Jefferson Lab
Thomas Jefferson National Accelerator Facility

12000 Jefferson Avenue
Newport News, VA 23606

SPECIFICATION NO:
104211500-M8U-8200-A002-SOW

TITLE: *Statement of Work – SNS PPU Cold Mass Machined Parts*	
DATE: 03/16/2020	REVISION: Original
BY:	APP:
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CHK:	APP:
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REV.	ECO#	DESCRIPTION	BY	CHK.	APP.	APP.	DATE
SUMMARY OF CHANGES FROM PREVIOUS REVISION:							

Approved: 3/20/2020; E-Sign ID : 414782; signed by: Ap. 1: M. Wiseman; Ap. 2: E. Daly; C.: K. Wilson; D: A. Barron

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1.0 SCOPE

1.1 Purpose.

This Statement of Work (SOW) specifies the minimum requirements for the materials of construction, fabrication, testing and inspection of Spallation Neutron Source (SNS) Proton Power Upgrade (PPU) Cryomodule Cold Mass Assembly Machined Parts, Final Assembly Supply & Return Piping and Guard Vacuum Piping.

1.2 In this text, and in applicable specifications, references such as vendor, seller, manufacturer, fabricator and the like, mean the same thing. Furthermore Jefferson Lab, JLAB and CEBAF are different names for the same entity. Herein references to older documents that denote CEBAF are still valid and are applicable.

1.3 Deliverables to JLAB.

1.3.1 Multiple kits of SNS PPU Cryomodule Cold Mass Assembly Machined Parts per this specification and associated drawings. A kit of Machined Parts consist of parts/subassemblies as listed in the following table with the specified quantities per kit. The required number of kits is specified on the purchase order.

Qty	Drawing	Description
1	CRM9007000-3013	PIPE-3/4IPS SCH10S-FR HEAT EX.81
1	CRM9007000-3014	PIPE-3/4IPS SCH10S TO HEAT EX.81
1	104211500-M8U-8200 -A018	HELIUM INLET BAFFLE ASSY
1	104211500-M8U-8200 -A019	HE RETURN FITTING ASSY
8	CRM9007020-1026	3/4 INCH PIPE CLAMP
8	CRM9007020-1027	1/4 INCH TUBE CLAMP
2	CRM9007000-1053	.25 TUBING-COOLING (FPC/FPC SHT)
1	CRM9007000-1069	1/4 TUBE COUPLER-FPC-3
1	CRM9007000-3005	.25 TUBING-COOLING (.81 RTN)
1	CRM9007000-3006	1/4 TUBE COUPLER-FPC-1 (.81)
1	CRM9007000-3007	1/4 TUBE COUPLER-FPC-2 (.81)
1	CRM9007000-3008	1/4 TUBE-COOLING-1 (.81 FPC/OUT)
1	CRM9007000-3009	1/4 TUBE-COOLING-2 (.81 FPC/OUT)
1	CRM9007000-3010	.25 TUBING-CLG .81FPC 4SUPLY
1	CRM9007000-3011	1/4 TUBE COUPLER INPUT-4 (.81)
1	CRM9007000-3012	.25 COUPLER TUBING
1	CRM9007000-3015	.25 OD COUPLER TUBING

1.3.2 SNS PPU Cryomodule Final Assembly Supply Piping as per this specification and drawing number 104210200-M8U-8200-A011, which defines a kit of parts/subassemblies. Quantity of kits is specified on the purchase order. The content of this kit is listed as follows:

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QTY	PART/DRAWING NO.	DESCRIPTION
1	104210200-M8U-8200-A013	SHIELD SUPPLY PIPING
1	104210200-M8U-8200-A014	HE SUPPLY FROM H/X
1	104210200-M8U-8200-A015	HE SUPPLY TO H/X
1	104210200-M8U-8200-A016	PRIMARY HE SUPPLY
1	104210200-M8U-8200-A043	FPC SUPPLY TUBE
4	-	SHCS, 1/4-20 UNC X .625" LG

