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Design Specification

Packaging Glovebox System for the OU 7-10 Glovebox Excavator Method Project

Prepared for:
U.S. Department of Energy
Idaho Operations Office
Idaho Falls, Idaho

Idaho National Engineering
and Environmental Laboratory

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1. SCOPE

1.1 General

This specification covers the requirements for the procurement of material, fabrication, assembly, integration, testing, packaging, and shipment of a Packaging Glovebox System (PGS). The PGS is part of the OU 7-10 Glovebox Excavator Method Project. This project will demonstrate the feasibility of retrieval and repackaging Pit 9 waste at the Idaho National Engineering and Environmental Laboratory (INEEL) located near Idaho Falls, Idaho.

The PGS will be used for the confinement of radioactive contamination that could be released in the process of handling and repackaging Pit 9 waste. The waste will be removed from the pit and placed into a cart. The cart will move the waste into the PGS for examination and sampling. The waste will then be moved through loadout ports in the floor of the PGS into clean 55-gallon or 85-gallon drums for subsequent storage and disposal.

1.2 Work Included

The Subcontractor shall provide all labor, material, equipment, and services necessary to fabricate, assemble, inspect, test, disassemble, package, and deliver a PGS, complete and in accordance with this specification and the contract drawings, subject to terms and conditions of the contract or purchase order. The subcontractor shall provide a technical representative on site during assembly and installation of the PGS units at the Contractor's facility.

1.3 Work Not Included

Final assembly and installation of the PGS at the INEEL and integration of the PGS with INEEL facility systems will be the responsibility of the Contractor and is not within the scope of this specification.

2. APPLICABLE CODES, PROCEDURES, AND REFERENCES

The following documents form a part of this specification to the extent specified herein. Unless otherwise specified, the issue in effect on the date of invitation to bid shall apply. In the event of a conflict between the documents referenced herein and the contents of this specification, the contents of this specification shall be considered a superseding requirement.

2.1 National and Local Codes

Code of Federal Regulations

10 CFR 830.120	Nuclear Safety Management, Quality Assurance Requirements

National Fire Protection Association (NFPA)

NFPA 70-2002	National Electric Code (NEC)

2.2 Industry Procedures and DOE Orders

American Glovebox Society (AGS)

AGS-G001-1998	Guidelines for Gloveboxes, Second Edition

American Society of Mechanical Engineers (ASME)

ASME NQA-1	Quality Assurance Program Requirements for Nuclear Facilities

American Society of Nondestructive Testing (ASNT)

SNT-TC-1A	Recommended Practice

American Society of Testing and Materials (ASTM)

ASTM A 36	Standard Specification for Carbon Structural Steel
ASTM A 167	Standard Specification for Stainless and Heat- Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
ASTM A 240	Standard Specification for Heat-Resisting Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels
ASTM A 276	Standard Specification for Stainless and Heat- Resisting Steel Bars and Shapes
ASTM A 380	Standard Practice for Cleaning, Descaling, and Passivation of Stainless Steel Parts, Equipment, and Systems
ASTM A 480	Standard Specification for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip

ASTM A 500	Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
ASTM D 2000	Classification System for Rubber Products in Automotive Applications

American Welding Society (AWS)

AWS A2.4	Standard Symbols for Welding, Brazing, and Nondestructive Examination
AWS B2.1	Specification for Welding Procedure and Performance Qualification
AWS D1.1	Structural Welding Code - Steel
AWS D1.6	Structural Welding Code B Stainless Steel

Department of Energy

DOE-STD-1090-99	Hoisting and Rigging

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3. SUBMITTALS

3.1 General

Vendor data shall be submitted as instruments of the Subcontractor. Therefore, prior to submittal, the Subcontractor shall ascertain that material and equipment covered by the submittal and the contents of the submittal itself, meet all the requirements of the subcontract specifications, drawings, or other contract documents.

Each submittal shall contain identification for each separate piece of material or equipment, and literature with respect to the information provided in the specification and on the Vendor Data Schedule. Submittals shall be numbered consecutively for each different submittal.

Vendor Data required by this specification to support fabrication, testing, and shipment is identified on the Vendor Data Schedule. The Vendor Data Schedule provides a tabular listing by specification reference and description of the item or service. The type of submittal is identified by a "Vendor Data Code", and the time required to submit the item is identified by a "When to Submit" code. An "Approval" code specifies whether the submittal is for Mandatory Approval or for Information Only. One copy of routine paper or electronic file submittals is required; additional copies may be required by the Vendor Data Schedule. Electronic file submittals are preferred.

All vendor data shall be submitted to the Contractor using the Vendor Data Transmittal and Disposition Form. The form provides the Subcontractor a convenient method to submit vendor data and provides the Contractor a means of dispositioning the submittal. The Subcontractor shall list the Vendor Data Schedule item number, a Vendor Data Transmittal tracking number (if applicable), specification number reference, a Tag Number (if applicable), the submittal status (e.g., Mandatory Approval, Information Only, Re-submittal, or Or-equal), the Revision Level, and the item Description.

The Contractor's comments and required action by the Subcontractor will be indicated by a disposition code on the submittal. The disposition codes will be classed as follows:

"Work May Proceed." Submittals so noted will generally be classed as data that appears to be satisfactory without corrections.

"Work May Proceed with Comments Incorporated. Revise Affected Sections and Resubmit." This category will cover data that, with the correction of comments

noted or marked on the submittal, appear to be satisfactory and require no further review by the Contractor prior to construction. Revised drawings shall be provided upon request.

"Work May NOT Proceed. Revise and Resubmit." Submittals so dispositioned will require a corrected resubmittal and approval prior to proceeding with work for one of the following reasons:

Submittal requires corrections, per comments, prior to final review.

