panels:
1. Panels shall be high-pressure die-cast aluminum construction.
  2. Die-casting shall conform to Federal Specification QQ-A-591-383.
  3. Static-dissipative vinyl floor covering shall be factory applied to required tolerances with compatible creep resistance or conductive adhesives.
    - a. Finish:
      - 1) Base: Forbo; ColoRex SD.
      - 2) Optional: VPI, Flexco.
      - 3) Colors: To be selected by the Architect from the manufacturer's selection.
        - a) Three colors required: Field color, accent color, and safety accent color (for use at safety showers).
    4. Grating finish shall be baked-on conductive epoxy powder finish.
    5. Panel types:
      - a. Raised Access Floor 1 (CRAF-1): Maxcess H 24 Solid Panels.
      - b. Raised Access Floor 2 (CRAF-2): Maxcess HR 24 Perforated Round-hole Panel, 17% open; provided with dampers.
      - c. Raised Access Floor 3 (CRAF-3): Maxcess HS 24 Perforated Slotted-hole Panel, 25% open.
      - d. Raised Access Floor 4 (CRAF-4): Maxcess GP 24 Grated Panel, 54% open.
        - 1) Finish: Conductive epoxy.
        - 2) Colors:
          - a) Maxcess 'Excel White' for the field.
          - b) Maxcess 'Green' at safety showers (4 tiles per shower); in chase areas only.
    6. Locate panel types as Indicated on the Drawings.

E. Slide Dampers

    1. Slide dampers shall be fabricated of bare aluminum sheet conforming to Federal Specification QQ-A-250/8 with rack and pinion mechanism.
    2. Adjustments shall be made from the tope of the panel, from full open (34% open area) to full closed and lockable from the top.
    3. Damper kit shall include eight 8/32 x 3/8" (4 mm x 9.5 mm) round heal Phillips Type-F self-tapping stainless steel machine screws.

F. Ledger Angles: Provide 3 IN x 3 IN x 1/8 IN aluminum ledger angles at access floor perimeter for support of edge panels.

G. Panel lifting device: Double, suction type. Provide 3 sets.

H. Utility Access Panels: Clear transparent polycarbonate sheet viewing lid integrated into cast aluminum panel.

    1. Lid shall be 1/2 IN thick, 12 IN or 16 IN square with 1 IN finger-hold and hinge on opposite side. Optional finger-hole on opposite edges for complete removal is acceptable.

- a. Provide 10 panels for field location.
- b. Provide cut-outs for mounting of in-floor power and data outlets at locations shown on Electrical Drawings.

## **PART 3 - EXECUTION**

### **3.1 INSPECTION**

- A. Examine area where access flooring is to be installed.
- B. Correct unsatisfactory conditions.
- C. Installation constitutes acceptance of responsibility for performance.

### **3.2 INSTALLATION**

- A. Install floor system under supervision of manufacturer or authorized representative, rigid, free of vibration, rocking, rattles, squeaks, and other objectionable defects.
  1. Provide ledger angles to support access floor panels at perimeter.
- B. Layout floor panels as indicated in the drawings and in order to minimize number of cut panels at floor perimeter.
  1. Scribe panel assemblies at perimeter to provide fit with no voids greater than 0.125 IN where panels abut vertical surfaces.
  2. Caulk voids and perimeter if floor is a plenum.
- C. Make cutouts required in floor panels where indicated on the Mechanical, Plumbing, and Electrical drawings.
  1. Trim with rubber or plastic edging and provide foam rubber pad for sealing and protection of cables.
  2. Verify locations, numbers and sizes with other trades.
  3. Provide additional support as required if cutouts lessen panel strength.
- D. Locate each pedestal and complete necessary subfloor preparation.
  1. HEPA vacuum clean subfloor.
  2. Set pedestals in adhesive as recommended by manufacturer to provide full bearing. Shim plumb as recommended by floor system manufacturer.
  3. Seal around bases with cleanroom sealant.
- E. Vacuum and wipe-down subfloor area as installation proceeds.
- F. Level installed access flooring to within 0.10 IN over entire area and within 0.06 IN in any 120 IN.
- G. Edge cut panels with manufacturer's standard trim, to fit panels to perimeter or obstructions.
- H. Provide positive electrical grounding of entire system. Reference Electrical Drawings and Specifications.

### **3.3 ADJUST AND CLEAN**

- A. After completion of installation, vacuum entire floor.
- B. Cover with plastic.
- C. Maintain and repair damages to protective covering until directed to remove.
- D. Replace damaged or stained components.
- E. Prior to final inspection, vacuum entire floor.

## **END OF SECTION**

# HDR

D I V I S I O N    1 4

CONVEYING EQUIPMENT



## SECTION 14 21 23

### MACHINE ROOM-LESS ELECTRIC TRACTION ELEVATOR - PASSENGER

#### PART 1 - GENERAL

##### 1.1 QUALITY ASSURANCE

- A. Optional manufacturers are responsible for, at no additional cost to BNL:
  - 1. Costs for dimensional adjustments to fit their elevators to openings.
  - 2. Hoistway inside dimensions or floor to floor heights shall not be changed.
  - 3. Provide or arrange for additional electrical wiring, energy, panels, transformers etc., required to accommodate their elevators.
- B. Applicable Codes and Standards:
  - 1. Comply with Building Codes and Elevator Codes as locally adopted and amended, including but not limited to the following:
    - a. ANSI A117.1, Buildings and Facilities, Providing Accessibility and Usability for Physically Handicapped People.
    - b. ADAAG, Americans with Disabilities Act Accessibility Guidelines.
    - c. Operation and installation standards in conformance with ADA Accessibility Guidelines; 28, CFR, Part 36.
    - d. ANSI/NFPA 70, National Electrical Code.
    - e. ANSI/NFPA 80, Fire Doors and Windows.
    - f. ANSI/UL 10B, Fire Tests of Door Assemblies.
    - g. ASME/ANSI A17.1, Safety Code for Elevators and Escalators.
    - h. New York State Building Code.
    - i. All other local applicable codes.
- C. Seismic Design Parameters:
  - 1. Design and install equipment complying with seismic requirements of Building Codes listed above.
- D. Manufacturer Qualifications:
  - 1. Provide elevators manufactured by a firm with a minimum of 10 years experience in fabrication of elevators equivalent to those specified.
- E. Installer Qualifications:
  - 1. Installed by the manufacturer.
  - 2. Permits and Inspections: Provide licenses and permits and perform required inspections and tests.

