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**PROCUREMENT SPECIFICATION
6600 PSIG PRESSURE VESSEL**

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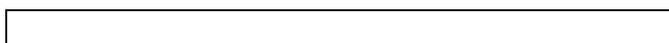
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ENGINEERING AND TECHNOLOGY DIRECTORATE

National Aeronautics and
Space Administration

John F. Kennedy Space Center

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**PROCUREMENT SPECIFICATION
6600 PSIG PRESSURE VESSEL**

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6600 PSIG PRESSURE VESSEL**1. SCOPE**

This procurement specification establishes the minimum design, fabrication, inspection and quality control requirements for one ASME code-stamped storage vessel for inert gas with a design pressure of 6600 psig. The vessel will be located at Kennedy Space Center (KSC), Florida, on the Space Launch System (SLS) mobile launcher platform.

The Contractor shall furnish all labor, equipment, materials, and services to schedule, coordinate, supervise, and provide quality control for fabrication, testing, and delivery of the pressure vessel as defined by this specification and referenced standards.

2. APPLICABLE DOCUMENTS

The latest revision in place at the time of award of this Delivery Order (DO) of the documents listed below form a part of this specification to the extent specified herein.

2.1 Governmental Documents

The governmental standards and specifications as a whole supplies the resources to establish good engineering practices and procedures to ensure the safe and effective performance of operational and maintenance activities, and non-routine procedures.

Document Number	Revision	Title
75M50393	K	Identification Plate, Ground Support Equipment, Kennedy Space Center
FED-STD-595	C Chg. 1	Colors Used in Government Procurement
GP-425	G	KSC Fluid Fitting Engineering Standards
KDP-KSC-P-2388	Basic	Processing Contractor Request for Use of Nonconforming Supplies or Services
KDP-F-5042 A-K	Basic	Acceptance Data Package Required Documents
KDP-P-5042	Basic	Acceptance Data Package Process Document
KSC-C-123	J	Surface Cleanliness of Fluid Systems, Specification for
KSC-F-124	E	Specification for Fittings, Flared Tube
KSC-STD-E-0015	B	Marking of Ground Support Equipment Standard
NASA-STD-5008	B	Protective Coating of Carbon Steel, Stainless Steel, and Aluminum on Launch Structures, Facilities, and Ground

		Support Equipment
NPR 6000.1	H	Requirements for Packaging, Handling, and Transportation for Aeronautical and Space Systems, Equipment, and Associated Components

2.2 Non-Governmental Documents

Document Number	Title
ASME B&PVC Section V	Nondestructive Examination
ASME B&PVC Section VIII, Division 2	Rules for Construction of Pressure Vessels – Division 2, Alternate Rules
ASME B&PVC Section IX	Welding and Brazing Qualifications
ASTM E515	Standard Practice for Leaks Using Bubble Emission Techniques
ISO 14952	Space Systems – Surface Cleanliness of Fluid Systems
SSPC SP-1	Solvent Cleaning
SSPC SP-3	Power Tool Cleaning

3. SUBMITTALS AND COMMUNICATION

The Contractor shall provide all of the data, listed in Appendix A of this specification, entitled "Contract Data Requirements List (CDRL)". All contract data requirements shall be submitted to the Contracting Officer as identified in the purchase contract unless otherwise specified. All CDRL items shall be subject to the unilateral approval of the Contracting Officer. In the event of disapproval, the Contractor shall initiate immediate corrective action and shall resubmit to the NASA Contracting Officer for approval within five working days.

3.1 Deliverables

The Contractor shall submit all data deliverables electronically. All documents shall be submitted in an electronic format that is searchable (e.g., PDF). For documents that were scanned, the Contractor shall run "paper capture" or optical character recognition to convert the file to a searchable format before submittal.

3.2 Acceptance Data Package (CDRL Item C1)

An Acceptance Data Package (ADP) shall be maintained through the duration of the contract in accordance with KDP-P-5042. The Contractor shall complete all KDP-F-5042 documents

provided by the Government and include them in the ADP as specified in KDP-P-5042. The Contractor shall also include in the ADP all correspondence between the Contractor and NASA, quality control documents, all CDRL items in the order shown in Appendix A, and any other documentation required to administer the successful completion of the contract. The ADP shall include a cover page and a table of contents with each section linked to the cover page of that section, and shall be in text searchable format.

The Contractor shall provide a complete ADP for each unit. An electronic copy of the in-work ADP shall be delivered to the Contracting Officer for review and approval prior to hardware delivery as stated in Appendix A. In the event of disapproval, the Contractor shall initiate immediate corrective action and shall resubmit to the NASA Contracting Officer for approval, prior to shipping the hardware. The approved ADP shall be provided in electronic and hard copy with the final hardware shipment. Hardware deliveries will not be accepted by the Government without an accompanying ADP.

3.3 Subcontractor Specifications (CDRL Item C2)

The Contractor shall provide the Contracting Officer with specifications that the Contractor intends to submit to any subcontractors for the Government to review prior to any subcontract work being performed.

