

## SECTION 15130

### PUMPING EQUIPMENT

#### PART 1 GENERAL

##### 1.1 SUMMARY

###### A. Scope

1. Provide pumping equipment as shown, scheduled or specified, complete with components and accessories necessary for fully functional operating systems.

###### B. Related Work Specified Under Other Sections

1. Division 15 Section "General Mechanical Requirements."
2. Division 15 Section "Aboveground Piping Systems."
3. Division 15 Section "Valves."
4. Division 15 Section "Piping Specialties."
5. Division 15 Section "Atmospheric Cooling Equipment."
6. Division 13 Sections for Instrumentation and Control Work.
7. Division 16 Sections for Electrical Work.
8. Division 09 Sections for Finish Field Painting.

##### 1.2 QUALITY ASSURANCE

###### A. Installation Supervisor

1. Include the services of a competent engineer to supervise the installation, and at a later date, test and provide technical assistance and instructions with reference to the operation and maintenance of the pumps. The number of days included shall be adequate to cover the installation, test and operation.

###### B. Vibration Control Design

1. Under installed, operating conditions, equipment and piping vibration measured at specified or approved points in mils peak-to-peak displacement or velocity in inches/second shall not exceed the following:
  - a. Limits specified in the latest edition of the ASHRAE Handbook: HVAC Applications, Sound and Vibration Control Section.
  - b. Limits for motors shall be per NEMA MG-1 standards.

###### C. Noise Control Design

1. Under installed, operating conditions, equipment and piping vibration measured at specified or approved points in mils peak-to-peak displacement or velocity in inches/second shall not exceed the following:
  - a. Limits specified under specific equipment.
  - b. Limits specified in the latest edition of the ASHRAE Handbook: HVAC Applications, Sound and Vibration Control Section.
  - c. Limits for motors shall be per NEMA MG-1 standards.

- d. Refer to Division 15 Section “General Mechanical Requirements” for other specific noise criteria.

### 1.3 SUBMITTALS

- A. Furnish submittals for items that are identified in this SECTION by a different typeface and a bracketed code (e.g., *Item [L]*). Refer to Division 01 Section “Shop Drawings, Product Data And Samples” for definition of codes for types of submittals and the administrative requirements governing submittal procedure. Additional submittal requirements pertaining to this SECTION are specified herein under this Article.
- B. Shop drawings for pumping equipment shall include curves, exact selection points, exact impeller diameters, cuts, statements, calculation and data sheets required to verify or clarify the manufacturer’s conformance to requirements specified. Provide sound pressure levels for each pump assemblage, list on attached shop drawing submittal form. Where not otherwise specified, provide manufacturer’s “installed” vibration limits in mils, peak-to-peak displacement, based on  $G=0.05AF/2$ . Include:
  - 1. Plan and elevation views showing dimensions and details required for installation, including anchor bolt locations and total weight of unit assemblage.
  - 2. Selected views as required to describe accessories and show required connections and dimensions.
  - 3. Electrical system and instrumentation connections for packaged self-contained equipment.
  - 4. Piping system connections.
- C. For each pump, include materials, performance curves, sizes, catalog data and other data necessary to verify compliance with CONTRACT DOCUMENTS.
- D. Test reports. Provide as described under “QUALITY ASSURANCE”.

### 1.4 OPERATION AND MAINTENANCE DATA

- A. Provide installation, operation, lubrication and maintenance instructions and spare parts data manuals, per Division 01 Section “Operating and Maintenance Data.”
- B. For packaged self-contained equipment furnish complete sets of instruction books with depth of coverage sufficient for OWNER personnel training and operational use. Include description and an installation man-hours estimate of items shipped loose for field installation. If CONTRACTOR is required to provide supplementary materials, identify same.
- C. Include on standard forms from the vibration test equipment manufacturer, for each equipment item tested, dated copies of equipment vibration levels with tabulation of readings, points and direction read to reflect equipment data at the time of acceptance. Provide complete data of test equipment used.
- D. Provide one complete set of special tools as recommended by the manufacturer for field maintenance. Tools shall be contained in a locked toolbox and four keys shall be provided.

