PROCUREMENT SPECIFICATION FOR MIST ELIMINATOR ASSEMBLY TANK FARM SINGLE-SHELL VENTILATION

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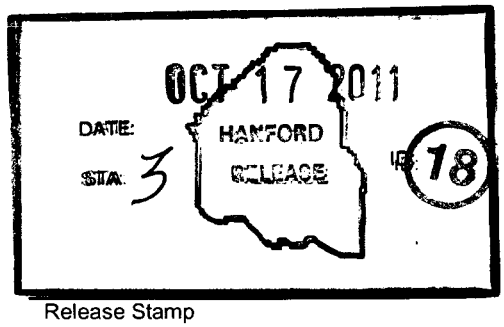
Abstract: This Specification covers the technical requirements for the fabrication and delivery of a mist eliminator as specified.



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MIST ELIMINATOR ASSEMBLY
TANK FARM SINGLE-SHELL VENTILATION

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1.0 INTRODUCTION

1.1 SCOPE

This Specification covers the technical requirements for the fabrication and delivery of a single mist eliminator as specified in this document. Work includes fabrication, inspection, testing, documentation, packaging, and shipping of the assemblies. Work does not include site services, installation, or operation of equipment.

This Procurement Specification is a "fabrication" Specification, delineating the required functions and requirements that the Seller shall adhere to in providing the finished product to the Buyer.

1.2 BACKGROUND

Waste retrieval activities for the single-shell tanks require an active ventilation system. Moisture separators are required to remove entrained moisture from ventilation air stream to prevent moisture damage of the downstream HEPA filter system.

1.3 SPECIFICATION APPROACH

The Buyer will provide to the Seller the necessary technical requirements to fabricate, test, and deliver the mist eliminator assemblies via this Procurement Specification. The Seller shall perform the fabrication and testing tasks to the requirements of this Specification, and deliver the mist eliminator assemblies as specified in the purchase order. The Seller shall provide documented evidence that the mist eliminator assemblies meet the requirements of this Specification.

1.4 TRADEMARK DISCLAIMER

Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply endorsement, recommendation, or favoring by the United States Government or any agency thereof or its contractors or subcontractors.

1.5 ABBREVIATIONS AND ACRONYMS

CofC	Certificate of Conformance
DOE	Department of Energy
HEPA	High-Efficiency Particulate Air
NCR	Non-Conformance Report
QA	Quality Assurance
QAP	Quality Assurance Plan
SCFM	Standard Cubic Feet per Minute

2.0 APPLICABLE DOCUMENTS

The following documents of the exact issue shown form a part of the basis of design to the extent specified in the applicable sections of this document. In the event of a conflict between the documents referenced herein and the requirements of this Specification, the requirements of this Specification shall take precedence.

2.1 NATIONAL CODES AND STANDARDS

Document Number	***Title***
ASME AG-1 - 2009	*Code on Nuclear Air and Gas Treatment*, American Society of Mechanical Engineers (ASME)
ASME N510-2007	*Testing of Nuclear Air Treatment Systems,* American Society of Mechanical Engineers (ASME)
ASME N511	*In-Service Testing of Nuclear Air Treatment, Heating, Ventilating, and Air-Conditioning Systems,* American Society of Mechanical Engineers (ASME)
ASME NQA-1 - 2004	*Quality Assurance Program Requirements for Nuclear Facilities With Addenda 1a 2005 and 1b 2007*, American Society of Mechanical Engineers (ASME)
ASME B31.3-2002	*Process Piping,* ASME, New York, NY
ASME B46.1-2009	*Surface Texture (Surface Roughness, Waviness, and Lay)* , American Society of Mechanical Engineers (ASME)
ASME B&PVC, Section IX	*ASME Boiler and Pressure Vessel Code,* Section IX, "Welding and Brazing Qualifications," ASME, New York, NY
AWS D1.6	*Structural Welding Code – Sheet Steel*, American Welding Society (AWS), Miami, FL
AWS D9.1	*Sheet Welding Code,* American Welding Society (AWS) , Miami, FL
AWS QC1 - 2007	*Standard for AWS Certification of Welding Inspectors*, American Welding Society (AWS) , Miami, FL

2.2 BUYER SUPPLIED DOCUMENTS

Document Number	***Title***
ASME Letter 11-460	*ASME AG-1 Technical Interpretation*, external letter from American Society of Mechanical Engineers (ASME), O. Martinez, Secretary to T.D. Kaiser, WRPS, Dated August 26, 2011.
Attachment A	*Bypass Flow Test*, WRPS, Richland, Washington
Attachment B	*Pressure Decay Test WRPS Mist Eliminators*, WRPS, Richland, Washington
Attachment C	*Packaging, Shipping, and Storage Plan for Mist Eliminators,* WRPS, Richland, Washington
Attachment D	*Spray System Test Procedure,* WRPS, Richland, Washington
Attachment E	*Lift Procedure for Mist Eliminator Assembly*, WRPS, Richland, Washington
H-14-109521, Sht. 1, Rev. 0	*Mist Eliminator Main Dual Assembly 12"Inlet to 14" Outlet,* U.S. Department of Energy, Office of River Protection, Richland, Washington
H-14-109522, Sht. 1-3, Rev. 0	*Mist Eliminator Assembly #1, 12" Inlet to 14" Outlet,* U.S. Department of Energy, Office of River Protection, Richland, Washington
H-14-109523, Sht. 1-3, Rev. 0	*Mist Eliminator Housing Assembly #1, 12"Inlet to 14" Outlet,* U.S. Department of Energy, Office of River Protection, Richland, Washington
H-14-109524, Sht. 1, Rev. 0	*Drain Pan Assembly,* U.S. Department of Energy, Office of River Protection, Richland, Washington
H-14-109525, Sht. 1-2, Rev. 0	*Lid Assembly,* U.S. Department of Energy, Office of River Protection, Richland, Washington
H-14-109526, Sht. 1-2, Rev. 0	*Right Spray Lance Assembly,* U.S. Department of Energy, Office of River Protection, Richland, Washington
H-14-109527, Sht. 1, Rev. 0	*Left Spray Lance Assembly,* U.S. Department of Energy, Office of River Protection, Richland, Washington

Document Number	***Title***
H-14-109528, Sht. 1-2, Rev. 0	*Moisture Separator Wedge Assembly,* U.S. Department of Energy, Office of River Protection, Richland, Washington
H-14-109529, Sht. 1, Rev. 0	*Moisture Separator Assembly,* U.S. Department of Energy, Office of River Protection, Richland, Washington
H-14-109530, Sht. 1-2, Rev. 0	*Mist Eliminator Assembly #2, 12" Inlet to 14" Outlet,* U.S. Department of Energy, Office of River Protection, Richland, Washington
H-14-109531, Sht. 1-4, Rev. 0	*Mist Eliminator Housing Assembly #2, 12"Inlet to 14" Outlet,* U.S. Department of Energy, Office of River Protection, Richland, Washington
H-14-109532, Sht. 1-2, Rev. 0	*Structural Support Assembly,* U.S. Department of Energy, Office of River Protection, Richland, Washington
H-14-109533, Sht. 1, Rev. 0	*Mist Eliminator Lock Assembly,* U.S. Department of Energy, Office of River Protection, Richland, Washington
H-14-109534, Sht. 1, Rev. 0	*Concrete Support Footing Assembly,* U.S. Department of Energy, Office of River Protection, Richland, Washington
H-14-109612, Sht. 1, Rev. 0	*Mist Eliminator Dual Main Assembly 12" Inlet to 12" Outlet,* U.S. Department of Energy, Office of River Protection, Richland, Washington
H-14-109613, Sht. 1, Rev. 0	*Mist Eliminator Main Assembly 12" Inlet to 12" Outlet,* U.S. Department of Energy, Office of River Protection, Richland, Washington
H-14-109614, Sht. 1-2, Rev. 0	*Mist Eliminator Assembly #1, 12" Inlet to 12" Outlet,* U.S. Department of Energy, Office of River Protection, Richland, Washington
H-14-109615, Sht. 1-4, Rev. 0	*Mist Eliminator Housing Assembly #1, 12" Inlet to 12" Outlet,* U.S. Department of Energy, Office of River Protection, Richland, Washington
H-14-109616, Sht. 1-2, Rev. 0	*Mist Eliminator Assembly #2, 12" Inlet to 12" Outlet,* U.S. Department of Energy, Office of River Protection, Richland, Washington

Document Number	***Title***
H-14-109617, Sht. 1-4, Rev. 0	*Mist Eliminator Housing Assembly #2, 12" Inlet to 12" Outlet,* U.S. Department of Energy, Office of River Protection, Richland, Washington
H-14-109618, Sht. 1, Rev. 0	*Concrete Support Footing Single Assembly,* U.S. Department of Energy, Office of River Protection, Richland, Washington
H-14-109720, Sht. 1, Rev. 0	*Mist Eliminator Lid Gasket,* U.S. Department of Energy, Office of River Protection, Richland, Washington
H-14-109721, Sht. 1, Rev. 0	*Mist Eliminator Mist Separator Gasket,* U.S. Department of Energy, Office of River Protection, Richland, Washington
RPP-22239, Rev. 1	*Procurement Specification for 8", 10", 12", and 14" Manually Operated Butterfly Valves in 241-C-Tank Farm Primary Ventilation,* WRPS, Richland, Washington
TFC-ENG-STD-02	*Environmental/Seasonal Requirements for TOC Systems, Structures, and Components*, WRPS, Richland, Washington
TFC-ENG-STD-07	*Ventilation System Design Standard*, WRPS, Richland, Washington
TFC-ENG-STD-12	*Tank Farm Equipment Identification Numbering and Labeling Standard*, WRPS, Richland, Washington
TFC-ESHQ_Q-C-C-03	*Control of Suspect Counterfeit Items*, WRPS, Richland, Washington

3.0 TECHNICAL REQUIREMENTS

3.1 GENERAL ITEM DESCRIPTION AND REQUREMENTS

The Seller shall fabricate, test, and deliver the mist eliminator assemblies in accordance with the requirements of this Specification and as specified in the purchase order.

The Buyer shall provide a complete set of drawings which depict how all the assemblies are fabricated.

The Seller shall fabricate and deliver the mist eliminator assemblies to the Buyer's location specified in the procurement documentation. Payment will not occur until all requirements of the specification have been satisfied.

3.1.1 Mist Eliminator Assemblies

The intent of this Specification is to provide the overall requirements for a fabrication build of mist eliminator assemblies listed below. A Request for Information, or a Request for Proposal, or a Purchase Order may only be applicable to a subset of the list below, to be fabricated, tested, and delivered. The mist eliminator assemblies covered under this specification are:

- Mist Eliminator Assembly #1, 12" Inlet to 14" Outlet, as shown in drawing H-14-109522,
- Mist Eliminator Assembly #2, 12" Inlet to 14" Outlet, as shown in drawing H-14-109530,
- Mist Eliminator Assembly #1, 12" Inlet to 12" Outlet, as shown in drawing H-14-109614,
- Mist Eliminator Assembly #2, 12" Inlet to 12" Outlet, as shown in drawing H-14-109616,
- Structural Support Assembly, as shown in drawing H-14-109532,
- Concrete Support Footing Assembly, as shown in drawing H-14-109534,
- Concrete Support Footing Single Assembly, as shown in drawing H-14-109618,

3.1.2 Packaging, Shipping, and Storage

The mist eliminator assemblies shall be contained within a shipping container or suitable protective measures for shipment and storage.

The shipping container or method shall be capable of storing the mist eliminator assemblies outside for up to 5 years without permanent damage that would impair the assemblies from installation and operation.

3.2 FABRICATION

Fabrication of the mist eliminator assemblies shall be directed by this Specification and the drawings referenced in this Specification. The Seller shall provide a procedure to the Buyer for approval that describes their procedure for requesting changes (redline change process) to the Buyer's supplied design media. Changes requested by the Seller shall be submitted to the Buyer and approved by the Buyer prior to implementation. Approved changes shall be documented (redlined) on the design media. Changes made without the Buyer's authorization will be at the risk of the Seller.

3.2.1 Materials, Processes, and Parts

3.2.1.1 Quality

Materials shall be free from any defects or imperfections that may affect performance. The Seller shall not incorporate any rebuilt or refurbished assemblies.

Where specified herein by the Buyer, the Seller shall provide a Certificate of Conformance (CofC) that must certify conformance and traceability of supplied materials to the subject Purchase Order/Contract Order. The document must be legible and reproducible.

The Seller shall warrant that "all items furnished under this Purchase Order/Contract Order are genuine (i.e., not counterfeit, see TFC-ESHQ_Q-C-C-03) and match the quality, test reports, markings and/or fitness for use required by the Purchase Order/Contract Order". The statement shall be on Seller letterhead and signed by an authorized agent of the Seller. Any materials furnished as part of this Purchase Order/Contract Order, which have been previously found to be suspect/counterfeit by the Department of Energy, shall not be accepted.

3.2.1.2 Deterioration and Protection

Material subject to deterioration when exposed to climatic and other environmental conditions specified herein shall be protected against such deterioration. The use of any protective coating that will crack, scale, or erode due to extremes of climatic or other environmental conditions shall not be used. All protective coatings shall require the concurrence of the Buyer.

3.2.1.3 Fasteners

All fasteners provided must meet the following requirements:

Fasteners shall exhibit grade marks and manufacturer's identification symbols (head marks) as required in the specifications referenced in the Purchase Order/Contract Order.

Any fasteners supplied with head marks described in TFC-ESHQ_Q-C-C-03 shall be deemed to be unacceptable under the terms of this Purchase Order/Contract Order.

Fasteners shall be inspected to verify compliance with the Purchase Order/Contract Order requirements. Additionally, fasteners may also be subjected to destructive testing.

3.2.1.4 Edges

All sharp and flame-cut edges shall be deburred.

3.2.2 Mist Eliminator Assemblies

Drawings listed in Section 3.1.1 are to be used for the fabrication of the mist eliminator assemblies. Any deviations from the parts list contained on the drawings shall be approved by the Buyer per the Seller's approved redline process.

3.2.3 Welding

Welding, welding procedures, welder qualifications, and inspections of the mist eliminator housing shall be in accordance with ASME AG-1, Section AA-6300 and CA-6120. All welding shall be based on published consensus codes AWS D1.6, AWS D9.1, and ASME Section IX. Per ASME Letter 11-460, AWS D1.6 is included in ASME AG-1.

Welding, welding procedures, welder qualifications, and inspections of the mist eliminator piping shall be in accordance with ASME B31.3.

Special care shall be taken to limit contamination of stainless steel components with halides, which are common to adhesive products. If necessary, stainless steel components shall be cleaned with neutral detergent and water.