3.4 Requests for Information (CDRL Item C3)

After contract award, the Contractor shall, when contract information or clarification is required by the Contractor, prepare and submit KSC Form 8-268, "Request for Information (RFI)/Clarification." The form shall be submitted to the Contracting Officer and will be returned to the contractor with the appropriate response within five working days. The Contractor shall indicate on the RFI if the concern or question has an effect on schedule or cost. The blank KSC Form 8-268 will be provided to the Contractor at the post-award pre-work meeting.

3.5 Deviations and Waivers (CDRL Item C4)

The Contractor shall follow KDP-KSC-P-2388, Processing Contractor Request for Use of Nonconforming Supplies or Services, for any deviation or waiver for the use of nonconforming supplies or services. The Contractor shall use KSC Form 8-69 for all deviation or waiver requests. Deviation requests are to be submitted when the Contractor wishes to deviate from a requirement in this specifications, or the listed standards. Waiver requests are to be submitted when the Contractor is unable to meet a requirement in this specification, drawings, or standards, and is requesting relief from that requirement. The Contracting Officer shall hold final decision rights for the approval of deviation and waiver requests. The blank KSC Form 8-69 will be provided to the Contractor at the post award pre-work meeting.

3.6 Meeting Records (CDRL Item C5)

The Contractor shall schedule and conduct post-award pre-work and other Technical Interchange Meetings as required by the Government at the Government's required need time throughout the period of performance. The Contractor shall allow periodic visits to the Contractor's facilities for the purpose of in-process inspections and to convey additional information as required.

The Contractor shall be available for meetings as required by the Government. The Contractor shall provide meeting minutes to attendees two days after the meetings.

3.7 Progress Schedules (CDRL Item C6)

The Contractor shall provide a progress schedule to be updated monthly. The schedule shall include planned and actual completion dates of important tasks and milestones, and shall summarize any problems and potential schedule delays.

4. DESIGN AND FABRICATION

The Contractor shall provide all management, material, labor, facilities, tools, equipment, and transportation necessary to procure, fabricate, assemble, inspect, test, mark, package and deliver the line items specified in the purchase contract. The User's Design Specification can be found in Appendix B. All engineering and analysis shall be in US customary units.

4.1 Design Code and Stamping (CDRL Item 7)

The pressure vessel shall be designed, fabricated, tested, and quality controlled per the requirements of ASME Boiler & Pressure Vessel Code (B&PVC), Section VIII, Division 2, latest addenda (hereafter referred to as "ASME Code"). The manufacturer of the pressure vessel shall hold a current ASME Code stamp. The vessel shall be ASME Code stamped and registered with the National Board of Boiler and Pressure Vessel Inspectors. The Contractor shall provide the Manufacturer's Data Report for Pressure Vessels (ASME A-1 form) in the ADP.

4.2 Design Proposal (CDRL Item C8)

The Contractor shall submit all design calculations and the proposed fabrication drawings to the Contracting Officer for approval prior to the start of fabrication. The pressure vessel shall be designed and fabricated such that it meets the requirements of the ASME Code. Stress calculations shall include, but are not limited to, the following:

- Loads resulting from the internal design pressure, external pressure, and temperature gradients
- Blast loads of 2 psi in the vertical direction and 1 psi in the horizontal direction, concurrently applied
- Dead weight loads of vessel materials

- Loads due to the weight of contents based on maximum capacity and operating conditions specified herein
- Maximum concentrated stresses associated with saddles, pads, supports, etc., due to shear, bending, and torsion

4.3 Pre-Fabrication Design Package (CDRL Item C9)

After approval of the design proposal and prior to the start of fabrication, the Contractor shall submit the final fabrication drawings and design analysis to the Contracting Officer for approval.

4.4 As-Built Design Package (CDRL Item 10)

As-built drawings and updated design analysis shall be included in the ADP.

4.5 Physical Requirements

4.5.1 Vessel Envelope

The pressure vessel shall have an internal volume between 260 and 280 ft³. The pressure vessel shall be cylindrical, single-layer, with a seamless or welded shell and seamless heads concave to internal pressure. The pressure vessel shall be supported horizontally from the bottom of the vessel. The vessel including all nozzles and attachments shall be no greater than 30 ft horizontal length, and 8 ft vertical height.

4.5.2 Moisture Entrapment

The pressure vessel design shall eliminate the possibility of moisture entrapment from both the interior and exterior of all pressure vessel components and associated hardware, including supports.

4.5.3 Attachment Pads

Attachments (excluding nozzles) shall be welded to a pad with the same material composition as that used in the head and shell. The pad shall have rounded corners (minimum ½ inch radius) and shall extend at least two inches in each direction from the point of attachment and three inches from a seam weld. The pad shall be attached to the shell or head with a continuous fillet weld. Weep holes shall be placed in the attachment pads to indicate leakage.

4.5.4 Openings

The pressure vessel shall contain at least two openings fabricated in accordance with the appropriate ASME code(s), which are located on the vessel heads, coaxial with the vessel centerline. These openings shall extend a minimum of 18 inches from the outside surface of the vessel heads. One opening shall be 1-1/2 inch nominal pipe size (NPS) located on the forward

head. One opening shall be 3 inch NPS located on the rear head. The vessel shall also contain a low-point drain. Additional openings may be added to comply with ASME code requirements.