##### 1.2 SUBMITTALS

- A. Shop Drawings:
  - 1. Hoistway Plans and Sections clearly showing the following:
    - a. Structural Loads imposed on building superstructure.
    - b. Clearances and travel of car.
    - c. Hoistway and pit dimensions.
    - d. Location and sizes of access doors, hoistway entrances and frames.
    - e. Car, guide rails, buffers and other components in hoistway.
    - f. Signal and operating fixtures, operating panels and indicators.
    - g. Cab design, dimensions and layout.
    - h. Hoistway-door and frame details.
    - i. Electrical characteristics and connection requirements.
    - j. Heat dissipation (BTU) of elevator equipment.

- B. Product data.
- C. Samples:
  - 1. Cab and entrance finishes.
- D. Contract Closeout Information:
  - 1. Operating and maintenance data.
  - 2. BNL instruction report.
  - 3. Warranty.

### **1.3 WARRANTY**

- A. 1-year from Substantial Completion including 1-year Service Contract.
- B. Service Contract:
  - 1. Service frequency: Semi-monthly.
  - 2. Include examination, oiling, greasing, adjustment and repairs as required.
  - 3. Emergency overtime service.

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS**

- A. Acceptable manufacturers:
  - 1. Machine room-less electric traction elevator - passenger:
    - a. Base:
      - 1) Kone, Inc.
    - b. Optional:
      - 1) Otis Elevator.
      - 2) Schindler Elevator.

### **2.2 GENERAL PARAMETERS**

- A. Quantity of Elevators in this Group: 1.
- B. Elevator operating equipment:
  - 1. Machine: Gearless Electric Traction.
  - 2. Machine Location: Hoistway, mounted on guide rail at top.
- C. Cab Dimensions (inside clear) and Capacity Rating:
  - 1. 5 FT - 6 IN x 8 FT - 9 IN Deep, 5,000 LBS.
- D. Cab Height:
  - 1. 108 IN gross; 103 IN clear under finished ceiling.
- E. Speed:
  - 1. 150 FPM.
- F. Travel: 37 FT 0 IN.
- G. Number of Stops: 3.
- H. Hoistway Entrances - General:
  - 1. Quantity:
    - a. Front: 3.
    - b. Rear: None.
  - 2. Door Type:
    - a. Single-speed, opening to the side.
  - 3. Door Opening Width (clear):
    - a. 48 IN.
  - 4. Door Height (clear):

- a. 96 IN.
- I. Base Product: "Model: "Ecospace KCM831" by Kone, Inc.
- J. Optional Products:
  - 1. "Gen2" by Otis Elevator.
  - 2. "400A" by Schindler Elevator.

## 2.3 MACHINE EQUIPMENT

- A. General:
  - 1. Main Power Supply: 480 volts, 3 Phase, 60 Hz, with separate equipment grounding conductor.
  - 2. Car Lighting Power Supply: 120 VAC, 1 Phase, 15 Amp, 60 Hz.
  - 3. Speed:  $\pm 2\%$  of specified speed under any loading condition or direction of travel.
  - 4. Stopping Accuracy:  $\pm 1/4$  IN under any loading condition or direction of travel.
  - 5. Electrical work: Provide necessary wiring to connect parts of equipment.
- B. Machine, machine room-less:
  - 1. Compact gearless type, AC motor, brake and driving sheave mounted on a rigid bedplate.
  - 2. Large diameter, forged shaft shall serve as a support for the motor armature and for the removable drive sheave and brake drum/disc. Support by roller bearings.
  - 3. Steel deflector sheaves of adequate diameter and strength provided as necessary.
  - 4. Sound isolation: To reduce vibration and noise transmission to the building structure.
- C. Drive:
  - 1. Variable Voltage Variable Frequency (VVVF) AC drive.
    - a. Non-regenerative, or regenerative.
- D. Governor:
  - 1. Car safety: Operated by a centrifugal speed governor located at the top of the hoistway in the machine room.
- E. Controller:
  - 1. Microcomputer based control system to perform functions of safe elevator operation.
    - a. Provide microcomputer based control system to perform all functions.
      - 1) High voltage contact points shall be inside controller cabinet and protected from accidental contact when controller doors are open.
      - 2) Controller shall be separated into two distinct halves:
        - a) Motor side and control side.
        - b) High voltage motor power conductors shall be routed and physically segregated from rest of controller.
      - 3) Provide serial cardrack and main CPU board containing non-erasable EPROM and operating system firmware.
      - 4) Variable field parameters and adjustments shall be contained in a non-volatile memory module.
    - 2. Drive: Provide Variable Voltage, Variable Frequency AC drive system to develop high starting torque with low starting current.
    - 3. Controller Location: Locate controller in integral cabinet adjacent to entrance frame at top elevator landing.

## 2.4 HOISTWAY EQUIPMENT

- A. Hoistway Operating Devices:
  - 1. Emergency stop switch in the pit.
  - 2. Terminal stopping switches.
  - 3. Car positioning vanes.
- B. Buffers: Oil type for car and counterweight at the bottom limits of travel.

- C. Guide Rails:
  1. Tee-section steel rails with brackets and fasteners.
  2. Use heavy-weight rail sections as required to span between structural supports indicated, or include supplemental steel bracing/sub-frame as required for structural support.
- D. Ropes:
  1. Steel hoist ropes of size and number to ensure proper wear qualities shall be used.
  2. Wedge shackles designed for use with steel ropes shall be used.
  3. Governor rope shall be 3/8 IN iron.
- E. Pit Ladders:
  1. Coordinate pit ladders per ANSI/ASME-A17.1.
  2. Ladders are specified in Section 05 50 10.

## **2.5 HOISTWAY ENTRANCES**

- A. General:
  1. Fire Label: 1-1/2 HR UL "B" labels.
- B. Frames:
  1. Bolted construction for complete one-piece unit assembly.
  2. Securely fastened to fixing angles mounted in the hoistway.
  3. Material: 14 GA sheet.
    - a. Type 304 Stainless Steel (non-magnetic).
      - 1) Finish:
        - a) #4, Brushed Satin.
- C. Doors:
  1. Flush, 16 GA hollow metal construction with vertical internal channel reinforcements and sound deadening material.
  2. Material:
    - a. Type 304 Stainless Steel.
      - 1) Finish:
        - a) #4, Brushed Satin.
- D. Flush Transom Panels:
  1. Flush with doors.
  2. Material: Same material and finish indicated for Hoistway Doors.
  3. Install Hall Lanterns, and Car Position Indicators where specified.
- E. Sills:
  1. Extruded aluminum with slip resistant wearing surface.
  2. Supported on steel anchors secured to floor construction.
  3. Elevator contractor to provide sill angles as required.
- F. Entrance Markings:
  1. Entrance jambs shall be marked with 4 x 4 IN plates having raised floor markings with Braille adjacent.
    - a. Markings shall be provided on both sides of the entrance.
- G. Sight Guards: Finish compatible or matching door frames.
- H. Fascia:
  1. Galvanized sheet steel shall be provided at the front of the hoistway.
  2. Include necessary supports, connections and filler pieces.

