SECTION 15065
OFF-SITE MECHANICAL FABRICATION FOR NUCLEAR SERVICE

PART 1 - GENERAL

1.1 SCOPE

A. This specification addresses the fabrication, materials, testing and inspection, preparation for shipment, performance testing, and documentation of Off-Site Mechanical Fabrication. Mechanical Fabrication will include gloveboxes, supplemental shielding, shield doors, mechanisms, custom weldments, and other systems.

1.2 INDUSTRY CODES AND STANDARDS

A. Portions of Mechanical Fabrication shall be governed by the industry codes and standards listed below. Specific Requirements are indicated in this document and on the fabrication drawings furnished by the Buyer.
   1. 10 CFR Part 830.122.
   2. ASME Boiler and Pressure Vessel Code, 1998 Base with 1999 Addenda.
   3. ASME B31.3 Process Piping, 1999.
   4. ASME N509 Nuclear Power Plant Air-Cleaning Units and Components, 1989.
   5. ASTM A480 Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip, 1999.
   6. ASTM E499 Standard Test Methods for Leaks using the Mass Spectrometer Leak Detector in the Detector Probe Mode, 1995.
   7. AWS D1.1 2000 Structural Welding Code-Steel.
   8. ASNT-TC-1A Recommended Practice for Personnel Qualification and Certification in Non-Destructive Testing, 1984.
   9. AWS D1.6 1999 Structural welding Code – Stainless Steel

1.3 RELATED SECTIONS

A. Section 09960, “High Performance Coatings.”

B. Section 15050, “Piping Systems.”

C. Section 15072, “Cleaning.”

D. Section 15073, “Pressure/Leak Testing.”

E. Section 15128, “Stainless Steel Piping Systems – Certified Materials.”

F. Section 15146, “Stainless Steel Piping Systems – Non-Certified Materials.”

G. Section 15895, “Stainless Steel High Pressure Ductwork and Accessories (Certified Materials).”

H. Section 18100A, “General Welding Requirements.”

I. Section 18310, “Pipe Welding Requirements.”

J. Section 18350, “Pipe Welding Procedure Specifications.”

1.4 QUALITY ASSURANCE

A. Mechanical Fabrication shall be furnished by a firm which is qualified and regularly engaged in this type of work. The firm shall maintain facilities for fabrication of subject items and shall have a minimum of five years of current experience.

B. Materials and products used in Mechanical Fabrication shall be new. Materials shall be furnished and installed in strict accordance with Sub-Tier Supplier's current published recommendations, recognized good practices, Buyer supplied drawings, and these specifications.

C. Items used in quantity, such as globe valves, ball valves, accessories, fittings, etc., shall be the product of one Supplier and used only for the recommended services.

D. The Supplier shall have a quality assurance program in place that complies with the requirements of 10 CFR 830.120 and the elements outlined below, as applicable:
   1. Program.
   2. Personnel Training and Qualification.
   3. Quality Improvement.
   4. Documents and Records.
   5. Work Processes.
   6. Design.
   7. Procurement.
   8. Inspection and Acceptance Testing.
   9. Management Assessment.
   10. Independent Assessment.

E. The program shall provide control over activities affecting quality to an extent consistent with their importance. The Supplier's quality assurance program shall be reviewed and approved by the Buyer.

F. The Buyer reserves the right to access the Supplier's and Sub-Tier Supplier's facilities at which work is being performed. Access shall be provided for any personnel designated by the Buyer. The purpose of accessing the facilities shall be to perform assessments, reviews, surveillance, inspections, investigations, or test witnessing applicable to the work being performed by the Supplier or Sub-Tier Suppliers under this specification.

G. The Supplier shall resolve all deficiencies noted to the Buyer's satisfaction. The Buyer's concurrence with "use-as-is" or "repair" disposition of any nonconformance must be obtained. Concurrence will not be reasonably withheld. The terms "use-as-is, "repair, and "rework" are defined below.
   1. "Use-as-is" is a disposition permitted for a nonconforming item when it can be established that the item is satisfactory for its intended use.
   2. "Repair" is the process of restoring a nonconforming characteristic to a condition to ensure that the capability of an item to function reliably and safely is unimpaired, even though that item still does not conform to the original requirements.
   3. "Rework" is the process by which an item is made to conform to the original requirements by completion or correction.