4.5.5 Pressure Connection Interfaces

The maximum allowable working pressure of the openings shall be no less than the design pressure of the vessel. Socket weld joints shall not be used.

4.5.5.1 Vessel Connection

The pressure vessel ports shall be Grayloc-style butt weld hubs, material 316 or 316L stainless steel per ASTM A182, or equivalent.

4.5.5.2 Mating Connection

Blind hubs, clamps, and seals shall be provided for the 3 inch NPS port. Material for the blind hub and clamp shall be the same as the vessel connection. The seals shall be PTFE-coated AISI 630 (17-4 PH). A tapped hub with clamp and seal ring shall be provided by the Contractor for the 1-1/2 inch NPS port as shown in Figure 1.

4.5.6 Lifting Lugs

The pressure vessel shall be outfitted with crane attachment points for lifting.

4.5.7 Name Plates and Marking

The following title shall be lettered in black, similar to No. 17038 per FED-STD-595, on both sides of the cylinder body in block letters no less than 4 inches in height:

MAWP 6600 PSIG
MOP 6000 PSIG

The ASME name plate shall be affixed using a permanent sealing compound or rivets. If rivets are used, it shall be affixed to a 1/4" or thicker pad that is seal welded to the vessel.

In addition to the vessel nameplate marking required by ASME Code, a KSC Ground Support Equipment (GSE) identification plate per 75M50393-2 shall be permanently attached to the vessel assembly in a location readily accessible for inspection. Upon final acceptance of the completed pressure vessel by the Government, the information called out drawing 75M50393, note 7, items A through N, shall be die stamped per KSC-STD-E-0015 with 0.010 inch characters in the appropriate blocks. The Contractor shall provide this information to the Contracting Officer's Technical Representative for verification prior to stamping.

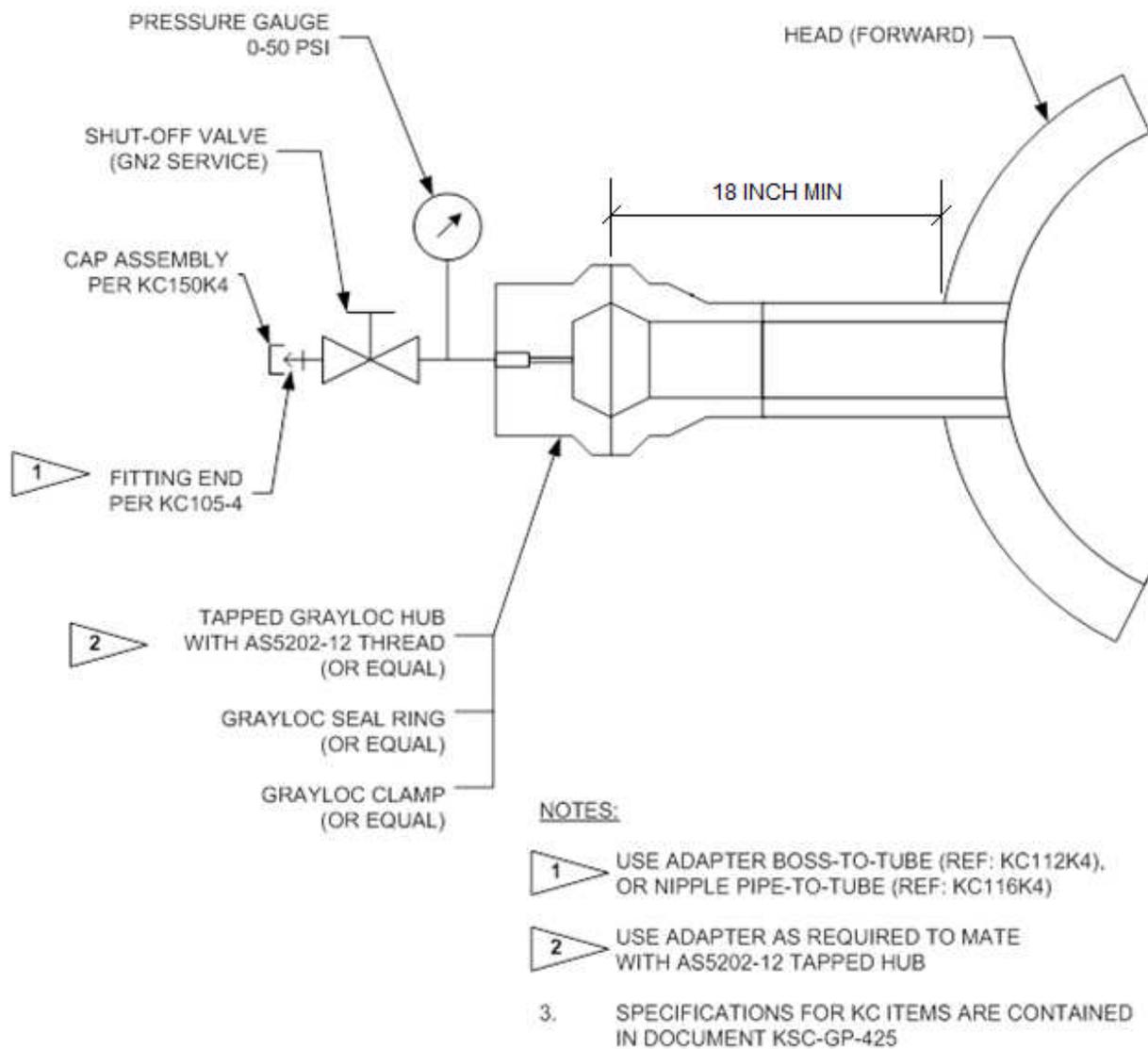


Figure 1: Shipping Hub Assembly

4.6 Performance Requirements

4.6.1 Design Pressure

The design pressure of the pressure vessel, as defined by the appropriate ASME code(s), shall be 6600 psig. The design pressure shall be limited by the shell or the heads of the vessel, and not by any other parts.

