National Compact Stellarator Experiment (NCSX)

Toroidal Field Coil Conductor

Statement of Work

NCSX-SOW-131-01-00

May 20, 2004

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Controlled Document

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Check the NCSX Engineering Web prior to use to assure that this document is current.

Revisions

Revision No.	Description of Change	Date
0	Initial Issue	5/20/2005

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1 SCOPE

1.1 Scope

This Statement of Work is for the production and delivery of the extruded copper conductor for a complete set of Toroidal Field (TF) Coils (18 coils) and one spare for the National Compact Stellarator Experiment (NCSX). The technical specification for a spool of conductor is provided in product specification NCSX-CSPEC-131-02. Each coil requires 4 spools plus one spool extra provided for brazing development for a total procurement of 77 spools. The due dates for all deliverables are defined in the Subcontract.

1.2 Background

NCSX is the first of a new class of stellarators known as "compact stellarators." Stellarators are a class of magnetic fusion confinement devices characterized by three-dimensional magnetic fields and plasma shapes and are the best-developed class of magnetic fusion devices after the tokamak. The stellarator concept has greatly advanced since its invention by Dr. Lyman Spitzer, the founding director of the Princeton Plasma Physics Laboratory (PPPL), during the 1950's. Improved fundamental understanding coupled with advanced parallel computers has enabled the design of practical stellarators, optimized for plasma confinement and stability but with an aspect ratio similar to tokamaks. The NCSX design used this capability to combine the best features of both stellarators and tokamaks, providing solutions to the challenges of fusion plasma confinement.

The NCSX project is managed by PPPL in partnership with the Oak Ridge National Laboratory. This Subcontract will be administered by PPPL. Operation of NCSX is scheduled to begin in May 2008. Further description of the NCSX can be found at:

http://ncsx.pppl.gov/

2 APPLICABLE DOCUMENTS

2.1 Product Specification

The product specification NCSX-CSPEC-131-02 in the following folder under file name NCSX-CSPEC-131-02-XX-signed.pdf

ftp://ftp.pppl.gov/pub/ncsx/manuf/TF-Conductor/

3 WORK REQUIREMENTS

3.1 Manufacture, Inspection, Test Plan

The Subcontractor shall submit a Manufacturing, Inspection, and Test (MIT) Plan that describes the process flow and identifies in the process flow the inspections and tests (required per the product specification NCSX-CSPEC-131-02) that will be performed. The MIT Plan shall be approved by PPPL prior to the start of conductor manufacture.

3.2 Shipping Container

Description, text, drawing or both, of the Subcontractor's proposed shipping container shall be provided for PPPL approval.

3.3 Copper Conductor

The Subcontractor shall manufacture, inspect, test and deliver to PPPL 77 spools of copper conductor that conform to the product specification NCSX-CSPEC-131-02.

3.4 Process Documentation

The Subcontractor shall provide all process documentation identified in Section 5 of this SOW

4 QUALITY ASSURANCE

4.1 Subcontractor's Quality Assurance Program

The Subcontractor shall maintain an effective Quality Assurance Program to assure that the Subcontractor's work meets the required quality and is performed in accordance with contractual requirements. Subcontractor's quality assurance function shall be actively involved in the planning, processing oversight, problem resolution, and determination of acceptability of all work under this SOW. The function shall be organized to have sufficient authority and independence to identify quality problems, verify conformance of supplied items or services to specified requirements and obtain satisfactory resolution of conflicts involving quality.

4.2 **Inspection/ Surveillance/Audit by PPPL**

Authorized representatives of PPPL and the U. S. Government shall have the right at all reasonable times to visit the Subcontractor's premises and those of Subcontractor's suppliers during the performance of the Subcontract for the purposes of inspection, surveillance, audit and/or obtaining any required information as may be necessary to assure that items or services are being furnished in accordance with specified requirements. Such visits shall be coordinated with the Subcontractor's personnel to minimize interference with the normal operations of said premises. The Subcontractor shall make available records and documentation necessary for this function and shall provide all reasonable facilities and assistance for the safety and convenience of PPPL and/or U. S. Government representatives in the performance of their duties. PPPL and the U. S. Government recognize the Subcontractor's right to withhold information concerning proprietary processes. The Subcontractor agrees to insert the paragraph above in each lower-tier procurement issued hereunder.

4.3 **Subcontractor's Responsibility for Conformance**

Neither PPPL review and/or approval of Subcontractor's documents nor PPPL inspection of Subcontractor's items or services shall relieve the Subcontractor of responsibility for full compliance with requirements of the Subcontract. The Subcontractor is responsible for assuring that all requirements and restrictions are imposed on any sub-tier suppliers.

4.4 **Nonconforming Items**

Nonconforming items shall be positively identified, and, where possible, segregated to prevent use. PPPL must be notified of nonconformances as part of the status reporting. The Subcontractor shall document each nonconformance, identifying the extent and location of the nonconformance and proposing a disposition. The written concurrence of PPPL is required prior to implementing of any disposition to use the item (Use-as-is, Rework, Repair, or similar). The Subcontractor's system shall provide not only for timely resolution of nonconformances but also for analysis of nonconformances to determine root causes and to implement appropriate and effective corrective actions.