3.2.3.1 Qualification of Welding Personnel and Procedures

Personnel and procedures for welding shall be qualified in accordance with ASME Boiler and Pressure Vessel Code (ASME B&PVC), Section IX prior to the start of welding. A copy of welder performance qualification test results and renewal of qualification documentation shall be maintained at the job site for evaluation at the Buyer's discretion. Likewise, a copy of the weld procedure specifications, procedure qualification records, and supporting demonstration records, as applicable, shall be maintained at the job site for evaluation at the Buyer's discretion.

Welding of piping, as well as any repairs to such parts, shall be performed in accordance with the normal fluid service category of ASME B31.3.

3.2.3.2 Nondestructive examination

Weld inspection shall be performed as specified by applicable construction codes specified in ASME AG-1 and B31.3. Weld examinations shall be performed and appropriate documentation prepared by the certified welding inspectors, as required.

All housing welds shall be visually inspected. Lifting lugs and the inlet/outlet pipe flange welds shall also be examined by the liquid penetrant method.

Weld inspection for piping shall be the "In-Process Examination" method in accordance with ASME B31.3, paragraph 344.7.

Personnel performing nondestructive examination (with the exception of the hydrostatic leak test) shall be certified in accordance with ASME AG-1 and B31.3 as applicable.

The Seller shall maintain a file containing personnel certifications and nondestructive examination performance procedures, as applicable, at the fabrication site for evaluation at the Buyer's discretion.

Weld and inspection records/maps shall be prepared for all welds and shall be submitted to the Buyer as part of the submittal documentation.

3.2.3.3 Additional Welding Requirements

a) All tools used for stainless steel shall be kept separate from any tools previously used or currently being used for cleaning carbon steel components. For example, tools for stainless steel shall be used only on stainless steel surfaces.

b) All areas from which temporary attachments have been removed shall be examined by the liquid penetrant method after the surface has been restored.

c) Preparation for welds shall be by non-thermal methods where practical.

d) Thermally cut surfaces shall be ground to provide slag-free metal and fit-up equivalent to machining.

3.2.4 Cleanliness

Before assembly, all components shall be clean to the extent that extraneous materials, such as those listed below, are not present:

a) Metals poly dusts (shop dust), chips, and turnings,

b) Abrasive particles,

c) Weld spatter,

d) Rust and other loose corrosion products,

e) Magnetic/liquid penetrant residues, dye check, etc,

f) Foreign material, such as paper, plastic, and wood,

g) Cutting oils,

h) Excess lubrication grease and oil,

i) Marking dyes,

j) Adhesives.

3.2.5 Identification and Markings

3.2.5.1 Labeling

The Seller shall provide labeling for all components. The labeling shall be per TFC-ENG-STD-12. The Buyer shall provide the Equipment Identification Numbers. The Seller shall also provide permanently affixed nameplates for each of the mist eliminator housings with at least the following information:

a) Manufacturer's name or symbol,

b) Model number,

c) Serial number,

d) Rated Flow capacity (Buyer supplied)

e) Pressure drop (in. WC or Pascals) at rated capacity (Buyer supplied),

f) Removal efficiency at rated flow (Buyer supplied),

g) Date of manufacture,

h) Purchase order number.

The nameplates shall be legible and conform to human visual capabilities and limitations in regard to physical characteristics, (e.g. letter and symbol size, contrast, font, simplicity, spacing, and stroke width).

3.2.6 Fabrication Inspection

Workmanship acceptance shall be based on satisfactory completion of the following inspections, and those required by the drawings:

a) Overall dimensional check for compliance with the drawings,

b) All interface dimensions checked and verified to meet drawing requirements,

c) Satisfactory completion and acceptance of all specified nondestructive examinations,

d) Visual inspection and acceptance of welded components to specified standards (e.g., no undercutting, cracks, crevices),

e) Surface finishes per drawing requirements, ensuring that no scratches or gouges that violate these finishes are present,

f) Cleanliness in accordance with specified requirements,

g) Fabrication inspections stamped or signed off by the Seller's quality control organization,

h) Completed weld map(s) per applicable industry standard,

i) Completed map(s) of areas from which temporary attachments have been removed.

3.2.7 Documentation

The Seller shall provide documentation covering fabrication notes, Buyer approved redlines to supplied drawings, CofC's, welding qualifications, and inspection reports. Section 5.3 provides requirements for submitted documentation.

4.0 QUALIFICATION AND VERIFICATION

The objective of qualification and verification is to define methods for ensuring that all requirements have been included and that the fabrication of the mist eliminator components are complete.

4.1 VERIFICATION METHODS

4.1.1 Inspections and Tests

The Buyer reserves the right to witness all tests and shall be given a minimum of (20) working days written notice prior to each test date.

Prior to performance of these tests, the Seller shall submit a procedure for each test to the Buyer for review and approval. The procedure shall be submitted a minimum of 20 working days prior to the test. Test information recorded shall be documented and submitted to the Buyer. A test log shall be used to document all testing. Attachment F, "Test Log", shall be provided to the seller to edit and use for the testing as required by this Specification.

Measurement and test equipment used in the tests shall comply with ASME AG-1, ASME N510, and ASME N511.

4.1.2 Dimensional Inspection

The mist eliminator assemblies shall be visually inspected to show conformance to dimensions depicted in the drawings and other inspection requirements specified in the drawings.

4.1.3 Pressure Boundary Leak Test

The mist eliminator housings shall be leak tested in accordance with ASME AG-1, ASME N510, and ASME N511 between the connection flanges. Attachment B, "Pressure Decay Test", shall be provided to the seller to edit and use for the test as required by this Specification. The test shall be performed with the 12" butterfly valves installed. The Buyer shall provide the leakage rate criteria.

4.1.4 Bypass Flow Test

The mist eliminator housings shall have a bypass flow test around the mesh pad to ensure bypass flow is within acceptable limits. Attachment A, "Bypass Flow Test", shall be provided to the seller to edit and use for the test as required by this Specification. Bypass flow shall be no greater than 5.0 SCFM at a differential pressure of 3.0 inches water column or greater.

4.1.5 Spray System Test

The mist eliminator housings shall have a spray system test to verify

a) Flow is within acceptable limits (at least 3 gallons per minute),

b) Spray system provides complete coverage over moisture separator pad,

c) Drain system capacity is at least 3 gallons per minute with no liquid buildup.

Attachment D, "Spray System Test", shall be provided to the seller to edit and use for the test as required by this Specification.

5.0 PROJECT MANAGEMENT

5.1 WORK PLAN

The Seller shall ensure all work is consistent with the requirements of the purchase order terms and conditions, and this Specification.

A work plan describing all deliverable dates shall be submitted to the Buyer. The work plan must include a complete project schedule. The deliverable schedule must meet the overall project schedule listed in the request for proposal and/or purchase order. To ensure the schedule is maintained, the Seller shall provide schedule status weekly.

5.1.1 Comment Tracking List

The Seller shall maintain a listing of all Buyer-Seller review comments generated during the fabrication and inspection process. The Seller shall track the status of comment disposition until all comments are satisfactorily resolved.

5.2 FABRICATION

The fabrication includes material procurement, component fabrication, assembly, and inspection. The Seller shall be responsible for the manpower, facilities, and equipment to complete purchasing, fabrication, assembly, checkouts, and delivery of the mist eliminator assemblies. The Seller shall also manage the fabrication activities, which include creating and maintaining production scheduling, and the quality assurance plan (QAP).

5.2.1 General Requirements

a) Seller shall warrant that "all items furnished under this purchase order are genuine (i.e., not counterfeit) and match the quality, test reports, markings and/or fitness for use required by the purchase order". The statement shall be on Seller letterhead and signed by an authorized agent of the Seller.

b) Any materials furnished as part of this purchase order which have been previously found to be suspect/counterfeit by the Buyer or any U.S. Government agency shall not be accepted.

c) Additional guidance is provided in DOE G 414.1-3c, *Suspect/Counterfeit Items Guide for Use with 10 CFR 830 Subpart A, Quality Assurance Requirements, and DOE O 414.1B, Quality Assurance*. See also TFC-ESHQ-Q-C-C-03 for guidance. This procedure describes the process for the identification, prevention, evaluation, notification, and disposition of suspect/counterfeit items.

5.2.2 Fabrication and Inspection Plan

The Seller shall provide to the Buyer for review and approval a Fabrication and Inspection Plan to include a sequential listing of major fabrication steps and the associated inspections required for compliance with this contract. The fabrication plan will define all inspection hold points and critical

items or features as defined from the design to be inspected. The Buyer shall reserve the right while reviewing this plan to identify in writing to the Seller inspection or testing activities to be witnessed by the Buyer representative. The Buyer retains the right to witness any and all critical items/feature inspections. The Seller shall notify the Buyer no later than 10 working days prior to any specified witness points.

5.2.3 Contact Materials (Austenitic Metals)

Contact materials including marking materials, temperature indication crayons, adhesive backed and pressure sensitive tape, and barrier and wrap materials may be used only under the following conditions:

a) The total halogen content will not exceed 50 parts per million (ppm).

b) The total sulfur content will not exceed 400 ppm.

c) No added low melting point metals such as lead, zinc, copper, tin, antimony, silver and mercury.

d) Anti-spatter compounds are not to contain chlorine, fluorine, sulfur, mercury or other low melting point metals.

5.3 SUBMITTALS

The Seller shall submit the specified documents to the Buyer at the address specified in the procurement documentation. Each submittal should be marked with this Specification number, the item number, the purchase order number and the Seller's identification number. Three copies of each document submitted, along with a transmittal letter shall be forwarded to the Buyer. The Seller shall also provide the electronic native files of generated documents (procedures, etc). All of this information shall become the property of the Buyer.

Table 5-1 contains the submittal schedule for the contract and the following sections provide a description of the required submittals. All submittals shall be in English. Electronic copies of submittals can be provided wherever practical.

5.3.1 Submittal Compliance Requirements

The Seller shall comply with the inspection plans and welding procedures and plans submitted and approved by the Buyer and utilize, except as authorized by the Buyer in writing, only those qualified personnel to perform or verify the special processes and operations for whom the certified records were reviewed and approved by the Buyer.

5.3.2 Approval of Submittals

Submittals are of the types: 1) those requiring "approval" and 2) those "not requiring approval". Submittals "not requiring approval" will be reviewed to verify completeness and adequacy for their intended purposes. A submittal requiring approval that is not approved is identified as follows:

1) "Not Approved –Revise and Resubmit." The submittal is considered technically deficient, or incomplete, and therefore unacceptable. Resubmittal is required; hence the fabrication, procurement, or performance of procedures shall not proceed.

   OR

2) "Approved with Exception." Fabrication, procurement, or performance may proceed, but resubmittal is required to verify incorporation of the exception.

Submittals "not requiring approval" that are determined to be incomplete or inadequate will be marked "Resubmit." An explanation of the deficiencies will be included for corrective action by the Seller.

Approval by the Buyer does not relieve the Seller of responsibility for accuracy or adequacy of design under this Specification.

If any revision has been made to previously submitted items, the Seller shall resubmit updated versions of items for approval, in addition to the requirements listed above.

5.3.3 Submittals Required with Proposal

5.3.3.1 Quality Assurance Program

The Seller shall provide a copy of their Quality Assurance Plan (see Section 5.6).

5.3.3.2 Preliminary Schedule

The Seller shall provide a schedule assuming that the start date is the receipt of the order. The schedule shall contain a summary of activities required to design, fabricate, test, and ship the mist eliminator assemblies.

5.3.4 Submittals Required after Receipt of Order

5.3.4.1 Work Plan

The Seller shall submit a work plan per Section 5.1 of this Specification.

5.3.4.2 Schedule

The Seller shall provide a final schedule showing the activities required to fabricate, inspect, and ship the mist eliminator assemblies.

5.3.5 Submittals Required Prior to Fabrication

5.3.5.1 Fabrication and Inspection Plan

The Seller shall submit a fabrication and inspection plan per Section 5.2.2 of this Specification.

5.3.5.2 Welding

Qualified Welding Procedures and Certified Procedure Qualification Records shall be submitted by the Seller for each type of weld and each characteristically different welding joint listed in the plan for welding.

Certified records of qualified personnel who will perform or verify the welding, if not already provided with the proposal, shall be submitted by the Seller.

5.3.6 Submittals Required for Contract Completion

The Seller shall not ship the mist eliminator assemblies until all inspections have been performed and the documentation data package is complete and approved by the Buyer.

5.3.6.1 Testing Procedures

The Seller shall submit testing procedures per Section 4.1 of this Specification.

5.3.6.2 Lifting Procedure

The Seller shall provide a lifting procedure for the mist eliminator assemblies. Attachment E, "Lift Procedure for Mist Eliminator Assembly", shall be provided to the Seller to edit and use as required by this Specification.

5.3.6.3 Inspection and Test Reports

Inspections and testing shall be documented and the documentation delivered before shipment of the product. Inspection and testing reports shall provide actual inspection and test results, specifying what was performed, who performed it, the characteristics inspection or test, and the acceptance criteria.

5.3.6.4 Certificate of Conformance

The Seller shall provide the Buyer with Certificate of Conformance stating that the mist eliminator assemblies conform to all the requirements of this Specification. This Certificate of Conformance shall, as a minimum:

1) Identify the appropriate purchase order/contract number under which the material, equipment, item, or service is being supplied.
2) The Certificate of Conformance shall identify the specific procurement requirements to be met by the purchased item or service. The procurement requirements identified shall include any approved changes, waivers, or deviations applicable to the item or service.
3) The supplier's/manufacturer's authorized representative responsible for quality shall sign the Certificate of Conformance.
4) One copy of the documentation, unless otherwise specified, shall accompany the applicable item shipped. For subsequent shipments on this purchase order/contract order, reference may be made to documentation provided with earlier shipments, instead of duplication such documentation.

5.3.6.5 Packaging, Shipping, and Storage Plan

The Seller shall submit for Buyer approval a packaging, shipping, and storage plan which contains Seller's procedures for packaging, marking, and shipping the mist eliminator assemblies to the Buyer. Attachment C, "Packaging, Shipping, and Storage Plan for Mist Eliminators", shall be provided to the Seller to edit and use as required by this Specification. Buyer approval of the plan is required before packaging and shipment. If special handling devices are needed, those devices shall be part of the Seller's package and identified as special equipment.

The mist eliminator assemblies shall be packaged to prevent exposure of elements due to outside storage for up to one year, or damage due to shipping and handling by forklift or hoist. All openings of the demister housing shall be covered to prevent the intrusion of dirt and debris during handling, shipping, and storage. The mist eliminator assemblies shall be marked at the Seller's site with the Buyer's purchase order number. Equipment shall be dismantled only as necessary for shipment, and dismantled equipment shall require the approval of the Buyer. Each component to be shipped loose shall be marked at the

Seller's site with the Buyer's purchase order number and the identifying number of its respective component. Lift points or centers of gravity shall be marked on shipping crates.