4.6.2 Design Temperature

The design temperature of the pressure vessel (coincident metal temperature) shall be 150 °F. The minimum design metal temperature (MDMT) shall be 20 °F.

4.6.3 Operating Conditions

The normal operating conditions of the pressure vessel are as follows:

- Operating pressure 6000 psig
- External pressure atmospheric
- Fluid media inert gas
- Ambient temperature 20-110 °F
- Cycle rate 10 per year
- Cycle pressure range 650 to 6000 psig

4.6.4 Corrosion Allowance

A corrosion allowance of 1/8 inch shall be assumed for the pressure vessel.

4.6.5 Structural Components

All structural components not designed per ASME Code shall be designed to a minimum safety factor of 2 against deformation or yielding that impairs the function of the part, and a minimum safety factor of 3 against collapse, buckling, or failure to support design loads.

4.6.6 Lifting Lugs

All lifting lugs and attachment welds shall be designed to a minimum design load safety factor of 5 against the material ultimate tensile strength.

4.6.7 Cycling

The pressure vessel shall be designed to safely endure at least 300 pressure cycles at the pressures and temperatures listed above.

4.6.8 Operating Life

The pressure vessel shall be designed as a permanent installation with a minimum operating life of 30 years.

4.7 Welding Requirements

4.7.1 Welding Certifications and Procedures (CDRL Items C11, C12)

Welding certifications and welding procedures shall be submitted to the Contracting Officer for approval prior to the start of work. Weld traceability maps of welder and procedure number at each joint are required.

4.7.2 Pressure Vessel Welding

All pressure vessel welding shall be performed by qualified welders per the welding procedure for each weld, in accordance with ASME B&PVC, Section IX. Joint efficiency of all welds subject to internal design pressure or external loading shall be 100%.

4.7.3 Structural Welding

All structural welds shall be in accordance with the AWS D1.1, except vessel structural attachment welds, which shall be in accordance with ASME Code.

4.7.4 Weld Inspection (CDRL Items C13, C14)

All pressure containment welds shall be 100% radiograph inspected. Weld inspections shall be performed by inspectors trained and certified in use of the techniques applied, in accordance with the requirements of ASME B&PVC, Section V. Weld inspector certifications and records shall be submitted to the Contracting Officer for approval.

4.8 Materials and Processes

The pressure vessel assembly, including shell, head, and nozzles, shall be fabricated from compatible carbon/low alloy steels and shall be an acceptable material for the application per ASME Code. Material selections shall be made by the Contractor. All materials that contact the service medium shall be compatible with the service medium. Welding of dissimilar metals shall be avoided except for nameplates, tags, or where specifically called out in this specification.

Standard and commercial parts shall be used whenever possible provided they conform to all requirements in this specification.

4.9 Workmanship

The fabricated assembly shall be clean and free from burrs, sharp edges, casting projection, metal shavings, dirt, and other foreign matter. There shall be no cracks, breaks, bends, dents,

chips, gouges, loose connections, loose attaching parts, misalignment, or other defects that could render the vessel assembly unsuitable for its intended use. Metal corners shall be radiused, and edges shall be ground smooth.

Failure to maintain acceptable standards of workmanship, as determined through visual inspection by the Contracting Officer or the Contracting Officer's designee, may result in rejection of the finished product.

5. PROTECTIVE COATING SYSTEM

The pressure vessel will be exposed to the elements in a salt corrosive, semi-tropical environment at Kennedy Space Center, Florida. The site location will be in an open area on the SLS mobile launcher. Temperature effects due to solar radiation shall be calculated at peak summer loads for 28° north latitude.

Degrease per SSPC SP-1 and mechanically clean per SSPC SP-3 using non-ferrous sanding abrasive discs/sheets. Remove abrasive residue. Clean and dry surfaces. Apply a 4-6 mil dry film thickness inhibited polyamide epoxy primer coat and an aliphatic polyurethane topcoat conforming to paragraphs 4.1.2.2.1 and 4.1.2.3.1, respectively, of NASA-STD-5008, to a dry film thickness of 3-5 mil from the approved products list of NASA-STD-5008, Appendix B. After application of the primer coat, completely seal the perimeter of all faying surfaces, joints open less than 1/2 inch, and skip welded joints by applying polysulfide rubber or polyurethane sealant per guidelines in NASA-STD-5008, paragraph 4.4.4. Topcoat color shall be white, similar to No. 17925 per FED-STD-595. The preparation of the metals and application of the coating to the thickness required shall be in compliance with the manufacturer's recommendations.