Submittal data incomplete and requires more detailed information prior to final review.

Submittal data does not meet Subcontract document requirements.

"Accepted for Use. Information Only Submittal." Submittals so dispositioned will generally be classified as Information Only for as-specified material and equipment.

Mandatory – Approval coded vendor data will be reviewed by the Contractor and receive an A, B, or C disposition. Information Only submittals without comments will receive a D disposition. A, B, and C coded dispositioned submittals will be returned to the Subcontractor. D dispositioned submittals will not be returned to the Subcontractor. The Contractor may provide internal review of Information Only submittals. In the event that comments or questions are generated on an Information Only submittal, the submittal may be dispositioned B or C and returned to the Subcontractor for appropriate action. Acknowledgment of receipt of dispositioned vendor data by the Subcontractor will not be required.

The Contractor will return dispositioned submittals with reasonable promptness. The Subcontractor shall note that a prompt review is dependent on timely and complete submittals in strict accordance with these instructions.

All Vendor Data must be dispositioned A or D before the subcontract can be considered complete.

Where submittal of data items such as drawings, vendor data, analysis, require approval or concurrence, the Contractor will return such concurrence or corrections or comments to the Subcontractor within five (5) working days after receipt of submittal. Where corrections are required, the Subcontractor shall submit corrected drawings, analysis, etc., until approval is granted, at which time the Contractor will return one (1) approved and signed copy to the Subcontractor. It is not the intent of the Contractor to be obstructive, arbitrary, or capricious in

reviewing data submittals, but to simply ensure compliance with the intent and requirements of this specification.

3.2 Vendor Data Schedule

The following information shall be submitted by the Subcontractor as indicated on the Vendor Data Schedule. A complete independent set of information shall be submitted for each PGS ordered.

3.2.1 Schedule

The Subcontractor shall prepare and submit a project schedule 10 working days after award of the Subcontract. The schedule shall identify the scheduled dates and duration of fabrication steps, hold points, tests, inspections, disassembly, preparation for shipping, shipment, and scheduled delivery to the Contractor. The Subcontractor shall also provide, for Contractor approval, a revised schedule within five (5) working days of any modification to the subcontract that revises the scheduled delivery date or when other approved Contractor changes affect a scheduled assembly step, hold point, test, or inspection.

3.2.2 Subtier Services Plan

The Subcontractor shall prepare and submit a subtier services plan that includes the name, address, telephone number, and point of contact for all outside services that the Subcontractor intends to use to perform any portion of the work required by this specification. This plan shall also identify the specific work requirements of this specification that will be performed by those outside services.

3.2.3 Status Reports

Written status reports shall be submitted by the Subcontractor on a monthly basis with the report due on the last business day of each month. At a minimum, the report shall include a narrative progress summary describing accomplishments and any areas of concern in addition to the status of the fabrication schedule.

3.2.4 Material Control Procedure

The Subcontractor shall prepare and submit the procedure(s) that identify and control the material that will be used in the manufacture of the PGS.

3.2.5 Weld Procedures

The Subcontractor shall prepare and submit copies of the weld procedure(s) that will be used for the fabrication of the PGS.

3.2.6 Welder Qualifications

The Subcontractor shall prepare and submit copies of the welders' qualifications.

3.2.7 Weld Inspector Qualifications

The Subcontractor shall prepare and submit copies of the qualifications of the individuals that will be performing the weld inspections.

3.2.8 Weld Inspection Procedures

The Subcontractor shall prepare and submit copies of the weld inspection procedure(s) to be used to inspect the welds.

3.2.9 Certificates of Conformance

The Subcontractor shall prepare and submit copies of the required material certificates of conformance. See section 6.3.3.

3.2.10 Cleaning Procedures

The Subcontractor shall prepare and submit copies of the procedure(s) to be used to clean the components and assemblies prior to and after fabrication.

3.2.11 Calibration Procedure

The Subcontractor shall prepare and submit the calibration procedures to identify how the calibrations are performed and documented.

3.2.12 Manufacturing / Inspection / Test Plan

The Subcontractor shall prepare and submit to the Contractor a plan that outlines all the manufacturing, testing, and inspections to be performed. The plan shall be prepared with the participation of the Contractor during the fabrication phase of the PGS. The plan shall be written with the intent of verifying conformance to the requirements specified in this

specification. The plan shall be written to ensure personnel safety during the testing operations.

The plan shall include the nondestructive testing to be performed. The nondestructive testing includes the weld examination, load tests, pressure tests, continuity tests, dimensional, and configurational inspections. The plan shall include an integrated functional checkout of all operating systems and controls including the carts, limit switches, single beam access guards, hoist, electrical power outlets, load cell, and lighting. Any special tooling, equipment, or instrumentation used to perform such inspections should be identified as well as the required limits of accuracy or calibration.

The subcontractor should use existing planning and inspection documentation wherever possible. It is not the intent of this specification to cause the subcontractor to generate an inspection planning system separate from the system normally used to satisfy the requirements specified in paragraph 6.1.

3.2.13 Hoist Load Test Procedure

The Subcontractor shall prepare and submit a procedure for performing the load test on the hoist.

3.2.14 Eyebolt Load Test Procedure

The Subcontractor shall prepare and submit the procedures for performing the load test on the shield eyebolts.

3.2.15 Inspection and Test Reports

The Subcontractor shall prepare and submit the following inspection and test reports, which include certificates of conformance that document the results of the inspections and testing performed.