5.3.6.6 Records Maintenance, Control, and Disposition

The Seller shall collect, identify, and maintain originals of records generated for this contract and included in Table 5-1. Where contract records include generic procedures such as welding procedures, reproducible copies may be submitted instead of originals if validated.

Where submittals are required during the term of the contract for the Buyer's review, copies shall be submitted. Within 10 days of contract completion, however, the originals (or validated reproducible copies) of the records shall be delivered to the Buyer at a location specified by the Buyer's Contract Specialist.

All records shall be protected against damage, deterioration, loss or unauthorized use. All records shall meet the following standards:

1) Signed, initialed, or otherwise authenticated and dated. Handwritten signatures are not required if a statement from the reporting individual or organization identifies the record.
2) Traceable to the item or activity.
3) Legible, accurate, reproducible, and complete.
4) Corrected, if necessary, by the record originator, who shall mark out the incorrect information with a single line, enter the correct information and then initial and date the correction. If the reason for the change is not obvious, then it must be stated.

Table 5-1. Deliverables and Schedule

Item	Title	Copies	Purpose	Schedule
1	Quality Assurance Program	3	Approval	With proposal
2	Preliminary Schedule	3	Evaluation	With proposal
3	Work Plan	3	Evaluation	2 weeks after receipt of order
4	Final Schedule	3	Information	2 weeks after receipt of order
5	Schedule Status	3	Information	Weekly

Table 5-1. Deliverables and Schedule

Item	Title	Copies	Purpose	Schedule
6	Fabrication and Inspection Plan	3	Review & Comment	2 weeks prior to fabrication
7	Final Fabrication and Inspected Plan (5.2.2)	3	Approval	2 weeks prior to fabrication
8	Weld inspection personnel certification	3	Approval	2 weeks prior to fabrication
9	Welding procedure specifications procedure qualification records Welder qualification test records Welder continuity records Weld repair procedures Fill Metal Control Procedure	3	Approval	2 weeks prior to fabrication
10	Inspection and Testing Procedures	3	Approval	2 weeks prior to fabrication
11	Packaging, Shipping, and Storage Plan	3	Approval	2 weeks prior to shipment
12	Lifting Procedure	3	Approval	2 weeks prior to shipment
13	Fabrication Notes (Commitment Tracking List)	3	Approval	At shipment
14	Buyer approved redlines	3	Approval	As required during execution of purchase order
15	Inspection and Testing Reports	3	Approval	At shipment
16	Certificate of Conformance for System	3	Approval	At shipment

Table 5-1. Deliverables and Schedule

Item	Title	Copies	Purpose	Schedule
17	Fabrication completion documentation data package (Catalog Cut Sheet Notebooks)	3	Approval	At shipment
18	Non-Conformance Reports (5.6.1)	3	Approval	Prior to Corrective Action

5.4 DOCUMENT CONTROL

5.4.1 Changes to Buyer's Documents

Changes to Buyer's purchase order requirements will be documented by issuance of Buyer's Purchase Order Modification that will be transmitted to Seller for determination of impact on cost and schedule.

Changes to Buyer's design documents (redlines) shall be controlled by a redline change control process approved by Buyer. Seller shall notify Buyer of proposed change. Detailed description of change, including justification for change, shall be included.

5.5 CORRESPONDENCE

The Seller shall deliver legible copies, as required by document submittal. The Seller shall send these and all other documents to:

[AS REQUIRED PER PURCHASE ORDER]

ATTN: (Buyer's name and MSIN as it appears on the purchase order).

5.6 QUALITY ASSURANCE PROGRAM

The Seller shall conduct work in accordance with a Quality Assurance Program (QAP) that meets the requirements of ASME NQA-1-2004, *Quality Assurance Requirements for Nuclear Facility Applications with Addenda 1a 2005 and 1b 2007,* as specified in the Statement of Work.

The Seller shall provide assurance through their QAP that the program shall provide for control over activities affecting quality and the indoctrination and training, as necessary, of personnel performing activities affecting quality to assure that suitable proficiency is achieved and maintained. The program shall provide for any special controls, processes, test equipment, tools, and skills to attain the required quality and verification of quality. The program shall provide control over activities affecting quality consistent with their importance.

The Buyer reserves the right to verify the quality of work at the Seller's facilities including any sub tier facilities. Access to sub tier facilities shall be requested through the Seller and verification may be performed jointly with the Seller.

5.6.1 Non-Conformance Reports

Non-conformance reports (NCRs) identified at the Subcontractor's or lower-tier subcontractor's facility, associated with this Procurement Specification, with a proposed disposition of "Accept as is" or "Repair", shall be submitted to and approved by Washington River Protection Solutions Engineering and QA before the Subcontractor takes any corrective action on the nonconformance. Submission and approval process associated with NCRs will be coordinated via the procurement specialist. Seller must notify the Buyer within 24 hours of any quality/safety deficiency/nonconformance identified during the execution of this Purchase Order.

5.6.2 Inspection/Examination

The Seller shall include the qualifications of the inspectors for all critical items or features identified in this Specification.

5.6.3 Quality Clauses

The following quality clauses shall be applicable, but not limited to;

B13, B16, B22, B25, B28, B31, B32, B33, B34, B37, B52, B58, B61, B65, B79, B85.

The Quality Clauses specified in the procurement document shall be operative for the Seller. The Buyer shall identify the appropriate clauses in the Request for Proposal.

5.7 RIGHT OF ACCESS

The Seller shall permit and make arrangements in writing for the Buyer to enter all areas of the Seller's or subcontractor's facilities associated with producing the mist eliminator assemblies, for the purpose of examining the materials, equipment, processes, and procedures employed during the design, fabrication, assembly, testing, and shipment of the equipment. The Seller shall permit photograph and video records by the Buyer in the Seller's facilities associated with producing the mist eliminator assemblies.

ATTACHMENT A

BYPASS FLOW TEST

CONTENTS

ACRONYMS

CFM	Cubic Feet per Minute
MEA	Mist Eliminator Assembly
M&TE	Measuring and Test Equipment
QA	Quality Assurance
SCFM	Standard Cubic Feet per Minute
TE	Test Engineer
TER	Test Exception Report
W.G.	Water Gauge

REFERENCES

RPP-SPEC-46546, *"Procurement Specification for a Mist Eliminator Assembly,* Rev.1, Washington River Protection Solutions, LLC

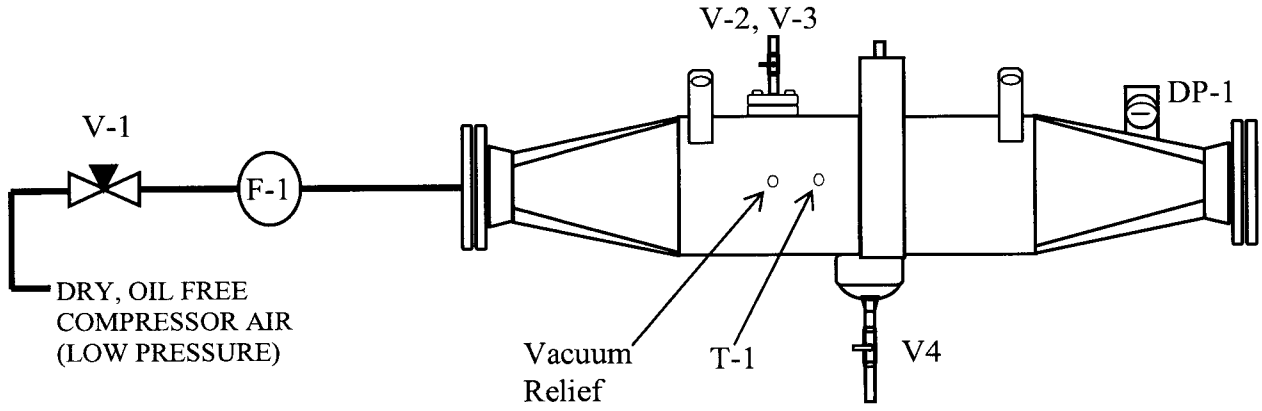
1 INTRODUCTION

This test procedure supports acceptance testing of Mist Eliminator Assemblies (MEA) which have been fabricated in accordance with RPP-SPEC-46546, *Procurement Specification/or a Mist Eliminator Assembly* (Reference 1). The purpose of the MEA is to remove moisture from the airstream in a portable exhaust system used during single shell tank waste retrieval operations. The MEAs will be located upstream of a high efficiency particulate air filter. The MEA consists of three major parts: 1) a moisture separator (the "separator") consisting of a mesh pad inside an associated rigid frame structure used to support and protect the pad during handling, installation and operation, 2) a housing that holds the separator and functions as the ventilation system pressure boundary to provide confinement of the air stream and also prevents moisture bypass around the separator, and; 3) a support structure. The purpose of this test is to verify that the bypass flow around the separator is within acceptable limits

1.1 TEST DESCRIPTION

1.1.1 Test Setup

Figure 1 is a schematic diagram of the test set-up. Note that the Inlet and Outlet Valves for the MEA will have been removed before the test.



V-1 Needle Valve
V-2 Mist Eliminator Left Spray Valve (Existing)
V-3 Mist Eliminator Right Spray Valve (Existing)
V-4 Mist Eliminator Drain Valve (Existing)
T-1 Thermocouple to be installed in available port

- F-1 Flow Meter 8.5 SCFM Max range (Subject Omega FL 4611-NIST 5PT)
- DP-1 Existing DP Gauge. Remove and preplace with Digital Gauge
- Vacuum relief Use a PRV or a U-Tube 1" (pipe or tube) 12" $\pm$ 2" WG

Figure 1. Test Setup

The test apparatus will consist of a low pressure source of air connected to a needle valve, flow meter, and a U-Tube Safety Valve, all connected in series and attached to a 12 inch flange that will be connected to the MEA. The upstream side of the separator will be sealed with a plastic sheet and tape, and the separator will be installed in the assembly. After verification that the test prerequisites

have been completed, the separator would be installed and the valve configuration would be verified to be in accordance with Table 1. The compressed air source would then be turned on and V-1 would then be slowly opened while monitoring the flow rate (F-l) and the differential pressure (DP-1). Opening of V-1 would be stopped upon achieving either of the following results: I) DP-1 indicates 3 inches H_20 or greater, or 2) F-1 indicates a flow of 5.0 SCFM or greater. Minor adjustments would then be made to V-1 until the system has stabilized, and the readings would then be recorded. If DP-1 indicates 3±0.3 in H_20 and F-1 indicates less than 5.0 SCFM then the success criteria are satisfied. DP-1 indicates 5.0 ± 0.2 SCFM and DP-1 indicates less than 3 in. H_20 then the success criteria are not satisfied and a test exception is required. The separator will then be removed and re-installed and the test will be repeated. The separator will then be removed and re-installed and the test repeated again, for a total of three tests in succession.

Table 1. Initial Valve Configuration for Bypass Flow Test

Valve	Description	Configuration
V-1	Needle Valve	**Closed**
V-2	Demister Left Spray Valve	**Closed**
V-3	Demister Right Spray Valve	**Closed**
V-4	Demister Drain Valve	**Closed**

1.2 TEST OBJECTIVES AND SUCCESS CRITERIA

The Test Objective and the associated Success Criteria are provided in Table 2.

Test Objective	Acceptance Criteria
Ensure that the Bypass flow around the moisture separator is within acceptable limits	This objective is satisfied when the sealed moisture separator has been installed three times in succession and that each time, the bypass flow around the moisture separator is demonstrated to be less than 5.0 SCFM when the differential pressure across the moisture separator is 3 in. H_20 or greater
Notes: I. This criteria is based on the following engineering judgment: The Demister is required (Reference 1) to have a removal efficiency of 99% of the nominal rated flow of 1000 CFM, thus allowing a total bypass of 10 CFM through and around the pad. The maximum differential pressure of a clean, wet pad is 2 in H_20. The test criteria allows for half of the bypass to be around the filter pad with differential pressures 50% higher than the maximum differential pressure. The test is performed three times to verify that the seal between the moisture separator and the housing is repeatable.	

1.2.1 TOOLS MATERIALS AND EQUIPMENT

1.2.2 Test Equipment

• Test apparatus consisting of air source and system of valves and flow meter as shown in Figure 1.

- Flow meter with range of .85 to 8.5 SCFM and accuracy of 0.2 SCFM or better
- Temperature measurement device with a sensitivity of ± 1 °F (i.e. RTD etc.).
- Digital Differential Pressure gauge with a range of 0.01 inches W.G. to 60 inches W.G.

1.2.3 PREREQUISITES

The tasks listed in Table 3 are to be completed prior to the start of the test for each MEA. These tasks are also incorporated in the Test Checklist. A separate checklist will be used for each assembly. There is no specific order required for completion of the Tasks 1 through 5.

Task	Task Description
1	Verify all instruments are calibrated as required and are connected as required for the test (See Section 5, Tools Materials and E equipment). Record calibration dates in the Test Checklist.
2	Verify that the MEA inlet and outlet valves have been removed.
3	Verify that the test rig (air supply, tubing and valves etc.) has been assembled in accordance with Figure 1 and is in good condition
4	Verify that the V-Tube in Figure 1 has been filled with water and is properly configured to prevent over-pressurization (> 3.5 in. H_20) of the test setup
5	Verify that leak testing of the MEA has been successfully completed in accordance with Reference 1, RPP-SPEC-46546 and that all unused ports have been closed.
6	Verify that the separator has been sealed off on the upstream side with a plastic sheet and tape that has been approved for use on stainless steel and that the separator is not installed. *Note that the tape and plastic sheeting must not cover or interfere with the gasket that seals the separator to the housing.*
7	Verify that the two outside drain holes have been blocked
8	Verify that the Washington River Protection Solutions, LLC buyer has been given the required 20 day notification of the test.

1.2.4 Precautions

The following precautions are to be observed for this test

Hazard	Test Precaution
No Hazards have been identified for this task **Manufacture to add to this section as required by their facility / safety program**	

2 TEST PROCEDURE STEPS

The procedure steps are described in the Test Checklist (Attachment I). A Separate Test Checklist will be completed for each MEA. Major steps can be conducted in any order, at the discretion of the Test Director

2.1 Verify all instruments are calibrated as required and are connected as required for the test (See Section 5, Tools Materials and Equipment). Record calibration dates below.

