

# HEX Superconducting Wiggler

## Statement of Work (Abbreviated Version)

QA Category: A-2

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## Definitions/Acronyms

ABL	As-Built List
ATP	Acceptance Test Procedure
ASME	American Society of Mechanical Engineers
BNL	Brookhaven National Laboratory
BSA	Brookhaven Science Associates
CAD	Computer Aided Design
CDR	Conceptual Design Review
EPICS	Experimental Physics and Industrial Control System
EPS	Equipment Protection System
ESH	Environment, Safety, and Health
FAT	Factory Acceptance Test
FDR	Final Design Review
LHe	Liquid Helium
LN2	Liquid Nitrogen
LSZH-FR	Low-Smoke, Zero Halogen-Fire Retardant
MRB	Material Review Board
MRP	Material Requirements Planning
NFPA	National Fire Protection Association
NRTL	Nationally Recognized Test Lab
NSLS-II	National Synchrotron Light Source II
PDR	Preliminary Design Review
QA	Quality Assurance
SR	Storage Ring
HEX	High Energy X-ray Diffraction
SOW	Statement Of Work
SCW	Superconducting Wiggler
UL	Underwriters Laboratories
VDCT	Visual Database Configuration Tool

## 1 INTRODUCTION AND OVERVIEW

### 1.1 Background

The HEX-SCW described in this document, hereafter referred to as “the Equipment,” will be used as a vital part of the HEX beamlines ensuring that the X-ray beam at the end stations meets the requirements of the scientific experiments to be performed.

### 1.2 Scope

This Statement of Work (SOW) is the basis for the procurement of the Equipment, which will be used for the High Energy X-ray Diffraction (HEX) beamlines at the National Synchrotron Light Source II (NSLS-II) at Brookhaven National Laboratory (BNL). This SOW outlines the Contractor’s responsibilities and obligations necessary for completing the requirements as set forth herein.

## 2 REFERENCES

The following documents are an integral part of this SOW; the applicable revision level will be the latest that is in effect at the time of award:

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Document Number	Document Title
10CFR851	Worker Safety and Health Program
ASME B30.26	Rigging Hardware
ASME BTH-1	Design of Below-the-Hook Lifting Devices, Design Category “A”
ASME Y14.5M	Dimensioning and Tolerancing: Engineering Drawing and Related Documentation Practices
BNL-QA-101	BNL Supplier Quality Assurance Requirements
IEEE 1202	IEEE Standard for Flame-Propagation Testing of Wire and Cable
NX-C-HEX-SPC-SCW-001	Technical Specification for the HEX superconducting wiggler, henceforth referred to as “the Specification.”
LT-ENG-RSI-STD-002	NSLS-II Nomenclature Standard
NFPA 70	National Electrical Code <a href="http://www.nfpa.org/aboutthecodes/AboutTheCodes.asp?DocNum=70">http://www.nfpa.org/aboutthecodes/AboutTheCodes.asp?DocNum=70</a>
UL 508	Industrial Control Equipment

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### 2.1 Conflicts

In the event of a conflict between the Specification and the SOW, the Contractor shall immediately notify the BSA contractual representative. Failure to notify the BSA contractual representative of a document conflict shall not relieve the Contractor’s responsibility to ensure full compliance with all requirements.

## 3 REQUIREMENTS

In accordance with the applicable specifications, referenced documents, and instructions as defined in this SOW, the Contractor shall be responsible for the design, engineering, purchase of all materials, manufacturing, assembly, testing, and delivery of the Equipment.

## 3.1 Contractor Responsibilities

### 3.1.1 Technical Performance

In accordance with the Specification document and all referenced documents, the Contractor shall design, engineer, manufacture and assemble the Equipment.

### 3.1.2 Tools/Fixtures/Test Equipment

The Contractor shall be responsible for supplying all materials, including (but not limited to) the construction of all tools, jigs, fixtures, and test equipment required to complete the manufacture and installation of Equipment.

### 3.1.3 Spare Parts/Special Tools

The Contractor must identify the critical components with the shortest life, if they exist and deliver enough spare parts for the first life cycle as a minimum.

### 3.1.4 Training

The Contractor shall provide hands-on training by project-experienced personnel for three (3) BSA personnel for the safe operation and maintenance of the Equipment.

## 3.2 Design and Manufacturing Requirements

### 3.2.1 Detailed Design Requirements

#### 3.2.1.1 *Conceptual Design Review (CDR) Report*

The Contractor shall be responsible for providing a CDR report that reflects the state of the developed design. The CDR report shall consist of the following items to be addressed in detail and supported by preliminary calculations that shall be presented at the CDR for review and approval.

All magnetic computation shall be performed using RADIA or Opera 3D, or a similar software package subject to review and approval in writing by BSA; the analysis source files shall be provided to BSA. Field analysis shall be provided to BSA at the conceptual design review.

The Contractor shall provide a 2D plan or block 3D model of the equipment, showing the Contractor's proposed component designs. All drawings shall be to scale, and include sufficient dimensional detail (e.g., overall height, width, length, interface details, beam height and any deflections, etc.) to confirm fit within the straight section. Note that in all drawings and models the beam direction shall go from Left to Right.

#### 3.2.1.2 *Preliminary Design Review (PDR) Report*

The Contractor shall be responsible for providing a PDR report that reflects the state of the developed design. The PDR report shall consist of the following items to be addressed in detail and supported by preliminary calculations that shall be presented at the PDR review meeting for discussion and approval.

All vibration, thermal and stress analyses shall be performed using the ANSYS program, or equivalent. Analysis files shall be provided to BSA at the preliminary design review.