3.2.15.1 Pressure Test Report

3.2.15.2 Leak Test Report

3.2.15.3 Hoist Load Test Report

3.2.15.4 Lift Eye Load Test Report

3.2.15.5 Visual Weld Inspection Report

3.2.15.6 LP Weld Inspection Report

3.2.15.7 Operational Test Report

3.2.15.8 Electrical Continuity Test Report

3.2.16 Preliminary Assembly Plan

The Subcontractor shall prepare and submit a preliminary assembly plan. The plan shall be submitted to the Contractor 3 weeks after award of the subcontract.

This plan is required by the Contractor to provide preliminary PGS assembly information to other non-PGS bidders who will be submitting proposals for the construction of the OU 7-10 Glovebox Excavator Method Project Facility. These non-PGS bidders will need to understand the scope of the PGS assembly work to be able to supply a complete bid for the facility fabrication task.

The preliminary assembly plan shall include a basic description of the following work:

A. The extent of disassembly. To what extent will the parts of the glove box be disassembled.
B. Quantity of boxes, packages, containers, etc. to be shipped.
C. The estimated weights of the major components and assemblies
D. The relative order of reassembly
E. Basic and any special instructions for reassembly
F. A general time frame for reassembly based on the presence of the Subcontractor representative at the INEEL for consultation during reassembly.

3.2.17 Final Assembly Plan

The Subcontractor shall prepare and submit assembly instructions that can be used by the Contractor to assemble and install the PGS at the INEEL. See section 7.1.2.

3.2.18 Special Tools List

The Subcontractor shall identify any special tools required for maintenance or replacement of windows, glove rings, or other equipment.

3.2.19 Marked-up (Redline) Drawing Information

The Subcontractor shall track and document all approved changes made to the Contractor's drawings during fabrication. After the fabrication and assembly has been completed and accepted by the Contractor, the Subcontractor shall mark up (redline) a set of Contractor drawings to reflect the "as-built" condition. These marked-up drawings shall reflect all modifications to and deviations from the fabrication drawings that have been approved by the Contractor and subsequently implemented by the Subcontractor. Actual dimensions deviating from the nominal but within the tolerance of the Contractor's drawings shall not be noted as exceptions. The Subcontractor shall submit the marked-up drawings to the Contractor.

3.2.20 Variable Frequency Drive Programming and Parameters

The Subcontractor shall provide documentation of all the programmed parameters for the cart variable frequency drive.

A variable frequency drive users manual shall be provided to the Contractor.

3.2.21 OEM Documentation

The Subcontractor shall request documentation from the manufacturers of the OEM equipment. The Subcontractor shall organize this information and provide it to the Contractor. These documents shall be included in the project file for the equipment. As applicable, the documentation shall include the following:

- Installation and calibration information
- Operation instructions and procedures
- Maintenance information and procedures
- Catalog and technical information
- Drawings, sketches, or other configurational information
- Vendor address and contact information.

3.2.22 OEM Recommended Spare Parts List

The Subcontractor shall request a list of recommended spares for the OEM equipment. The Subcontractor shall organize this information and provide it to the Contractor.

4. DESIGN

No Subcontractor design services are included in the scope of this specification. The PGS shall be fabricated to conform to information shown on the drawings listed in Table 1 and in this specification.

5. FABRICATION AND ASSEMBLY

5.1 General

The Subcontractor shall fabricate the PGS in compliance to the information documented on the drawings listed in Table 1 and in this specification. Note that although the drawings may imply an order of fabrication, it is strictly up to the Subcontractor to determine the actual approach. The PGS shall be fabricated in the Subcontractor's shop to ensure proper fit and operation.

The Contractor's technical representative or designated alternate shall inspect the assembled final product prior to disassembly for shipment. The Subcontractor shall provide temporary marking of windows and mating body joints for ease of in-place reassembly by the Contractor. Assembly of the equipment shall be made in a clean dust-free area of the Subcontractor's shop.

5.2 Prohibitions

Controls are to be exercised during all stages of fabrication to minimize exposure of stainless steel to contaminants, particularly chlorides. Chloride-bearing compounds shall be avoided. However, if used, they shall be completely removed by thorough cleaning. Any compounds, liquids, or markers that come into contact with stainless steel surfaces shall not contain more than 250 ppm by weight of chlorides. Cutting of stainless steel shall be performed with mechanical shop tools, plasma arc, laser, or water jet. Carbon arc or iron powder cutting shall not be permitted on stainless steel.

5.3 Equipment

The naming of a manufacturer in this specification or contract drawing(s) shall not be construed as the intent to eliminate the products of other manufacturers

having equivalent products. The substitution of materials other than those named in this specification or on the drawing may be made with the prior written approval of the Contractor. Requests for material substitution must be accompanied and substantiated by written technical data. Acceptance of a selected material shall not be construed as acceptance of the finished product. The use of reclaimed or recycled material is permissible provided that the material has been reprocessed so as to be indistinguishable from new, virgin material.

5.3.1 Confinement Windows

Two types of window material are used in the PGS. See the drawings for the type of window in each location. The windows in the upper portion of the PGS shall be ½-inch laminated safety glass per ASTM C 1172. The windows in the lower portion shall be fabricated from clear, transparent 9/16-inch thick, D-fence glass (DFG 9/16)[1].

5.3.2 Widow Gaskets

Gasket materials shall be 30–55 durometer (Shore A) fluorosilicone or approved equal. All gaskets shall be of a continuous or mitered and vulcanized construction.

Installation of the clamped window assemblies shall be as shown on the drawings. Bolt torque information shall be as indicated in AGS-G001-1998 section 5.7.2.2.

5.3.3 Hoist

The hoist shall be the Coffing 1-ton monorail hoist described below or an approved equal.