Instrument (See Fig 1)	Instrument Description/Range	Instrument ID	Cal. Date
F-1			
DP-1			
T-1			

2.2 Verify that the MEA inlet and outlet valves have been removed

2.3 Verify that the test rig (air supply, tubing and valves etc.) has been assembled in accordance with Figure 1 and is in good condition

2.4 Verify that the U-Tube in Figure 1 has been filled with water and is properly configured to prevent over-pressurization (12in W.G.$\pm$ 2 in W.G.) of the test setup

2.5 Verify that leak testing of the MEA has been successfully completed in accordance With RPP-SPEC-46546 (Bypass flow shall be no greater than 5.0 scfm at a differential pressure of 3.0 inches water column or greater) and that all unused ports have been closed

2.6 Verify that the separator has been sealed off on the upstream side with a plastic sheet and tape that has been approved for use on stainless steel and that the separator is not installed in the assembly. *Note that the tape and plastic sheeting must not cover or interfere with the gasket that seals the separator to the* housing.

2.7 Verify that the Washington River Protection Solutions, LLC buyer has been given the required 20 day notification of the test.

2.8 Perform the following steps three times, recording the data in the table below for each time.

2.8.1 Inspect the separator to verify that the seal on the upstream side is intact.

2.8.2 Install the separator

2.8.3 Verify that the valve configuration is in accordance with Table 1.

2.8.4 Activate the Air Supply

2.8.5 Gradually open V-1 while monitoring F-1 and DP-1 (see Figure 1). Stop changing V-1 as soon as F-1 becomes greater than 5.0 SCFM, *or* DP-1 becomes greater than 3.0 in. H2O.

2.8.6 Make minor adjustments in V-1 as necessary until the system stabilizes at F-1 = 5.0 ± 0.2 SCFM (if F-1 became greater than 5.0 SCFM in the previous step) or stabilizes at DP-1 > 3.0 in. H_20 (if DP-1 became greater than 3.0 in. H_20 in the previous step).

2.8.7 Record the Flow rate, Differential Pressure and Temperature in the table below, and verify by initialing that the bypass flow around the moisture separator has been demonstrated to be less than 5.0 SCFM when the differential pressure across the moisture separator is 3 in. H_20 or greater. *(Note: a test exception is required if these conditions are not met.)*

2.8.8 Deactivate the Air Supply

2.8.9 Remove the separator

Cycle	F-1 (SCFM)	DP-1 (in WG)	T-1 (Deg F)	Initials	
				TE	WQ
1					
2					
3					

2.8.10 Restore the system to the original condition

2.8.11 Verify that the moisture separator has been installed three times and that each time the bypass flow around the moisture separator has been demonstrated to be less than 5.0 SCFM when the differential pressure across the moisture separator is 3 in. H_20 or greater.

Test Engineer _____ _____ ___/___/___
Print Sign Date

Test Director _____ _____ ___/___/___
Print Sign Date

Quality Assurance _____ _____ ___/___/___
Print Sign Date

Customer Witness _____ _____ ___/___/___
Print Sign Date

APPENDIX A

TEST EXCEPTION

TEST DEFICIENCY REPORT **Date of Deficiency:**_____ **PER #**_____	**TDR Number:** _____ **Page ____ of ____**
Affected Steps/Sections:	
Deficiency Description/Evaluation:	
Continue Testing ☐**Yes** ☐**No** **Justification:**	
Corrective Actions: **(Attach applicable documentation)** ☐ **Use- as -is** ☐**Reject** ☐**Repair** ☐**Rework**	**Senior Test Director /Date** **Operations FLM-OE/Date** **Facility Manager/Date** **System Engineer/Date**
Results of Corrective Actions: Referenced CTL Entries:	**Senior Test Director /Date** **Operations FLM-OE/Date** **Facility Manager/Date** **System Engineer/Date**
Deficiency Category (mark one): ☐ **Design Deficiency** ☐ **Installation Deficiency** ☐ **Equipment Failure** ☐ **Software Deficiency** ☐ **Other:** _____	

ATTACHMENT B

Pressure Decay Test

TABLE OF CONTENTS

LIST OF APPENDICES

LIST OF TERMS

Abbreviations and Acronyms

Units

ft	foot
ft^3	cubic feet
Hg	mercury
in.	inch
lb	pound
min	minute
^oF	degrees Fahrenheit
psfa	pounds per square foot absolute
psi	pounds per square inch
psig	pounds per square inch gauge
^oR	degree Rankin
W.G.	Water Gauge

1.0 PURPOSE

This Mist Eliminator Assembly Ventilation AG-1 Leak Testing document will verify the integrity of the ducting pressure boundary of the mist eliminator assemblies. The testing may occur on installed equipment or on sub-assemblies prior to installation.

1.1 Background

The overall testing approach for this project includes Factory Acceptance Tests, Construction Acceptance Tests, and the Operational Acceptance Tests. Mist Eliminator Assembly Ventilation AG-1 Leak Testing is one of the tests used to satisfy the requirements from the overall testing approach.

1.2 Introduction

This test will verify the integrity of the pressure boundary of the Mist Eliminator Assembly.

Required leak testing is to be performed in accordance with American Society of Mechanical Engineers (ASME) AG-1, *Code on Nuclear Air and Gas Treatment*. The test outlined in this document meets the leak testing criteria from ASME AG-1, Article SA-4500. Basing the calculation on ASME AG-1, Article SA-4500 ensures compliance with RPP-19233, *General WAC 246-247 Technology Standards Exemption Justification for Waste Tank Ventilation Systems.*

2.0 ROLES AND RESPONSIBILITIES

Each company or organization participating in this test will designate personnel to assume the responsibilities and duties as defined in this document. The designees shall become familiar with this test to the extent necessary to perform their assigned duties. Testing will be witnessed by a Buyer Qualified representative.

3.0 CHANGE CONTROL

If the test needs to be changed, testing affected by the change shall be stopped until the change or revision is completed. Other test sections unaffected by the change may be performed at the Test Director's discretion.

Minor changes may be made by the Test Director using the redline and strikeout method as long as the changes do not impact operational facility performance, and will not compromise or influence the test data.

Major changes to the test must be implemented using the approved redline methods.

4.0 EXECUTION

4.1 Safety Precautions

Appendix A may be performed under an approved work package which will address Radiological and Industrial Health and Safety controls for performing test activities. Alternatively, the test may be performed at the fabricator's shop in accordance with the fabrication shop's approved safety programs which address Industrial Health and Safety controls for performing test activities.

4.2 Performance

The test steps are found in Appendix A. Test sections may be performed in any sequence at the direction of the Test Director. Individual test steps within a test section shall be completed in sequence. The test director will document the test using the test log provided as an attachment. The test log is used to document any issues, changes, or events of note that occur during the test.

Appendix A includes a place for initials to delineate that each specific step has been completed satisfactorily. As each test step is completed, the Recorder will check off, enter N/A, or initial and date the test Field Copy or data sheet as appropriate.

5.0 EXCEPTIONS

Test exceptions and re-testing shall be documented. Appendix E is an example of an acceptable test exception sheet.

6.0 SPECIAL TOOLS, EQUIPMENT, AND SUPPLIES

Verify that all Maintenance and Test Equipment have a valid calibration, and record make, model, and calibration data before performance of the test, as called for in Appendix A. Record all required test equipment M&TE information on the "**Measurement and Test Equipment (M&TE) Calibration Log**"

Special tools, equipment, and supplies required to complete testing will be identified in Appendix A.

7.0 PREREQUISITES

Specific prerequisites will be listed in Appendix A. Follow all safety controls as prescribed in the approved work plan.

Ensure that all drawings, specifications, and engineering documents used to support the performance of the test are the latest revision including any outstanding redline changes.

8.0 DATA AND REPORTING

The information collected in Appendices A, B, D, and E, as well as a sketch of the system being tested, will be gathered and approved by the submitter. The data will be sent to the Buyer for review. The data requires approval by the Buyer's Engineering Representative prior to final transmittal of the information.

9.0 REFERENCES

ASME AG-1-2009, *Code on Nuclear Air and Gas Treatment*, American Society of Mechanical Engineers, New York, New York.

ASME N510-2007, *Testing of Nuclear Air Treatment Systems,* American Society of Mechanical Engineers, New York, New York.

ASME N511-2007, *In-Service Testing of Nuclear Air Treatment, Heating, Ventilating and Air0Conditioning Systems,* American Society of Mechanical Engineers, New York, New York.

RPP-19233, *General WAC 246-247 Technology Standards Exemption Justification for Waste Tank Ventilation Systems*, CH2M HILL Hanford Group, Inc., Richland, Washington.

APPENDIX A

MIST ELIMINATOR ASSEMBLY VENTILATION AG-1 LEAK TESTING

Test No.	**Project Name:**	**Project No.:**
Leak Test:		**Completed By:**
Test Purpose: The purpose of this test is to verify the integrity of the ventilation ducting.		

Equipment Identification and Notes

The following equipment is needed to perform pressure decay method leak testing of all welded ventilation duct/pipe assemblies.

- Calibrated differential pressure measuring equipment with a range of 0-30 in. W.G., and an accuracy of $\pm$ 0.1 in. W.G.
- Calibrated barometer, accurate to $\pm$ 0.01 in. Hg or use weather station data. (Barometric pressure can be obtained by calling the local weather station)
- Calibrated temperature indicator, accurate to $\pm$ 0.5°F. Approximate range of 0 to 150°F.
- Clock or timer accurate to $\pm$ 1.0 seconds over the anticipated test duration (approximately 15 minutes).
- Vacuum source capable of 1 pound per square inch (psi), with appropriate isolation valve(s) and vacuum relief mechanism.
- Miscellaneous fittings to connect instruments and equipment to test assembly.
- Blanks, gaskets and bolts, and/or other materials necessary to seal temporary connections and test penetrations in the assembly.
- Bubble solution for detecting air leaks.

The basic steps of the leak test are included in the instruction section. Steps that are not applicable to the inspection/testing may be omitted. The test and test results shall be documented. A sample data/calculation sheet in provided. Assemblies may be bolted together and tested in groups, as necessary for efficiency purposes.

This pressure decay test is also used to effectively pre-test the joints which cannot be tested after installation (e.g., if the joint is connected directly to the volume being ventilated). Therefore, the gaskets installed for testing shall be the same size/dimensions and material as that specified in the installation design. The bolts used for the testing shall be the same size as that specified in the installation design, and installed in the same manner (if manner is not specified, then per standard industrial practice). Any temporary blanks used shall have the same basic dimensions (e.g., hole size and pattern) as the tested assembly flange. Tape or other sealants shall not be used to help seal any of the joints or the temporary blanks (except for instrument and test equipment connections).

Test No.	**Project Name:**	**Project No.:**

Leak Test:	**Completed By:**

Prerequisites

1. **RECORD** the Identification Number and Calibration Due Date for the following test equipment. **ID NUMBER** **CAL DUE DATE** Pressure Relief Valve (-31 to -33 in. W.G.) _____ _____ Temperature Measurement Instrument (0-150 ± 0.5°F) _____ _____ Differential Pressure Gauge (0-30 ± 0.1 in. W.G.) _____ _____	
NOTE: Barometric pressure can be obtained by calling the weather station or by obtaining local airport conditions. (offsite)	

Instructions

1. **SET UP** equipment per Attachment C and test director's instructions.	
2. **ISOLATE** the ends of assembly using temporary blanks.	
NOTE: If sufficient test ports are not available in the assembly, use blanks that have available test ports.	
NOTE: An airtight seal is required when installing the test equipment.	
3. **INSTALL and SEAL** the temperature measuring instrument into one of the ports in the assembly.	
4. **INSTALL and SEAL** the pressure measuring instrument into one of the ports in the assembly.	
5. **INSTALL** vacuum source (with isolation valve and vacuum relief mechanism) at one of the ports in the assembly.	
6. **ENSURE** pressure relief valve is set. _____ _____ Quality Assurance Date	
7. **SKETCH** the test assembly configuration. The sketch will be part of the test documentation package.	
8. **DECREASE** internal pressure to the pressure indicated by -32 in W.G.	

Test No.	**Project Name:**	**Project No.:**

Leak Test:	**Completed By:**
9. **IF** leaks in the test assembly are suspected, **THEN LOCATE** the leaks using a suitable bubble solution, audible methods, or other method.	
10. **SEAL** any leaks detected in step 9.	
11. **MAINTAIN** constant pressure until temperature remains constant within $\pm$ 0.5°F for a minimum of 10 minutes.	
12. **ISOLATE** the vacuum source from the duct.	
13. **RECORD** the initial time, initial barometric pressure, initial pressure, and initial temperature in Appendix D, Table 1.	
14. **RECORD** the pressure and temperature readings once a minute until pressure decays to 80% of the test pressure or for a maximum of 15 minutes in Appendix D, Table 1.	
15. **RECORD** the final time, final barometric pressure, final pressure, and final temperature in Appendix D, Table 1.	
16. **TRANSFER** the required information to Appendix D, Table 2.	
17. **PERFORM** the leak rate calculations in accordance with Appendix D, Table 2.	
18. **IF** $Q<L_s$, **THEN RECORD** "PASS" in Appendix D, Table 2 **AND GO TO** step 24.	
19. **IF** $Q>L_s$, **THEN RECORD** "RETEST" in Appendix D, Table 2.	
20. **LOCATE** the leaks using a suitable bubble solution, audible methods, or other method.	
21. Slowly **EQUALIZE** duct pressure to atmospheric pressure through the testing manifold assembly.	
22. **REPAIR** leaks.	
23. **REPEAT** steps 8 through 15 using new data sheets.	
24. Slowly **EQUALIZE** duct pressure to atmospheric pressure through the testing manifold assembly.	
25. **DISCONNECT** all test equipment.	
26. **RESTORE** equipment to its pre-test configuration.	
27. **MAINTAIN** constant pressure until temperature remains constant within $\pm$ 0.5 °F for a minimum of 10 minutes.	

Construction Acceptance Test	**By (Print Name & Sign)**	**Date**
Performed:		
Witnessed:		
Constr. Mgr. Rep:		
Buyer Quality Assurance:		

Measurement and Test Equipment (M&TE) Calibration Log

Equipment Number	Equipment Description	Calibration Due Date	Initials/ Date	Instrument Accuracy verification	Initial Calibration Date

M&TE accuracy requirements come from ASME N510-2007 Table 2 Instrument Accuracy Requirements.

