November 2005
Rev 0, 2005

Permit Attachment LL DBVS

Appendix 3 Waste Dryer System

Section 5 Specifications

145579-D-SP-001, Revision 1, Dryer and Condensate Recovery System
145579-D-SP-006, Revision 2, Dryer and Condensate Recovery Skid

Permit Attachment LL DBVS

Appendix 3 Waste Dryer System

Section 4 Engineering Change Notices

ECN 722466, Revision 0, DBVS – Electrical Equipment Foundation – Plans & Sections[a]

[a] ECN 722466 is located in Permit Attachment LL, Appendix 1, Section 4.

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TECHNICAL SPECIFICATION

The document revision number is indicated below. Please replace all revised pages of this document and destroy the superseded copies.

PROJECT:	Task 6 Initial DBVS Design	143643-D-SP-001	REV. 1
PROJECT NO:	143643	DRYER AND CONDENSATE RECOVERY SYSTEM	
CLIENT:	AMEC E&E - Richland, Washington		

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Date: 4/13/05

Discipline Lead:

Date: 4/13/05

Originator:

Date: 4/13/05

* Approved with the following comment: Change "25 inches Hg" to "26 inches Hg" in Section 3.3.1.1.2.

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TECHNICAL SPECIFICATION

PROJECT:	**Task 6 Initial DBVS Design**	**143643-D-SP-001**	**REV. 1**
PROJECT NO.:	**143643**	**DRYER AND CONDENSATE RECOVERY SYSTEM**	
CLIENT:	**AMEC E&E – Richland, WA**		

TABLE OF CONTENTS

Page

1.0 SCOPE OF WORK 6
1.1 BACKGROUND 6
1.2 SCOPE OF SUPPLY 7

2.0 APPLICABLE DOCUMENTS 9
2.1 GOVERNMENT DOCUMENTS 9
2.2 NON-GOVERNMENT DOCUMENTS 9

3.0 TECHNICAL REQUIREMENTS 12
3.1 ITEM DEFINITION 12
3.1.1 Item Diagram 12
3.1.2 Interface Definition 12
3.2 CHARACTERISTICS 14
3.2.1 Functional Characteristics 14
3.2.2 Physical Characteristics 16
3.2.3 Reliability 17
3.2.4 Maintainability 17
3.2.5 Environment 18
3.2.6 Transportability and Storage 18
3.2.7 Safety 19
3.3 DESIGN AND CONSTRUCTION 19
3.3.1 Parts/Materials/Processes 20
3.3.2 Industry and Government Standards 42
3.3.3 Radiation 44
3.3.4 Cleanliness 44
3.3.5 Corrosion of Parts 45
3.3.6 Protective Coatings 46
3.3.7 Interchangeability 47
3.3.8 Identification and Marking 47
3.3.9 Nameplates 50
3.3.10 Human Engineering 50
3.3.11 Qualification 50
3.3.12 Document Submittal 51
3.3.13 Personnel and Training 53

4.0 QUALITY ASSURANCE REQUIREMENTS 54
4.1 GENERAL 55
4.1.1 Responsibility for Verification 55
4.1.2 Verification Methods 55

4.1.3 Requirements Flow Down 55
4.1.4 10 CFR 830.120 Applicability 56
4.1.5 Right of Access 56
4.1.6 Certificate of Conformance 56
4.1.7 Nonconformance Reporting 56
4.2 QUALIFICATION VERIFICATION 57
4.3 INSPECTIONS AND TESTS 57
4.3.1 Manufacturer Test 57
4.3.2 Electrical Testing 58
4.3.3 Hydrostatic Test 58
4.3.4 Acceptance Criteria 59
4.3.5 Inspections 59

5.0 PREPARATION FOR DELIVERY 60
5.1 GENERAL 60
5.1.1 Packaging and Shipping Instruction Manual 60
5.2 PRESERVATION AND PACKAGING 60
5.3 PACKING 60
5.4 MARKING 61
5.5 HANDLING 61
5.6 SHIPPING 62

6.0 NOTES 63

7.0 APPENDICES 63

APPENDICES

A Data Sheets

B Bidder's Drawing and Data Commitments

C TFC-ESHQ-Q_C-C-03, Revision B, *Control of Suspect/Counterfeit Items*

FIGURE

Figure 3-1. Dryer System Interface Diagram 13

TABLES

Table 2-1. Applicable Documents. 9
Table 2-2. Applicable Documents. 9
Table 3-1. Waste Chemical Composition. 15
Table 3-2. Soil Formulation 15
Table 3-3. Wire Color Coding Requirements. 31
Table 3-4. Pipe Labeling Format 48

ABBREVIATIONS AND ACRONYMS

°C	degrees Celsius
°F	degrees Fahrenheit
µ	micrometers
AC	alternating current
AISC	American Institute for Steel Construction
ASCE	American Society of Civil Engineers
ASME	American Society of Mechanical Engineers
ASNT	American Society of Nondestructive Testing
ASTM	American Society for Testing and Materials
AWG	American wire gauge
AWS	American Welding Society
BTU	British thermal unit
CH2M HILL	CH2M HILL Hanford Group, Inc.
CoC	Certificate of Conformance
CMTR	Certified Material Test Report
CPE	Customer-provided equipment
CWI	Certified Welding Inspector
DCS	Distributed Control System
DCRS	Dryer and Condensate Recovery System
ft^3	cubic feet
gpd	gallons per day
gpm	gallons per minute
hp	horsepower
Hz	hertz
ISO	International Organization for Standardization
in. Hg	inches of mercury
lb	pound
lbm	pound mass
mA	milliamp
mph	miles per hour
NCR	nonconformance report
NDE	Nondestructive Examination
NEC	National Electrical Code
NEMA	National Equipment Manufacturers Association

NFPA	National Fire Protection Association
NPT	National Pipe Thread
NQA	Nuclear Quality Assurance
NRTL	nationally recognized testing laboratory
ppm	parts per million
psi	pounds per square inch
psig	pounds per square inch gage
PCB	polychlorinated biphenyl
PVC	Polyvinyl Chloride
QA	quality assurance
RGS	rigid galvanized steel
SAE	Society of Automotive Engineers
TBD	to be determined
TEFC	totally enclosed fan cooled
TEMA	Tank Equipment Manufacturers Association
UBC	Uniform Building Code
UHMWPE	ultra high molecular weight polyethylene
UL	Underwriters Laboratories
US	United States
V	volt
vol	volume
wt%	weight percent

TRADEMARKS

Electromark® is a registered trademark of Permar Systems, Inc.