Manufacturer	Coffing Hoists[2]
Model:	ECMT-2012-3-15
Power Voltage:	460 Volts – Three Phase
Control Voltage:	24 Volts
Lift:	15 ft
Speed:	Single
Options:	- Limit Switches for Trolley

[1] Sully North America, Box 70, Trumbauersville, PA, 18970-0070, Tim Cronrath, 1-888-785-5962 x-133

[2] Coffing Hoists, Box 779, Wadesboro, NC, 28170, Tony Horne, 800-477-5003

(Request and install the trolley limit switch brackets per manufacturer's recommendations)
- Upper travel limit switch
- 40 VA 24-Vac Control Transformer
- Power and control pig 2 ft out power side
- Less PB and cable
- Chain Container

5.3.4 Cart/Hoist/Trolley Pendant

The glovebox pendant shall be an eight–pushbutton pendant plus an emergency stop push button. The glovebox pendant operation is as follows:

5.3.4.1 HOIST

UP Pushbutton – When pressed and held, the hoist will raise until the hoist upper limit switch is tripped.

DOWN Pushbutton – When pressed and held, the hoist will lower until the hoist lower limit switch is tripped.

RIGHT Pushbutton – When pressed and held, the trolley will travel away from the glovebox pit side until the trolley right limit switch is tripped.

LEFT Pushbutton – When pressed and held, the trolley will travel toward the glovebox pit side until the trolley left limit switch is tripped.

5.3.4.2 CART

RIGHT Pushbutton – When pressed and held, the cart will move away from the glovebox pit side until the intermediate limit switch is tripped.

LEFT Pushbutton – When pressed and held, the cart will travel toward the glovebox pit side until the limit switch at the glovebox pit side is tripped.

OVR Pushbutton – When the cart has traveled to the intermediate limit switch, the intermediate limit switch shall be overridden by simultaneously pressing the RIGHT and

OVR Pushbutton – The cart shall stop when the furthest limit switch opposite the glovebox pit side is tripped.

E-Stop Pushbutton – When the E-Stop Pushbutton is pressed, all power shall be de-energized to the hoist, trolley, cart, and glovebox receptacles.

SPARE Pushbutton – Spare pushbutton.

5.3.5 Cart Limit Switches

Three limit switches shall be installed per glovebox to control the position of the cart. Cabling shall be run into the glovebox through a bulkhead connector to each of the limit switches. The limit switches shall be adjusted and tested to ensure the cart stops accurately. The pit side limit switch shall be operated to ensure that only the opposite direction voltage phase sequence shall be available when the end limit switch is tripped. The intermediate limit switch shall be operated to verify that power is removed to the cart when the limit switch is tripped. The override and right buttons shall be pressed and the cart shall continue to go past the intermediate limit switch to the end limit switch. Only the opposite direction voltage phase sequence shall be available when the end limit switch is tripped.

5.3.6 Safety Beam

The safety beam shall be installed as a safety device to prevent cart movement whenever the oval gloves are inside of the glovebox. The safety beam shall be long-range, single-beam safety control typically used for perimeter and access guarding. The unit shall consist of one transmitter and one receiver per PGS side that are immune from weld flash, ambient light, and interference from other units installed in close proximity. The double bounce configuration shall be used so that the transmitter and receiver can be installed outside of the glovebox. Stainless steel mirrors shall be mounted within the glovebox to reflect the beam from the transmitter to the receiver. Testing of the safety beam shall be completed to ensure that when the cart is not at a limit switch and any of the lower oval gloves are positioned into the glovebox, the cart motor shuts down.

5.3.7 Cart Motor Variable Frequency Drive

The variable frequency drive shall provide the cart motor with 480-Vac power. The parameters within the drive shall be set to provide a 3-second ramp-on acceleration and a 2-second ramp-on deceleration.

5.4 Fabrication

All components shall be fabricated in conformance with the drawings and as specified herein.

5.4.1 Electrical

The Subcontractor shall furnish all labor, materials, equipment and appliances required to complete the installation of the complete electrical systems. All labor, materials, service, equipment, and workmanship shall conform to the applicable chapters of the National Electrical Code (NEC), the National Electrical Safety Code (NESC), and Occupational Safety and Health Administration (OSHA).

5.4.1.1 Workmanship

All work shall be done in a skillful and workmanlike manner. The Subcontractor shall arrange work in a neat, well organized, manner.

Electrical connections shall be tightened to torque specifications stated by the NEC code and equipment manufacturer.

Ensure instruments and electrical equipment are mounted per manufacturer's recommendations using the provided mounting holes, brackets and hardware.

5.4.1.2 Labeling

Install the labels as shown on the drawings. Identifying items with marking pens, adhesive tape, embossed plastic or metal tape, or similar type means is not acceptable.

All conductors or cables shall be identified with white heat-shrink tubing and black letters typed a minimum of 3/32-inch high with non-smear ink such as Brady-321, Brady-322 or approved equal. Hand-lettered labels shall not be used.

5.4.1.3 Conductors and Cables

All conductors used for power circuits shall be type THHN. Minimum size of conductors shall be No 12 AWG. Conductors shall be copper.

5.4.1.4 Raceways

All raceways shall be Rigid Galvanized Steel (RGS), minimum size ½ inch. All device and junction boxes shall be cast steel. Provide liquid-tight flexible metal conduit for motor connections and for other electrical equipment connections where subjected to movement or vibration.

5.4.1.5 Wiring

Common neutrals, i.e., Edison type or multi-wire branch circuits, shall not be allowed. Where a neutral conductor is required, a dedicated neutral conductor shall be provided for each phase conductor.

5.4.1.6 Lighting

Externally mounted fluorescent fixtures shall supply lighting for the PGS. The fixtures shall be supplied with a primary cord and a NEMA 5-15P plug. The fixtures shall be supported and connected as shown on the drawings.