## **2.6 CAR - GENERAL**

- A. Carframe:
  1. Fabricated from formed or structural steel members and adequately braced to support the platform and car enclosures.

2. Roller guides: Rubber tired, spring loaded, adjustable, which engage guide rails.
- B. Carframe Safety:
  1. Integral to the carframe: Type "B", flexible guide clamp type.
- C. Elevator Car Platform:
  1. All-steel construction with welded steel frame reinforced as necessary.
  2. Floor area: Minimum 12 GA sheet steel.
  3. Fasten securely to frame and reinforcing members.
  4. Isolate platform on rubber pads supported on auxiliary steel frame fastened to car frame
  5. Threshold Material: Extruded Aluminum.
- D. Load weighing device:
  1. Mounted under the platform.
  2. Platform load weighing device set to a predetermined maximum load in car.
  3. Car bypasses hall calls when device is actuated.
- E. Exhaust Fan: Mounted on the car top.
- F. Emergency Car Lighting:
  1. Emergency power unit employing a 6 volt, sealed rechargeable battery.
  2. Purpose: To supply illumination of elevator car and activate alarm bell in the event of building power failure.
- G. Emergency Pulsating Siren:
  1. Mounted on top of the car and activated by Alarm button in the car operating panel.
  2. Rated sound pressure level: 80 dba at 10 FT.
- H. Provide 125 VAC, 20A, duplex receptacle with ground-fault interrupter protection connected to same circuit as car lights and fan.
- I. Provide accessibility code items.
- J. Exit Panel:
  1. Hinged, type, non-locking.
  2. Coordinate location with ceiling and lighting.

## **2.7 CAB TYPE**

- A. Cab Wall Materials and Finishes:
  1. 14 GA stainless steel sheet:
    - a. Finish: #4 Satin Brushed.
- B. Car Top: Cold rolled steel with hinged exit.

## **2.8 CAB FINISHES**

- A. Car Front:
  1. 14 GA stainless steel:
    - a. Finish: #4 Satin Brushed.
- B. Car Doors:
  1. Match materials and finished indicated for Hoistway Doors.
- C. Floor covering:
  1. Thin-set epoxy terrazzo specified in Section 09 66 23.
- D. Dropped Ceiling Type:
  1. Fluorescent lighting fixtures over white translucent polycarbonate diffusers set in metal frame.
  2. Frame Material:
    - a. Stainless Steel, #4 Satin brushed.

- E. Metal Handrails:
  - 1. General:
    - a. Locations: 3 walls.
    - b. Mounting Height: 32 IN above cab floor.
    - c. Material and finish:
      - 1) Stainless Steel, #4 Satin brushed.
  - 2. Profile:
    - a. Cylindrical Tubular Metal:
      - 1) Size: 2 IN diameter.
- F. Protective Pads:
  - 1. Quilted fire retardant protective pads.
  - 2. Include hooks/buttons.

## **2.9 FIXTURES AND DEVICES - GENERAL**

- A. Car and Hall Fixtures – Design and Style:
  - 1. Round Buttons: Vandal-resistant:
    - a. Illumination: Amber LED.
    - b. Stainless steel, vandal resistant bezel surrounding button.
    - c. Design:
      - 1) Flat-top button, flush, with 1/8 IN projecting target.
      - 2) Flat-top button, raised, with 1/8 IN projecting target.
    - d. Target Finish: #4 Satin Stainless Steel

## **2.10 FIXTURES AND DEVICES – HALLS**

- A. Hall Call Stations:
  - 1. Located adjacent to hoistway entrance, combining landing buttons and key switches required for elevator operation.
  - 2. Raised markings shall be provided for each push-button.
  - 3. Configurations:
    - a. Terminal Landings: Provide single button.
    - b. Intermediate Landings: Provide UP and DOWN button.
  - 4. At main lobby, include a keyswitch for “Car to Lobby”, integrated into Hall Call fixture.
- B. Hall Lantern and Chime:
  - 1. Directional lantern visible from the corridor, located in the hall entrance.
  - 2. When the car stops and the doors are opening, the lantern shall indicate the direction in which the car is to travel and a chime will sound.
- C. Hall Position Indicator:
  - 1. Displays the car’s current floor position.
  - 2. Integrate the features of Hall Position Indicator and Hall Lantern into one fixture.
  - 3. Provide at first floor lobby.
- D. Car to Lobby Operation:
  - 1. Key switch at Lobby.
  - 2. Actuation of car to lobby switch to call car to Lobby.

## **2.11 FIXTURES AND DEVICES - CAR OPERATING PANEL**

- A. General: Fully integrated unit containing phone, push buttons, key switches, and message indicators for elevator operation including:
  - 1. Phone
  - 2. Message indicator
- B. Buttons:
  - 1. Individually marked with landings served, “Emergency Call”, “Door Open”, “Door Close”, and other accessories indicated or required.
  - 2. “Emergency Stop” Button.

- C. Switches:
  1. "Lights", "Inspection", "Fan", "Independent Service", and other accessories indicated.
- D. Car Position Indicator: Digital readout, displaying the current position of the car.
- E. Landing Passing Signal: Chime which sounds in the car to notify passenger that the car is either stopping at or passing a floor served by the elevator.
- F. Independent Service: When switch in car is actuated, car operates independently from car buttons only and hall calls are ignored.
- G. Telephone Cabinet:
  1. Cover made of same material as wall it is mounted in.
  2. Include wiring connected to the car traveling cable.
  3. Telephone: Hands-free design complying with ADAAG requirements.
  4. Wire to PBX.