Quality control shall be performed by an independent National Association of Corrosion Engineers (NACE) certified coating inspector Level 3 provided by the Contractor. NACE inspection shall be required for all surface preparations and coating applications.

All required identification plates shall be attached after painting. Preventative measures are required to maintain the integrity of the protective coating between dissimilar metals, and to protect coated surfaces during handling and transport. Painting shall be done after all fabrication and machining processes.

5.1 Compressed Air Cleanliness Testing

Prior to using compressed air for abrasive blast cleaning, blowing down the surfaces, and painting with conventional spray, the Contractor shall verify that the compressed air is free of moisture and oil contamination according to the requirements of ASTM D 4285. The tests shall be conducted at least one time each shift for each compressor system in operation and recorded on the coating system daily inspection report. If air contamination is evident, the Contractor shall change filters, clean traps, add moisture separators or filters, or make other adjustments as necessary to achieve clean, dry air. The Contractor shall also examine the work performed since

the last acceptable test for evidence of defects or contamination caused by the compressed air. Affected work shall be repaired at the Contractor's expense.

5.2 NACE Inspector (CDRL Item C15)

The Contractor shall provide certification of a NACE inspector to be used in the performance of this contract. The certificate will be used to provide evidence of qualification for inspection of the specified coating system. The certification will be reviewed by NASA engineering for approval. A copy of the certification shall also be included in the ADP.

5.3 NACE Inspection Record (CDRL Item C16)

The Contractor shall provide a daily inspection record of NACE coating inspections performed by the NACE certified inspector. The format to be used is provided in NASA-STD-5008, Appendix E. A copy of the inspection record shall be submitted to the Contracting Officer within five business days of completion of the coating effort. A copy of each inspection record shall also be included in the ADP.

6. CLEANING (CDRL ITEM C17, C18)

The Contractor is responsible for the precision cleaning of the pressure vessel assembly. The pressure vessel shall be cleaned in accordance with KSC-C-123 or ISO 14952. The Contractor may clean the pressure vessel assembly to another cleaning standard with prior approval of the Contracting Officer.

The Contractor is also responsible for maintaining and preserving the cleanliness of the assembly in accordance with the surface cleanliness levels indicated below:

- Internal surfaces of the vessel and all appurtenances the contact the service medium shall be designated as critical surfaces and shall be cleaned to level 300A.
- All other surfaces shall be cleaned to level VC.

A list of facilities that have been verified to meet the requirements of KSC-C-123 is found below:

- Astro Pak, 12201 Pangborn Ave., Downey, CA 90421
- Chemko Technical Services, 5325 North U.S. Route 1, Mims, FL 32754
- Precision Fabricating and Cleaning, 3975 E. Railroad Ave., Cocoa, FL 32926
- United Contamination Control, 241 Zimmerman Ln., Langhorne, PA 19047

If the Contractor chooses to submit a cleaning facility not listed above, the proposed cleaning facility shall be certified by the Contractor at no cost to the Government prior to fabrication. All assembly and testing operations, unless otherwise specified, shall be performed in an environment conforming to ISO 14644 Class 8 to maintain the cleanliness level of the equipment

indicated on the drawing. The results from testing each clean room or clean zone and a statement of compliance with the specified cleanliness classification per the requirements in ISO 14644-1 shall be submitted prior to start of work.

The Contractor shall submit cleaning procedures to the Contracting Officer for approval prior to the start of cleaning, and shall include results of the cleaning process in the ADP.

7. VERIFICATION

7.1 Responsibility for Inspection

The Contractor shall be responsible for the performance of all inspection requirements set forth in this specification. Unless otherwise specified, the Contractor may use its own facilities or any commercial laboratory approved by the Government to perform inspections. The Government reserves the right to perform any of the inspections set forth in this specification, where such inspections are deemed necessary to ensure supplies and services conform to the prescribed requirements.

The Contractor shall allow the Contracting Officer or the Contracting Officer's designee safe access to the work in progress in order to determine that the pressure vessel is being fabricated, inspected, and tested in accordance with the fabrication drawings and this specification.

7.2 Non-Destructive Evaluation

All full-penetration butt welds shall be 100% digitally radiographed in accordance with ASME B&PVC, Section VIII. All partial penetration welds shall be tested by magnetic particle or liquid penetrant methods per ASME B&PVC, Section VIII. Any weld flaws identified shall be removed and repaired in accordance with ASME B&PVC, Section VIII. Results of all tests shall be documented per ASME B&PVC, Section VIII, and be included in the ADP.

7.3 Acceptance Testing (CDRL Items C19, C20, C21, C22, C23)

The Contractor shall submit an acceptance test procedure to the Contracting Officer for approval prior to the test. The acceptance test shall include a hydrostatic proof test and a pneumatic leak check.

7.3.1 Hydrostatic Test

The pressure vessel shall be subjected to a hydrostatic test in accordance with the applicable ASME code(s). The vessel shall be hydrostatically tested prior to painting or cleaning. The hydrostatic test pressure shall be maintained for an adequate time to permit a thorough inspection, and shall be no less than 30 minutes. No permanent deformation or defects may occur in the vessel as a result of the hydrostatic testing. The hydrostatic test fluid shall be clean potable water. The test fluid shall not have been used to test any other vessel.