5.4.1.7 Devices

All standard receptacles shall be specification grade, 20 Ampere, 125 Volts in a NEMA 5-20R configuration. Toggle switches shall be specification grade, 20 Ampere, 120 Volts.

5.4.2 Welding

Welds shall conform to the call-outs specified on the drawings and to the requirements of this specification. Weld procedures and welder qualifications shall be submitted to the Contractor for approval prior to performing any welding. Confinement welds shall be multiple pass to ensure gas tightness. The required thickness of all welds shall be met after final grinding and polishing. Where stress relieving is required to maintain dimensional requirements, it shall be done before machining.

Weld joints shall be degreased and brushed as necessary to remove dirt, scale, corrosion, dust, grease, oil, water, or other foreign material within 1-inch of the joint prior to welding.

Welds being ground must be kept cool at all times to preclude distortion and discoloration. Interior welds shall be ground flush with surrounding surfaces. Exterior welds shall be finished flush at locations where gasket seals must be made; at the top, bottom, or sides of structural joints if appropriate; or where flanges, connections, or other attachment points to the glovebox are to be made. Interior welds shall be free of the defects listed in paragraph 6.3.5, and the surface finish of the weld area shall match the respective interior or exterior surface to the extent possible. The original material thickness shall be maintained after all grinding and polishing processes. Frame welds do not require any other treatment except where a flat surface is required for mounting windows, gaskets, hatches, or similar appurtenances.

5.4.2.1 Stainless Steel

All stainless steel welding shall be performed in accordance with AWS D1.6. Welders and weld procedures should be qualified in accordance with AWS D1.6. Brushing shall be done with a clean stainless steel brush not previously used on other materials. In no case shall a carbon steel brush be used.

5.4.2.2 Carbon Steel

All carbon steel welding shall be performed in accordance with AWS D1.1. Welders and weld procedures should be qualified in accordance with AWS D1.1.

5.4.2.3 Stud Welding

Welding of threaded studs shall be performed in accordance with AWS D1.6, Section 7 and the following:

A. Studs shall be installed using an automatic weld machine (stud gun).

B. Only capacitive discharge (CD) weld studs shall be used and all weld spatter shall be removed by stainless steel wire brush or grinding.

C. The base of studs shall be flush with the material to which they are welded. The axis of the studs shall be perpendicular to the material to which they are welded within 2 degrees.

D. Failed studs shall be removed, the surface re-prepared, and the stud reinstalled.

5.4.3 Finish and Fit

All mill and fabrication markings such as center punch marks, scribe lines, and stamp marks shall be removed. All exposed surfaces shall be free of sharp edges, cracks, pits, oxides, embedded slag, burns, weld splatter, sharp ridges, grooves, tool marks, or any other surface irregularities.

Parts shall be free of burrs and sharp edges. All components drilled or machined shall be deburred and cleaned after the work is completed. The PGS floor and skin shall be flat to within 1/16-inch per 2 ft. after welding and shall be flat within 1/8-inch over its entire length. The individual parts and assemblies shall be capable of being assembled together without forcing components together and without the use of shims or spacers.

The interior walls of the PGS shall be smooth and crevice free with all corners or transition pieces smooth and rounded. In no event shall SST sheet be bent to an interior radius less than three (3) times the thickness of the material unless otherwise noted on the drawings.

The interior walls shall be polished to a No. 4 surface finish per ASTM A 480. The exterior finish of the walls may be a standard No. 2B mill finish per ASTM A 480 except on sealing surfaces. All sealing surfaces shall be finished to at least a 32 micro inch finish.

5.5 Identification and Marking

The Subcontractor shall attach an identification nameplate to the shell of each PGS with the following information:

A. Subcontractor's Name or Logo
B. Purchase Order Number
C. Year Built
D. Weight of the assembled glovebox

The nameplate identification shall be stamped or etched on 300 series stainless steel tag with 1/4-inch high letters and numbers. The nameplate shall be at least 3 in. high and 5.5 in. long and shall be tack-welded to the enclosure shell at a location convenient for viewing when assembled. The nameplate must be visible after assembly.

5.6 Cleaning

The cleanliness of the enclosure shall meet the approval of the Contractor at the time of final inspection. The Subcontractor's cleaning procedures shall be submitted for Contractor approval prior to fabrication.

Both interior and exterior surfaces shall be cleaned of weld flux, oil, grease, shop soil, and visible rust. Cleaning methods that expose the metal surfaces to iron or chloride contamination shall only be used if absolutely necessary. Methods may include cleaning by hot water spray, solvent wiping, or any consistent method specified in ASTM A 380.

If a detergent is needed to ensure thorough cleaning, it shall be low in chloride. The final wash and rinse shall be accomplished with fresh water. The detergent, wash, and rinse shall contain less than 250 ppm chlorides. After the water rinse, inside surfaces shall be dried using heat, lint-free cloth, or other means to ensure cleanliness. If heat is used for drying, the final rinse water must be full-softened, low-chloride water with less than 250 ppm chlorides.

5.7 Painting

The drawings identify the parts to be painted. In general the carbon steel material shall be painted. No stainless or aluminum material shall be painted. Note that the carbon steel and the carbon steel to stainless welds shall not be primed or painted prior to acceptance after inspection. The following provides painting information.

The walking surfaces on the PGS platform and stairs shall be painted using Keeler and Long 8400 Series (for horizontal application only). Prepare all metal walking surfaces by sandblasting to 2-3 mils of profile. The product is self-priming. Roll-on 10-15 mils and sprinkle with an alumina oxide grit and allow to cure. Provide a double application. Use light gray 5504.