H. Witness and hold points are specific points in the fabrication process requiring witnessing or verification by the Buyer. Activities shall not proceed past a hold point without witness or verification by the Buyer unless specifically waived in writing by the Buyer.

PART 2 - PRODUCTS

2.1 DESIGN REQUIREMENTS

A. Systems represented on Fabrication Drawings provided by the Buyer are fully detailed with the exception of weld maps. The Supplier has no responsibility to create new drawings for these systems. The Supplier shall maintain red-lined As-Built drawings indicating Buyer approved design modifications. Only Buyer approved changes are permitted. The Supplier shall also maintain weld maps for all Mechanical Fabrication weldments.

B. Other Mechanical Fabrication systems are represented on Construction Drawings. These systems are fully engineered with respect to material selection, material thickness, and weld sizes. The Supplier shall prepare and submit shop drawings for these systems to facilitate fabrication and ensure the Buyer that the Construction Drawings have been interpreted correctly. Mechanical Fabrication systems requiring shop drawings are liner panels and liner embeds.

C. Some systems require the fabrication of piping and ductwork systems in accordance with ASME B31.3 and ASME N509 respectively. The Supplier will be responsible for implementing the fabrication sections of those industry standards. B31.3 piping systems and N509 duct systems are identified in Table 15065-2.

2.2 MATERIAL REQUIREMENTS

A. ASTM numbers on the fabrication drawings specify materials for fabricated parts and weldments. The Parts List on the assembly drawing identifies material requirements for pre-engineered items (e.g. fasteners and gearboxes).

B. Paint notes referencing Section 09960 are included on the Fabrication Drawings.

C. The Supplier shall collect and organize CMTRs for all raw materials and fasteners used for Mechanical Fabrication.

PART 3 - EXECUTION

3.1 Fabrication Requirements

A. Controls are to be exercised during all stages of fabrication to minimize exposure of stainless steel to contaminants including chlorides and carbon steel. Any compounds, liquids or markers that come into contact with stainless steel surfaces shall not contain more than 250 ppm by weight chlorides.

B. Carbon arc or iron powder cutting shall not be used on stainless steel. All cut or raw edges shall be deburred and shall be smooth to the touch.

C. In order to preserve the original finish of stainless steel sheet material, care shall be exercised to prevent scratching, abrading, nicking, and denting during receiving, storage, fabrication, and handling. The original protective coating shall be preserved as long as practical.

D. Grinding wheels and wire brushes shall either be new or previously used only on austenitic stainless steel. Wire brushes shall have stainless steel bristles.

E. All welding associated with Mechanical Fabrication shall be in accordance with Section 18100, General Welding Requirements. Systems involving ASME B31.3 piping will also invoke Section 18310, Pipe Welding Requirements and Section 18350, Pipe Welding Procedure Specifications. Systems involving ductwork will invoke the welding requirements

of ASME N509. Detailed submittal requirements associated with pipe and duct welding are described in the referenced sections.

3.2 SURFACE AND WELD FINISH REQUIREMENTS

A. Finishing requirements listed in Table 15065-1 and Section 3.2 are in accordance with ASTM A480. Stainless steel sheets shall be purchased with a 2B finish. Stainless steel plate shall be purchased with a No. 4 finish. Carbon steel stock will be painted and may be purchased with the standard mill finish. All structural shapes shall be purchased with a standard mill finish.

B. Carbon steel welds are generally left in their as-welded condition. Specific finish requirements (e.g. grind flat) may be indicated within the weld symbol.

C. Stainless steel welds will either have Discoloration Removed, be Ground Flat, or be Ground Flat and Polished. Discoloration Removed requires wire brushing only. Ground Flat requires that the weld be ground flat with the parent metal. Final grinding shall be accomplished with 120 grit or finer. Ground Flat and Polished requires that the weld area be polished to a No. 4 finish. The polished area along a weld shall not be wider than 2 inches.

D. Table 15065-1 identifies the global weld preparation requirements for each Mechanical Fabrication subassembly. Requirements specific to a weld are noted on the drawings.