7.3.2 Leak Testing

The vessel shall be pneumatically leak tested once it has been fully assembled, at 110% of the maximum operating pressure, with clean, dry nitrogen. The vessel shall maintain the test pressure for a minimum of one hour prior to leak detection testing. All weld seams, nozzle attachments, pipe hub assemblies, fittings, etc., shall be tested using bubble soap test per ASTM E515 or ASME B&PVC Section V, Article 10.

8. QUALITY ASSURANCE

8.1 Inspection Control Point Outline (CDRL Item C24)

Prior to the start of work, the Contractor shall provide the NASA KSC Contracting Officer and Quality Assurance Representative (QAR) a schedule and Inspection Control Point Outline (ICPO) which shows the work sequence(s) to be employed during the performance of this Purchase Order. The contractor's schedule/ICPO must indicate what types of contractor inspections will be performed and where in the contract's sequence of events they will be accomplished. If applicable, the schedule/ICPO must also indicate the specification(s) (including revisions) and/or other documentation that will be used to perform the indicated inspections. Special inspections, called mandatory inspection points (MIP) for the contractor to perform, will be designated by the Government during the performance of this contract. Upon submittal of the ICPO, the Government will identify which inspections/tests/work steps require Government Quality Assurance (GQA) notification. The contractor shall notify The NASA KSC QAR at least five (5) working days prior to the occurrence of these MIP. The Government reserves the right to perform inspections at any point in the fabrication process.

8.2 Notifications (CDRL Item C25)

The KSC Contracting Officer's Technical Representative (COTR) and KSC QAR shall be notified of each scheduled MIP no less than five working days prior to initiating the task.

8.3 Contamination Control

The Contractor's cleaning procedures shall include Quality Assurance provisions for in-process controls to prevent contamination, including provisions for maintaining cleanliness of on-site, pre-packaged components, and sub-assemblies.

8.4 Aerospace Quality Clauses

The Aerospace Quality clauses have been derived from AS9100 requirements. The Contractor shall comply with the following clauses of this SOW.

8.4.1 AQC04 Flow Down Requirements

This clause mandates that all applicable requirements that are invoked or applied to the customer's purchasing document, including this clause, shall be flowed down to the Contractor's sub-tier suppliers.

8.4.2 AQC06 Certificate of Compliance – Raw Materials (CDRL Item 26)

The following clause applies when the Contractor will purchase raw materials to defined specifications.

The Contractor will include with each shipment the raw material manufacturer's test report (e.g., mill test report) that states that the lot of material furnished has been tested, inspected, and found to be in compliance with the applicable material specifications. The test report will list the specifications, including revision numbers or letters, to which the material has been tested and/or inspected and the identification of the material lot to which it applies.

When the material specification requires quantitative limits for chemical, mechanical, or physical properties, the test report will contain the actual test and/or inspection values obtained. For aluminum mill products (except castings), certifications for chemistry may indicate compliance within the allowed range. Certifications for physical properties will show actual values.

When contractor supplies converted material produced by a raw material manufacturer, the contractor shall submit all pre and post conversion chemical/physical tests reports.

8.4.3 AQC08 Special Process Certification (CDRL Item 27)

Certain special processes are required to comply with this contract. Special processes shall be performed only by sources that have been surveyed and qualified/approved, by the supplier and/or the Customer, to perform those processes. The contractor shall provide to the Customer upon request all documentation showing evidence of special processor qualification and/or certification to perform special manufacturing, assembling, and test processing as required by the contract. The Contractor may elect to use only Customer approved sources.

A special process certification shall be provided with each shipment of item(s) delivered on this contract. Special Process Certifications may be in supplier format and shall include the following:

- Customer's Order number
- Part number(s)
- Serial and/or lot numbers, of the hardware processed (if applicable)
- Material process specification & revision

- Objective evidence demonstrating compliance with the applicable process, (e.g., temperature charts and hardness test results for heat treatment, destructive test results, etc.)
- A certification stating the special process was performed per the applicable drawing/specification requirements.
- Organization's name and address

When special processor is other than the Organization, provide a certification of compliance from the special processor stating the special process was performed per the applicable drawing/specification requirements. Certifications must include the processor's name, address and be signed and dated by a company official.

Each certification must be signed and dated by a company official of the Organization and/or Processor attesting to the acceptance of the processes performed to the required specification(s).

The supplier shall retain all records associated with the selection and approval of supplier approved special process providers. These records shall be included in the ADP. The supplier shall notify the Customer prior to destruction of records relative to this contract.

The Contractor shall insert the substance of this clause, including this sentence, in all lower-tier subcontracts for work performed under this contract.

The special processes involved with this Delivery Order are tube flaring, tube bending, and welding (where applicable to specification).