4.5 **Subcontractor Inspection and Tests**

Subcontractor inspections and tests shall be performed in accordance with written procedures referencing criteria for acceptance or rejection. Except where specifically stated otherwise, actual data and accept/reject status for each inspection and test shall be documented. Reports

shall clearly identify the item inspected, the locations or areas covered by the report, the performing individual, the date performed, equipment used (with calibration status), and the signature of the authorized individual.

4.6 **Equipment/Material Identification and Status**

Material and equipment identification shall be maintained throughout the program and be traceable to records. Status of acceptability shall be readily discernible through the Subcontractor's use of tags, stamps, serial numbers or other positive means.

4.7 **Calibration of Test and Measuring Equipment**

Inspections and tests shall be performed using properly calibrated measuring and test equipment. Subcontractor shall have in its possession the necessary equipment to perform the required inspections and tests. Calibration standards shall be traceable to the National Institute for Standards and Technology (NIST) or equivalent acceptable to PPPL and shall not be used for shop inspections, but instead be protected against damage or degradation.

4.8 **Control of Special Processes**

Subcontractor shall use trained and qualified personnel and qualified written procedures in accordance with specified requirements for the performance of certain special processes, including but not limited to, dimensional inspection, nondestructive examination, and testing. Copies of special process procedures and personnel qualifications shall be submitted to PPPL for review and approval a minimum of five working days prior to performance of the work.

4.9 **Shipping Release**

Subcontractor shall have a signed "Product Quality Certification and Shipping Release" Form (Attachment 1 of this SOW) prior to NCSX Project acceptance of procured items or services for full or partial shipment. NCSX Project reserves the right to refuse to accept shipments unless accompanied by a signed "Shipping Release Form”. Subcontractor is responsible arranging shipment, and for the safe arrival of the item at PPPL in Princeton, New Jersey, USA. Subcontractor’s name, shipper, purchase order number, contents and gross weight shall be marked on the shipping container

4.10 **PPPL Receiving and Inspection**

PPPL will perform Receiving Inspection on items supplied by Subcontractor. Discrepant items or services will be rejected and returned to the Subcontractor.

5 DOCUMENTATION

5.1 **Process History**

Subcontractor shall provide one copy of a Process History with the shipping release request (Section 4.9) and two copies with the completed assembly. The Process History shall include the following:

- Original Reports

  Copies of the original reports of all required inspections, tests and examinations (as identified in the Manufacturing, Inspection, and Test Plan) which have been properly validated by authorized personnel.

- Material Test Reports

  Material Test Reports traceable to the actual material and showing actual relevant chemical, and mechanical properties of Subcontractor-provided materials used. One copy is to be submitted upon Subcontractor acceptance for use.

- Certificate of Compliance

  Stating that the supplied materials including cleaning and packaging, conform to the specification, except as documented in PPPL-approved non conformance reports.

5.2 **Status Reports**

The Subcontractor shall provide brief status reports (e-mail acceptable) every second week covering any notable technical, administrative, or quality problems/issues and progress status (including pertinent photographs). The report will include schedule progress with respect to milestones with the percent completion of the work and verification of the delivery date.

Attachment 1

PRINCETON UNIVERSITY
PLASMA PHYSIC LABORATORY—PPPL

<table>
<tr><td colspan="6">PRODUCT QUALITY CERTIFICATION AND SHIPPING RELEASE</td></tr>
<tr><td colspan="2">PROJECT</td><td colspan="3">ITEM DESCRIPTION</td><td>SHIPMENT NUMBER</td></tr>
<tr><td>PPPL Subcontract / Order No.</td><td>REV.</td><td>ITEM NO.</td><td>SUBCONTRACTOR REFERENCE NO.</td><td>REV.</td><td>QUANTITY SHIPPED</td></tr>
<tr><td colspan="6">SUBCONTRACTOR'S CERTIFICATION

This is to certify that the products and services identified herein have been produced under a controlled quality assurance program and are in conformance with the procurement requirements including applicable codes, standards and specifications as identified in the above-referenced documents unless noted below. Any supporting documentation will be retained in accordance with the procurement requirements.

SIGNED: _____ DATE: _____

TITLE: _____ COMPANY: _____</td></tr>
<tr><td colspan="6">PPPL (AUTHORIZED REPRESENTATIVE) SHIPPING RELEASE

This is to certify that evidence supporting the above Subcontractor's Certification statement has been audited and no product/service nonconformances from procurement requirements have been found unless noted below. This product/service is hereby released for shipment.

This section serves as the Quality Assurance release for the above described product for shipment. It does not constitute an acceptance thereof and does not relieve the Vendor, Manufacturer or Subcontractor of any and all responsibility or obligation imposed by the purchase contract. It does not waive any rights the Purchaser may have under the purchase contract, including the Purchaser's right to reject the above described material upon discovery of any deviations from requirements of the purchase contract, drawings and specifications.</td></tr>
<tr><td colspan="6">NONCONFORMANCES FROM PROCUREMENT QUALITY REQUIREMENTS:</td></tr>
<tr><td colspan="6">REMARKS/PRODUCT SERIAL NUMBERS:</td></tr>
<tr><td colspan="4">BY PPPL QA REPRESENTATIVE (OR DESIGNEE)</td><td colspan="2">DATE</td></tr>
</table>