Table 15065-1 Weld Finish Requirements

Mechanical Fabrication Subassembly	*Remove Discoloration*	*Ground Flat*	*Ground Flat and Polished*	*Comments*	*Primary Assembly Drawings*
Cask Cart and Platform				Subassembly is primarily carbon steel.	J3.60.30 J3.62.33
Bottom Loading Port, Plug, and Shield Ring			X		J3.62.31 J3.62.32 J3.62.34
Shield Doors			X	Ground flat and polished applies to stainless steel portions of the doors only.	J3.10.30 J3.12.30 J3.13.30 J3.26.30
Shielding Tees			X		J3.11.* J3.27.30 J3.14.31
Hot Cell Cooling Weldments	X				J3.21.30
Hot Cell Liner Embedments	X		X	Exposed surfaces shall contain welds that are ground flat and polished.	J9.*.* J3.51.38

Mechanical Fabrication Subassembly	*Remove Discoloration*	*Ground Flat*	*Ground Flat and Polished*	*Comments*	*Primary Assembly Drawings*
In-Cell HEPA Filters	X				J3.18.30 J3.29.30
Liner Panels		X	X	Surfaces exposed to the cell atmosphere shall contain welds that are ground flat and polished. Surfaces exposed to concrete only shall contain welds that are ground flat.	J8.*.*
Hot Cell Penetrations	X		X	Drawings indicate which welds need to be ground flat.	J3.39.30 J3.45.30 J3.45.31 J3.45.32 J3.45.37 J3.45.38 J3.47.30
Inter-Cell Door			X	Applies to stainless steel only	J3.51.30 J3.52.30
Tritium Removal Glovebox			X		J3.55.30
Tritium Removal Process Components	X				J3.56.31 J3.57.31 J3.58.31 J3.58.32 J3.59.31
Input Enclosure	X		X	Drawings indicate which welds need to be ground flat	J3.23.30
LLLW Sampling Station	X		X		J3.22.30

3.3 TESTING AND INSPECTION

A. The Supplier shall be responsible for all testing and inspection required by this specification. The Supplier shall provide the test procedures as appropriate, test location, equipment, instrumentation, and any temporary connections and auxiliary parts necessary to execute the tests. The Supplier shall also provide test personnel qualified to conduct, record and verify test results. Instruments used for testing and inspection shall carry a current certification from NIST.

B. All hold points shall be identified on the Fabrication Schedule and the Shop Traveler. For all hold points requiring witness or inspection at the Supplier's facility, the Supplier shall provide ten (10) working days advance written notification to the Buyer so that a Buyer representative may be present at the Supplier's shop. The Supplier shall incorporate, at a minimum, the following fabrication hold points.
   1. Fit-up and Weld Preparation Inspection for Large Weldments
   2. Leak Tests.
   3. Final Assembly Inspection.
   4. Functional Testing of Systems.

C. The Supplier shall thoroughly clean Mechanical Fabrication of water, debris, weld splatter, grease, oil, markings from pens and dyes, shop soil, visible rust, and other foreign matter before shipment.

D. Cleaning methods that do not introduce iron or chloride contamination shall be used for stainless steel fabrication. Cleaning materials must be controlled; no chloride bearing solvents may be used. If a detergent is needed to ensure thorough cleaning, it shall also be low in chloride concentration. The final wash and rinse shall be accomplished using fresh water. The detergent, wash and rinse shall contain less than 250 ppm chlorides. Piping Systems shall be cleaned in accordance with Section 15072, Cleaning.

E. The Supplier shall draft and execute a detailed Functional Test for each Mechanical Fabrication subassembly. Necessary aspects of Functional Testing are listed in Table 15065-2. The Supplier shall prepare a Functional Test Report documenting the results. The Buyer shall witness all Functional Testing.

F. Gloveboxes shall be pressure tested to withstand 7.5 inches water column pressure. The pressure shall be maintained for 5 minutes. No measurable permanent deformation to any structural components shall occur during the test period. The Supplier shall prepare and provide a Pressure Test Procedure and Test Report documenting the results. The pressure test shall be performed prior to helium leak testing.

G. A helium leak test shall be performed on gloveboxes. The leak tests shall be performed in accordance with ASTM E499 Test Method A. The Supplier shall submit a helium leak test procedure reflecting the requirements set forth in this industry standard. No individual leak shall be greater than 1×10^{-6} cc He per second with a pressure differential of 1 inch water column.