## 2.12 DOOR OPERATION

- A. Door Control Features:
  1. Electrically operated, quietly and smoothly operate car and hoistway doors.
    - a. Doors manually operable in emergency.
  2. Door control opens doors automatically when car arrives at landings in response to a normal hall or car call.
  3. Re-opening Device/Safety:
    - a. Purpose: To stop and reopen car and hoistway doors automatically should doorway become obstructed by object or person.
    - b. Primary Device:
      - 1) 2-dimensional, multi-beam array projecting across car door opening.
      - 2) Normal Operation:
        - a) Detect object, 1-1/3 IN diameter or larger, between car doors in following detection zone; within 1 IN to 71 IN above sill.
      - 3) Degraded Conditions (one or more blocked or failed beams):
        - a) Detect object, 4 IN diameter or larger, in same detection zone.
      - 4) If the system performance is degraded to point that 4 IN object cannot be detected; maintain the doors in open position, or permit closing only by nudging force conditions.
    - c. Secondary Device:
      - 1) 3-dimensional, triangular infrared multi-beam array projecting across door opening and extending into hoistway door zone.
      - 2) Operation: Cause doors to reopen when it detects person or object in area between hoistway doors or entryway area adjacent to hoistway doors.
      - 3) Secondary protection zone: Size varies with door positions.
  4. Door nudging operation to occur if doors are prevented from closing for adjustable period of time.

## 2.13 OPERATION AND LOGIC

- A. General Operating Features:
  1. Load Weighing Bypass: Car to bypasses hall calls, when car is filled to predetermined load.
  2. Independent Service: When switch in car is actuated, car operates independently from car buttons only and hall calls are ignored.
  3. Firefighters' Service Phase I and Phase II: Returns cars to designated floor by means of key operated switch located at a lobby location designated by Fire Marshal.
  4. Top of Car Inspection: Disable car when inspection switch is activated.
  5. Anti-nuisance service: Automatically cancel car calls if number of calls exceeds proportional load in car.
  6. Load weighing dispatch: Dispatch car UP from Lobby as soon as either dispatch time interval has expired or weight sensing device has determined car is loaded.

- B. Simplex Collective Operation (1 car):
1. General Description:
    - a. Operation: Automatic by means of the car and hall buttons.
    - b. If calls in the system have been answered, the car shall park at the last landing served.
  2. Operating Logic:
    - a. Momentary pressing of car or hall call buttons automatically starts car if hoistway doors are shut.
    - b. Car stops automatically at first stop for which car or corridor button has been pressed, corresponding to direction in which car is traveling.
    - c. Car stops automatically, in order, at stops for which such stops have been registered.
    - d. Car, when traveling in UP direction, answers UP calls, but passes stops where DOWN calls have been placed unless DOWN call is at highest stop for which any button has been pressed.
    - e. Pressing UP hall call button when car is traveling downward shall not intercept its travel, unless UP call is at floor for which lowest stop is registered.
    - f. When car has responded to its highest or lowest stop, and calls are registered for opposite direction, travel reverses automatically and answers those calls.
    - g. Should farthest stop in either direction be in response to corridor call, entering passenger at that floor may choose travel direction during predetermined period of time.
    - h. Should both UP and DOWN calls be registered at intermediate floor when car is traveling to floor beyond, reset only call corresponding to direction opposite to that which car is traveling.
    - i. Doors open only when stopping in response to calls.

## **2.14 EMERGENCY OPERATION**

- A. Emergency power operation (automatic):
1. Transfer to emergency power upon signal from emergency generator switchgear.
  2. Feed emergency power to elevator disconnect switches through normal power feeder.
  3. Contact on emergency switchgear to furnish signal through pair of No.12 wires to elevator controller that system is on emergency power.
  4. In event of power failure, shut elevator down.
  5. After approximately 15 seconds, provide emergency power of same characteristics as normal power supply to elevator feeders.
  6. Car will start and travel to Lobby where it will stop and open its doors.
  7. After car has have moved to Lobby, car shall operate at rated speed to serve calls after time delay.
  8. Manufacturer may attempt to rescue elevator at same time if power requirement in DOWN direction is small enough.
  9. On reestablishment of normal power, time delay on transfer switch shall keep system on emergency power for an adjustable time interval.

## **PART 3 - EXECUTION**

### **3.1 INSPECTION**

- A. Take field dimensions and examine conditions of substrates, supports, and other conditions under which this work is to be performed.
- B. Verify acceptability of shaftway to accept elevator and equipment.
- C. Notify Contractor of unsatisfactory conditions.
- D. Do not proceed with work until unsatisfactory conditions are corrected.
- E. Start of installation constitutes acceptance of conditions and responsibility for performance.

### **3.2 ERECTION**

- A. Erect sills, struts, hanger supports, hanger covers and unit frames, prior to erection of rough walls and set sills, supports, covers and frames in proper relation to elevator car guides.
- B. Provide protective covering for finished frame and door surfaces.
- C. Projections into Shaftway exceeding 4 IN:
  - 1. Notify Contractor if and where 75 degree bevels are necessary.
  - 2. Gypsum wallboard bevels: Specified in Section 09 29 00.
- D. Coordinate the installation of pit ladders ensuring that running clearances are maintained, location of ladder is optimal for servicing equipment, and in conformance with locally adopted codes.

### **3.3 GROUTING & CONCRETE FILL**

- A. Fully grout the following:
  - 1. Hoistway entrance frames.
  - 2. Block-outs and other recessed items.
  - 3. Sills and thresholds.
  - 4. Grout: Specified in Section 04 05 13.
- B. Closure between hoistway frames and Cast-in-Place Concrete shaft walls:
  - 1. Fill with concrete: Specified in Section 03 31 10.

### **3.4 DEMONSTRATION**

- A. Assist BNL in inspection and certificating of elevator.
- B. Ensure that control systems and operating devices are functioning properly and conform with locally adopted codes.
- C. Elevator manufacturer shall make a final check of each elevator operation with BNL's representative prior to turning each elevator over for use.

**END OF SECTION**



**SECTION 14 24 43**  
**HYDRAULIC ELEVATORS - SERVICE**

**PART 1 - GENERAL**

**1.1 QUALITY ASSURANCE**

- A. Optional manufacturers are responsible for, at no additional cost to BNL:
  - 1. Costs for dimensional adjustments to fit their elevators to openings.
  - 2. Hoistway inside dimensions or floor to floor heights shall not be changed.
  - 3. Provide or arrange for additional electrical wiring, energy, panels, transformers etc., required to accommodate their elevators.
- B. Applicable Codes and Standards:
  - 1. Comply with Building Codes and Elevator Codes as locally adopted and amended, including but not limited to the following:
    - a. ANSI A117.1, Buildings and Facilities, Providing Accessibility and Usability for Physically Handicapped People.
    - b. ADAAG, Americans with Disabilities Act Accessibility Guidelines.
    - c. Operation and installation standards in conformance with ADA Accessibility Guidelines; 28, CFR, Part 36.
    - d. ANSI/NFPA 70, National Electrical Code.
    - e. ANSI/NFPA 80, Fire Doors and Windows.
    - f. ANSI/UL 10B, Fire Tests of Door Assemblies.
    - g. ASME/ANSI A17.1, Safety Code for Elevators and Escalators:
      - 1) 2007 edition..
    - h. Building Code:
      - 1) New York State Building Code.
    - i. All other local applicable codes.
- C. Seismic Design Parameters:
  - 1. Design and install equipment complying with seismic requirements of Building Code listed above.
- D. Manufacturer Qualifications:
  - 1. Provide elevators manufactured by a firm with a minimum of 10 years experience in fabrication of elevators equivalent to those specified.
- E. Installer Qualifications:
  - 1. Installed by the manufacturer.
  - 2. Permits and Inspections: Provide licenses and permits and perform required inspections and tests.