1.3.3 SNS PPU Cryomodule Final Assembly Return Piping as per this specification and drawing number 104210200-M8U-8200-A012, which defines a kit of parts/subassemblies. Quantity of kits is specified on the purchase order. The content of this kit is listed as follows:

QTY	PART/DRAWING NO.	DESCRIPTION
1	104210200-M8U-8200-A020	HE SUPPLY TO H/X
1	104210200-M8U-8200-A022	SHIELD RETURN
1	104210200-M8U-8200-A023	PRIMARY HE RETURN
1	104210200-M8U-8200-A024	HE SUPPLY FROM H/X
4	-	SHCS, 1/4-20 UNC X .625" LG

1.3.4 SNS PPU Cryomodule Final Assembly Guard Vacuum Piping Assembly as per this specification and drawing number 104210200-M8U-8200-A050. Quantity is specified on the purchase order. This kit contains only one assembly.

1.3.5 All Documentations stated in section 3.6 and summarized in section 6.0 shall be provided as specified.

1.4 Seller Furnished Materials and Equipment

1.4.1 Seller shall provide all labor to assemble, test and supervise outsourcing fabricated parts.

1.4.2 All materials shall be provided by seller, including all consumables and raw materials.

1.4.3 All fixtures, assembly and test equipment, or any facility required to execute the fabrication of the procured assemblies.

2.0 APPLICABLE DOCUMENTS

2.1 No substitutions or deviations from JLAB drawings, as listed in 1.3, and specifications may be made without written authorization from the JLAB procurement representative.

2.1.1 JLAB Specification No. 11141S0029 REV B, "High Sensitivity Vacuum Leak Check Requirements"

2.1.2 JLAB Specification No. 11141S0034 Rev A, "Stainless Steel Cleaning Procedure".

2.1.3 JLAB Specification No. 11141S0035 Rev A, "General Cleaning and Handling Procedure".

A complete set of JLAB drawings and specifications for kits in 1.3 and 2.1 will be included in the procurement package.

2.2 Codes and Standards

The Vendor shall be responsible for updating any and all references to codes and other standards to reflect the latest editions and requirements. The vendor shall comply with the requirements shown or specified in this document when Codes, Rules, Regulations, Standards, and Ordinances are not in excess of these requirements.

2.2.1 American Society of Mechanical Engineers (ASME) B31.3 "Process Piping" Codes and Regulations.

2.2.2 American Society of Mechanical Engineers (ASME) B16.9 "Factory-Made Wrought Buttwelding Fittings" standard.

2.2.3 American Society for Testing and Materials (ASTM) listed, but not limited to the following (see drawings for details):

2.2.3.1 A269, Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service

2.2.3.2 A312, Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes

2.2.3.3 A403, Standard Specification for Wrought Austenitic Stainless Steel Piping Fittings

3.0 REQUIREMENTS

3.1 General.

The contractor is required to build, test, procure and deliver the items as specified in section 1.3. All deliverables shall be free of burrs, scratches, dents and fluids. The deliverables shall be structurally sound and uniform in shape. All applicable documents must be adhered to. Any conflict or ambiguity in these requirements must be brought to the attention of the JLAB procurement representative prior to any work being done or cost being incurred by JLAB.

Note: if subcontractors are employed, it is the responsibility of the contractor to ensure all requirements set forth herein are abided by the subcontractors. All required documentations applicable to subcontractors shall be submitted to JLAB.

3.2 Welding and Brazing

Vendor shall submit welding/brazing procedure qualifications (WPQ's/BPQ's), welding/brazing procedure specifications (WPS's/BPS's) and procedure qualification records (PQR's) in accordance with ASME BPVC

Sec. IX. Personnel conducting testing of welds shall be certified in accordance with ASME BPVC Sec. V.