Framework and other miscellaneous items shall be primed and painted using Keeler and Long No. 6040 (Tri-Polar Primer) Oil/Alkyd. For the topcoat use Keeler and Long P-Series (Poly-Silicone Enamel) Copolymerized Silicone-Alkyd Enamel. Use light gray 5504. Provide a flat finish.

5.8 Fasteners

Unless otherwise indicated, all fasteners shall be hand tightened plus 1/4 turn.

5.9 Support at the INEEL

The Subcontractor shall provide an individual to support the assembly and installation of the PGS at the INEEL for a minimum period of 2 consecutive weeks. The Contractor shall notify the Subcontractor 30 days before they are required to be at the INEEL.

5.10 Additional Equipment Purchase

The Subcontractor shall purchase and deliver to the Contractor the following additional equipment.

5.10.1 Glove Rings

- Description – Large Oval Push through Enclosure System
- Part No. – 43205
- Quantity – Four
- Vendor – Central Research Laboratories
- Safety Category – Safety Significant
- Note – This item is the same as item 24 on drawing 522008

5.10.2 Bag-out Ring

- Description – 12-inch Weld in Enclosure Ring Assembly for Panel thickness of 16 gauge (0.0595 inch)
- Part No. – 37973
- Quantity – One
- Vendor – Central Research Laboratories
- Safety Category – Safety Significant
- Note – This item is the same as item 25 on drawing 522019 except it is for a wall thickness of 0.0595 inch instead of 0.188 inch.

6. QUALITY ASSURANCE

6.1 Program

The Subcontractor shall maintain a Quality Assurance Program that satisfies the requirements of ASME NQA-1-1997.

The PGS components and assemblies are divided into three categories. They are Safety Significant (SS), Low Safety Consequence, and Consumer Grade (CG). The component or assembly designation is indicated on the drawing that documents that part or assembly.

6.2 Operational Testing

The Subcontractor shall prepare for and perform the operational testing as indicated in the test plan. The sequence of testing shall be determined by the Subcontractor. As a minimum the following operational testing shall be performed:

A. Drive Cart: The drive cart, loaded with a 350-lb weight, shall be moved between its travel limits by the electrically powered drive screw – using the operating pendant to demonstrate that the cart starts and stops as and where required. The override feature shall be demonstrated. This same test shall be used to verify cart, rail, and PGS capacity. The cart shall run freely and not bind on the rails.

The drive cart shall also be tested to verify that the rate of travel is approximately 3 inches per second. The buttons on the pendant shall be tested to verify that the drive cart moves in the direction specified (Right for right button and left for left button). The time and the distance the cart takes to stop shall be verified to be 2 seconds and 3 inches after release of the button.

B. Auxiliary Cart: The auxiliary cart shall be moved along the rails to verify rail alignment. A 200-lb weight shall be placed in the auxiliary cart and shall be moved through the cart movement range to verify cart and rail capacity. The cart shall run freely and not bind on the rails.

These test shall be performed initially at atmospheric pressure for operational verification and then at minus 0.7 iwg for operational verification at operating pressure.

C. Load Cell: Calibrated weights shall be placed on the load cell to verify that it is operating correctly. The weight shall be placed in 1-lb increments from 1 lb to 5 lb, 2-lb increments from 5 to 15 lb, and in 5-lb increments from 15 to 50 lb. The acceptance criterion for the readout is ±10% of the load.

D. Safety Beam: The safety beam (both sides require testing and verifying) shall be tested by placing an object into the beam to verify that after pushing the right or left cart button on the pendent, the cart will not start (the cart can be stopped anywhere in its range of travel). A second test shall be performed with the cart operating by placing an object into the beam to verify that the cart stops.

E. Hoist: The installed hoist and trolley system shall be fully and functionally tested at the Subcontractor's facility in accordance with the manufacturer's procedures, manuals, and recommendations. No load shall be applied to the hoist prior to load testing. The hoist shall move as indicated on the buttons on the hoist control pendant.

After load testing, the hoist shall be retested at minus 0.7 (+0.25,-0) iwg for operational verification at operating pressure. The hoist shall be run to each end of the PGS with a 350 lb weight.

F. Operational Leak Test: The glovebox portion of the PGS shall be helium leak tested under dynamic operational conditions. This helium leak test shall be performed using the same criteria as the test in section 6.3.7. The test pressure shall be plus 0.7 (+0, -.25) iwg. Due the difficulty associated with the sealing of the drive screw during rotation, it shall not be included for this test. A load of 200 lb shall be placed in the auxiliary cart and the cart shall be moved the length of the PGS during leak testing. The hoist shall then lift a load of 350 lb and shall be run along the length of the glovebox during leak testing.

6.3 Inspection and Hold Points

Inspection and testing of the PGS shall be conducted in accordance with Table 2.

Table 2. Inspection and testing.

Test or Inspection	Test Paragraph	Applicable Requirements
Operational Testing	6.2	6.2
Certificates of Conformance	6.3.3	5.3.1, 5.3.2, 5.3.3
Visual and Mechanical Inspection	6.3.4	5.3.3, 5.4, 6.3.6
Visual Weld Inspections	6.3.5	5.4.2, 5.4.2.3, 5.4.3
Pressure Test	6.3.6	6.3.6
Helium Leak Test	6.3.7	6.3.7
Liquid Penetrant Weld Examination	6.3.8	5.4.2
Load Testing of Hoists	6.3.9	6.3.9
Load Testing of Shielding Eyebolts	6.3.10	6.3.10
Electrical Continuity	6.3.11	6.3.11

6.3.1 Responsibility for Inspection

The Subcontractor shall be responsible for the performance of all inspections or tests specified herein unless otherwise specified by contract or purchase order. All data required by this specification to document that required tests have been performed shall be provided to the Contractor. The Subcontractor may utilize its own facilities, the facilities of a vendor or subtiered supplier, or any mutually acceptable independent test laboratory in performing these inspections.