## PART 2 PRODUCTS

### 2.1 CENTRIFUGAL PUMPS

#### A. General

1. Pumps shall be per Standards of the Hydraulic Institute and the requirements specified herein except as otherwise specified for specific pumps.
  - a. Base nonoverloading characteristics for pumps upon nameplate horsepower, at any point on performance curve.
  - b. Required NPSH less than available NPSH by not less than 3 feet.
  - c. Maximum impeller diameter not greater than 90% of maximum published diameter for a given casing and not smaller than smallest published diameter for casing. Do not base acceptable maximum diameter calculation on percentage of impeller diameter range for a given casing.
  - d. Proposed pump efficiency not less than that scheduled.
  - e. Pump speed limited to 1800 RPM except as specified.
  - f. Select at the point of maximum efficiency for a given impeller-casing combination. Deviations within 3% of maximum efficiency on the increasing capacity side of the maximum efficiency point and 3% on the decreasing capacity side of the maximum efficiency point are permissible.
  - g. High efficiency motor shall be per Section 15050 General Mechanical Requirements.

#### B. Selection

1. *Centrifugal split case pumps [D,P]*: Manufacturer's standard pumps per minimum requirements specified herein. Units shall be horizontal, single-stage, double suction, single or double volute, base mounted centrifugal type.
  - a. Peerless Series AE.
  - b. ITT Goulds 3400 Series.

#### C. Construction

1. Casing. Cast iron with a design working pressure of not less than 185 PSIG at 100 degF. Piping connections in sizes 2 inches and larger shall be flanged per ANSI B16.1. Furnish casing with tapped openings for air venting, priming, draining and for suction and discharge gages. Construct casing so that seals are convertible from mechanical to packing service without machining of casing.
2. Wearing Rings. Provide in every pump case and on impellers larger than 7 inches diameter.
3. Impellers. Enclosed, cast bronze, with smooth waterways, keyed to shaft in a fixed axial position by means of lock nuts. Comply with maximum and minimum diameter requirements. Protect impeller against damage due to reverse rotation.
4. Shaft:
  - a. For mechanical seal (water) service, provide solid AISI 300 Series stainless steel shaft. Construct shaft to prevent seal or bearing failure due to vibration. Set first critical speed at least 25% above operating speed but not less than 4000 RPM. Total shaft peak-to-peak dynamic deflection measured by vibrometer at pump seal face not to exceed 2.0 mils under shut-off head operating conditions. Fit with bronze or nylon

- water slingers at each bearing and seal at casing interface with a small clearance bronze throttling bushing.
5. *Mechanical Seals [D]*: Balanced or unbalanced, requiring no shaft or sleeve shoulder. AISI 18-8 stainless steel trim. Tungsten carbide to tungsten carbide or to silicon carbide stationary and rotating contacting surfaces. EPT or equivalent elastomer.
    - a. John Crane Packing Co..
    - b. Durametallic Corp.
    - c. Advanced Sealing Technology, Inc.
  6. Pump manufacturer shall provide seal chamber flushing water at a pressure, at bushing clearance flow rate, sufficient to satisfy seal lubrication and heat rejection requirements.
  7. Centrifugal Abrasives Separators. Pump “Mechanical Seals” shall be flushed with pump discharge water cleansed by centrifugal force in a cyclone abrasives separator. Separator shall be constructed of AISI Type 316 stainless steel. Pipe underflow to hub outlet or other visible point of discharge.
    - a. Durametallic Corp..
    - b. John Crane Packing Co.
    - c. Advanced Sealing Technology, Inc.
  8. Bearings and Lubrication.
    - a. Heavy duty ball or roller type with provisions for the mechanical and hydraulic radial and thrust loads imposed by any normal service condition. Manufactured from vacuum degassed or processed alloy steel and made in U.S.A. Certified L-10 rated life of not less than 30,000 hours or an average life of 150,000 hours. Provide oil-flood lubricated bearings with oil sumps fitted with 4 ounce constant level sight oilers and positive means of sump drainage and condensate detection. Include spring loaded brass plug cocks connected to lowest part of bearing sump. Bearing housings shall be cast iron, self-aligning on metal to metal surfaces and shall totally enclose bearings.
    - b. Heavy duty ball or roller type with provisions for the mechanical and hydraulic radial and thrust loads imposed by any normal service condition. Manufactured from vacuum degassed or processed alloy steel and made in U.S.A. Certified L-10 rated life of not less than 30,000 hours or an average life of 150,000 hours. Grease lubricated, provided with surface ball type grease supply fittings and with grease relief fittings located at bottom of bearing.
  9. *Flexible Coupling [D]*: Pump shaft shall be connected to the motor shaft through a flexible coupling. The flexible member shall be a tire shape, in shear, or a solid mass serrated edge disc shape, made of polymer materials suitable for constant or variable speed operation, as Scheduled, and retained by fixed flanges. Flexible coupling shall act as a dielectric connector and shall not transmit sound, vibration or end thrust.
    - a. Dodge “Paraflex”.
    - b. Falk “Torus”.
    - c. Kop-Flex “Elastomeric”.
    - d. T. B. Woods “Sureflex”.
  10. Bedplate. Mount pump and driver on a common bedplate, which shall be hollow cast iron, multi-ribbed for maximum rigidity, with grout holes, grout air vents, drip rim and drain tapping. In lieu of cast iron, bedplate may be a fabricated steel base constructed of a rolled structural steel perimeter frame, reinforced and cross braced internally with pipe or rolled