3.2.1 Welding shall be performed using the Gas-Tungsten-Arc Welding (GTAW) method. Seller shall ensure that no entrapped gases, fluxes, pits, cracks, or like imperfections are left in the heat affected zones. All edges shall be rounded and burrs removed from all seams, joints, and welded areas.

a. Observe ASME BPVC Section VIII, Division 1, UHA-51 rules on impact tests, weld filler material and Ferrite Number (FN) requirements.
b. Seller shall also observe the welding preparation and dimensional control standards set forth in ASME B16.25 code and perform the welding specimen mechanical tests as stated in ASME Boiler & Pressure Vessel code, Section IX, QW-141.

3.2.2 Vendor shall develop weld maps for all weldments. In-process weld records shall document that on which component, (quote the weld identification on the corresponding weld map) a certain weld is done following which WPS, by which welder (signature or stamp), on what date, weld inspector's name, inspection date and signature. Refer to 3.6.6 for submission requirement.

3.2.3 All expendable tooling (saw blades, files, cutters, grinding wheels, wire brushes, grinding burrs, etc.) used in fabrication shall be unused at the start of the process and shall not have come in contact with or contain carbon steel.

3.2.4 When multiple brazes need to be done on one assembly, manufacturer shall arrange the sequence of brazing and select appropriate brazing alloys so that a later brazing will not un-braze previous joints.

3.2.5 Post cleaning of welds is required to leave the surface in a bright finish condition with no trace of solvents residue. The Seller shall identify the cleaning process used to remove the residue as part of the bid package. Seller's cleaning procedure shall clearly demonstrate that the requirements of Section 3.7 will be met or exceeded.

3.3 Pressure System Requirements

All pressure piping shall be fabricated, inspected, and tested in accordance with ASME B31.3 for normal fluid service. Design temperature and MAWP for relevant pressure piping are given as follows:

Drawing	Description	Design Temperature (K)	MAWP (psig)
CRM9007000-3013	PIPE-3/4IPS SCH10S-FR HEAT EX.81	2-300	165
CRM9007000-3014	PIPE-3/4IPS SCH10S TO HEAT EX.81	2-300	165
104211500-M8U-8200 -A018	HELIUM INLET BAFFLE ASSY	2-300	60
104211500-M8U-8200 -A019	HE RETURN FITTING ASSY	2-300	60
CRM9007000-1053	.25 TUBING-COOLING (FPC/FPC SHT)	2-300	165
CRM9007000-1069	1/4 TUBE COUPLER-FPC-3	2-300	165
CRM9007000-3005	.25 TUBING-COOLING (.81 RTN)	2-300	165
CRM9007000-3006	1/4 TUBE COUPLER-FPC-1 (.81)	2-300	165
CRM9007000-3007	1/4 TUBE COUPLER-FPC-2 (.81)	2-300	165
CRM9007000-3008	1/4 TUBE-COOLING-1 (.81 FPC/OUT)	2-300	165
CRM9007000-3009	1/4 TUBE-COOLING-2 (.81 FPC/OUT)	2-300	165
CRM9007000-3010	.25 TUBING-CLG .81FPC 4SUPLY	2-300	165
CRM9007000-3011	1/4 TUBE COUPLER INPUT-4 (.81)	2-300	165
CRM9007000-3012	.25 COUPLER TUBING	2-300	165
CRM9007000-3015	.25 OD COUPLER TUBING	2-300	165
104210200-M8U-8200-A013	SHIELD SUPPLY PIPING	35-300	200
104210200-M8U-8200-A014	HE SUPPLY FROM H/X	2-300	165
104210200-M8U-8200-A015	HE SUPPLY TO H/X	2-300	165
104210200-M8U-8200-A016	PRIMARY HE SUPPLY	2-300	60
104210200-M8U-8200-A043	FPC SUPPLY TUBE	2-300	165
104210200-M8U-8200-A020	HE SUPPLY TO H/X	2-300	165
104210200-M8U-8200-A022	SHIELD RETURN	35-300	200
104210200-M8U-8200-A023	PRIMARY HE RETURN	2-300	60
104210200-M8U-8200-A024	HE SUPPLY FROM H/X	2-300	165
104210200-M8U-8200-A050	GUARD VACUUM PIPING ASSY	300	30

3.4 Testing

3.4.1 The contractor shall submit detailed cold shock, pressure test and leak check procedures for approval by JLAB as part of the bid package. All piping assemblies listed in 3.3, except 104210200-M8U-8200-A050, requires cold shock, pressure test and leak check. 104210200-M8U-8200-A050 requires pressure test and leak check.