8.4.4 AQC16 Nondestructive Inspection/Nondestructive Test Certification (CDRL Item 28)

The Contractor will include with each shipment a certificate for the nondestructive inspection (NDI)/nondestructive test (NDT) performed. As a minimum, the certification shall contain the following information:

- Customer's Purchase Order / Contract number
- Name and address of the Company performing NDI/NDT;
- Date of Inspection;
- Quantity of parts tested by part number;
- Specification or other requirement defining the NDI/NDT acceptance / rejection criteria;
- Inspector/name/stamp and NDI/NDT certification level;
- NDI/NDT specification including revision;
- Material or item identification (part number, heat lot number, Foundry Record (FR) number;
- Material or item traceability (serial number, lot number, batch number, lot/date code);

- Inspection results (accept/reject);
- Reference to previous NDI/NDT reports for repair/rework if applicable;
- Reference to attached recordings i.e., films or photographs if applicable.

These records shall include all information required in the previous paragraph as well as acceptance / rejection criteria, and related test instrument data used in the NDI/NDT process.

8.4.5 AQC17 100% Attribute Clause

The Contractor is responsible for the performance, on a one hundred percent (100%) basis of all inspections and tests and record requirements specified in the contract. Unless otherwise specified in the contract, the Contractor may utilize independent inspection and testing laboratories or services that are acceptable to the Government.

9. TRANSPORTATION AND DELIVERY

The pressure vessel shall be transported per NPR 6000.1, Class IV, Level C. An internal blanket pressure of at least 5 psig dry nitrogen shall be maintained throughout transportation, delivery, and acceptance of the pressure vessel. There is no requirement for this pressure vessel assembly to be boxed, crated, skidded, or covered for shipment. Bolts, nuts, spare gaskets, and other loose parts shall be packaged to prevent loss or damage. Open ports shall be covered to maintain the specified cleanliness level on critical surfaces.

9.1 Advance Shipping Notice (CDRL Item C29)

An Advanced Shipping Notice is a courtesy letter or fax which provides advance shipping information to the Contracting Officer to coordinate the receipt of the shipped items with the NASA receiving, transportation, and management personnel. An Advanced Shipping Notice shall be provided no less than 10 days prior to each shipment. The Contractor shall furnish the following written information to the Contracting Officer: date of shipment, method of shipment, complete or partial shipment, number of cartons, total weight, dimensions.

9.2 Shipping Documentation (CDRL Item C30)

The completed pressure vessel assembly is to be weighed before shipment and the weight recorded within the shipping documents. The Contractor shall also record the blanket pressure and temperature at the time of application of the blanket pressure. Pictures of the final assembly ready for shipment shall be taken and included in the ADP.

9.3 Material Inspection Receiving Report (CDRL Item C31)

All items shall be accompanied with Form DD250, "Material Inspection Receiving Report." Final acceptance shall be at the NASA destination. The Contractor shall record the blanket pressure on Form DD250 prior to shipment and provide a method for GQA to verify the pressure at the NASA destination.

9.4 Transportation

The Contractor is responsible for all fixtures, tie-downs and supports, and any applicable permits required for shipping. The point of acceptance will be Kennedy Space Center. Unless otherwise directed, the Contractor will ship all parts to: NASA Transportation Officer, ISC Warehouse Building, M6-0744, Kennedy Space Center, FL 32899.

NOTICE The Government drawings, specifications, and/or data are prepared for the official use by, or on behalf of, the United States Government. The Government neither warrants these Government drawings, specifications, or other data, nor assumes any responsibility or obligation, for their use for purposes other than the Government project for which they were prepared and/or provided by the Government, or any activity directly related thereto. The fact that the Government may have formulated, furnished, or in any way supplied the said drawings, specifications, or other data is not to be regarded, by implication or otherwise, as licensing in any manner the holder or any other person or corporation nor conveying the right or permission to manufacture, use, or sell any patented invention that may relate thereto.

Custodian:

Preparing Activity:

NASA John F. Kennedy Space Center
Kennedy Space Center, Florida 32899

John F. Kennedy Space Center
NE-F2

APPENDIX A. CONTRACT DATA REQUIREMENTS LIST

CDRL	Section	Description	Date(s) Required
C1	3.2	Acceptance Data Package	Electronic copy 15 days prior to delivery of hardware; updated electronic copy and hard copy with delivery of hardware
C2	3.3	Subcontractor Specifications	10 days prior to start of subcontract work
C3	3.4	Request for Information	As needed
C4	3.5	Deviation or Waiver Request	As needed
C5	3.6	Meeting Records	5 days after each meeting
C6	3.7	Progress Schedules	Monthly
C7	4.1	Manufacturer's Data Report for Pressure Vessels	With ADP
C8	4.2	Design Proposal	30 days after effective date of order
C9	4.3	Pre-Fabrication Design Package	10 days after acceptance of Design Proposal
C10	4.4	As-Built Design Package	With ADP
C11	4.7.1	Certification of Welders	30 days after effective date of order
C12	4.7.1	Welding Procedure	15 days prior to welding
C13	4.7.4	Certification of Weld Inspector	30 days after effective date of order
C14	4.7.4	Weld Inspection Record	5 days after weld inspection completion
C15	5.2	Certification of NACE Inspector	30 days prior to painting
C16	5.3	NACE Inspection Record	5 days after painting completion
C17	6.0	Cleaning Procedure	30 days prior to cleaning
C18	6.0	Cleaning Results	5 days after cleaning completion
C19	7.3	Acceptance Test Procedure	45 days prior to test
C20	7.3	Acceptance Test Notification	7 days prior to test
C21	7.3	Acceptance Test Record	5 days after test
C22	7.3	Field Discrepancy Reports	As needed
C23	7.3	Punch List with Disposition	With ADP
C24	8.1	Inspection Control Point Outline	30 days after effective date of order
C25	8.2	Mandatory Inspection Point Notification	5 days prior to each MIP/GMIP