The Contractor shall provide 2D plan and elevation drawings of the Equipment (on the basis of the specification), showing the Contractor's proposed component designs. All drawings shall be to scale, and include sufficient dimensional detail (e.g., overall height, width, length, interface details, beam height and any deflections, etc.) to confirm fit within the straight section, and component magnetic center locations. Note that in all drawings and models the beam direction shall go from Left to Right. A final version of the PDR report shall be submitted to BSA which includes the minutes and agreed-to changes as described in section 3.3.5.2. These minutes shall include:

- PDR comments and notes taken during the PDR meeting
- All items that require further resolution with details added explaining how these items will be acceptably resolved.

The final PDR report shall be reviewed and approved by BSA in writing before it can be considered complete.

#### 3.2.1.3 *Final Design Review (FDR) Report*

3.2.1.4 The Contractor shall be responsible for providing a FDR report that reflects the state of the developed design as it evolved from the PDR. The Contractor shall be responsible for developing the overall design of the Equipment in accordance with the applicable specifications and supporting documents as identified herein. The FDR will include a safety review of the designs and all recommendations of the review committee shall be implemented in the final designs. Approval to Proceed

### 3.2.2 **Integration of BNL supplied/specified equipment**

The following items will be supplied or specified to the Contractor by BNL in order to maintain compatibility with NSLS-II standards across the facility:

- All required vacuum pumps, valves and gauges and associated control and power units
- All control racks
- An EPICS based control system development environment and the interface components
- Power supplies, quench protection system and their sensors.
- Cryogen level meters.

BNL reserves the right to recommend other particular components.

### 3.2.3 **Acceptance Test Procedure**

The Contractor shall provide an ATP that is in accordance with this SOW, the specification, and all reference documents noted herein. The ATP must be approved by BSA in writing prior to use. The ATP shall ensure that all test requirements as defined in the Specification are achieved.

### **3.2.4 Detailed Manufacturing, Testing, and Commissioning Requirements**

*3.2.4.1 Factory Acceptance Test*

*3.2.4.2 Site Acceptance Test`*

*3.2.4.3 Final Acceptance Test*

### **3.3 Management**

**3.3.1 Program Plan**

**3.3.2 Progress Teleconference**

**3.3.3 Manufacturing / Test Plan**

**3.3.4 Performance Reporting**

**3.3.5 Design Reviews**

*3.3.5.1 Conceptual Design Review Technical Meeting*

*3.3.5.2 Preliminary Design Review Meeting.*

*3.3.5.3 Final Design Review Meeting*

### **3.4 Documentation and Data Management**

**3.4.1 General Documentation Requirements**

**3.4.2 Drawing and Model File Format Requirements**

**3.4.3 End Item Documentation**

### **3.5 Configuration Management**

### **3.6 Software Requirements**

### **3.7 Environment, Safety and Health (ES&H)**

**3.7.1 Fire Safety**

**3.7.2 Attachment Points and Lifting Fixtures**

### **Marking and Serialization**

### **3.8 Warranty**

### **3.9 Packaging**

## 4 QUALITY ASSURANCE

### 4.1 Quality Assurance Requirements

### 4.2 Material Review Board (MRB) Authority

### 4.3 QA Flow-Down

## 5 SCHEDULE / MILESTONES

The following schedule is for planning purposes only. Schedule requirements as set forth in the contract will take precedence.

### SCHEDULE IN WEEKS AFTER AWARD OF CONTRACT

Conceptual Design Review	3
Preliminary Design Review	12
Final Design Review	26
Factory Acceptance Test	66
Receipt of Equipment at BNL	72
Training Completed at BNL	75
Installation, Commissioning and Tests in the ring without beam	TBD
Final Acceptance Tests in the ring with beam	TBD

## 6 DELIVERABLES

The Contractor shall supply the following:

Item	Deliverable	Due	Approval Required
1	Program Plan	2 weeks after award of contract	Yes
2	Technical & Progress Teleconference	2 weeks after award/bi-weekly thereafter	No
3	Performance Reports	5 <sup>th</sup> of each month	Yes
4	Manufacturing / Inspection / Test Plan for Magnets	At the PDR	Yes
5	Manufacturing / Inspection / Test Plan for Mechanics	At the FDR	Yes
6	Draft Conceptual Design Review Report	2 working days prior to CDR	Yes
7	Conceptual Design Review Report and CDR Minutes	5 working days after CDR	Yes
8	Draft Preliminary Design Review Report	10 working days prior to PDR	Yes
9	Preliminary Design Review Report and PDR Minutes	10 working days after PDR	Yes
10	Draft Final Design Review Report	10 working days prior to FDR	Yes
11	Final Design Review Report and FDR Minutes	10 working days after FDR	Yes
12	Acceptance Test Report and test Certificates	14 calendar days after completion of FAT and prior to shipment of equipment	Yes
13	Delivery of Equipment and Spares at BNL	As set forth in contract	Yes
14	End Item documentation package	With the Equipment delivery	Yes

## 7 VALUE ENGINEERING

The Contractor is encouraged to make recommendations for changes that might lead to an improvement in performance, reliability, quality, safety, or reduction in cost. Simplicity in operation, ease of maintenance, and an improvement in the performance and reliability of the specific functions beyond the requirements of the specification are objectives which shall be considered in the production of each component type. Where it appears a substantial improvement in simplicity of design, performance, ease of maintenance or reliability will result from the use of materials, parts and processes other than those specified, it is desirable that their use be investigated. When investigations point to advantages that may be realized, the recommendation for change shall be presented to BSA for review and, if approved, authorized in writing. An equitable agreement will be negotiated between BSA and the Contractor to share the savings of any recommended change that is approved and implemented.