3.4.2 Cold Shock:

Guidelines on cold shock test of cryogenic piping assemblies:

a. Every cryogenic piping assembly shall be cold shocked.
b. Each cryogenic piping assembly shall experience at least one thermal cycle.

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c. Apply the fill or immersion method.
d. When performing "fill" cold shock test in a circuit, make sure that liquid nitrogen runs through until liquid comes out from the outlet, then fully warm up. When applying the immersion method, wait until the there is no more bubbles generation before warming up.
e. After cold shock tests, carry out pressure test, followed by helium leak check.

3.4.3 Pressure Test

a. The contractor shall perform the pressure tests on all piping systems listed in 3.3.
b. Observe ASME B31.3 rules and MAWPs given in 3.3.
c. Pressure tests can be carried out pneumatically, using clean dry air, nitrogen or helium, or hydrostatically.
d. Pressure tests to be performed before helium leak tests.

3.4.4 Helium Leak Test:

a. Specific helium leak check requirements are spelled out on relevant drawings.
b. In brief, pipes are required to have a helium leakage not exceeding 2.0×10^{-10} atm*cc/sec.
c. Exception to the leak rate shall be approved by JLAB.

3.5 Serialization and Marking

3.5.1 Serialization

All subassemblies listed in 1.3.1, subassemblies to make up Supply & Return Piping in 1.3.2 & 1.3.3 (use BOM as a guide), Guard Vacuum Piping Assy in 1.3.4, shall be serialized and the serial numbers (SN) shall be used on all related vendor documents. The SN serves as the main index to locate vendor supplied technical documentations associated with a certain assembly or subassembly. SN format is exemplified as follows:

104211500-A018-R-SSS
CRM9007000-3005-R-SSS

Where:

104210600-A018 = Abridged drawing number
CRM9007000-3005 = CRM drawing number kept in full form
R = Drawing Revision or – (dash) for initial drawing
SSS = Serial number of the assembly/subassembly (begin with 001)

Any loose parts shall be delivered in sealed bags labeled with their part number and kitted per 7.4.

3.5.2 Marking

The Seller shall inscribe all parts with clear markings (0.25" high characters) such that a visual inspection will provide traceability and fast identification. Identification applies to the smallest mechanically disassembled component. At a minimum, the markings shall include the drawing part or identifying number. The markings may also include identification of the component's source (i.e. contractor / subcontractor), material specification, and any other information that will allow for immediate recognition of said components and their source. Purchased parts are excluded from this requirement. Small parts that are impractical to inscribe shall be bagged and tagged.

3.6 Documentation

Vendor shall well organize the documents to be submitted for final acceptance. Table of contents, checklists, summary tables are recommended. The format of documentation package shall be discussed with JLAB after award. Digital documents vs paper copies are preferred.

3.6.1 Copies of WPS/BPS, the PQRs being used, and the WPQ/BPQ for the WPS/BPS's being used shall be provided to JLAB as part of the bid package.

3.6.2 Copies of certified qualifications in accordance with ASNT SNT-TC-1A or equivalent for personnel performing visual examination and leak checking NDE of welds shall be provided to JLAB as part of the bid package.

3.6.3 Production timeline for fabrication, starting from time of award running through F.O.B. JLAB. Following JLAB approval of timeline and contract award, it is the responsibility of the contractor to comply with and meet dates specified in approved timeline. This timeline shall be provided to JLAB as part of the bid package.

3.6.4 Seller's general Quality Assurance and Quality Control manuals shall be submitted as part of the bid package. The general QA/QC manuals shall address at a minimum the following elements: training and qualifications, improvement process, documents and record control program, control of procedures, design control, procurement control, inspection and test program and management assessment program. Templates of travelers, procedures, sign-off forms, etc. shall be submitted.