H. Liquid penetrant examination and acceptance shall be conducted in accordance with ASME Section VIII, Division 1, Appendix 8. Liquid penetrant examinations shall be performed on all primary confinement welds as noted on the drawings and in Table 15065-2. Only aqueous based, non-chloride containing penetrants, cleaners, and developers shall be used.

I. The Supplier shall conduct in process dimensional inspections of work and dimensional inspection of finished weldments, and finished machined work. Discrepancies shall be handled in accordance with 1.4 Quality Assurance, Section F.

J. The Buyer reserves the right to visually inspect all welds at the Supplier's facility during acceptance tests. The Supplier shall visually inspect all non-piping welds. All welds shall be visually free from defects per AWS D1.1 Section 6 or AWS D1.6, Section 6 for welding of carbon steel and stainless steel as appropriate. Primary confinement welds shall be free from defects per ASME Section VIII.

K. Non-Destructive Examination (NDE) personnel performing examinations and testing operations shall be certified per the guidelines of ASNT SNT-TC-1A. All NDE reports shall

be signed by personnel holding either Level II or Level III certifications and who either performed or witnessed the activity. The Supplier shall provide the NDE certifications for personnel performing or witnessing non-destructive examinations.

L. The following table identifies the testing and inspection requirements for each mechanical system considered part of Mechanical Fabrication.

Table 15065-2 Testing and Inspection Requirements

Mechanical Fabrication Subassembly	*Functional Testing*	*Pressure Testing*	*ASME B31.3 Piping*	*ASME N509 Ductwork*	*Helium Leak Testing*	*Liquid Penetrant Examination*	*Dimensional Inspection*	*Visual Weld Inspection*	*Aspects of Functional Testing*	*Primary Assembly Drawings*
Cask Cart and Platform	X						X	X	-Raise and lower 40 tons -Drive with 40 tons -Verify load cell operation	J3.60.30 J3.62.33
Bottom Loading Port, Plug, and Shield Ring	X						X	X	-Fit and function of shielded lid	J3.62.31 J3.62.32 J3.62.34
Shield Doors	X						X	X	-Door rotation -Fit and function of latch -Gasket compression -Function of hot cell entry door operator	J3.10.30 J3.12.30 J3.13.30 J3.26.30
Shielding Tees	X						X	X	-Fit of tees -Gasket compression	J3.11.* J3.27.30 J3.14.31
Hot Cell Cooling Weldments	X						X	X	-Air flow performance	J3.21.30
Hot Cell Liner Embedments						X	X	X	-Not applicable	J9.*.* J3.51.38
In-Cell HEPA Filters	X						X	X	-Replace filters by hand -Plumb test of filter weldment	J3.18.30 J3.29.30
Liner Panels						X	X	X	-Not applicable	J8.*.*

Mechanical Fabrication Subassembly	*Functional Testing*	*Pressure Testing*	*ASME B31.3 Piping*	*ASME N509 Ductwork*	*Helium Leak Testing*	*Liquid Penetrant Examination*	*Dimensional Inspection*	*Visual Weld Inspection*	*Aspects of Functional Testing*	*Primary Assembly Drawings*
Hot Cell Penetrations	X		X	X			X	X	-Verify fit and function	J3.39.30 J3.45.30 J3.45.31 J3.45.32 J3.45.37 J3.45.38 J3.47.30
Inter-Cell Door	X						X	X	-Operate under gravity load -Verify limit switch operation -Verify function of rolling door including upper latch	J3.51.30 J3.52.30
Tritium Removal Glovebox	X	X	X		X		X	X	-Operate valves using gloves -Replace filters using gloves	J3.55.30
Tritium Removal Process Components					X	X	X	X		J3.56.31 J3.57.31 J3.58.31 J3.58.32 J3.59.31
Input Enclosure	X					X	X	X	-Shield door operation -Shield plug operation -Transfer Tray Operation	J3.23.30
LLLW Sampling Station	X		X				X	X	-Sash operation -Pump operation -Valve operation	J3.22.30

3.4 Packaging, Delivery, Storage and Handling

A. The Supplier shall provide written recommendations for field storage and handling of Mechanical Fabrication.

B. Mechanical Fabrication shall not be packaged and shipped until all testing and inspection has been performed and the results have been approved by the Buyer.