ICV™ (In-Container Vitrification) is a trademark of AMEC Inc.

Line Backer® is a registered trademark of Professional Services Industries, Inc.

Loctite® is a register trademark of Henkel Loctite.

NEC® is a registered trademark of National Fire Protection Association.

Quaker Quintolubric® is a registered trademark of Quaker State Corporation.

Viton® is a registered trademark of DuPont DOW Elastomers.

1.0 SCOPE OF WORK

1.1 BACKGROUND

AMEC is part of a team that has been selected by the CH2M HILL Hanford Group, Inc. (CH2M HILL) to design, fabricate, test, and deploy a Demonstration Bulk Vitrification System (DBVS) using a process referred to as In-Container Vitrification (ICV™) to receive, dry, and glassify waste from a underground storage tank located in the 200 West Area of the Hanford Nuclear reservation. A main subsystem of the DBVS is the Dryer and Condensate Recovery System (DCRS). The major components of the DCRS are a dryer unit, filter assembly, steam generator system, condenser, condensate recovery system, vacuum pump, chilled water system and a dryer International Organization for Standardization (ISO) container. The DBVS will have a single dryer and condensate recovery system feeding the ICV™ container. Note: the ISO container, chilled water system, and steam generator system are not part of this specification scope of work.

Throughout this specification, Contract Responder shall act as the Seller and AMEC shall act as the Buyer.

Throughout this document, the process fluid, or waste, will be referred to as the liquid salt-solution; the dried waste product after drying will be referred to as dried waste; and the liquid condensate condensed from the liquid salt-solution will be referred to as the liquid effluent.

The primary function of the DCRS is to receive liquid salt-solution from the Waste Receipt System, mix the liquid salt-solution with soil plus additives and desorb enough water in the dryer under vacuum to meet the criteria for dried waste (section 3.2.1.2 performance range). The evaporated water is condensed and transferred to the Secondary Waste System with the condensate recovery system. The dried waste soil mixture is discharged to a transfer system to transport the dried waste to dried waste hoppers located above the ICV™ container.

1.2 SCOPE OF SUPPLY

This specification provides the minimum requirements for design, analysis, fabrication, inspection, testing, documentation, packaging, and shipping of a DCRS consisting of:

- Batch Dryer or approved equivalent complete with hydraulic drive, drive support system on a separate skid including hydraulic pumps, electric motors and hydraulic drive controls, discharge valve with air actuator, and load cells under the dryer.
- Close coupled sintered metal filter complete with pneumatic pulsejet control system, internal water wash distribution system.
- Electrical and instrument control wiring from connected load to a termination box. Motor rated field disconnect switches complete with auxiliary contacts shall be supplied for each motor. A three position Hand/Off/Auto switch shall be provided for each motor and may be mounted in the disconnect switch.
- skid-mounted condensate recovery system consisting of:
    - Condenser to condense liquids in the vapor phase stream using Buyer supplied chilled water.
    - Condensate receiver tank with partial cooling jacket and instruments for level control and indication.
    - Condensate pump complete with motor and controls to deliver condensed liquids to a storage tank (supplied by others).
    - Vacuum pump complete with motor and controls to provide vacuum assisted drying and the main motive force for the vapor phase stream through the dryer, filter and condenser.
    - All interconnecting piping valving and instruments between condenser inlet, condensate receiver tank, condensate pump and vacuum pump.
    - Electrical and instrument control wiring from connected load to a termination box. Motor rated field disconnect switches complete with auxiliary contacts shall be supplied for each motor. A three position Hand/Off/Auto switch shall be provided for each motor and may be mounted in the disconnect switch.

- As an option, the intensifier drive motor and blades shall be quoted and their incorporation shall be determined by the Buyer prior to approval of final design.

All above shall be suitable for installation by others in an ISO rated container. It is acceptable for the hydraulic drive pumps and associated electric motors to be external to the container and supported separately in a skid unit.

An inspection and test plan, including Factory Acceptance Tests for systems, subsystems and components at the vendor's site shall be provided (see section 4.2 and 4.3).

The DCRS equipment shall be demonstrated to be capable of processing the simulant liquid salt-solution in a full-scale performance test involving the entire system (i.e., fully-integrated dryer, filter, dryer motor and skid mounted condensate recovery system). This test will occur in the Hanford area after shipment from the Seller's fabrication facilities. The Seller shall witness this test and provide support.

Work not included in this specification is:

- Supply of DCS Input/Output Modules.
- Supply of filter wash water reservoir and pump.
- Supply of piping and valves between dryer filter and condensate recovery skid.
- The installation of the DCRS into a container.
- Process testwork to confirm drive sizing and optimum operation modes of the dryer to produce a product with minimum fines and minimum dusting capabilities. The characteristics of drying the liquid salt-solution and mixing with soil will be confirmed after completion of bench-scale testing of non-radioactive simulant at the Sellers Test Center. The detailed planning of the bench and pilot-scale testing is described in test plan A006.TPLN.001.
- Integration testing with other systems and subsystems using simulant.

2.0 APPLICABLE DOCUMENTS

Documents applicable to the work scope are shown in this section. The latest issue and addenda to the documents in effect at the time of procurement (unless otherwise specified), shall apply and form a part of the basis of design for this specification to the extent specified in the applicable sections of this document. All conflicts between documents referenced herein and the requirements of this specification shall be brought to the attention of the Buyer for resolution.

2.1 GOVERNMENT DOCUMENTS

Table 2-1. Applicable Documents.