3.6.5 Certified mill test reports (CMTR) of all raw materials used to fabricate deliverables shall be provided to JLAB prior to the final acceptance of deliverables by JLAB. These material certifications shall include all processes and tests with grade and composition being clearly identifiable. A summary table associating the CMTRs and components shall be supplied to JLAB.

3.6.6 Copies of all in-process inspection and test reports shall be provided to JLAB prior to the final acceptance of deliverables by JLAB. These include weld maps, in-process weld report, pressure test report, cold shock report, leak check report and final dimensional inspection report.

3.7 Cleanliness

3.7.1 Surfaces shall be cleaned at stages of fabrication such that dust, oils and other contaminants are removed prior to final assembly and preparation for delivery to JLAB.

3.7.2 Seller shall follow cleaning specifications in 2.1.2 & 2.1.3. Seller may submit his/her own cleaning specifications for JLAB's approval.

3.7.3 Copper shall be cleaned to a bright metal condition.

3.7.4 No anti-seize compounds shall be used on the assemblies that can be removed by normal handling procedures. Dicronite and the use of dissimilar metals are recommended.

4.0 QUALITY ASSURANCE PROVISIONS

4.1 The Seller shall ensure that all work is done in accordance with the Seller's QA/QC manuals/procedures received and approved by JLAB.

4.2 The seller shall maintain records of all inspections and tests in the course of fabrication. Specifically, the following information shall be made available for inspection to any JLAB or SNS representative at any time.

4.1.1 Leak checking method and report
4.1.2 Cold shocking method and report
4.1.3 Parts/process/materials tracing method
4.1.4 Any other Non-Destructive Test (NDT) method that may be applicable to the seller's Quality Control program

4.3 Access for Source Surveillance Inspections

Source surveillance activities may be conducted at the Seller's facility or any subcontractor's facility that JLAB determines necessary to ensure that quality objectives are met. Such surveillance may include auditing and monitoring of production processes, in-process inspection and controls, chemical and physical certifications, final inspection and tests, preparation for shipment, and review of certification data. The Seller shall provide JLAB representatives access to all data and operating areas pertinent to the contract. Source surveillance by JLAB representative shall not constitute product acceptance by JLAB and shall in no way relieve the Seller of the responsibility to furnish acceptable items.

The Seller shall disclose to JLAB any subcontractors to be employed during this project as part of the bid package.

4.4 Calibration Program

All equipment used in tests, inspections, and examinations shall be calibrated in accordance with the equipment manufacturer's recommendations. All equipment shall be tagged in some manner to indicate the date of last calibration and the status of that calibration. Procedures shall be established for correction of out-of-tolerance equipment. The procedures shall provide for tagging and removal of such equipment from the work area. Procedures shall be established for re-testing or re-inspecting when out-of-tolerance equipment has been used for testing or inspection.

4.5 Control of Non-Conformances

The Seller may use their existing nonconformance program to identify, report, and recommend disposition of all non-conformances, but dispositions that would leave any remaining nonconformity must be submitted to JLAB for approval. The request should identify the affected item(s) by name, serial number, citing the drawing/specification number and revision number containing the specific requirement that has not been met. It should state the number of nonconforming items being reported. The request should include a description of the nonconformity, identifying requirement(s) not met. The supplier may attach a description of the cause and a corrective action plan and schedule if pertinent.

Note: The issuance and acceptance of such a request in no way limits or affects the warranty provision of the Agreement. Such a request shall not establish a precedent or obligation to accept existing or future items not conforming to all provisions of the Agreement.

4.6 Deviations

The Seller may propose deviations from the specifications, drawings, or other technical requirements of the procurement. Where time is a consideration, the Seller may communicate the proposed deviation directly to the engineer or technical lead, with a copy to JLAB's buyer. The engineer or technical lead will evaluate the technical aspects and recommend to the buyer, who will communicate acceptance or disapproval to the Seller. The request should identify the affected items, drawing/specification number and revision number, a description of the proposed deviation, and justification for it. The request for deviation shall be submitted to JLAB prior to making any change.