C. Mechanical Fabrication shall be shipped completely assembled. If shipping limitations prevent complete assembly, the Supplier shall propose a recommended alternative for approval by the Buyer.

D. Ship large items mounted on skids or in crates suited for the intended method of transport. Lifting weight of large skids shall be clearly marked and listed in the shipping documents.

E. Loose components shall be bagged, identified and crated separately. Each shipping package shall be labeled with a waterproof label indicating applicable Subassembly name and purchase order number. The Supplier shall completely identify the quantity and location of temporary material contained within the Mechanical Fabrication for shipment, handling or storage.

F. The Supplier shall be responsible for the dimensional stability and overall integrity of the items during shipment. The center of gravity shall be clearly marked on the skids or crates for hoisting and rigging purposes.

3.5 Submittals

A. A Fabrication Schedule shall be provided showing all fabrication steps, hold points, tests and inspections. The Supplier shall provide the Buyer a revised Fabrication Schedule within seven (7) working days of a modification to the contract document which revises the required delivery date or when other approved Buyer modifications change a scheduled assembly step, hold point, test or inspection.

B. A controlled copy of the Supplier's Quality Assurance Program Manual and an index of the implementing procedures shall be submitted with the proposal.

C. The Supplier's standard helium leak test procedure shall be submitted. The procedure shall describe how to accomplish leak detection; test report forms shall be included.

D. The Supplier shall submit a complete package of material certifications for all materials used in the fabrication and assembly of Mechanical Fabrication, including, but not limited to, stainless steel sheet, structural steel, welding filler rods, and fasteners. Material certifications shall be legible copies of Certified Mill Test Reports (CMTR) indicating chemical analysis, physical test data and heat number. Certificates of Conformance (CoC) may be submitted in lieu of CMTRs, with prior approval by the Buyer.

E. Test reports shall be provided for each series of stud welding operations performed by the Supplier. These test reports shall comply with the Supplier's stud test procedure. The test report shall include, but is not limited to, the following information.
   1. Date of test.
   2. Test method and acceptance criteria used.
   3. Stud gun make, model and settings.
   4. Size of stud.
   5. Name and signature of test operator.
   6. Torque values at failure or tensile values at failure.

7. Failure mode of each test stud.

F. Shipping lists shall be prepared and submitted, and shall clearly identify the contents of each package sent to the Buyer. All submittals and shipping containers shall be identified with the Buyer's purchase order number.

G. The Supplier shall provide a detailed cleaning procedure specifically addressing the requirements of this specification.

H. The Supplier shall submit shop drawings for the systems identified in Section 2.1. As-Built drawings (redlines) shall be submitted for fabricated systems represented on Buyer supplied fabrication drawings.

I. The Supplier shall submit a detailed Functional Test Procedure and Report. Mechanical Fabrication requiring Functional Testing is identified in the Table 15065-2.

J. The Supplier shall submit a detailed dimensional inspection procedure. A dimensional inspection report shall be submitted for each Mechanical Fabrication subassembly.

K. The Supplier shall submit a weld map for each Mechanical Fabrication weldment. The map shall identify the welder and welder operator used to create each weld.

L. The Supplier shall prepare documentation packages with the proposal, prior to fabrication, and after fabrication in accordance with Table 15065-3.

Table 15065-3 Documentation Requirements

Document Description	*With Proposal*	*Prior to Fabrication*	*Prior to Shipment*
Quality Assurance Program Manual	X		
Fabrication Schedule	X	X	
Functional Test Procedures		X	
Functional Test Report			X
Shop Drawings		X	
Pressure Test Procedure	X	X	
Pressure Test Report			X
Helium Leak Test Procedure	X	X	
Helium Leak Test Report			X
CMTRs for Raw Materials and Pre-Engineered Items		X	X
As-Built Mechanical Fabrication Drawings			X
Liquid Penetrant Examination Procedure	X	X	
Liquid Penetrant Examination Report			X
Cleaning Procedure	X		
Packaging and Shipping Procedure and Lists	X		X
Material Control Procedures	X		
Dimensional Inspection Procedures	X		
Dimensional Inspection Reports			X
Visual Inspection Procedures		X	
Visual Inspection Reports			X
Stud Welding Test Reports			X
Weld Maps			X
NDE Personnel Certifications		X	

END OF SECTION 15065