Document	Title
10 CFR 830	"Nuclear Safety Management," *Code of Federal Regulations*, as amended.
DOE/RL-92-36	Hanford Site Hoisting and Rigging Manual
29 CFR 1910	Occupational Safety and Health Standards – *Code of Federal Regulations.*

2.2 NON-GOVERNMENT DOCUMENTS

Table 2-2. Applicable Documents.

Code/Standard	Title
AISC	Manual of Allowable Stress Design
ASCE 7-98	Minimum Design Loads for Buildings and other Structures
ASME B16.5	Pipe Flanges and Flared Fittings
ASME B18.2.1	Square and Hex Bolts and Screws Inch Series Including Hex Cap Screws and Lag Screws
ASME B31.1	B31.1, Power Piping
ASME B31.3	B31.3, Process Piping
ASME Boiler and Pressure Vessel Code	*ASME Boiler and Pressure Vessel Code*, American Society of Mechanical Engineers. Section VIII, "Rules for Construction of Pressure Vessels" Section IX, "Welding and Brazing Qualifications"

Table 2-2. Applicable Documents.

Code/Standard	Title
ASME NQA-1-1994* (See note at end of table)	Quality Assurance Requirements for Nuclear Facility Applications
ASME PCC-1	Guidelines for Pressure Boundary Bolted Flange Joint Assembly
ASNT-TC-1A	Recommended Practice
ASTM A36	Standard specification for Structural Steel
ASTM A108	Standard specification for Steel Bars, Carbon, Cold Finished, Standard Quality
ASTM A182	Standard specification for Forged or Rolled Alloy-Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service
ASTM A193	Standard specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service
ASTM A194	Standard specification for Carbon and Alloy Nuts for Bolts for High-Pressure and High-Temperature Service
ASTM A240	Standard specification for Heat-Resisting Chromium and Chromium Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels
ASTM A276	Standard specification for Stainless and Heat-Resisting Steel Bars and Shapes
ASTM A307	Standard specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength
ASTM A312	Standard specification for Seamless and Welded Austenitic Stainless Steel Pipes
ASTM A354	Standard specification for Quenched and Tempered Alloy Steel Bolts, Studs and other Externally Threaded Fasteners
ASTM A403	Standard specification for Wrought Austenitic Stainless Steel Piping Fittings
ASTM A480	Standard specification for General Requirements for Flat-Rolled Stainless Heat-Resisting Steel Plate, Sheet, and Strip
ASTM A500	Standard specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
ASTM A516	Pressure Vessel Plates, Carbon Steel for Moderate- and Lower-Temperature Service

Table 2-2. Applicable Documents.

Code/Standard	Title
ASTM A563	Standard specification for Carbon and Alloy Steel Nuts
ASTM A569	Standard specification for Steel, Carbon, (0.15 Maximum, Percent), Hot-Rolled Sheet and Strip Commercial Quality
AWS D1.1	Structural Welding Code - Steel
AWS D1.6	Structural Welding Code - Stainless Steel
IEEE 141	Electric Power Distribution for Industrial Plants
IEEE 142	Recommended Practice for Grounding of Industrial & Commercial Power Supplies, Institute of Electrical and Electronics Engineers, Piscataway, New Jersey.
IEEE 519	Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems
IEEE C62.41	IEEE Recommended Practice on Surge Voltages in Low-Voltage AC Power Circuits, Institute of Electrical and Electronics Engineers, Piscataway, New Jersey.
NEMA MG-1	Motors and Generators
NEMA MG-13	Frame Assignments for Alternating Current Integral Horsepower Induction Motors
NFPA 70	National Electric Code, 2002 Edition
RPP-8530	Tank Farm Labeling Standard
SAE J429	Mechanical and Material Requirements for Externally Threaded Fasteners, Standard
UBC 1997	Uniform Building Code, Volume 2 and Seismic Zone 2B
UL 508A	Standard for Industrial Control Panels
*These requirements will be met through compliance with the Buyer's NQA-1 program. Work performed by subcontractors will be consistent with this program.	

3.0 TECHNICAL REQUIREMENTS

3.1 ITEM DEFINITION

For this specification, the DCRS consists of a Batch Dryer or "approved" equivalent and associated vacuum filter, dryer drive system, and skid-mounted condensate recovery system.

3.1.1 Item Diagram

The piping and interface sketch shown in Figure 3-1 depicts the dryer and condensate recovery system equipment and interfaces to be provided by the Seller (actual equipment configuration may vary from this depiction). Major components of the DCRS include: the batch dryer, hydraulic drive system, sintered metal filter, condenser, condensate receiver tank, vacuum pump, and condensate pump. Pipe sizes shown are sizes at the interface point between Seller and Buyer scope. Pipe design and configuration for Seller's scope to be by Seller.

3.1.2 Interface Definition

The DCRS will eventually be installed in an ISO container for secondary containment and because of that, the DCRS will interface with an incoming liquid waste system, a clean soil system, a vacuum conveyance system to transport the dried waste from the dryer, a steam supply, a chilled water supply, electrical supply, and the off-gas treatment systems. System interface requirements for the DCRS are shown on Data Sheet 143643-D-DS-001.1 (Appendix A). Some interfaces require input from the Seller.