**1.2 SUBMITTALS**

- A. Shop Drawings:
  - 1. Hoistway Plans and Machine Room Plans and Sections clearly showing the following:
    - a. Structural Loads imposed on building superstructure.
    - b. Clearances and travel of car.
    - c. Hoistway and pit dimensions.
    - d. Location and sizes of access doors, hoistway entrances and frames.
    - e. Car, guide rails, buffers and other components in hoistway.
    - f. Signal and operating fixtures, operating panels and indicators.
    - g. Cab design, dimensions and layout.
    - h. Hoistway-door and frame details.
    - i. Electrical characteristics and connection requirements.

- j. Heat dissipation (BTU) of elevator equipment.
- B. Product data.
- C. Samples:
  - 1. Cab and entrance finishes.
- D. Contract Closeout Information:
  - 1. Operating and maintenance data.
  - 2. BNL instruction report.
  - 3. Warranty.

### **1.3 WARRANTY**

- A. 1-year from Substantial Completion including 1-year Service Contract.
- B. Service Contract:
  - 1. Service frequency: Semi-monthly.
  - 2. Include examination, oiling, greasing, adjustment and repairs as required.
  - 3. Emergency overtime service.

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS**

- A. Acceptable manufacturers:
  - 1. Oil Hydraulic Elevators:
    - a. Base:
      - 1) ThyssenKrupp.
    - b. Optional:
      - 1) Otis Elevator.
      - 2) Schindler Elevator.

### **2.2 GENERAL PARAMETERS**

- A. Quantity of Elevators in this Group: 1.
- B. Elevator Names / Mark Numbers: EL-02.
- C. Elevator operating equipment - General:
  - 1. Oil Hydraulic power unit and cylinder(s).
  - 2. Cylinder Configuration:
    - a. Holed Type: Single, direct-acting cylinder in well hole.
- D. Cab Dimensions (inside clear) and Capacity Rating:
  - 1. 7 FT-4 IN Wide x 9 FT-4 IN Deep, 7000 LBS.
- E. Cab Height:
  - 1. Extended-height Cabs: 115 IN gross; 106-1/2 IN clear (under finished ceiling).Speed:
    - 1. 100 FPM.
- G. Travel: 32 FT\_\_ IN.
- H. Number of Stops: 3.
- I. Hoistway Entrances - General:
  - 1. Quantity (per each elevator):
    - a. Front: 3.
    - b. Rear: None.
  - 2. Door Type:
    - a. Single-speed, opening to the side.
  - 3. Door Opening Width (clear):

- a. 48 IN.
- 4. Door Height (clear):
  - a. 114 IN.

### 2.3 MACHINE ROOM EQUIPMENT

- A. General:
  - 1. Hydraulic system: Compact design suitable for operation under the required pressure.
  - 2. Main Power Supply: 480VAC, 3 Phase, with a separate equipment grounding conductor.
  - 3. Car Lighting Power Supply: 120 VAC, 1 Phase, 15 Amp, 60 Hz.
  - 4. Speed: + 2% of specified speed under any loading condition or direction of travel.
  - 5. Stopping Accuracy:  $\pm 1/4$  IN under any loading condition or direction of travel.
  - 6. Electrical work: Provide necessary wiring to connect parts of equipment.
- B. Power Unit:
  - 1. Mounted in the hydraulic-fluid storage tank.
  - 2. Control valve shall control flow for up and down directions hydraulically and include an integral check valve.
  - 3. Control section including control solenoids shall direct the main valve and control:
    - a. Up and down starting, acceleration, transition from full speed to leveling speed, up and down stops, pressure relief and manual lowering.
    - b. Fully adjustable for maximum smoothness.
  - 4. Include: Muffler, low-pressure switch and a shut-off valve.
  - 5. Mount motor and pump assembly on rubber isolated base.
  - 6. Removable drip pan.
  - 7. Control valve assembly designed to reduce transmission of vibrations and noise to elevator car.
  - 8. Metered bypass, check, relief, and manual lowering valves, and metered lowering and leveling devices.
  - 9. Manual valve for lowering of car when power fails.
- C. Controller:
  - 1. Microprocessor-based control system to perform functions of safe elevator operation.
  - 2. The system shall also perform car and group operational control.
  - 3. Include necessary starting switches, relays, switches, solid-state components and hardware required for car and door operation.
  - 4. Provide 3-phase overload device to protect the motor against overloading.
- D. Provide microprocessor-based control system, which utilizes on-board diagnostics for servicing, trouble-shooting, and adjusting without requiring the use of an outside service tool.
  - 1. If an on-board diagnostic system is not provided, a handheld service tool (or laptop), Owner's license, operation manual, and tool instructions must be provided in addition to the control system.
- E. Manual lowering feature: To permit lowering the elevator at slow speed in the event of power failure or for adjusting purposes.
- F. Miscellaneous options required:
  - 1. Low-oil control.
  - 2. Pressure Switch.

### 2.4 HOISTWAY EQUIPMENT

- A. Hoistway Operating Devices:
  - 1. Emergency stop switch in the pit.
  - 2. Terminal stopping switches.
  - 3. Car positioning vanes.
- B. Plunger(s) and Cylinder(s):
  - 1. General:

- a. Install assemblies plumb to operate freely with minimum friction.
- 2. Cylinder:
  - a. Made of steel pipe of sufficient thickness and suitable for the operating pressure.
  - b. Drip ring to collect any oil seepage as well as an internal guide ring and self-adjusting packing.
- 3. Plunger:
  - a. General:
    - 1) Constructed of select steel tubing or pipe of proper diameter machined true and smooth with a fine polished finish.
    - 2) Stop ring: Welded to plunger to prevent over extension.
- C. Cylinder Protection:
  - 1. Sealed PVC cylinder protection system.
  - 2. Means for monitoring the space between the PVC sleeve and cylinder wall.
  - 3. Means for evacuated of unwanted fluids to prevent such fluids from remaining in contact with the cylinder.
- D. Hydraulic Oil: Hydraulic system shall operate with and be provided with manufacturer's recommended hydraulic fluid.
  - 1. Bio-based hydraulic fluid is preferred.
- E. Guide Rails:
  - 1. Tee-section steel rails with brackets and fasteners.
  - 2. Use heavy-weight rail sections as required to span between structural supports indicated, OR include supplemental steel bracing/sub-frame as required.
- F. Spring Buffer: Helical coil spring type.
- G. Wiring: Wiring for hoistway electrical devices included in scope of the elevator system, hall panels, pit emergency stop switch, and the traveling cable for the elevator car.
- H. Pit Ladders:
  - 1. Coordinate pit ladders per ANSI/ASME-A17.1.
  - 2. Ladders are specified in Section 05 50 10.