- Calibrated differential pressure measuring equipment with a range of 0-30 in. W.G., and an accuracy of $\pm$ 0.1 in. W.G.
- Calibrated barometer, accurate to $\pm$ 0.01 in. Hg or use weather station data. (Barometric pressure can be obtained by calling the local weather station)
- Calibrated temperature indicator, accurate to $\pm$ 0.5°F. Approximate range of 0 to 150°F.
- Clock or timer accurate to $\pm$ 1.0 seconds over the anticipated test duration (approximately 15 minutes).
- Vacuum source capable of 1 pound per square inch (psi), with appropriate isolation valve(s) and vacuum relief mechanism. (No M&TE Required)

Quality Control (Quality Engineer) verification of M&TE equipment:

Pint Name: _____ QC Stamp: _____

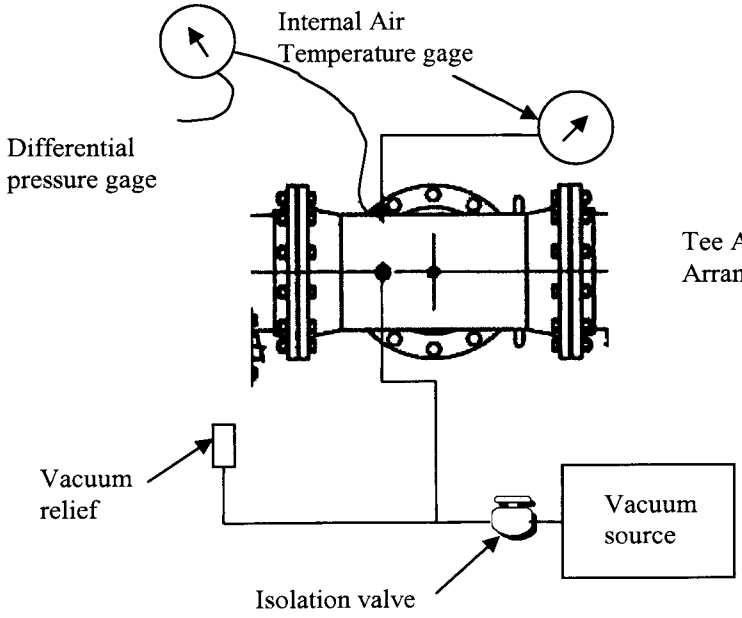
Sign: _____

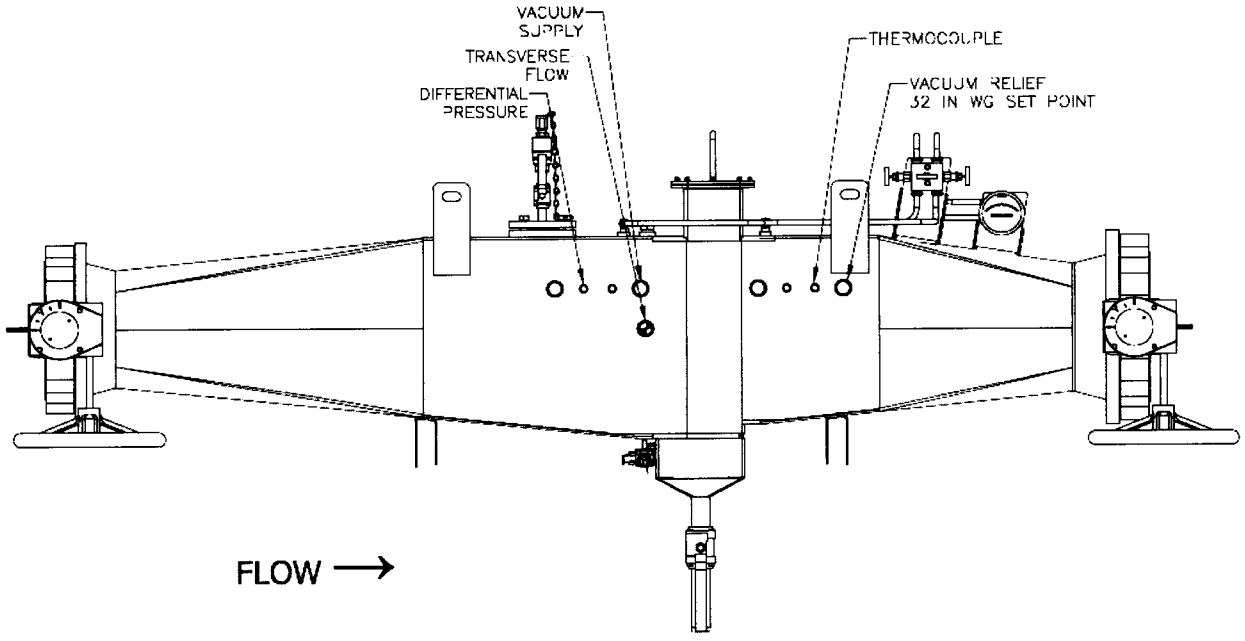
Date: ____/____/____

APPENDIX B

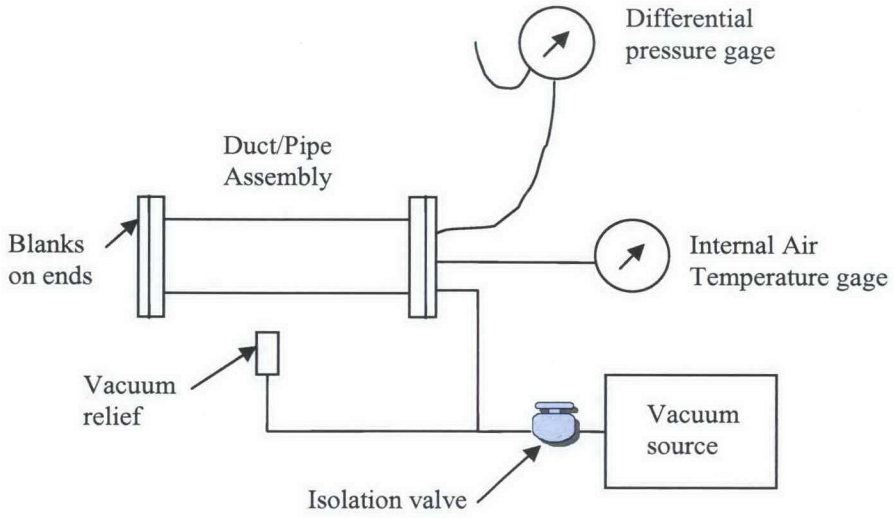
SUGGESTED TEST APPARATUS CONFIGURATIONS

SUGGESTED FIELD TEST APPARATUS CONFIGURATION





SUGGESTED SHOP TEST APPARATUS CONFIGURATION



APPENDIX C

PRESSURE DECAY METHOD LEAK CHECK DATA SHEETS

TABLE 1

(This page may be reproduced as necessary)

(Check One) **ORIGINAL TEST: _____** **RETEST: _____** **#: _____**

SYSTEM BEING TESTED: _____

DATE: _____

Initial Barometric Pressure (BP_i): _____ in. Hg Initial Time (t_i): _____

Final Barometric Pressure (BP_f): _____ in. Hg Final Time (t_f): _____

Time	t_i	t_i+1	t_i+2	t_i+3	t_i+4	t_i+5	t_i+6	t_i+7
Pressure (in. W.G.)	P_i=							
Temperature (° F)	T_i=							
Time	t_i+8	t_i+9	t_i+10	t_i+11	t_i+12	t_i+13	t_i+14	t_f=t_i+15
Pressure (in. W.G.)								P_f=
Temperature (° F)								T_f=

Where:

- t_i = Initial time
- t_f = Final time
- P_i = Initial Pressure
- P_f = Final Pressure
- T_i = Initial Temperature
- T_f = Final Temperature

WEATHER STATION – obtain local airport conditions

_____ _____
Test Director, Print / Signature Date

_____ _____
Buyer Quality Assurance, Print / Signature Date

TABLE 2

(This page may be reproduced as necessary)

(Check One) **ORIGINAL TEST:** _____ **RETEST:** _____ **#:** _____

SYSTEM BEING TESTED: _____

DATE: _____

	INITIAL		FINAL	
Time	t_i =		t_f =	
Pressure	P_i = in. WG	$\frac{P_i}{27.7} = a_i$ = psig	P_f = in. WG	$\frac{P_f}{27.7} = a_f$ = psig
Barometric Pressure	BP_i = in. Hg	$BP_i \times 0.491 = b_i$ = psi	BP_f = in. Hg	$BP_f \times 0.491 = b_f$ = psi
Duct Pressure		$DP_i = (a_i + b_i) \times 144$ = psfa		$DP_f = (a_f + b_f) \times 144$ = psfa
Temperature	T_i = °F	$T_{iR} = T_i + 460$ = °R	T_f = °F	$T_{fR} = T_f + 460$ = °R

Test Volume: V = Provided by Buyer (Reference: TBD

Gas Constant: R = 53.35 ft lb / (lb x °R)

Test Duration: $\Delta t = t_f - t_i$ = minutes

$$Q = \frac{((DP_i/T_{iR}) - (DP_f/T_{fR})) * V}{(R \times \Delta t \times 0.075)} = \frac{((DP_i/T_{iR}) - (DP_f/T_{fR})) * V}{(53.35 \times \Delta t \times 0.075)} =$$

(Q is the average total leak rate per ASME AG-1-2009, Article TA- III-4200, in standard ft^3/min)

L_s = Allowable Leak Rate (Reference: TBD)

PASS / FAIL (CIRCLE ONE)

_____ _____
Test Director, Print / Signature Date

_____ _____
Buyer Engineering Representative, Print / Signature Date

APPENDIX D

TEST EXCEPTION

TEST DEFICIENCY REPORT **Date of Deficiency:** _____ **PER #** _____	**TDR Number:** _____ **Page** ____ **of** ____
Affected Steps/Sections:	
Deficiency Description/Evaluation:	
Continue Testing ☐ **Yes** ☐ **No** **Justification:**	
Corrective Actions: **(Attach applicable documentation)** ☐ **Use- as -is** ☐ **Reject** ☐ **Repair** ☐ **Rework**	**Senior Test Director /Date** **Operations FLM-OE/Date** **Facility Manager/Date** **System Engineer/Date**
Results of Corrective Actions: Referenced CTL Entries:	**Senior Test Director /Date** **Operations FLM-OE/Date** **Facility Manager/Date** **System Engineer/Date**
Deficiency Category (mark one): ☐ **Design Deficiency** ☐ **Installation Deficiency** ☐ **Equipment Failure** ☐ **Software Deficiency** ☐ **Other:** _____	

Attachment C

PACKAGING, SHIPPING AND STORAGE PLAN FOR MIST ELIMINATORS

Table of Contents

1.0 INTRODUCTION

This document contains information related to the shipping, storage and handling of The Mist Eliminator assembly. The scope covered by this document includes the details associated with the shipment, storage and handling of the Mist Eliminators from the fabricator to the customer's storage facility. It also covers details related to the storage at the customer's location. The document covers the handling details for the Mist Eliminators as well as issues related to storage.

2.0 PACKAGING

The following describes how the Mist Eliminators will be packaged. A packing list will be included with the package that will identify the products within the package. No package shall exceed 6000 lb.

2.1 Mist Eliminators

Each Mist Eliminator will be shipped together in a package separate from the other. The Mist Eliminators will be shipped together with the steel framing and concrete bases. All lifting and transport of the Mist Eliminators are to be performed within the guidelines of the lifting plan. All items will be identified on the packing list for each package.

3.0 PART IDENTIFICATION AND NUMBERING

Each Mist Eliminator has a part number associated with it. The part number will be marked on each Mist Eliminators. The marking will be on an attached tag.

4.0 DESCRIPTION

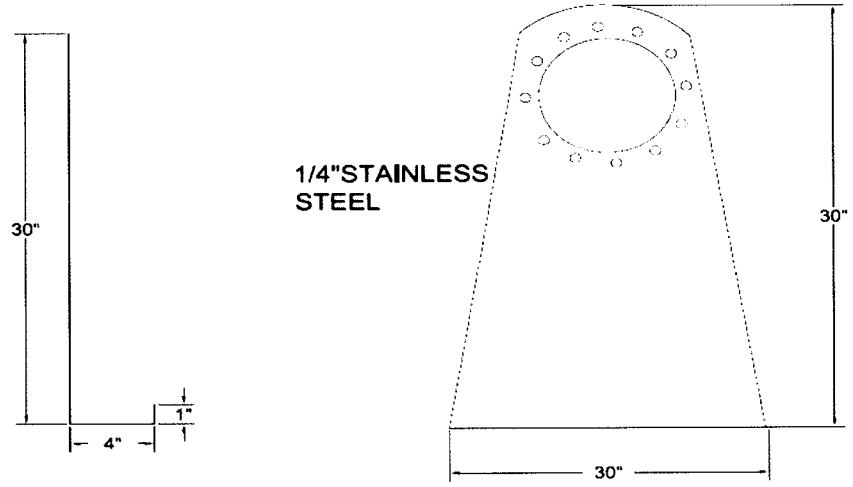
The mist Eliminators are made from Stainless steel. The Mist Eliminators are a filtering chamber used to draw moisture from airflow through a filter pad. The drawings associated with the Mist Eliminators are listed below.

Design Drawings TBD

5.0 MIST ELIMINATORS PACKAGE

The Mist Eliminators will be packaged per system by using 1/4" stainless steel end caps that will be 30" high by 30" wide. The end caps will act as a seal for storage as well as strapping point for shipping. Please see diagram A-1.The base stands will be strapped to the bed of the truck using nylon strapping. The concrete blocks will be strapped to the bed of the truck.

A-1 SHIPPING STAND SKETCH



6.0 STORAGE AND HANDLING INSTRUCTIONS

6.1 Storage

The Mist Eliminators will be sealed with the shipping plates and will not need any further storage material. It is recommended that the Mist Eliminator assemblies be stored in a dry covered area when not in use.

6.2 Packaging

Retaining all original packaging intact is recommended until items are deployed. Recommended equivalent packaging methods are covering with plastic wrap (7 mil thickness min.) or securely covering with a tarp.

6.3 Handling

Handling of packaged items should be performed with forklift or crane. Carbon steel may not come in contact with stainless steel. In order to eliminate contamination originating from rigging hardware, carbon steel rigging components shall not be utilized on stainless steel. An exception to this situation exists whenever carbon steel rigging equipment is able to be attached directly to rigging points such as lifting lugs, eyes, or pads installed on the stainless equipment. All lifting shall follow the approved lifting plan for the Mist Eliminators.

7.0 MAINTENANCE DURING STORAGE

Maintenance is not required during storage. Monthly inspections should be performed while in storage to verify condition of items and packaging. Inspections should verify the condition and integrity of the packaging materials.

7.1 Control of Items Removed from Storage

Facility approved procedures shall be used to control transfer of Mist Eliminators from storage.

8.0 INSPECTION SCHEDULE

Routine inspection of stored items should be performed on a monthly basis at a minimum. These inspections should include the following recommended inspections.