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TECHNICAL SPECIFICATION

PROJECT:	**Task 6 Initial DBVS Design**	**143643-D-SP-001**	**REV. 1**
PROJECT NO.:	**143643**	**DRYER AND CONDENSATE RECOVERY SYSTEM**	
CLIENT:	**AMEC E&E – Richland, WA**		

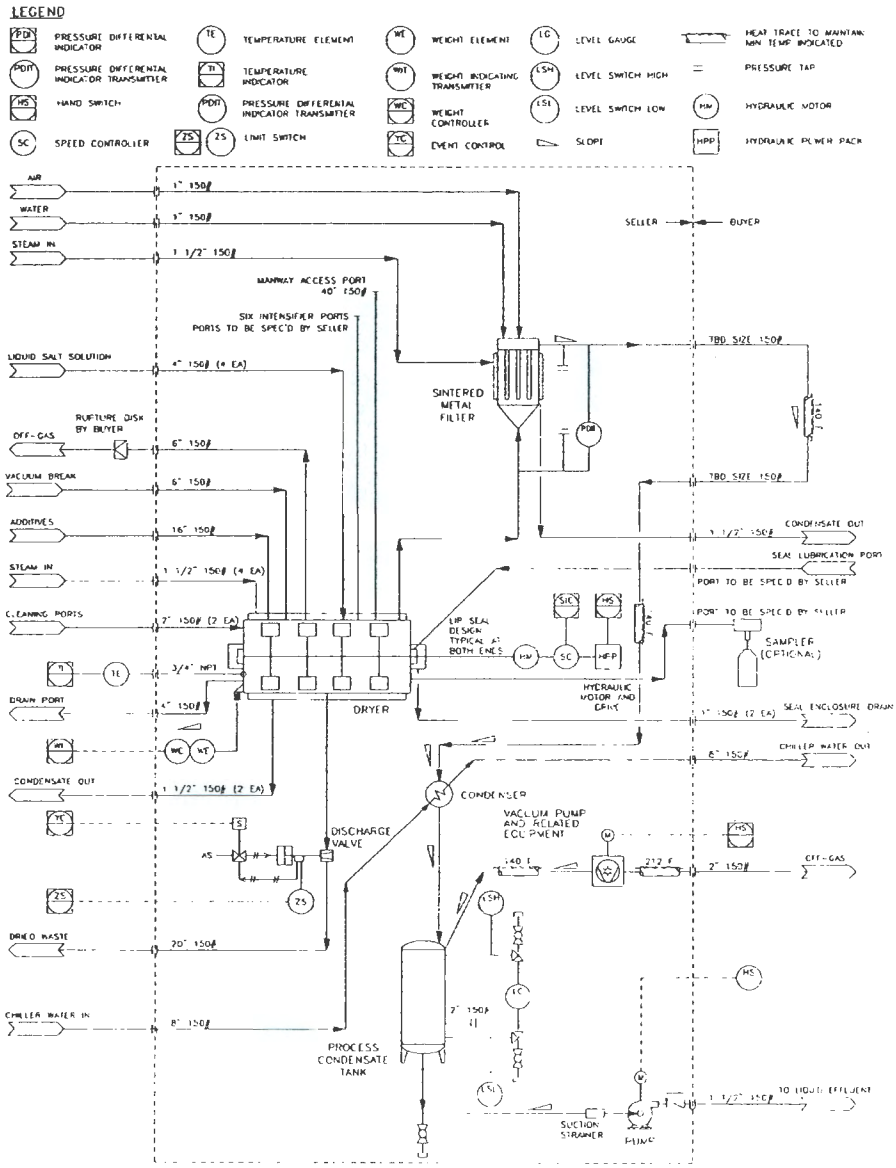

Figure 3-1. Dryer System Interface Diagram.

3.2 CHARACTERISTICS

The characteristics (e.g., functional, physical, performance, and environmental) that the DCRS must comply with to satisfy the requirements of this specification are described below and on the datasheet.

3.2.1 Functional Characteristics

The DCRS shall be designed to receive batches of liquid salt-solution from the Waste Receipt System, mix the liquid salt-solution with soil plus additives and evaporate enough water in the dryer under vacuum to provide a suitable dried waste product. The DCRS shall also condense the evaporated water and transfer it to the Secondary Waste System supplied by others. The DCRS shall also discharge the dried waste to the dried waste transfer system supplied by others.

3.2.1.1 Waste Properties

The DCRS equipment shall be capable of processing supernate liquid salt-solution with little to no solids. The chemical composition of the waste is shown in Table 3-1. The soil formulation is shown in Table 3-2. The liquid salt solution is a nominal 5 Molar Sodium concentration. Physical properties are shown on Data Sheet 143643-D-DS-001.1 (Appendix A).

The maximum estimated contact radiation dose based on a five year design life is 4.5×10^5 Rad.

Table 3-1. Waste Chemical Composition.

Analyte	Average Analyte to Na Mole Ratio
Al^{+3}	9.32E-03
Ca^{+2}	2.43E-04
Cl^{-1}	1.50E-03
Cr (TOTAL)	2.96E-03
F^{-1}	1.13E-03
Fe^{+3}	9.57E-04
K^{+}	8.73E-04
Mn^{+4}	2.85E-05
Ni^{+2}	2.13E-05
NO_2^{-1}	1.31E-02
NO_3^{1-}	9.29E-01
Pb^{+2}	2.78E-05
PO_4^{-3}	1.16E-02
Si^{+4}	1.13E-03
SO_4^{-2}	7.79E-03
Sr^{+2}	6.53E-06
TIC as CO_3^{-2}	3.58E-02
Total Organic Carbon (TOC)	5.26E-03
U (Total)	2.34E-05

Table 3-2. Soil Formulation.

Component	Reagent Formula	Mass (g)/kg of Soil Mixture
Hanford Soil (damp)*	NA	868
Boron Oxide	B_2O_3	55
Zirconium Oxide	ZrO_2	77
*A soil sample will be available upon request		

3.2.1.2 Performance Range

The dryer shall receive and mix a minimum of three batches every 24 hours of liquid waste and soil with additives. Each batch of liquid and soil with additives shall be dried until a homogenous and flowable mixture is obtained without bridging. The product target size and consistency should be similar to standard, commercially available "kitty litter" and as dust-free as practically possible. The ability of the dried waste granules to resist breaking down into fine dust is desired. The batch dryer shall be capable of adding waste and/or soil during operation. The two operating scenarios for the dryer are:

1) fill the dryer with approximately 200 gallons of waste, and then start the paddles. With the dryer motor running, the soil will be added and then additional waste will be added in smaller ~100 gallon batches throughout the drying cycle until the drying cycle is complete. The waste/soil mixture will be dried to a flowable, dust-free product as described above or a 2% moisture content;

2) fill the dryer with the necessary amount of soil to complete a batch while the blades are turning, then spray in only small amounts of waste ~100 gallon batches, and dry the water off the soil mixture as a dry bed always maintaining a dry consistency within the dryer until the appropriate waste loading is reached.