structural members, capped with 3/8 or 1/2 inch steel plate and provided with grout holes, grout air vents, drip rim or sloped collection chamber construction and drain tapping. Formed or bent steel bedplates are not acceptable.

11. Balancing. Statically and dynamically balance impellers and rotating element, if necessary to comply with specified limits.
12. Guard. Per the applicable requirements of the Occupational Safety and Health Act (OSHA). Enclose coupling and rotating components. Use angle iron frame and enclosing 18 gage sheet steel. Secure in place to be easily removable for access.
13. Nameplates. In addition to standard nameplate data, furnish the following data, modified as necessary, on a 1/16 inch thick brass, deeply stamped, separate nameplate or manufacturer's standard, but extra large nameplate, attached to pump base. Manufacturer's pump serial number; OEM model number of each bearing; recommended lubricant; OEM gasket type and thickness for casing joints and bearing cap cover; OEM mechanical seal identification.

## 2.2 LINE MOUNTED PUMPS

1. *TYPE A [D,P]*: Single stage, end suction centrifugal line-mounted pump. With casing and seal suitable for operating at pressures up to 125 PSI at temperatures to 250 degF, bronze or stainless steel fitted, AISI 300 Series stainless steel or the manufacturer's standard alloy steel pump shaft with nonferrous sleeve. Couplings shall be elastomer-in-shear type or four-spring type. Provide mechanical seals designed for service with water normal to the system. Bearings shall be permanently lubricated.
  - a. Aurora Pump.
  - b. American Marsh.
  - c. Bell and Gossett.
  - d. Grundfos.
  - e. Taco.

## 2.3 CONDENSATE RETURN UNIT

- A. *Condensate Return Unit [D,P]*: Close-coupled Centrifugal, duplex packaged self-contained unit, with automatic controls including starter and alternator which will automatically transfer the operation from one pump to the other, and will also operate both pumps in the event of abnormal conditions. Pumps designed to operate at 209 degF without vapor binding and without cavitation under system operating conditions. The only acceptable means of rectification of cavitation shall be by replacement of entire pump assembly. Furnish cast iron or steel receivers with a mechanical alternating float switch, seamless copper float, gauge glass, strainer on the return inlet, and dial thermometer. Furnish receiver with capability to withstand an internal pressure of 50 PSIG and sized for capacity as Scheduled.
  1. American Marsh Pumps, Inc. Type CV.
  2. Domestic Pump Company, Type CB.
  3. Roth Pump Co.

## 2.4 SUMP PUMP

### A. General

1. *Sump Pump [D,P]*: Packaged duplex non-clog wastewater lift station shall include: submersible pumps; discharge connection; guide bars (3 inch Schedule 40 galvanized pipe); upper guide bracket; cable holder; liquid level sensors; control panel; intercomponent piping and wiring; pump lift chains; chain hook.

### B. Pump

1. *Pump [D,P]*: Totally submersible, sewage type with a 460 volt, 3 phase, 60 Hertz motor and supplied with a mating cast iron discharge connection. Pump capacity shall be as indicated.
  - a. Flygt Model CP-3085-MT.
  - b. Hydromatic.

### C. Controls

1. Control panel to be NEMA 12 dead front enclosure containing combination starter, with fused disconnect switch, selector switch, control circuit transformer, 120 volt, 60 watt marine type alarm light mounted on top of panel and wired thru control circuit breaker, audible alarm horn with silencing push button, terminal blocks, necessary intercomponent wiring.
2. Provide a high-water alarm switch complete with actuating mechanism for operation on an electrical circuit other than the pump motor circuit. Design switch to operate indicated and specified alarm devices whenever a predetermined high water level is reached in the sump because of pump failure or fluid inflow that exceeds the capacity of pump.
3. Manufacturers:
  - a. *Control panel [D]*:
    - 1) Flygt Model FMC-200.
    - 2) Hydromatic Q Panel.
  - b. *Level controls [D,P]*:
    - 1) Flygt Model ENH-10.
    - 2) Hydromatic.