## 2.5 HOISTWAY ENTRANCES

- A. General:
  - 1. Fire Label: 1-1/2 HR UL "B" labels.
- B. Frames:
  - 1. Bolted construction for complete one-piece unit assembly.
  - 2. Securely fastened to fixing angles mounted in the hoistway and shall be of 14 GA sheet steel.
  - 3. Material:
    - a. Type 304 Stainless Steel (non-magnetic).
      - 1) Finish:
        - a) #4, Brushed Satin.
- C. Doors:
  - 1. Flush, 16 GA hollow metal construction with vertical internal channel reinforcements and sound deadening material.
  - 2. Material:
    - a. Type 304 Stainless Steel.
      - 1) Finish:
        - a) #4, Brushed Satin.
- D. Sills:
  - 1. Extruded aluminum with slip resistant wearing surface.
  - 2. Supported on steel anchors secured to floor construction.
  - 3. Elevator contractor to provide sill angles as required.

- E. Entrance Markings:
  - 1. Entrance jambs shall be marked with 4 x 4 IN plates having raised floor markings with Braille adjacent.
    - a. Markings shall be provided on both sides of the entrance.
- F. Sight Guards: Finish compatible or matching door frames.
- G. Fascia:
  - 1. Galvanized sheet steel shall be provided at the front of the hoistway.
    - a. Include similarly at rear of hoistway where rear openings where indicated.
  - 2. Include necessary supports, connections and filler pieces.

## **2.6 CAR - GENERAL**

- A. Carframe:
  - 1. Fabricated from formed or structural steel members and adequately braced to support the platform and car enclosures.
  - 2. Roller guides: Rubber tired, spring loaded, adjustable, which engage guide rails.
  - 3. Buffer striking plate on the underside of the car-frame platform must fully compress the spring buffer before the plunger reaches its lower limit of travel.
- B. Elevator Car Platform:
  - 1. All-steel construction with welded steel frame reinforced as necessary.
  - 2. Floor area: Minimum 12 GA sheet steel.
  - 3. Fasten securely to frame and reinforcing members.
  - 4. Isolate platform on rubber pads supported on auxiliary steel frame fastened to car frame
  - 5. Threshold Material: Extruded Aluminum.
- C. Load weighing device:
  - 1. Mounted under the platform.
  - 2. Platform load weighing device set to a predetermined maximum load in car.
  - 3. Car bypasses hall calls when device is actuated.
- D. Exhaust Fan: Mounted on the car top.
- E. Emergency Car Lighting:
  - 1. Emergency power unit employing a 6 volt, sealed rechargeable battery.
  - 2. Purpose: To supply illumination of elevator car and alarm bell in the event of building power failure.
- F. Emergency Pulsating Siren:
  - 1. Mounted on top of the car and activated by Alarm button in the car operating panel.
  - 2. Rated sound pressure level: 80 dba @ 3 M.
- G. Provide 125 VAC, 20A, duplex receptacle with ground-fault interrupter protection connected to same circuit as car lights and fan.
- H. Provide accessibility code items.
- I. Exit Panel:
  - 1. Standard: Hinged, type, non-locking.
  - 2. Coordinate location with ceiling and lighting.

## **2.7 CAB TYPE**

- A. Cab Series, Stainless Steel:
  - 1. Cab Wall Materials and Finishes:
    - a. 14 GA stainless steel sheet:
      - 1) Finish: #4 Satin Brushed.
  - 2. Car Top: Cold rolled steel with hinged exit.

## 2.8 CAB FINISHES

- A. Car Front:
  - 1. 14 GA stainless steel:
    - a. Finish: #4 Satin Brushed.
- B. Car Doors:
  - 1. Match materials and finished indicated for Hoistway Doors (above).
- C. Floor covering:
  - 1. Sheet Rubber SR-1 as specified in Section 09 65 18.
- D. Dropped Ceiling Type:
  - 1. Halogen Downlight:
    - a. Finish:
      - 1) Stainless Steel, #4 Satin brushed.
- E. Metal Handrails:
  - 1. General:
    - a. Locations: 3 walls, (Except: Omit from rear wall where cars are “rear-opening” type).
    - b. Mounting Height: 32 IN above cab floor.
    - c. Material and finish:
      - 1) Stainless Steel, #4 Satin brushed.
  - 2. Profile:
    - a. Flat Solid Metal:
      - 1) Size: 1/4 IN x 6 IN.
- F. Bumper Rail:
  - 1. General:
    - a. Locations: 3 walls, (except: omit from rear wall for rear-opening cabs).
    - b. Mounting Height: 12 IN above cab floor.
    - c. Material and finish:
      - 1) Stainless Steel, #4 Satin brushed.
  - 2. Flat Solid Metal:
    - a. Profile: 1/4 IN x 6 IN.
- G. Protective Pads:
  - 1. Quilted fire retardant protective pads.
  - 2. Include hooks/buttons.

## 2.9 FIXTURES AND DEVICES - GENERAL

- A. Car and Hall Fixtures – Design and Style:
  - 1. Traditional Fixtures:
    - a. Faceplates: Flush-mounted, with square corners.
      - 1) Material and Finish:
        - a) #4 Satin Stainless Steel.
    - b. Indicators: Digital display for floor positions; backlit for directional indication.
    - c. Raised and Braille markings.
    - d. Buttons.

## 2.10 FIXTURES AND DEVICES – HALLS

- A. Hall Call Stations:
  - 1. Located adjacent to hoistway entrance, combining landing buttons and key switches required for elevator operation.
  - 2. Raised markings shall be provided for each push-button.
  - 3. Quantity per landing: 1 centrally located fixture.
  - 4. Configurations:
    - a. Terminal Landings: Provide single button.