Process testing is a crucial part of determining the operating parameters and dryer loading value to obtain an acceptable product. Based on testing that has been performed to date, the mixing speed of the dryer ranges from 45 rpm for normal operation to 90 rpm for upset condition speeds. Characteristics and requirements for the dryer and condensate recovery system shall be as specified on Data Sheet 143643-D-DS-001.1 (Appendix A).

3.2.2 Physical Characteristics

The DCRS shall be sized for transport using local roadways and freeways (i.e., less than 14 feet tall, 8.5 feet wide, and 53 feet long). The system shall be separated into the largest components/sections (if necessary) to minimize system teardown time, readying for transport, and reassembly effort.

The dryer and condensate recovery system with associated supports, piping, instruments and electrical infrastructure is expected to be installed within the confines of a 48-foot standard ISO rated container (inside dimensions are 11 feet wide by 47 feet long by 11 feet tall). The vacuum filter is expected to penetrate the ceiling of the ISO container and into a cupola attached to the ISO container and the electrical motors and hydraulic pumps powering the hydraulic drive unit are expected to be external to the container and supported separately.

3.2.3 Reliability

All DCRS equipment, including but not limited to, the motor, hydraulic power pack, casings, shafts, plows, valves, filters, bearings, seals, and fasteners shall have a minimum service life of 18 months. All minimum service life requirements for the DCRS equipment shall be submitted to and verified by the Buyer before fabrication. The design life of the equipment shall be five years.

3.2.4 Maintainability

Maintainability characteristics that affect the design (lubrication, parts replacement and repair, spares, modular construction, test points, etc.), including, but not limited to, shall include the following:

1. Maintenance and Repair Cycles. The Seller shall specify frequency or availability requirements for maintenance of the component (e.g. scheduled maintenance every 40 operating hours, etc.).

2. Spares and Spare Parts. The Seller shall specify identification of recommended spares and spare parts.

3. Service and Access. The Seller shall specify requirements for ease of service (access openings/spacing, self-test capability, inspection windows, test fixtures, sealed bearings, etc.). Include requirements for service (remove and replace only, bench repair, special tools, remote handling/maintenance, etc.) and for capability of the item to be drained, connected, discharged, etc.

3.2.5 Environment

Any equipment and related enclosures shall be designed to operate and be stored in the climatic and environmental conditions listed below.

- Heating and cooling basis wind factors for enclosures around equipment shall be derived from ASHRAE Fundamentals Handbook for the Hanford site.
- Ambient air temperature range is -25°F to 115°F with a maximum 24-hour differential of 52°F (the system is not expected to operate in temperature conditions less than 0°F (-18°C); however, the equipment could be stored in this condition);
- Relative humidity ranges from near 0 to 100%;
- Maximum precipitation is 2.5 inches in a 6-hour period;
- Sand and dust concentrations are 1.10×10^{-5} lbm/ft^3 with a typical size of 150 μm or less;
- Solar radiation is expected to be a maximum 900 langleys, distributed over a 12-hour period; and

3.2.6 Transportability and Storage

The DCRS equipment shall have a modular design to facilitate disassembly and relocation to the final destination at the Hanford Site.

1. The DCRS equipment and components shall be capable of being moved by crane, forklift, or truck with no modifications.
2. Lift points shall be provided for the lifting and handling of equipment and components.
3. The DCRS equipment packaging shall support the contained equipment so it can withstand a 0.75-gravity (forward), hard-braking stop and a rearward acceleration of 0.25 gravity, as well as shock and vibration loads associated with transportation.

3.2.7 Safety

The equipment shall be designed to maintain the safety of operators and the general public. The Seller shall provide all necessary guards, lockouts, and other safety equipment for safe operation as required under 29 CFR 1910 – Occupational Safety and Health Standards – Code of Federal Regulations.

The manway cover on the dryer shall have a safety interlock switch to be interlocked with the hydraulic drive system to prevent inadvertent starting of the dryer plows during manned entries into the dryer for any necessary maintenance.

3.3 DESIGN AND CONSTRUCTION

The Seller shall provide or provide access to all design calculations necessary for the DCRS which includes, but is not limited to, dryer size calculations, pump and pipe sizing calculations, motor current starting calculation, motor sizing calculations, hydraulic power pack sizing, electrical system calculations (i.e. load, voltage, and fault), and structural calculations. Calculations shall be submitted to the Buyer in accordance with the Bidder's Drawing and Data Commitments sheet (Appendix B). The Seller shall provide all design drawings necessary for the DCRS which includes, but is not limited to, drawing outlines, interface drawings, electrical wiring diagrams, control wiring diagrams, pipe support drawings, dimensional drawings, rigging sketches, and as-built drawings. Drawings shall be submitted to the Buyer in accordance with the Bidder's Drawing and Data Commitments sheet (Appendix B).

Alternative equipment designs are permissible, if proven to be effective in meeting the endurance specified in this specification. Any alternative design must be thoroughly explained with text supplemented by drawings or sketches and proposed with the original bid. Buyer approval is required before proceeding with an alternative equipment design.

Any discrepancies noted in this specification or between this specification and other documentation shall be noted and referred to the Buyer for resolution before proceeding with design or fabrication of the item in question.

3.3.1 Parts/Materials/Processes

The DCRS equipment shall be analyzed and designed to perform the associated operating loads, hoisting and rigging loads, and the natural phenomena hazard loads specified. The design of the DCRS shall satisfy the requirements of the specification and the referenced codes and standards when subjected to the design loads and load combinations to within the allowable stress limits. The analysis of the equipment shall include a stability evaluation and shall establish the design provisions for adequate stability and anchorage of the equipment during transport, installation and operation.

3.3.1.1 Batch Dryer

3.3.1.1.1 Type of Construction

The dryer shall be a horizontal cylindrical type mixing vessel with main shaft supported by heavy duty, self-aligning, outboard mounted anti-friction bearings with mechanical lip seals with inner and outer packing gland.