### D. Lift station galvanized steel guide rail system shall include:

1. Upper bracket.
2. Chain hook.
3. Cable holder.
4. Anchor bolts.
5. Lifting chain.
6. Guide bars.

## PART 3 EXECUTION

### 3.1 INSTALLATION AND RUN-IN

- A. Perform installation and related WORK under the direction of an authorized representative of the manufacturer.
- B. Pumps mounted on concrete bases or foundation shall be grouted in place in accordance with manufacturers instructions.
- C. Provide pump discharge check valves as specified under Division 15 Section “Valves”, SPECIAL SERVICE VALVES. Install check valves in horizontal position, not in vertical.
- D. Perform field run-in under the direction of an authorized representative of the manufacturer who shall inspect, make critical adjustments, start-up and run-in each pump after installation, to verify a complete, properly functioning, installation with capacity as scheduled.
- E. In addition to manufacturer’s requirements, the authorized representative shall:
  - 1. Instruct CONTRACTOR to check for correct direction of motor rotation only after system is full of operating liquid.
  - 2. Verify that pump casing is free of any external piping loads when piping is full of operating liquid and that installation is correct.
  - 3. Verify that alignment of centrifugal pumps and motors is within 50% of manufacturer’s maximum allowable limits, but in no case shall angularity exceed 1/2 degree and parallel misalignment exceed 0.002 inch.
  - 4. Verify correct functioning and adjustments of pump controls.
  - 5. Provide the services of an authorized representative of the manufacturer for start-up and personnel training.
  - 6. Re-check adjustments after run-in period.
  - 7. Furnish two record copies of adjustments.

### 3.2 FIELD QUALITY CONTROL

- A. Shop Tests
  - 1. Perform manufacturer’s standard shop tests for each component to ensure compliance with intent of these SPECIFICATIONS.
- B. Field Start-Up Vibration Test
  - 1. At time of start-up, the manufacturer’s qualified, authorized representative, shall test, with a certified, calibrated vibrometer, readable to 0.0001 inch displacement, rotating machinery and deliver two copies of readings. Readings shall be taken in the presence of the ARCHITECT-ENGINEER.
  - 2. Test motors for vibration in excess of NEMA prescribed standard limits or manufacturer’s more stringent limits.
  - 3. Test pumps for vibration within specified limits under shut-off head and design capacity operation.

4. Immediately replace any faulty bearing and rectify any other cause of vibration to bring equipment into compliance with the CONTRACT DOCUMENTS.

C. Field Tests During Guarantee Period

1. GENERAL

- a. If the testing or retesting of the unit furnished should indicate failure to meet the requirements of the CONTRACT DOCUMENTS, provide whatever additions, modifications or replacements may be necessary to provide a unit which fully conforms to these performance requirements. Repair work shall be scheduled at a time convenient to the facility being served.
- b. Testing to determine compliance or lack of compliance with requirements of CONTRACT DOCUMENTS shall be performed per the following:
  - 1) Testing procedures for items not delineated in CONTRACT DOCUMENTS, shall be mutually agreed upon, in writing, prior to start of testing.
  - 2) Test procedure participant's costs shall be borne by:
    - c. OWNER if compliance is verified.
    - d. The CONTRACTOR if testing indicates failure to comply.
- e. Testing will be performed in the presence of the ARCHITECT-ENGINEER.

2. EQUIPMENT VIBRATION

- a. In the event that ARCHITECT-ENGINEER determines that testing is required, specified limits of vibration shall be verified under operating conditions by an independent equipment and testing source.
- b. Entek IRD.
- c. Other approved.

3. PERFORMANCE TESTING

- a. In the event that ARCHITECT-ENGINEER determines that testing is required, the test procedures of the Hydraulic Institute shall be utilized.

END OF SECTION

Revision History	
Date	Rev. No.
A	0
B	0
C	0
D	0
E	0
F	0
02-19-09	0

LMS/djo

Y:\d\timdatasf\BROOKHAVEN\_NATIONAL\_LABORATORY\SF070003\200-PROJEXEC\280-SPEC\15130.doc