Inspection	Condition to Check	Action
General Condition and Cleanliness	Signs of physical damage	Notify person in charge
	Excessive dirt or debris	Clean
	Rodent, bird, or insect intrusion	Remove all traces of rodent, bird, and insect intrusion using appropriate cleaning procedures and safety precautions
Fasteners	Loose or missing fasteners	Replace missing fasteners, retighten loose ones to specifications
Finish	Chipped or damaged paint	Clean and touch up paint as required

Attachment D

MIST ELIMINATOR ASSEMBLY

SPRAY SYSTEM TEST

Table of Contents

LIST OF TERMS

Abbreviations and Acronyms

ACRONYMS

CFM	Cubic Feet per Miuute
MEA	Mist Eliminator Assembly
M&TE	Measuring and Test Equipment
QA	Quality Assurance
SCFM	Standard Cubic Feet per Minute
TE	Test Engineer
TER	Test Exception Report
W.G.	Water Gauge

Units

ft	foot
ft^3	cubic feet
Hg	mercury
in.	inch
lb	pound
min	minute
^oF	degrees Fahrenheit
psfa	pounds per square foot absolute
psi	pounds per square inch
psig	pounds per square inch gauge
^oR	degree Rankin
W.G.	Water Gauge

1 INTRODUCTION

This test procedure supports acceptance testing of Mist Eliminator Assemblies (MEA) which have been fabricated in accordance with RPP-SPEC-46546, *Procurement Specification/or a Mist Eliminator Assembly,* (Reference 1). The purpose of the MEA is to remove moisture from the airstream in a portable exhaust system used during single shell tank waste retrieval operations. The MEA will be located upstream of a high efficiency particulate air filter. Figure I is a schematic illustration of the MEA.

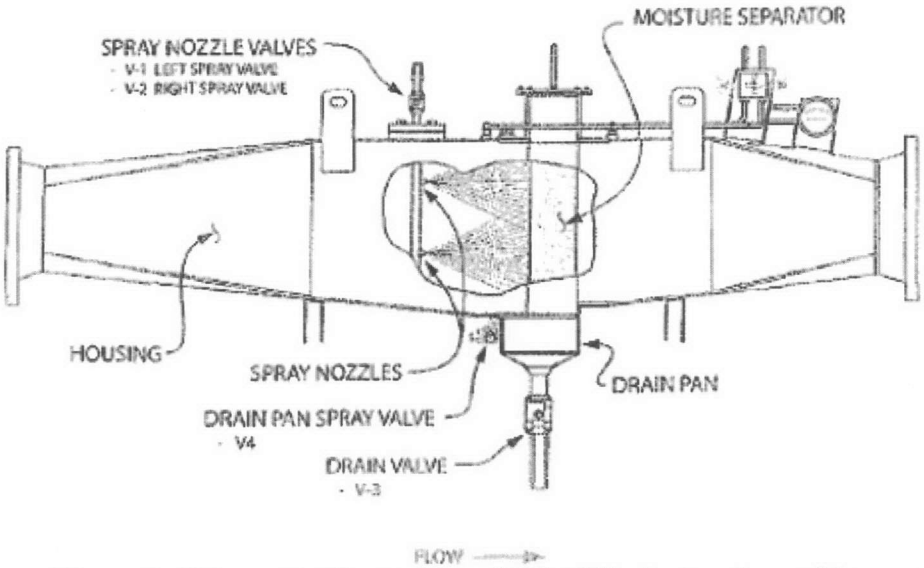


Figure 1. Schematic Illustration of Mist Eliminator Assembly

Major portions consist of i) a moisture separator (the "separator") consisting of a mesh pad inside an associated rigid frame structure used to support and protect the pad during handling, installation and operation, 2) a housing that holds the separator and functions as the ventilation system pressure boundary to provide confinement of the air stream and also prevents moisture bypass around the separator, 3) a support structure, which is not shown in the illustration, 4) a system of spray nozzles that are used to clean the moisture separator and: 5) a Drain Pan and Valve that drains accumulated moisture from demisting and also cleaning spray. There is also a small spray nozzle that cleans the Drain Pan. The purpose of this test is to 1) verify that the spray system will provide cleaning spray at a minimum rate of three gallons per minute (gpm), 2) Demonstrate that the spay system provides complete coverage of the moisture separator; and 3) verify that the Drain system will accommodate 3 gpm from the spray system without excessive buildup of liquid in the Drain Pan.

2 TEST DESCRIPTION

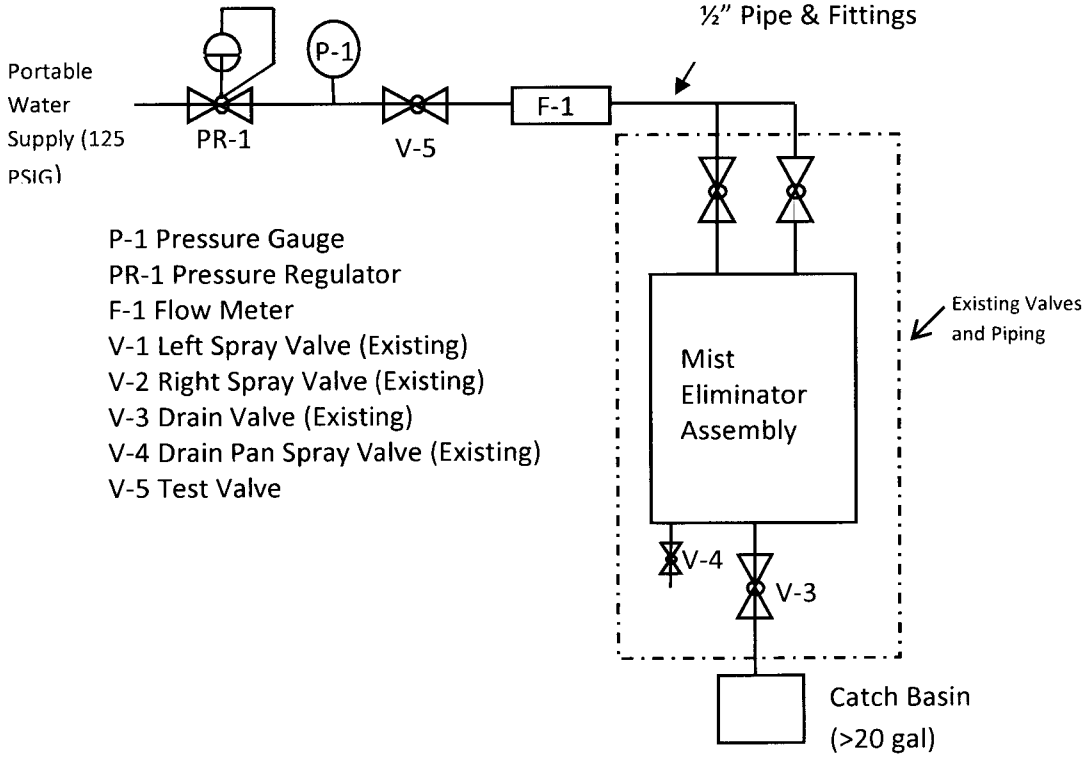
2.1 Test Setup and Description

Figure 2 is a schematic diagram of the test set-up. Prerequisites will include removal of the moisture separator and covering the upstream side with a layer of absorbent material such as filter paper (this will be referred to as the 'sheet') that will absorb the spray.

2.2 Verification of Minimum Flow Rate.

The initial phase of testing will be performed before the separator is replaced. Testing will commence with verification that the prerequisites have been completed and that the valve line-up is in accordance with Table 1. PR-1 will be gradually opened until the now rate at F-1 is observed to be 3.2 ±0.2 gpm. After allowing the system to stabilize, the pressure (P-1) and flow rate (F-1) will be recorded to verify the spray system will deliver water at a minimum rate of 3.0 gpm. Valve V-5 will then be closed.

Figure 2. Test Setup



2.3 Demonstration of Spray Coverage

Portions of the interior of the housing next to the slot for the separator will be dried with towels and the separator with the associated "sheet" will be installed. Pretesting will have established if higher flow rates and pressures are required to achieve complete spray coverage. The pressure will be adjusted if required. The sheet will then be monitored visually and with a video camera while valve V-5 is briefly opened (for ~1 - 3 seconds). Immediately after closing the valve, the separator with the sheet will be removed for inspection. The extent of coverage will then be subjectively evaluated by the pattern on the sheet and the digital images to verify complete coverage.

Table 1. Initial Valve Configuration for Bypass Flow Test

Valve	Description	Configuration
PR-1	**Pressure Regulator**	**Closed**
V-1	**Left Spray Valve**	**Open**
V-2	**Right Spray Valve**	**Open**
V-3	**Drain Valve**	**Open**
V-4	**Drain Pan Spray Valve**	**Closed**
V-5	**Test Valve**	**Open**

2.4 Verification of Drain System Capacity

The sheet will be removed from the separator and the separator will be reinstalled. Valve V-5 will be opened, and ran for a period of 5 minutes. During this period

- F-1 will be monitored to verify the flow rate is 3.2 $\pm$ 0.2 gpm
- The Interior of the assembly will be monitored visually by looking through the assembly outlet and inlet, at the bottom of the interior section, to verify water is not building up in the assembly.

3 TEST OBJECTIVES AND SUCCESS CRITERIA

The Test Objective and the associated Success Criteria are provided in Table 2.

Table 2, Test Objectives and Success Criteria

Test Objectives	Success Criteria
Verify that the spray system will provide water at a minimum rate of 3 gallons per minute (gpm)	This objective will be accomplished when the spray system has been operated at a flow rate in excess of 3.0 gpm and the flow rate and water pressure have been recorded.[1]
Demonstrate that the spray system provides complete coverage of the moisture separator pad	This objective will be accomplished when the spay system has been operated and complete coverage has been verified by visual observation of the spray pattern on an absorbent sheet attached to the front of the Separator.[2]
Verify that the drain system will accommodate a minimum flow of 3 gpm of water from the spray system without excessive build up	This objective will be accomplished when the spay system has been operated at a flow rate of 3.2 ± 0.2 gpm for a period of 5 minutes and visual monitoring of the MEA revealed no excess buildup of liquid.[1]
Notes: 1. Criteria based on specifications (Reference 1) 2. Criteria based on engineering judgment.	

4 TOOLS MATERIALS AND EQUIPMENT

4.1 Test Equipment includes:

- Test apparatus consisting of water source and system of valves, meter as shown in Figure 2.
  - Pressure gauge with a range 0 to 150 psig and accuracy of 1 psig or better
  - Pressure regulator capable of controlling pressures of a range of 0 to 125 psig
- Digital Camera and highlighting equipment
- Watch with seconds capability or stop watch

5 PREREQUISITES

The tasks listed in Table 3 are to be completed prior to the start of the test for each MEA, These tasks are also incorporation in the Test Checklist. A separate checklist will be used for each assembly, There is no specific order required for completion of the Tasks 1 through 5,

Table 3, Prerequisites for Spray System Test

Task	Task Description
1	Verify all instruments arc calibrated as required and arc connected as required for the test (See Section 4,Tools Materials and Equipment), Record calibration dates in the Test Checklist.
2	Verify inlet valve and outlet valve are removed from assembly.
3	Verify that the moisture eliminator assembly has been completed and inspected and found to be in good condition.
4	Verify that hydrostatic testing of the mist eliminator flush piping has been completed and documented.
5	Verify that the test rig (water supply, tubing, and valves etc) has been assembled in accordance with Figure 2 and is in good working condition.
6	Verify that the separator has been removed and fitted with a sheet of absorbent material on the upstream side of the separator.
7	Verify that the Washington River Protection Solutions LLC buyer has been given the required 20 days notification of the test.

5.1 PRECAUTIONS

The following precautions are to be observed for this test.

Hazard	Test Precaution
No Hazards have been identified for this task **Manufacture to add to this section as required by their facility / safety program**	

6 REFERENCES

6.1 RPP-SPEC-46546, "PROCUREMENT SPECIFICATION FOR A MIST ELIMINATOR ASSEMBLY, REV 1 WASHINGTON RIVER PROTECTION SOLUTIONS LLC.

7 TEST STEPS

The procedure steps are described in the Test Checklist (Attachment 1), A Separate Test Checklist will be completed for each MEA. Major steps can be conducted in any order, at the discretion of the Test Director,

7.1 Verify M&TE has been recorded

Equipment Number	Equipment Description	Calibration Due Date	Initials/ Date	Instrument Accuracy verification	Initial Calibration Date

M&TE accuracy requirements come from ASME N510-2007 Table 2 Instrument Accuracy Requirements.

Quality Control (Quality Engineer) verification of M&TE equipment:

Pint Name: _____ QC Stamp: _____

Sign: _____

Date: ____/____/____

7.2 Verify inlet valve and outlet valve are removed from the assembly

7.3 Verify the Moisture Eliminator Assembly has been completed, inspected and to be in good condition.

7.4 Verify that hydrostatic testing of the mist eliminator flush piping has been completed and documented.

7.5 Verify that the test rig (water supply, tubing, and valves ect) has been assembled in accordance with figure 2 and is in good working condition.

7.6 Verify that the separator has been removed and fitted with a sheet of absorbent material on the upstream side of the separator.

7.7 Verify that the Washington River Protection Solutions LLC buyer has been given the required 20 days notification of the test.

8 FLOW RATE VERIFICATION

8.1 Verification of minimum flow rates

8.2 Verify valve configuration is in accordance with table 1

8.3 Gradually open PR-1 while monitoring F-1, allow system to stabilize at 3.2 $\pm$ 0.2 gpm. A test exception is required if it is not possible to achieve a flow rate greater than 3.0 gpm.

8.4 Record the flow rate, F-1 and the pressure P-1

a. Flow Rate, F-1 (gpm) _____

b. Pressure, P-1 (psig) _____

8.5 Verify that the spray system has been operated at a flow rate in excess of 3.0 gpm and the flow rate and water pressure have been recorded.

9 DEMONSTRATION THAT THE SPRAY SYSTEM PROVIDES COMPLETE COVERAGE

9.1 Use towels to dry those portions of the interior of the housing next to the slot for the separator.

9.2 Install the separator with its associated sheet of absorbent material.

9.3 Setup the camera and lighting as necessary too provide for video recording and visual monitoring of the spay pattern during the next step.

9.4 Make any adjustments to PR-1 to achieve higher pressures if required. Note that higher pressure (and flow rates) are permissible if required to achieve complete coverage. These values will be determined during Pre-test and grooming activities. Enter the pressure and flow rates used here.

a. Flow Rate, F-1 (gpm) _____

b. Pressure, P-1 (psig) _____

9.5 Initiate monitoring and briefly open V-5 (1 to 3 seconds) while monitoring

9.6 Record separator with sheet and inspect for evidence of spray pattern. Take pictures as required.

9.7 Record File Name of pictures/Videos as required

File Name	Location	Description

9.8 Verify that the spray system has been operated and complete coverage has been verified by visual observation of the spray pattern on the absorbent sheet attached to the front of the separator.