3.3.1.1.2 Vacuum Construction

The vessel shall be designed and constructed for full vacuum operation. Vessel to be operated at vacuum rating of 25 inches Hg or better with a maximum of 75 pounds per square inch gage (psig) external design pressures. Vessel shall be structurally designed for 5 psig internal pressures, while the steam jacket shall be design, fabricated, tested, and stamped per ASME B&PV code Section VIII.

3.3.1.1.3 Materials of Construction

All dryer waste contacting surfaces shall be constructed of 300 series stainless steel and comply with ASTM A240.

3.3.1.1.4 Dryer Drive System

A hydraulic drive motor system shall be quoted. Final selection of the motor shall be determined by the Buyer prior to approval of final design. The size of the drive system is estimated by the Buyer through preliminary testing to be 500 hp for an electric motor, however with the hydraulic drive system; the motors shall not be more than 200 hp each. The Seller shall size the drive unit independently and

provide motor-sizing calculations to the Buyer for review and approval in accordance with the Bidder's Drawing and Data Commitments sheet (Appendix B). The Seller shall also provide calculations defining the mechanical gear ratio and safe operating frequencies of the motor that meet the performance requirements of this specification and datasheet. The drive motor shall consist of a base-mounted speed reducer directly coupled to the dryer main shaft with drive motor on a separate mount. The unit should be designed to be compatible with Quaker Quintolubric® 822-EHC Series, Cosmolubric B-230 by Houghton International, Inc., or equivalent fire-resistant hydraulic fluid. Final selection of the motor shall be determined by the Buyer before approval of final design.

The motor horsepower shall be non-overloading when operating at any point during the loading and mixing of the dryer. The following are general requirements for all motors in the DCRS:

- Motors shall be used with a soft start.
- Motors up to 250 hp shall be rated for use on a 480 AC volts/3 phase/60 Hz, and the minimum motor size shall be 1 hp.
- The motor shall have a minimum service factor of 1.15. (Service factors shall not be used in the motor sizing calculations).
- The motor shall have a minimum insulation class of F as defined in National Equipment Manufacturer's Association (NEMA) MG 1.
- Motor shall comply with the frame size assignments of NEMA MG 1.
- Motor balance and vibration shall meet NEMA standards MG 1-12.06 and -12.07.
- The motors shall operate in an outdoor environment under conditions described in this specification.
- The Seller shall provide the motor specifications and data sheet.
- Motors shall be T.E.F.C. type.

3.3.1.1.5 Power Transmission (Gearbox)

The gearbox design requirement is a minimum service life of 18 months without maintenance. Belts and/or chains shall not be used. The gearbox lubrication system design, including the material properties of the lubrication medium, as well as any other gearbox maintenance required or anticipated shall be submitted to the Buyer before fabrication.

3.3.1.1.6 Shaft

Shaft shall be removable coincident with the shaft axis on the end opposite the motor. A flat vertical wall is expected to be placed (by others) between the dryer and hydraulic drive unit to isolate the airspace surrounding the dryer from the airspace surrounding the motor. The shaft shall be constructed to allow steam heating of the entire length of the portion of the shaft that shall be in contact with the waste.

3.3.1.1.7 Electrical Wiring

All electrical wiring is to terminate in a NEMA 4X terminal box mounted on the dryer.

3.3.1.1.8 Mixing Tools

Bolted mixing tools shall be concentrically arranged on the dryer shaft with head scrapers welded onto the end plows. Plow design shall have a service life of 18 months without maintenance. Selection of the abrasion resistant coating shall be determined after testing with the manufacturer's recommendations and Buyer approval. Plow/wall clearance shall be determined during scale testing but shall not exceed ASME code requirements for eccentricity on vessels of this diameter..

3.3.1.1.9 Flanged Ports and Manways

a. The following flanged port and manway locations shall be provided and indicated on submittal drawings to the Buyer for review and approval in accordance with the Bidder's Drawing and Data Commitments sheet (Appendix B). Manway—One (1) 40-inch diameter access manway with

bolted cover. A NEMA 12 minimum safety limit switch shall be included. View ports shall be added to the top of the man-way cover.

b. Additive Charging Port(s)—One (1) 16-inch diameter ANSI 150 lb welded flange charging port located on the top of the dryer.

c. Product Discharge Port—One (1) 12-inch diameter ANSI 20-inch 150 lb welded flange discharge port located at center of dryer bottom. Seller to confirm size.

d. Liquid Salt-Solution Charging Ports—Four (4) 4-inch diameter ANSI 150 lb welded flange charging port equally spaced along the top of the dryer.

e. Vacuum Filter Port—A flanged vent port located on top of the dryer for mounting filter housing and arranged so material back pulsed off filters falls back in dryer. The opening in the dryer must be equal or larger than the body opening of the filter. Buyer believes a 28 inch diameter opening will suffice. Seller to confirm.

f. Rupture Disc Port—One (1) 6-inch diameter ANSI 150 lb welded flange rupture disc port. Rupture disk port should be located in top of dryer.

g. Steam supply and condensate return ports to and from dryer and vacuum filter jackets shall be 1.5-inch diameter ANSI 150 lb welded flange. Quantity to be determined by Seller. If multiple nozzles are required they shall be brought out to a common connection for each service.

h. Thermocouple Port—One (1) 3/4-inch diameter NPT connection with thermo well mounted in the dryer used for waste temperature.

i. Intensifier Port(s)—Seven (7) intensifier or chopper ports are required for a robust and flexible dryer design. Each port will include contoured plugs. Six of the intensifier ports shall be located at the Seller recommended chopper locations on one side wall of the dryer (back or front). One port shall be located on the opposite side of the dryer from the intensifier ports as recommended by Seller. This single port will become the dryer sampler port.

j. Drain Port—One (1) 4-inch diameter ANSI 150 lb welded flange liquid drain port shall be located through the dryer end plate as close to the bottom of the dryer drum and in a location to achieve maximum drainage.

k. Cleaning Port—Two (2) 2-inch diameter ANSI 150 lb welded flange cleaning ports, one on each end of the dryer, shall be located near the top of a dryer end plates.

l. Vacuum Break Port – One (1) six 6-inch diameter ANSI 150 lb welded flange port in the upper position of the dryer for connection to a vacuum breaker supplied by others.