The Subcontractor shall provide the Contractor with full access to its facility to perform random or scheduled inspections and/or surveillance of work being performed. The Contractor reserves the right to perform or witness any inspections or testing specified to ensure conformance with the requirements specified herein. The Subcontractor shall provide the Contractor with at least five (5) working days notice prior to performing any test or designated hold point. At the option of the Contractor, the Subcontractor may be required to provide any documentation associated with such inspection or test for approval.

6.3.2 Calibration of Measuring and Test Equipment

The calibration of test equipment used for performance of the inspections or tests specified herein shall be traceable to a nationally recognized standard as maintained by the National Institute of Standards & Technology (NIST). The calibration shall be current and extend through the contract period.

6.3.3 Certificates of Conformance

Certificates of Conformance shall be furnished for all non-consumer grade steel material as indicated on the drawings, including weld filler material. The material certificates shall indicate chemical analysis, physical test data, and heat number.

In addition, the subcontractor shall provide Certificates of Compliance for all window gasket materials. The material certificates shall indicate chemical analysis and physical test data.

6.3.4 Visual and Mechanical Inspection

The PGS shall be inspected to verify dimensional and configuration compliance with the drawings and the information in this specification.

6.3.5 Visual Weld Inspection

The carbon steel welds identified on the drawings requiring visual inspection shall be inspected in accordance with AWS D1.1 statically loaded criteria. The stainless steel welds identified on the drawings requiring visual inspection shall be inspected per AWS D1.6 statically loaded criteria. In addition, welds on all interior or sealing surfaces of the glovebox shall be free of the following defects and conditions:

A. Slag or porosity.
B. Cold laps in the deposited weld metal.
C. Overlap of weld metal on the base metal.
D. Undercutting.
E. Depressions in welds below the base metal surface.
F. Unfilled weld craters (shrinkage cavities).
G. Evidence of damage to the weld metal through oxidation. Oxidation is defined as granulation or scaling of the metal surface that cannot be removed or restored to a bright metal by wire brushing.
H. Weld splatter.
I. Arc burns or scars on the base metal caused by striking or dragging the welding arc across the base metal.

Fillet welds shall meet size requirements after grinding and finishing. Welded areas shall not be ground below the original material thickness. Defective areas may be reworked by re-welding and grinding smooth.

After rework, welds shall be reinspected per original requirements. Weld studs shall meet the criteria specified in paragraph 5.4.2.3.

6.3.6 Pressure Test

The PGS shall be independently pressurized to a differential pressure of positive 4 iwg (+0.0, -0.25) and evacuated to a pressure differential of -4 iwg (-0.0, +0.25). No testing shall be performed without the use of a pressure relief device to preclude subjecting the enclosures to pressures in excess of 4 iwg.

After the test, the Subcontractor shall visually inspect for any noticeable damage such as cracks and deformation.

The Subcontractor may, at his option during the pressure test, perform a bubble test on mechanical joints (gaskets, seals, covers) using a leak detection solution to eliminate gross leaks prior to performing the leak test per paragraph 6.3.7. *Leak detection fluid shall not be applied to weld joints prior to performing the leak test per paragraph 6.3.7.*

6.3.7 Helium Leak Test

The leak test shall be conducted after in-shop assembly of the glovebox. All openings in the enclosure such as feed-throughs, flanges, ports, or connections to the glovebox shall be sealed with plugs, caps, or cover plates as appropriate. The electrical connectors must be in place. (The glove rings are supplied with plugs installed). The Subcontractor is responsible for plugging and capping all openings. All plugs, caps, or covers shall be labeled and shipped to the INEEL with the glovebox.

The glovebox shall be pressurized to an internal pressure of 4 iwg (+0.0, -0.25) using a mixture of air with a minimum of 25% helium. The pressurization system shall incorporate the use of a pressure relief device to preclude subjecting the enclosures to pressures in excess of 4-in. of water.

Using a helium leak detection instrument capable of detecting leaks down to $1x10^{-5}$ cm^3/sec, sniff all welds and mechanical joints. There shall be no detectable leakage (individual leaks) in excess of $1x10^{-3}$ cm^3/sec in any weld or mechanical joint, except leakage via the drum loadout port and RCS penetration covers shall not constitute failure of the test. Leak test personnel shall be qualified in accordance with SNT-TC.1A.

Leaks that are detected shall be reworked, repaired, and retested until leakage in excess of the allowable rate is eliminated.

6.3.8 Liquid Penetrant Weld Examination

All shell welds that form the primary confinement and any welds so specified on the drawings shall be subjected to liquid penetrant examination in accordance with AWS D1.6, Part E. Welds shall be free of defects noted per AWS D1.6 and section 6.3.5.

6.3.9 Load Testing of Hoists

The Subcontractor shall perform a load test on the hoist after installation and operational testing. Before load-testing the hoist, the following shall be performed:

A. Examine the hook for cracks, deformation and damage. Measure the throat opening. A hook with more than a 10-degree twist from the normal (new hook) plane of the hook shall be replaced. Lubricate the hook bearing. The hoist hook shall not be equipped with a hook latch.

B. Inspect the hoist chain for nicks, gouges, distortion, wear, and corrosion.

The load test shall be conducted in accordance with the following requirements:

A. The test load shall be 1,250 lb (-5, +0%).

B. The load shall be lifted a sufficient distance to ensure that the load is supported by the hoist, bridge, and trolley and held by the hoist brakes. (Personnel should be kept clear of the test load while it is suspended.)