9.9 Verify that the drain system will accommodate 3 gpm from the spray system without excessive buildup of liquid.

9.10 Adjust PR-1 as required to achieve the same pressure recorded in step 8.4

9.11 Open V-5 and record start time (hours, Minutes, Seconds) or start stop watch. Time (Hrs, Min, Sec) _____

9.12 Visually monitor the interior of the MEA via the inlet and exit ports. Accumulation of water to a level higher than the top of the drain indicated excessive water buildup. A test exception is required if excessive water buildup occurs. After 5 minutes, record stop time (Hrs, Min, Sec)

_____

9.13 Verify that the spray system has been operated at a flow rate of 3.2 ± 0.2 gpm for a period of 5 minutes and visual monitoring of the MEA revealed no excessive build up of liquid.

Test Engineer _____ _____ ___/___/___
Print Sign Date

Test Director _____ _____ ___/___/___
Print Sign Date

Quality Assurance _____ _____ ___/___/___
Print Sign Date

Customer Witness _____ _____ ___/___/___
Print Sign Date

APPENDIX A

TEST EXCEPTION

TEST DEFICIENCY REPORT **Date of Deficiency:**_____ **PER #**_____	**TDR Number:** _____ **Page** ____ **of** ____
Affected Steps/Sections:	
Deficiency Description/Evaluation:	
Continue Testing ☐ **Yes** ☐ **No** **Justification:**	
Corrective Actions: **(Attach applicable documentation)** ☐ **Use- as -is** ☐ **Reject** ☐ **Repair** ☐ **Rework**	**Senior Test Director /Date** **Operations FLM-OE/Date** **Facility Manager/Date** **System Engineer/Date**
Results of Corrective Actions: Referenced CTL Entries:	**Senior Test Director /Date** **Operations FLM-OE/Date** **Facility Manager/Date** **System Engineer/Date**
Deficiency Category (mark one): ☐ **Design Deficiency** ☐ **Installation Deficiency** ☐ **Equipment Failure** ☐ **Software Deficiency** ☐ **Other:** _____	

ATTACHMENT 1

Test Checklist

Mist Eliminator Assembly Project
Spray System Test Procedure

TEST CHECKLIST

ASSEMBLY ID_____

Step	Step Description	Initials TE / QA	Date
6.0	**Prerequisites**		
6.1	Verify all instruments are calibrated as required and are connected as required for the test (See Section 5, Tools Materials and Equipment). Record calibration dates below.	/	
6.2	Verify inlet valve and outlet valve are removed from assembly.		
6.3	Verify that the Moisture Eliminator Assembly has been completed and inspected and found to be in good condition.	/	
6.4	Verify that hydrostatic testing of the demister flush piping has been completed and documented.	/	
6.5	Verify that the test rig (water supply, tubing and valves etc.) has been assembled in accordance with Figure 2 and is in good condition.	/	
6.6	Verify that the separator has been removed and fitted with a sheet of absorbent material on the upstream side of the separator.	/	
6.7	Verify that the Washington River Protection Solutions, LLC buyer has been given the required 5 day notification of the test.	/	

Instrument (See Fig 1)	Instrument Description/Range	Instrument ID	Cal. Date
F-1			
P-1			

Mist Eliminator Assembly Project
Spray System Test Procedure

TEST CHECKLIST

ASSEMBLY ID_____

Step	Step Description	Initials TE / QA	Date
8.0	**Procedure Steps**		
8.1	**Verification of Minimum Flow Rate**		
8.1.1	Verify valve configuration is in accordance with Table 1.	/	
8.1.2	Gradually open PR-1 while monitoring F-1. Allow system to stabilize at 3.2 ±0.2 gpm. *A Test exception is required if it is not possible to achieve a flow rate greater than 3.0 gpm.*	/	
8.1.3	Record the Flow Rate, F-1, and the Pressure, P-1. Flow Rate, F-1 (gpm)_____ Pressure, P-1 (psig)_____	/	
8.1.4	Verify that the spray system has been operated at a flow rate in excess of 3.0 gpm and the flow rate and water pressure have been recorded.	/	
8.2	**Demonstration that the Spray System provides complete coverage.**		
8.2.1	Use towels to dry those portions of the interior of the housing next to the slot for the separator.	/	
8.2.2	Install the separator with its associated sheet of absorbent material.	/	
8.2.3	Set up cameras/lighting as necessary to provide for videos and visual monitoring of spray pattern during next steps.	/	

TEST CHECKLIST

ASSEMBLY ID_____

Step	Step Description	Initials TE / QA	Date
8.2.4	Make any adjustments to PR-1 to achieve higher pressures if required. Note that higher pressure (and flow rates) are permissible if required to achieve complete coverage. These values will be determined during Pre-test and grooming activities. Enter the pressure and flow rates used here. Flow Rate, F-1 (gpm)_____ Pressure, P-1 (psig)_____	/	
8.2.4	Initiate monitoring and briefly open V-5 (1-3 seconds) while monitoring.	/	
8.2.5	Remove separator with sheet and inspect for evidence of spray pattern. Take pictures as required.	/	
8.2.6	Record File Names of pictures/videos as required File Name | Location | Description	/	
8.2.7	Verify that the spray system has been operated and complete coverage has been verified by visual observation of the spray pattern on an absorbent sheet attached to the front of the separator.	/	
8.3	**Verify that the drain system will accommodate 3 gpm from the spray system without excessive build up of liquid.**		
8.3.1	Adjust PR-1 as required to achieve the same pressure recorded in step 8.1.3.	/	

TEST CHECKLIST

ASSEMBLY ID_____

Step	Step Description	Initials TE / QA	Date
8.3.3	Open V-5 and record start time (hours, minutes, seconds), or start stop watch. Time (hrs, min, sec) _____	/	
8.3.4	Visually monitor the interior of the MEA via the inlet and the exit ports. Accumulation of water to a level higher than the top of the drain indicates excessive water build-up. A test exception is required if excessive water build-up occurs. After 5 minutes, close V-5 and record the time. Time (hrs, min, sec) _____	/	
8.3.5	Verify that spray system has been operated at a flow rate of 3.2 ±0.2 gpm for a period of 5 minutes and visual monitoring of the MEA revealed no excessive build-up of liquid.	/	

	Print Name	Signature	Date
Test Engineer	_____	_____	_____
Test Director	_____	_____	_____
Quality Assurance	_____	_____	_____
Additional Witness (If Necessary)	_____	_____	_____

ATTACHMENT E

LIFT PROCEDURE
FOR
MIST ELIMINATOR ASSEMBLY

TABLE OF CONTENTS

1.0 INTRODUCTION

The Mist Eliminator is an in-line, outdoor, above grade demister assembly that is to be used at the Hanford site located North of Richland, Washington. This demister provides a key function in the Single-shell tank ventilation process during High Level Waste retrieval activities by removing entrained water droplets (aerosols) from the underground nuclear waste storage tank exhaust air stream to protect the high efficiency particulate filters located downstream.

2.0 SCOPE

The scope of this procedure is to raise the mist eliminator assemblies, structural support assemblies, and concrete support assemblies from an appropriate staging area onto a sufficiently sized transportation vehicle using approved cranes, forklifts, lifting devices, and riggings.

3.0 LOAD DESCRIPTION

The mist eliminator main assembly consists of the following: two mist eliminator assemblies, two structural support assemblies, and two concrete support assemblies. For shipment, the main assembly will be broken down to these three main components. The mist eliminator assemblies each weigh approximately 1393 pounds and are to be lifted by a crane with the use of four fixed lift lugs. The structural support assemblies each weigh approximately 271 pounds and are to be lifted using an approved forklift. The concrete support assemblies each weigh 2125 pounds and are to be lifted with the aid of two open slots on the underside of the block. Depending on the desired orientation of the concrete support assemblies on the transportation vehicle, the concrete supports can be lifted by either forklift or crane with appropriate rigging.

4.0 PRECAUTIONS AND LIMITATIONS

The mobile crane shall be positioned such that there are no power lines or other overhead obstructions near the lift. When positioning the crane, the swing radius of the crane shall not conflict with adjacent structures and other equipment. All lift personnel shall don proper protective equipment and adhere to safe lifting operations.

5.0 EQUIPMENT AND RIGGING

5.1 Equipment

- Forklift capable of lifting at least 2656 pounds *.
- Crane capable of lifting at least 2656 pounds *.

* Safety Factor of 1.25.

5.2 Rigging

- (4) Lifting shackles, 5/8 inch diameter, 3/4 pin diameter, stainless steel, minimum working load limit of 1250 pounds.

- (4) Slings, minimum length 35 inches, minimum vertical working load limit of 1250 pounds.
- (2) Slings, minimum length 84 inches, minimum basket working load limit of 2500 pounds.

6.0 LIFT CONFIGURATION

6.1 Mist Eliminator Assemblies

Per NuVision Engineering calculation number 4757-3-001 section 5.2.2, the mist eliminator assemblies shall be lifted using two diagonal lift lugs as restraint locations and a third will be used to provide stability. This was possible due to the model center of gravity being almost centered between the diagonal of the lift lugs. Section 5.2.2 also requires that slings attached to the lifting lugs be at a 45-degree angle as a minimum. Lifting will require four lifting shackles and four slings with a minimum vertical working load limit of 1250 pounds.

Mist Eliminator Assemblies

$La := 42.250$ Length C_L to C_L of Lift Lugs (in)

$Lb := 24.125$ Width of Lift Lugs (in)

$Lc := \sqrt{La^2 + Lb^2}$

$Lc = 48.653$ Diagonal of Lift Lugs (in)

Force and Length Based on Sling Angle

$A45 := 45$ Degrees

$A60 := 60$ Degrees

$AW := 1393.00$ Assembly Weight (lb)

$SF := 1.25$ Safety Factor

$$SL45 := \frac{(0.5 \cdot Lc)}{\cos(A45\ \text{deg})} \qquad F45 := \frac{(AW \cdot SF)}{2 \cdot \sin(A45\ \text{deg})}$$

$$SL60 := \frac{(0.5 \cdot Lc)}{\cos(A60\ \text{deg})} \qquad F60 := \frac{(AW \cdot SF)}{2 \cdot \sin(A60\ \text{deg})}$$

$SL45 = 34.403$ Sling Length (in) at 45 degrees

$F45 = 1231.25$ Force in Sling (lb) at 45 degrees

$SL60 = 48.653$ Sling Length (in) at 60 degrees

$F60 = 1005.311$ Force in Sling (lb) at 60 degrees

Figure 6.1.1: Sling angle, sling length, and tension per sling based on dimensional properties and weight of the mist eliminator assemblies. The tension in the sling is based upon a two-point lift used in NuVision calculation 4757-3-001. Actual sling length will be shorter based on the length of the shackle used.

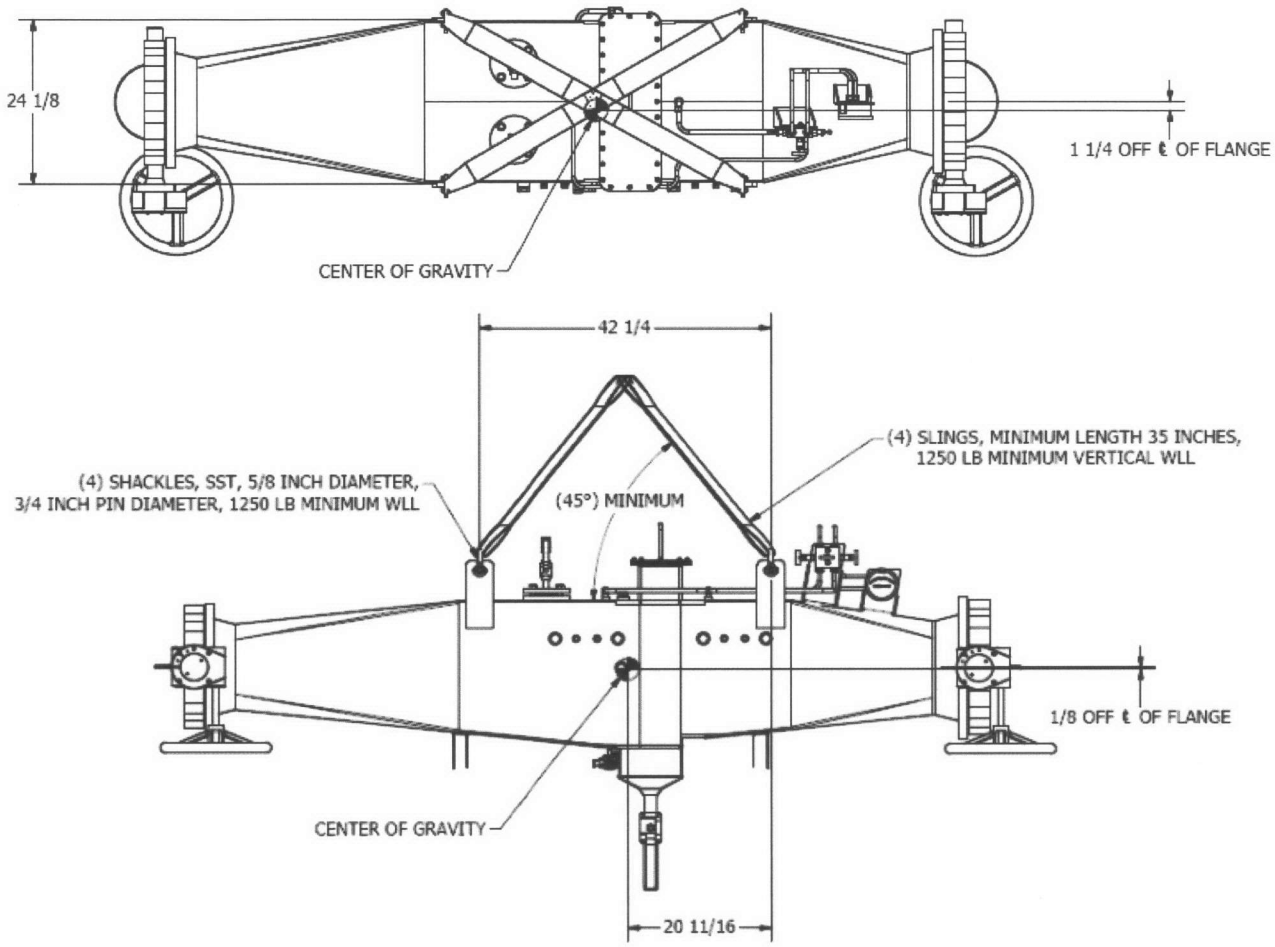


Figure 6.1.2: Dimensional properties of the mist eliminator assemblies.