- b. Intermediate Landing, UP and DOWN button.
- 5. At main lobby, include a keyswitch for “Car to Lobby”, integrated into Hall Call fixture.
- B. Hall Lantern and Chime:
  - 1. Directional lantern visible from the corridor, located in the hall entrance.
  - 2. When the car stops and the doors are opening, the lantern shall indicate the direction in which the car is to travel and a chime will sound.
- C. Hall Position Indicator:
  - 1. Displays the car’s current floor position.
  - 2. Integrate the features of Hall Position Indicator and Hall Lantern into one fixture.
  - 3. Provide at first floor lobby.
- D. Express Priority Service:
  - 1. Keyswitch Location(s):
    - a. Locate at landings at Floor Levels: 1.
  - 2. Operating Logic:
    - a. Staff use keyswitch to call nearest car in group for immediate response.
    - b. Message indicator in selected car(s) shall inform passengers that the car is responding to special call and that they are required to exit at next stop.
    - c. Upon arrival, doors open for predetermined time and shall be placed in independent service.
    - d. Car to resume normal service when independent service keyswitch is deactivated or preset time period has expired.
    - e. Illuminate signal light while car is responding to priority call and extinguish when car is placed on independent service or returned to normal service.
    - f. Signal light shall remain illuminated until car becomes available for priority service.
    - g. Additional priority calls cannot be initiated until signal light is extinguished.

## **2.11 FIXTURES AND DEVICES - CAR OPERATING PANEL (COP)**

- A. General: Fully integrated unit containing phone, push buttons, key switches, and message indicators for elevator operation including:
- B. Buttons:
  - 1. Individually marked with landings served, “Emergency Call”, “Door Open”, “Door Close”, and other accessories indicated or required.
  - 2. “Emergency Stop” Button.
- C. Switches:
  - 1. “Lights”, “Inspection”, “Fan”, “Independent Service”, and other accessories indicated.
- D. Car Position Indicator: Digital readout, displaying the current position of the car.
- E. Landing Passing Signal: Chime which sounds in the car to notify passenger that the car is either stopping at or passing a floor served by the elevator.
- F. Independent Service: When switch in car is actuated, car operates independently from car buttons only and hall calls are ignored.
- G. Telephone Cabinet:
  - 1. Cover made of same material as wall it is mounted in.
  - 2. Include wiring connected to the car traveling cable.
  - 3. Telephone: Hands-free design complying with ADAAG requirements.
  - 4. Wire to PBX or Lobby Panel (as directed).

## **2.12 DOOR OPERATION**

- A. Door Control Features:
  - 1. Electrically operated, quietly and smoothly operate car and hoistway doors.
    - a. Doors manually operable in emergency.

2. Door control opens doors automatically when car arrives at landings in response to a normal hall or car call.
3. Re-opening Device/Safety:
  - a. Purpose: To stop and reopen the car and hoistway doors automatically should the doorway become obstructed by an object or person.
  - b. Primary Device:
    - 1) 2-dimensional, multi-beam array projecting across the car door opening.
    - 2) Normal Operation:
      - a) Detect object, 1-1/3 IN diameter or larger, between the car doors in the following detection zone; within 1 IN to 71 IN above the sill.
    - 3) Degraded Conditions (one or more blocked or failed beams):
      - a) Detect object, 4 IN diameter or larger, in the same detection zone.
    - 4) If the system performance is degraded to the point that the 4 IN object cannot be detected; maintain the doors in open position, or permit closing only by nudging force conditions.
  - c. Secondary Device:
    - 1) 3-dimensional, triangular infrared multi-beam array projecting across the door opening and extending into the hoistway door zone.
    - 2) Operation: Cause the doors to reopen when it detects a person or object in the area between the hoistway doors or the entryway area adjacent to the hoistway doors.
    - 3) Secondary protection zone: Size varies with door positions.
4. Door nudging operation to occur if doors are prevented from closing for an adjustable period of time.

### 2.13 OPERATION AND LOGIC

- A. General Operating Features:
  1. Independent Service: When switch in car is actuated, car operates independently from car buttons only and hall calls are ignored.
  2. Firefighters' Service Phase I and Phase II: Returns cars to designated floor by means of key operated switch located at a lobby designated by Fire Marshal.
  3. Top of Car Inspection: Disable car when inspection switch is activated.
- B. Simplex Collective Operation (1 car):
  1. General Description:
    - a. Microprocessor-based controller.
    - b. Operation: Automatic by means of the car and hall buttons.
    - c. If calls in the system have been answered, the car shall park at the last landing served.
  2. Operating Logic:
    - a. Momentary pressing of car or hall call buttons automatically starts car (assuming hoistway doors are shut).
    - b. Car stops automatically at first stop for which car or corridor button has been pressed, corresponding to direction in which car is traveling.
    - c. Car stops automatically, in order, at stops for which such stops have been registered.
    - d. Car, when traveling in UP direction, answers UP calls, but passes stops where DOWN calls have been placed (unless DOWN call is at highest stop for which any button has been pressed).
    - e. Pressing UP hall call button when car is traveling downward shall not intercept its travel, unless UP call is at floor for which lowest stop is registered.
    - f. When car has responded to its highest or lowest stop, and calls are registered for opposite direction, travel reverses automatically and answers those calls.
    - g. Should farthest stop in either direction be in response to corridor call, entering passenger at that floor may choose travel direction during predetermined period of time.
    - h. Should both UP and DOWN calls be registered at intermediate floor when car is traveling to floor beyond, reset only call corresponding to direction opposite to that which car is traveling.
    - i. Doors open only when stopping in response to calls.

## **2.14 EMERGENCY POWER OPERATION**

- A. Emergency power operation (manual):
  1. Provide automatic override switching to lower 1 car at a time to lobby on emergency power.
  2. After cars are lowered, select 1 car to operate on emergency power.
  3. Provide manual strip switch on lobby floor panel for individual selection of elevators.
  4. Contact on emergency switchgear to furnish signal through pair No. 12 wires to elevator controller that system is on emergency power.
  5. Manufacturer may attempt to rescue elevators at same time if power requirement in DOWN direction is small enough.

## **2.15 EMERGENCY RETURN OPERATION (SELF-CONTAINED)**

- A. Emergency return operation:
  1. Provide battery powered emergency return device to prevent passengers from being trapped in power outage.
  2. When activated, car will return to Lobby floor and open doors.
  3. Then elevator will shut down and close doors.
  4. Doors will be capable of operation from within car.
  5. Power for emergency return power from suitable batteries automatically maintained at full charge with regulated charging voltage.