4.7 JLAB reserves the right to have its technical or procurement representatives witness any or all manufacturing steps, tests and inspections established under the seller's Quality Assurance Program to demonstrate compliance with this specification. Any information of a proprietary nature must be identified in the bid process.

4.8 JLAB representatives shall have unannounced visitation access to the seller's plant and personnel during normal operation hours for the purpose of conducting Quality Assurance audits.

5.0 ACCEPTANCE

5.1 The completed assemblies shall be offered to JLAB for inspection at the Seller's facility. Advanced notice of two weeks shall be provided to JLAB for travel arrangements. JLAB representatives may elect to witness tests as detailed in 4.2.

5.2 Documents required before final acceptance shall be submitted to and approved by JLAB prior to shipping.

5.3 After inspection and acceptance, the assemblies shall be prepared for crating and shipment to JLAB.

5.4 The assemblies will be inspected and tested at JLAB prior to final acceptance.

6.0 SUBMITTALS

The following table lists all submittals that the Seller shall supply to the Buyer:

No.	Section	Description	When required	Approval	CVI*
1	3.4.1	Leak Check, Cold Shock and Pressure Test procedures	Part of bid package	Required	-
2	3.6.1	WPS/BPS, WPQ/BPQ, and PQR	Part of bid package	Required	-
3	3.6.2	Weld inspector qualification evidence	Part of bid package	Required	-
4	3.6.3	Production timeline	Part of bid package	Required	Yes
5	3.6.4	General QA/QC manuals	Part of bid package	Required	-
6	3.6.5	CMTRs	Prior to final delivery	Required	Yes
7	3.6.6	Inspection/test reports	Prior to final delivery	Required	-

*Certified Vendor Information (CVI).

For submittals that require Buyer's approvals, Vendor shall wait for the approval notices to continue fabrication activities.

7.0 PREPARATION FOR SHIPMENT

7.1 All deliverables, including documentation shall be catalogued and offered for acceptance to JLAB via letter or hard copy transmission prior to shipment. Electronic copies of the documentation is preferred.

7.2 Shipping documentation must accompany the products such that JLAB receiving personnel clearly understand the contents and can match delivery to a purchase order.

7.3 Packaging shall be such that no damage is incurred during transit. This shall include weather protection and the closure of all open pipes with test plugs

or removable caps. Sizing shall be such that handling is facilitated and weight limitations imposed by the transportation industry can readily be met. All flanges and openings shall be blanked of

7.4 Kitting requirements- deliverables listed in 1.3.1, 1.3.2, 1.3.3 & 1.3.4 shall be kitted to form 4 respective kits. A kit consists of the required assembly or subassemblies as well as hardware. Each kit shall be independently packaged, not to mix with any parts/subassemblies/assembly belonging to other kits. Packages shall be clearly marked with kit identification information and kit number, see details below:

7.4.1 The kits for 1.3.1 deliverables shall be marked with "SNS PPU Cryomodule Cold Mass Assembly Machined Parts Kit# XX".

7.4.2 Kits for 1.3.2 deliverables shall be marked with "SNS PPU Cryomodule Supply Piping Assembly Kit# XX".

7.4.3 Kits for 1.3.3 deliverables shall be marked with "SNS PPU Cryomodule Return Piping Assembly Kit# XX".

7.4.4 Kits for 1.3.4 deliverables shall be marked with "SNS PPU Cryomodule Guard Vacuum Piping Assembly Kit# XX".

7.4.5 "XX" is an assigned two-digit kit number starting with 01.

7.4.6 JLAB Purchase Order number shall also be marked on each kit's package.

7.5 A packing list of items per kit/package shall be included in any kits required.

7.6 Shipping address:

Attn: Gary Cheng/Mike Dickey
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12000 Jefferson Ave.
Newport News, VA 23606