3.3.1.1.10 Port Contoured Plugs

All spare, cleaning, drain and intensifier ports shall have contoured plugs installed to prevent material buildup in the port cavity.

3.3.1.1.11 Product Discharge Valve

One (1) 12-inch diameter, full port Dome Valve located on bottom center of dryer, pneumatically operated, including solenoid valve and piping to valve actuator shall be provided by vendor. The Seller shall provide compressed air volume and pressure requirements to operate the pneumatic actuator. The discharge valve of the dryer will be fail closed and designed for repetitive cycling without leakage of the contained material. Port and valve design shall preclude a dead leg of liquid or solid in the discharge port during operation. The valve shall have a self-cleaning sealing area with radiation resistant Teflon compound (i.e., Teflon FEP or Teflon PFA, seats and seals). The valve shall have an ANSI class V shut-off for leak tightness of liquids that shall be certified by the Vendor. The valve shall mate to a standard 20-inch ANSI 150 lb welded flange. (Suggested Manufacturer: Gemco Valve Company.)

3.3.1.1.12 Pulse Back Filter

The dryer filtration system shall be Microfiltrex or equal sintered metal fiber with a removal efficiency equivalent to 0.6 μm or better. The filter shall be in the evaporated water vapor stream to remove particulates before the condensate recovery system. Pulsed jet cleaning shall be used for in-situ removal of accumulated particulate from the filter element. If filter elements should become contaminated or laden with particles, a short sonic pulse of air shall be blown back through the Seller's predetermined number of elements to discharge the

contaminates and allow them to drop back into the dryer vessel. The filter housing shall be heated with steam from the same supply as the boiler. The steam jacket around the filter shall be a 75 psig maximum operating pressure stainless-steel steam jacket, designed, fabricated, tested, and stamped in accordance with ASME B&PV Code Section VIII, Division I requirements. The filter elements are to be mounted to a removable top on the filter unit for maintenance purposes. The Seller shall provide a pneumatic pulsejet control system, including electrical termination box and electrical connections that provides cycled automatic filter element cleaning without causing process interruption. The filter housing shall have two (2) sets of NPT couplings; one on the filter inlet and one on the filter outlet for a differential pressure transmitter supplied by the Buyer and a Seller-provided differential pressure switch.

The metal filter assembly shall have a filtered water wash clean-in-place system that will aid in the recovery of contaminated filters if particulates concrete on the filters. The volume of wash water shall be measured at the vendors recommended wash pressure. Outline and interface diagrams shall indicate wash water interface. Rotary spinners for the clean-in-place system shall be fabricated from ultra high molecular weight polyethylene (UHMWPE) from a rod stock of TIVAR as manufactured by Poly Hi Solidur, Fort Wayne, Indiana

The filter housing shall have a direct flanged connection to the dryer. The inside diameter of the filter housing shall not be larger than the inside diameter of the flanged interface on the dryer to prevent material from being lodged in the filter housing and not falling directly back into the dryer. The filter discharge flange shall be an ANSI class 150, the same diameter as the process inlet of the condenser. The Seller shall determine and indicate the appropriate size and flange orientation on the design drawings.

3.3.1.1.13 Seals

The dryer shaft seals shall be lip seals designed to preclude leakage of contaminated materials. Three installed spare seals shall be provided. The Seller is responsible for all seal designs. In addition, a secondary enclosure shall be built around the dryer shaft seal to contain any potential leak. The enclosure shall gravity drain through a drain line to a 2-inch flange termination. Seal and

enclosure designs shall be submitted to the Buyer for review and approval. Seals in potential contact with the liquid salt-solution shall be compatible with the liquid salt-solution properties in this specification.

3.3.1.1.14 Steam Jacket

The dryer steam jacket shall be a fully stayed stainless steel jacket of labyrinth design to insure uniform flow. The steam jacket shall be designed, fabricated, tested, and stamped in accordance with ASME B&PV Code, Section VIII, Division I requirements for a 75 psig maximum allowable operating pressure.

3.3.1.1.15 Load Cells

The Batch Dryer shall be designed with an integrated pontoon-style load cell system or "approved" equivalent. The load cell system shall provide the ability to determine the weight of the process material in the batch dryer. The system shall have an isolated 4-20mA output signal provided for input to the Distributed Control System (DCS).

3.3.1.2 Condensate Recovery System

3.3.1.2.1 Vacuum Pump

A vacuum pump shall be rated for continuous duty and constructed with 316 stainless steel wetted parts having mechanical seals manufactured from Viton® elastomers. The pump shall be coupling driven by an electric motor 10 HP, TEFC, C-face motor (Seller to confirm HP size). Motor voltage shall be 460 volts, 3 phase, 60 hertz. The Seller shall provide pump and motor specification and datasheet.

3.3.1.3 Condenser

The interior of the condenser in contact with the liquid salt-solution condensate shall be fabricated from 300 series Stainless Steel. The condenser shall be designed such that the condensate recovery drains by gravity feed to the condensate receiver tank. The condenser will be designed, fabricated and stamped in accordance with TEMA C standard. The cooling media will be a 35% propylene glycol–water mixture. The process inlet of the condenser shall be an

ANSI class 150, the same diameter as the filter discharge flange. The Seller shall determine and indicate the appropriate size and flange orientation on the design drawings.

3.3.1.3.1 Condensate Receiver Tank

The condensate receiver tank shall be a 500 gallon tank fabricated from 304 Stainless Steel. The tank shall be designed for full vacuum and have a partially surrounding cooling jacket using chilled water supplied by others. The cooling jacket shall be designed to keep the condensate cooler than the condenser so that minimal water vapor will be removed from the receiver tank through the vacuum pump. The condensate receiver tank and vacuum pump shall completely gravity drain to the transfer pump via a drain line that shall have a drain valve with cap as shown in Figure 3-1. The tank shall also include a 2 in. ANSI 150 class flange near the bottom side to allow for a Buyer provided level transmitter.