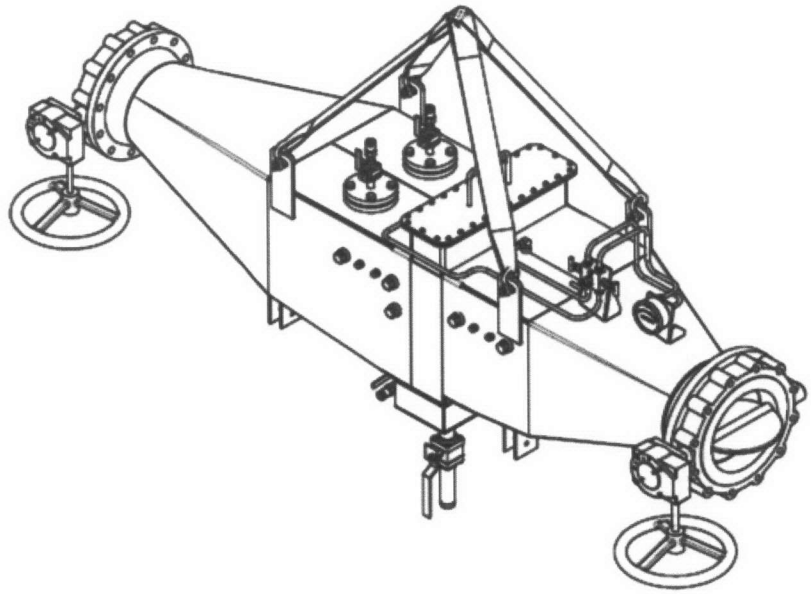


Figure 6.1.3: Rigging for the mist eliminator assemblies. Refer to Figure 6.1.1 for angle, length, and tension in the lifting straps.

6.2 Structural Support Assemblies

The structural support assemblies shall be lifted with a capable forklift that can lift approximately 350 pounds. The fork distance will have to be adjusted to be able to accommodate the structural support assemblies.

6.3 Concrete Support Assemblies

The concrete support assemblies shall be lifted with either a forklift or crane capable of lifting 2656 pounds. This variance is based on the desired positioning of the concrete support assemblies on the truck for shipment. The following information provides a detailed look at lifting the concrete support assemblies using two slings that wrap underneath with each end clipping onto the crane lift hook. Lifting by crane will require two, seven-foot slings with a minimum basket working load limit of 2500 pounds each.

Concrete Support Assemblies

$SL := 7.00$ Sling Length (ft)

$WB := 12.00$ Width of Assembly (in)

$AW1 := 2125$ Assembly Weight (lb)

$SF1 := 1.25$ Safety Factor

$W1 := 20$ Centerline of Assembly to Edge of Slot (in)

$W2 := 20$ Height of Assembly - Height of Slot (in)

Forces and Angles Based on 7ft Sling

$$L1 := \frac{(SL \cdot 12) - WB}{2} \qquad A1 := \left(\operatorname{acos}\left(\frac{W1}{L1}\right)\right) \cdot \left(\frac{180}{\pi}\right)$$

$$Lx := \frac{W2}{\sin(A1 \cdot \deg)} \qquad Ly := \frac{W2}{\tan(A1 \cdot \deg)}$$

$$Lz := \sqrt{(WB \cdot 0.5)^2 + (W1 - Ly)^2}$$

$$Lu := L1 - Lx \qquad A3 := \left(\operatorname{acos}\left(\frac{Lz}{Lu}\right)\right) \cdot \left(\frac{180}{\pi}\right)$$

$$Lv := \sqrt{(Lu)^2 - (Lz)^2} \qquad A2 := \left(\operatorname{atan}\left(\frac{Lv}{WB \cdot 0.5}\right)\right) \cdot \left(\frac{180}{\pi}\right)$$

$$FA1 := \frac{(AW1 \cdot SF1)}{(4 \cdot \sin(A1 \cdot \deg))} \qquad FA3 := \frac{FA1}{\sin(A3 \cdot \deg)}$$

$L1 = 36$ Usable Length per Side (in)

$A1 = 56.251$ Angle 1, Degrees

$Lx = 24.054$ Length X (in)

$Ly = 13.363$ Length Y (in)

$Lz = 8.947$ Length Z (in)

$Lu = 11.946$ Length U (in)

$A3 = 41.503$ Angle 3, Degrees

$Lv = 7.916$ Length V (in)

$A2 = 52.841$ Angle 2, Degrees

$FA1 = 798.652$ Force in Sling at Angle 1 (lb)

$FA3 = 1205.228$ Force in Sling at Angle 3 (lb)

Figure 6.3.1: Sling angles and force per sling (tension) based on using a seven-foot sling. Actual numbers will vary slightly if any type of softeners is used on the corners of the concrete support assemblies to reduce wear. Refer to Figure 6.3.2 for illustration of called out lengths and angles.

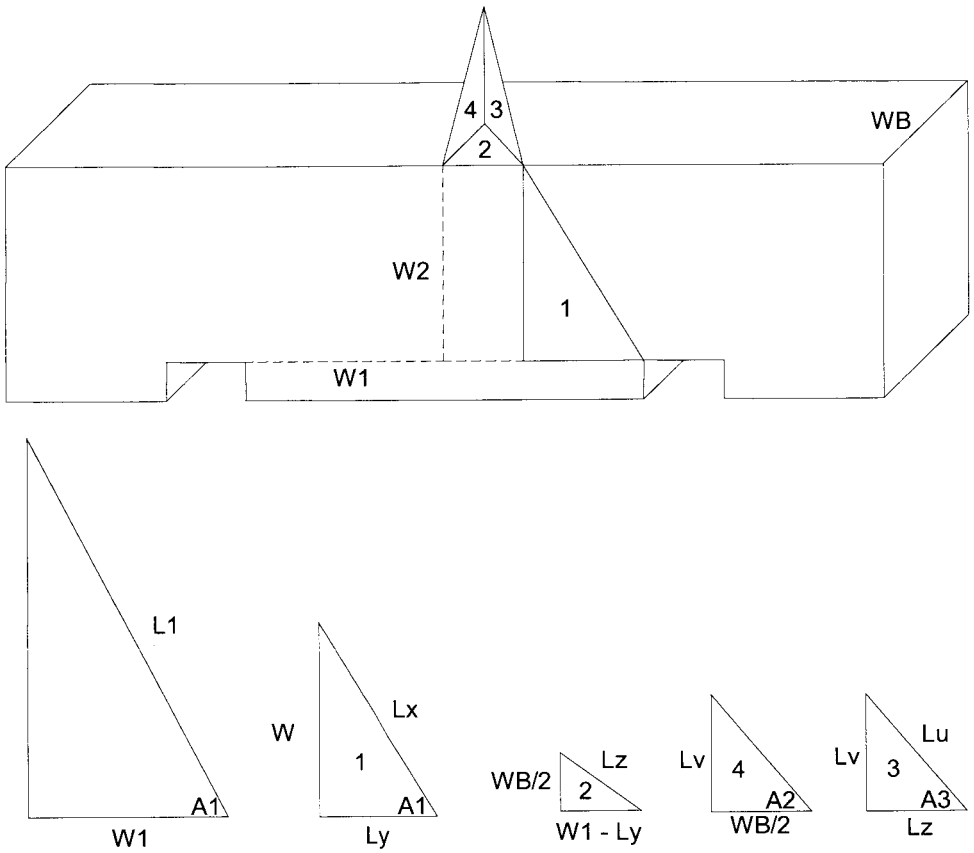


Figure 6.3.2: Illustration of design geometry. All lengths and angle are associated with using a seven-foot sling.

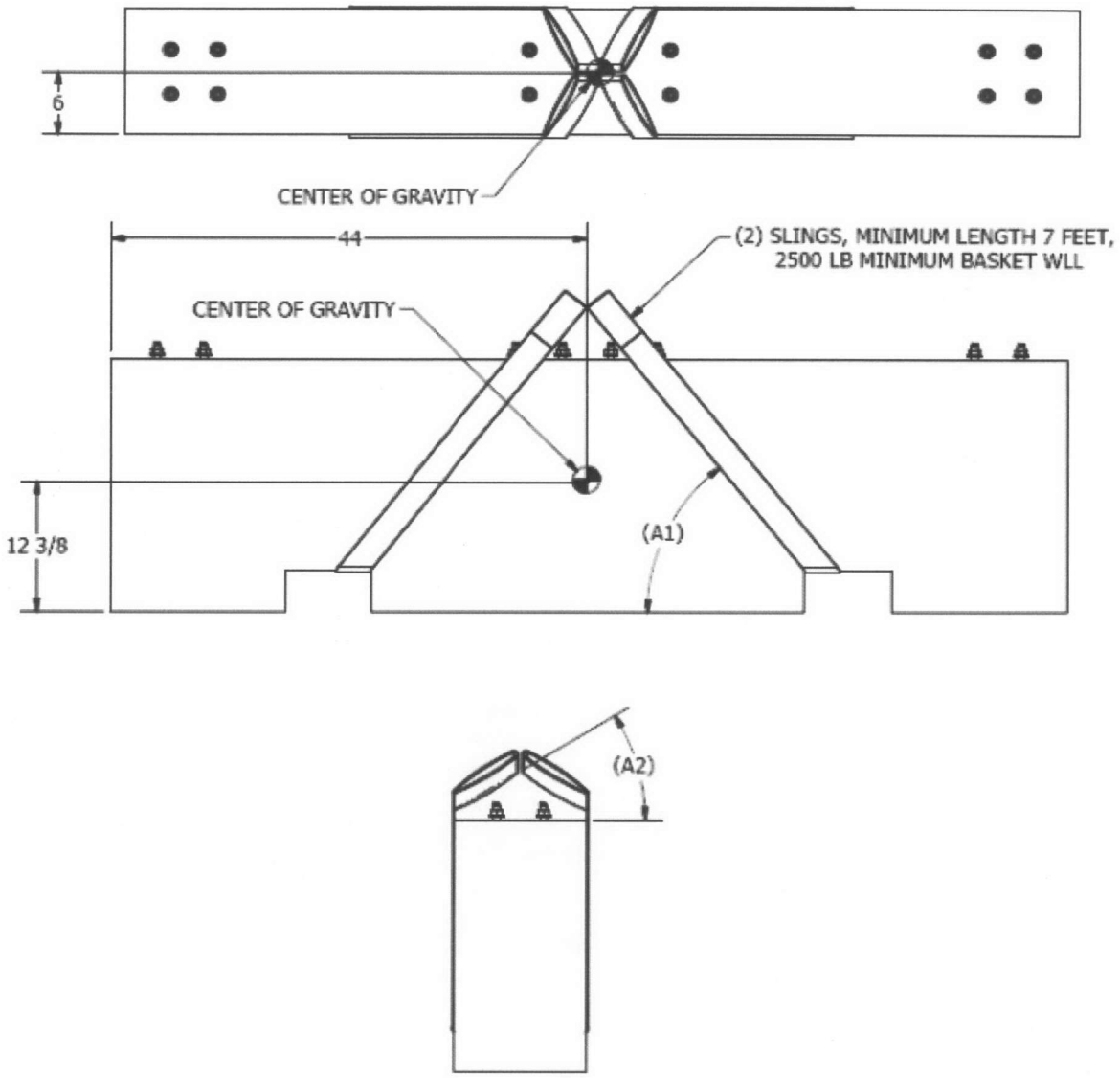


Figure 6.3.2: Dimensional properties for the concrete support assemblies.

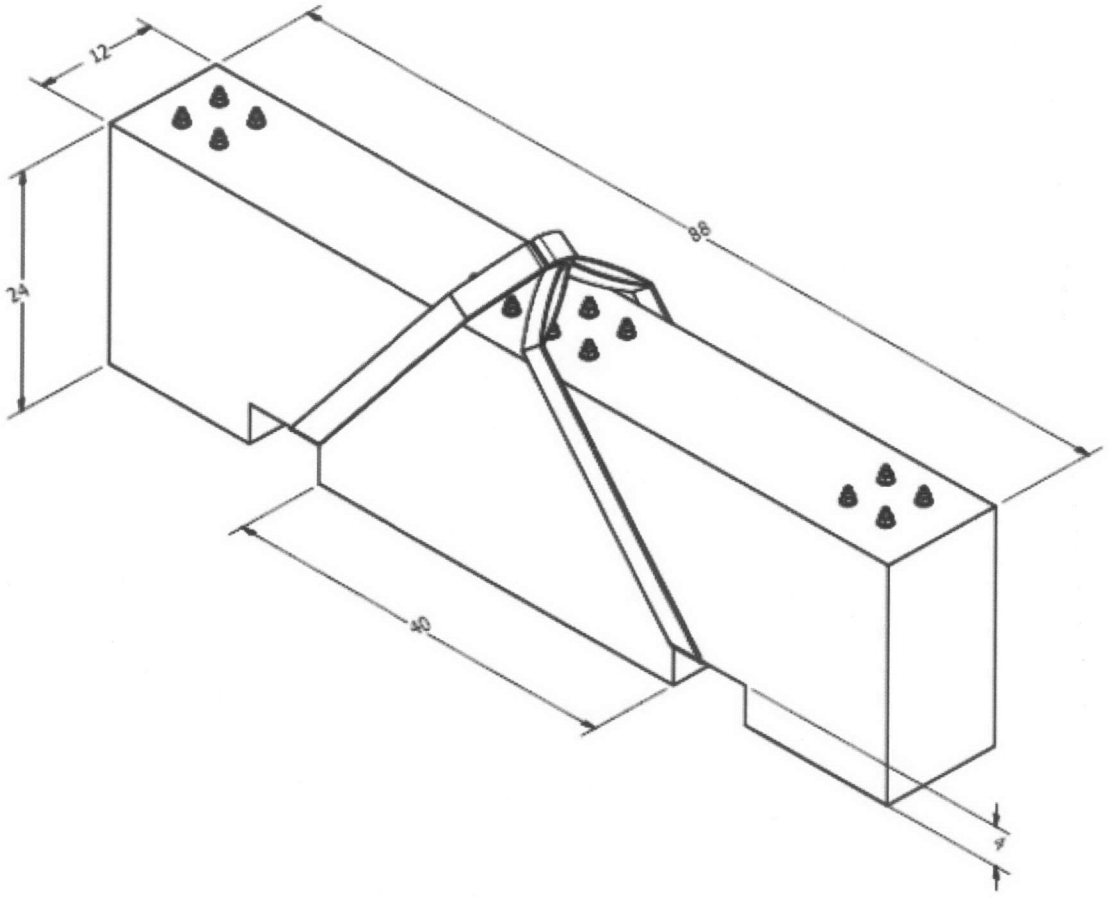


Figure 6.3.3: Rigging for the concrete support assemblies. Refer to Figure 6.3.1 for angle, length, and tension in the lifting straps.

7.0 REFERENCE DOCUMENTS

- NuVision Engineering calculation #4757-3-001 Rev. 0, Hanford Site – E124 Mist Eliminator Analysis
- Engineering drawing set Mist Eliminator Assembly
- Procurement Specification for a Mist Eliminator Assembly RPP-SPEC-46546

ATTACHMENT F

Test Log

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