## **PART 3 - EXECUTION**

### **3.1 INSPECTION**

- A. Take field dimensions and examine conditions of substrates, supports, and other conditions under which this work is to be performed.
- B. Verify acceptability of machine rooms and shaftway to accept elevator and equipment.
- C. Notify Contractor / Construction Manager of unsatisfactory conditions.
- D. Do not proceed with work until unsatisfactory conditions are corrected.
- E. Start of installation constitutes acceptance of conditions and responsibility for performance.

### **3.2 EXCAVATION OF CYLINDER WELL HOLE**

- A. Cylinder well, including a casing shall be installed.
  1. Coordinate with vapor retarder and waterproofing installation.
- B. Soil Type is unclassified.
  1. Utilize Soils Report, and experience in region to anticipate and include costs of adverse drilling conditions.
  2. Soils Report available on request.

### **3.3 ERECTION**

- A. Erect sills, struts, hanger supports, hanger covers and unit frames, prior to erection of rough walls and set in proper relation to elevator car guides.
- B. Provide protective covering for finished frame and door surfaces.
- C. Projections into Shaftway exceeding 4 IN:
  1. Notify Contractor / Construction Manager where 75 degree bevels are necessary.
  2. GWB bevels: Specified in Section 09 29 00.
- D. Coordinate the installation of pit ladders ensuring that running clearances are maintained, location of ladder is optimal for servicing equipment, and in conformance with locally adopted codes.

### **3.4 GROUTING & CONCRETE FILL**

- A. Fully grout the following:
  - 1. Hoistway entrance frames.
  - 2. Block-outs and other recessed items.
  - 3. Sills and thresholds.
  - 4. Grout:
    - a. Specified in Section 04 05 13.
- B. Closure between hoistway frames and Cast-in-Place Concrete shaft walls:
  - 1. Fill with concrete: Specified in Section 03 31 10.

### **3.5 DEMONSTRATION**

- A. Assist BNL in inspection and certificating of elevator.
- B. Ensure that control systems and operating devices are functioning properly and conform with locally adopted codes.
- C. Elevator manufacturer shall make a final check of each elevator operation with BNL's representative prior to turning each elevator over for use.

**END OF SECTION**

**SECTION 14 43 21**  
**SCISSORS LIFT**

**PART 1 - GENERAL**

**1.1 QUALITY ASSURANCE**

- A. Comply with OSHA, ANSI/HM 14.1, ANSI/HM 30.1, CS202-56 and NEC requirements.
- B. Installer qualifications: Manufacturer or installer authorized by manufacturer.

**1.2 SUBMITTALS**

- A. Contract closeout information:
  - 1. Operating and maintenance data.
  - 2. BNL instruction for equipment systems.
  - 3. Warranty.

**1.3 WARRANTY**

- A. Warrant entire unit for a period of 5 years.
  - 1. Warranty signed jointly by Contractor and manufacturer.

**PART 2 - PRODUCTS**

**2.1 MATERIALS**

- A. Acceptable manufacturers:
  - 1. Scissors Lift (pit-mounted):
    - a. Base:
      - 1) Advance Dock Lift.
    - b. Optional:
      - 1) Blue Giant.
      - 2) ECOA Industrial Products.
      - 3) Pentalift Equipment Corporation.

**2.2 SCISSORS LIFT – PIT-MOUNTED**

- A. General:
  - 1. Hydraulic, pit-mounted, elevating platform with removable guardrails.
  - 2. Platform Size (nominal): 6 x 8 FT.
    - a. Lowered Height: 15 IN.
    - b. Vertical Travel: 58 IN.
    - c. Raised Height: 73 IN.
  - 3. Rated Lifting Capacity:
    - a. 8,000 LBS.
  - 4. Operating Speed: 10 FT/Minute.
  - 5. Finish:
    - a. A baked-on enamel paint finish.
    - b. Color: To be selected by Architect.
    - c. 2 IN black and yellow safety markings on toe guards.
  - 6. Lifetime lubricated bearings.
  - 7. 100,000 PSI, Chrome-plated axels and pins.
  - 8. Flow control per ANSI to limit downward travel speed in the event of a line failure.
  - 9. Base Product: “#3200” by Advance.

- B. Platform:
  - 1. Material: Safety tread steel platform with minimum 8 IN beveled toe guards.
  - 2. Electric toe-guard sensors.
- C. Night locks:
  - 1. Manufacturer's standard mechanical locking device for nighttime use.
  - 2. Locate on all 4 corners.
- D. Hinged steel bridge plate:
  - 1. 1/4 IN thick, checkered plate.
  - 2. Depth: 12 IN.
  - 3. Width: Same width as platform.
- E. Controls:
  - 1. Platform-mounted controls:
    - a. NEMA 4 weatherproof pendant push button control.
    - b. 20 FT coil cord and quick connect receptacle located on side rail of platform.
- F. Remote Power Unit (pre-wired assembly):
  - 1. 5-HP, 480VAC 3PH continuous duty power unit.
  - 2. NEMA 12 UL-approved controller assembly with 24 Volt 4 AMP control circuit.
  - 3. Magnetic motor starter and 24-volt control transformer.
  - 4. Steel oil reservoir.
- G. Include, and install all of the following:
  - 1. Steel edge angles for embedment at perimeter of pit.
    - a. Size: 3 x 3 x 1/4 IN by length required.
  - 2. 3 IN conduit from scissors lift to power unit.
  - 3. Required amount of hydraulic fluid.
    - a. Type as recommended by lift manufacturer.
  - 4. Anchor bolts, fasteners, and shims as required.
- H. Dock Bumpers:

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Verify suitability of substrate and opening to accept installation.
  - 1. Correct unsatisfactory conditions.
  - 2. Installation constitutes acceptance of responsibility for performance.

### **3.2 INSTALLATION**

- A. Install so unit in full lowered position is level with loading dock surface.
- B. Install in accord with manufacturer's instructions.
- C. Shim as necessary; weld into pit.
- D. Adjust for safe, efficient operation.
- E. Restore marred or abraded surfaces.
- F. Coordinate electric hook-up with Electrical Specification Divisions.

### **3.3 INSPECTION**

- A. Manufacturer's representative shall install equipment and confirm that it is accordance with approved shop drawings and manufacturer's recommendations.
  - 1. Test to ensure proper operation.
    - a. Test lift operation and vertical travel limits to comply with specified requirements.

- b. Test emergency stop mechanism.
  2. Require that all connections and adjustments necessary to assure proper operation of lifts be made.
  3. Before acceptance, a demonstration shall be conducted in the presence of the BNL's representative that all lifts operate properly in every respect.
- B. User/Operator Training:
1. Conducted at time and place agreed upon by BNL.

**END OF SECTION**