C. Transport the test load by means of the trolley for the full length of the PGS. Do not permit the load to impact the wall of the glovebox.

D. Lower the test load part way, stopping by the brakes. Brakes shall work satisfactorily and hold the test load without slipping or overheating.

E. Measure the distance from the suspended load to the floor of the glovebox. (Personnel should be kept clear of the test load while

it is suspended.) Allow the load to hang for 20 minutes. Re-measure the distance from the load to the floor of the glovebox. Drift shall measure less than 0.25 in.

F. Lower the test load and remove any associated slings and lift hardware.

Following the load test, the Subcontractor shall inspect and verify that no parts subject to wear or distortion have been adversely affected by the load test. Parts found to be defective during any inspection or nondestructive examination shall be replaced or repaired and retested as necessary. Post-test inspections shall include the following items:

A. Inspect glovebox attach points and glovebox frame for cracks, deformation, or structural damage.

B. Visually inspect and re-measure the load chain after the load test. Check for deformed or broken links, stretch, etc.

C. Inspect load hook and suspension hook for bending or twisting. Hooks with more than 15% the original throat opening shall be replaced. Hooks with more than 10-degree twist from the normal plane shall be replaced.

6.3.10 Load Testing of Shielding Eyebolts

The Subcontractor shall perform a load test on each of the eyebolts that are used to lift the shields. Before load-testing the eyebolts, the following shall be performed:

A. Examine the eyebolts for cracks, deformation and damage.

The load test shall be conducted in accordance with the following requirements:

B. The test load shall be 300 lb (-5, +0%).

C. The load shall be lifted a sufficient distance to ensure that the eyebolt is supporting the entire load. (Personnel should be kept clear of the test load while it is suspended.)

D. Allow the load to hang for 20 minutes.

E. Following the load test, the Subcontractor shall inspect and verify that the eyebolts have not been adversely affected by the load test.

6.3.11 Electrical Continuity

After conductor connectors are installed and conductors are labeled, but prior to termination to terminals or devices, an electrical continuity test shall be performed on each conductor using a battery powered buzzer or ohmmeter to determine that all conductors are properly installed and identified.

7. PACKAGING AND SHIPPING

7.1 Packing and Packaging

7.1.1 Preparation for Shipment

The Subcontractor shall prepare, package, and ship the PGS and any associated hardware to the INEEL. The Subcontractor shall provide all crates, skids, protective devices, and materials used for shipping and handling of the PGS units.

The Subcontractor shall provide adequate protection for shipping the fabricated components to the INEEL without damage. Particular care shall be exercised to ensure that the surface finishes, cleanliness, dimensional stability, and overall integrity of the equipment achieved during fabrication are not impaired during shipment.

Windows shall be removed from the PGS. Exposed surfaces shall be covered with soft tissue paper, cardboard, or foam sheets to reduce the possibility of scratching. Windows shall be crated by a 3/8-in. minimum thickness of plywood sheet to protect from mechanical damage. Any alternate substitute method proposed by the Subcontractor shall be a proven method for shipping glass, and shall retain the capability of being easily removed. Glass-bearing crates shall be prominently marked.

The PGS units shall be wrapped in vinyl or cellophane sheet to provide protection from dirt and moisture during shipment. Bracing shall be provided to avoid undue stress on any part during shipment. (The Subcontractor may, with the approval of the Contractor, use alternative shipping protection methods that the Subcontractor has successfully used in the past.) Components should be crated or mounted on pallets to

withstand handling during shipment. Plugs or caps shall be installed on any open fittings or connections.

The hoist shall be repacked in its original shipping container. All electrical wire, cabling, and panels not permanently mounted to the enclosure shall be repacked for shipment.

All installation, operation, and maintenance documentation provided by the hoist manufacturer shall be shipped to the Contractor.

7.1.2 Installation and Assembly Instructions

The Subcontractor shall provide with the glovebox, detailed written instructions for reassembly of the glovebox at the INEEL. The reassembly instructions shall include provisions or special instructions learned in the process of fabrication and operational testing.

The instructions shall provide the recommended order for assembly of various component equipment and identify any precautions needed to prevent damage to the glovebox or potential safety hazards that may exist in the assembly and installation of the glovebox.

The instructions shall identify the bolting patterns and torque values originally used to seal the windows, joints, access panels, and other bolt-in hardware.

7.1.3 OEM Equipment

The OEM equipment items shall be repackaged and shipped in the original shipping containers to the extent possible. Plugs or caps shall be installed on any open fittings or connections. All manufacturer's documentation shall be sent with the unit.

7.1.4 Shipping of Glove Rings

Glove rings shall be repackaged in the original manufacturers shipping container. All mounting and maintenance instructions for glove rings supplied by the manufacturer shall be shipped to the INEEL with the glove rings.

7.2 Marking and Handling

Crates shall be marked with the contract number, the actual weight of the loaded crate, the assembly orientation in the crate, and the contents of the crate. Bulky

items or pallets requiring movement by forklift or crane shall have the weight and lift points conspicuously identified or labeled. Handling and storage instructions shall be permanently marked on or attached to the shipping crate.

7.3 Special Transportation Requirements

All components shall be shipped via a dedicated truck(s) trailer. The Subcontractor is responsible for all necessary packaging and shipping. Components and assemblies shall be anchored and braced to prevent shifting during transit. The Subcontractor shall notify the Contractor of the method of shipment, waybill number, pick-up date, and other relevant information immediately following delivery to or pick-up by the shipper. An itemized packing list shall accompany the shipment.