CDRL	Section	Description	Date(s) Required
C26	8.4.2	Material Certificates of Compliance	With ADP
C27	8.4.3	Special Process Certification	With ADP
C28	8.4.4	Nondestructive Inspection/Test Certification	With ADP
C29	9.1	Advanced Shipping Notice	10 days prior to shipment
C30	9.2	Shipping Documentation	With shipment
C31	9.3	Material Inspection Receiving Report	With shipment

APPENDIX B. USER'S DESIGN SPECIFICATION

USER'S DESIGN SPECIFICATION

User: National Aeronautics and Space Administration
Vendor: _____
Project: _____
Vessel: 6600 psig pressure vessel

Applicable Code Year and Addenda: ASME Section VIII, Division 2 - 2010 (2011 addenda)

A. Installation Site

- (1) Location: John F. Kennedy Space Center, Florida
- (2) Jurisdictional authority if applicable: _____
- (3) Environmental conditions
 - (i) Wind design loads
 - Design code: N/A Exposure: _____
 - Wind speed: _____ Importance Factor: _____
 - (ii) Earthquake design loads
 - Design code: 2 psi vertical, 1 psi horizontal, concurrently applied
 - Acceleration, S_s: _____ Site Class: _____
 - Acceleration, S₁: _____ Importance Factor: _____
 - (iii) Snow loads: N/A
 - (iv) Lowest one day mean temperature for location: 30 °F

B. Vessel Identification

- (1) Vessel number or identification: _____
- (2) Service fluid e.g. gas, liquid, density, etc.: inert gas (helium, nitrogen)

C. Vessel Configuration and Controlling Dimensions

- (1) Outline drawings: per vendor fabrication drawings
- (2) Vertical or horizontal: horizontal
- (3) Openings, connections, closures including quantity, type and size, and location (i.e. elevation and orientation): 1-1/2 in. NPS Grayloc, 3 in. NPS Grayloc located on vessel heads, coaxial with vessel centerline; low-point drain; other openings as required by ASME code
- (4) Principal component dimensions in sufficient detail so that volume capacities can be determined: 260-280 cu. ft. approximately 4 ft. inner diameter, 30 ft. maximum overall length including attachments
- (5) Support method: saddles

D. Design Conditions

- (1) Specified design pressure: 6600 psig
- (2) Design temperature and coincident specified design pressure: 150 °F at 6600 psig
- (3) Minimum Design Metal Temperature (MDMT) and coincident specified design pressure: 20 °F at 6600 psig
- (4) Dead loads, live loads and other loads: _____

USER'S DESIGN SPECIFICATION

E. Operating Conditions

- (1) Operating pressure: 6000 psig
- (2) Operating temperature: 20-110 °F
- (3) Fluid transients and flow and sufficient properties for determination of steady state and transient thermal gradients across the vessel sections, if applicable: _____
- (4) Pressure drop, if applicable: _____

F. Design Fatigue Life

- (1) State whether or not a fatigue analysis is required per Paragraph 4.1.1.4 of the Code: _____
- (2) If a fatigue analysis is required, state number of design cycles per year and the required vessel design life:
10 cycles per year, 30 year design life
- (3) If cyclic operating conditions exist and a fatigue analysis is not required based on comparable equipment experience, this shall be stated:

G. Materials of Construction

- (1) Specify materials of construction: _____
- (2) Corrosion allowance: 0.125 in.
- (3) Damage mechanisms associated with service fluid at design conditions: corrosion

H. Load and Load Cases

- (1) Any expected loads: _____
- (2) Load case combination: _____

I. Overpressure Protection

- (1) Overpressure protection system by: owner (NASA)
- (2) Type of overpressure protection system (type of pressure relief valve, rupture disc, etc.):
UV-stamped safety relief valve
- (3) Is jurisdictional acceptance required prior to operation of the vessel ?
no

J. Additional Requirements: _____

USER'S DESIGN SPECIFICATION

**CERTIFICATION OF COMPLIANCE OF
THE USER'S DESIGN SPECIFICATION**

I (We), the undersigned, being experienced and competent in the applicable field of design related to pressure vessel requirements relative to this User's Design Specification, certify that to the best of my knowledge and belief it is correct and complete with respect to the Design and Service Conditions given and provides a complete basis for construction in accordance with Part 2, paragraph 2.2.2 and other applicable requirements of the ASME Section VIII, Division 2 Pressure Vessel Code, 2010

Edition with 2011 Addenda and Code Case(s) _____

This certification is made on behalf of the organization that will operate these vessels.

National Aeronautics and Space Administration - John F. Kennedy Space Center

Certified by: Stephen M. Anthony

Title and areas of responsibility: Design Engineer, High Pressure Gas Systems

Date: 04-23-2014

Certified by: _____

Title and areas of responsibility: _____

Date: _____

Professional Engineer Seal: _____

Date: _____