3.3.1.3.2 Protected Level Gauge

The receiver tank shall be fitted with stainless steel (with cleanouts), protected level gauge with manual drain valve, manual vent valve, and two (2) level switches (one high, one low).

3.3.1.3.3 Condensate Transfer Pump

The condensate recovery system transfer pump wetted component construction shall be stainless steel, with a minimum transfer rate of 25 gpm. Total head loss and pump motor size shall be determined by Seller with transfer line characteristics input provided by the Buyer. The pump shall have a minimum 1 hp TEFC motor, with suction strainer and discharge check valve. The transfer pump shall be capable of dewatering the condensate receiver tank while under vacuum. Motor voltage shall be 460 volts, 3 phase, 60 hertz. The Seller shall provide pump specification and datasheet. The transfer pump shall have a hand-off-auto switch for control. In the AUTO mode, the pump shall auto-pump down the condensate collection tank based on inputs from the tank level switches. In the HAND mode, the pump will be operated from a local start/stop panel or station.

3.3.1.4 Piping

3.3.1.4.1 General

Piping systems for the condensate recovery system and interconnecting piping from the dryer to the condensate recovery system shall be fabricated, inspected, examined, and tested in accordance with ASME B31.3, normal service. All waste containing lines shall be buttwelded. Anytime the requirements in this specification are more stringent, or are in addition to code requirements, the requirements in this specification shall be followed. Piping systems include all piping components and supports.

3.3.1.4.2 Line Routing

If pipe bending is necessary, the pipe shall be bent in such a manner to minimize pipe wall thinning and shall have a minimum bend radius of five times the nominal pipe diameter.

The proposed installation layouts shall meet the requirements of ASME B31.3.

3.3.1.4.3 Line Support

Piping shall be supported by attachment to the skid frame. The Seller shall provide rigid brackets or additional frame members for attaching piping when frame members are not in a convenient location. The pipe supports may be stainless or painted carbon steel.

All piping supports shall conform to ASME B31.3, with additional support at valves, elbows, tees, and equipment as required. Additional supports shall be provided, if necessary, to comply with the requirements stated in design loads.

Piping supports shall be capable of supporting the piping in all conditions of operation. The supports shall allow free expansion and contraction of the piping and prevent excessive stress resulting from transferred weight being introduced into the piping of connected equipment.

Seller shall level-plumb piping using shims, etc., to support the pipe and to avoid forced piping deflections at support points.

The Seller shall provide shop drawings of the required piping supports for review and approval.

3.3.1.4.4 Flange Joints

All flanges shall be standard ANSI 150 lb welded raised face flanges, except where otherwise specified in this document and per ASME B16.5, and shall be made from the same type of steel as the pipe they are welded or threaded to, unless otherwise noted.

3.3.1.4.5 Threaded Joints

Threaded joints in lines shall be joined using Loctite® PST.

3.3.1.4.6 Valves and Installation

All valves shall be installed per Manufacturer's instructions.

Seller shall review Manufacturer's supplied information for unique installation requirements and request written clarification if installation requirements do not match the design.

3.3.1.4.7 Insulation

Insulation and jacketing shall be installed on all heated or cooled components and piping by the Seller in accordance with Manufacturer's recommendations. The proposed insulation shall be non-asbestos and shall be submitted to the Buyer for review and approval before installation. The insulation shall not impede component performance or normal maintenance access. The insulation jacket shall allow for ease of decontamination.

3.3.1.5 Electrical

Design and installation of electrical equipment shall be in accordance with the NFPA 70 (National Electric Code (NEC)) and IEEE standards listed in Table 2-2. Electrical equipment installation and wiring practices will be subject to review by CH2M HILL NEC inspectors.

3.3.1.5.1 Conduit

Rigid galvanized steel (RGS) conduit shall be used. RGS shall be UL approved standard weight, electro-galvanized steel, 1/2 inch minimum size for control wiring and 3/4 inch minimum size for power wiring.

- Liquid tight flexible conduit shall be installed where flexible conduit is required. Liquid-tight flexible conduit shall be grounding type with a Polyvinyl Chloride (PVC) jacket.
- Conduit fittings shall be standard steel threaded, liquid-tight, type RGS fittings.

3.3.1.5.2 Wire and Cable

- Conductors shall be stranded copper for all sizes of wire and cable unless specifically designated otherwise on the drawings.
- Wire insulation shall be Type THHN (heat resistant thermoplastic) / THWN (moisture and heat resistant thermoplastic) for all 600V conductors unless specifically noted otherwise on the drawings.
- Minimum size of power conductors, 600V and below shall be No. 12 AWG.
- Conductors for control circuits shall be No. 14 AWG minimum, except that remote control circuits, signalling circuits, instrumentation, and power limited circuits may be sized smaller in accordance with the National Electric Code (NEC).
- Power wiring for single phase systems shall have color-coded insulation as indicated in Table 3-3.
- Instrumentation cable shall be 600V, multiconductor for discrete signals, flame retardant, jacketed cable suitable for installation in wet or dry locations. Conductors shall be #18 AWG stranded, copper, in twisted pairs/triads with ethylene propylene insulation. Each pair/triad shall be shielded with a drain wire and metallic tape. Multi-pair cables shall have an individual shield and an overall shield of metallic tape and drain wire. Conductor color coding shall be black, white (and red if triad). Temperature rating shall be 194°F (90°C). Each pair/triad shall be numbered for simplified termination.

- Control and power multi-conductor cable shall be 600V, flame resistant, radiation resistant, jacketed cable suitable for wet or dry locations. Conductors shall be stranded copper with ethylene propylene insulation with a temperature rating of 194°F (90°C).

Table 3-3. Wire Color Coding Requirements.

Service, Feeder, or Branch Circuit	Conductor	Insulation Color	Insulation Type
480Y/277 Vac, 3-phase systems	Phase A	Red	THWN/THHN or XHHW
	Phase B	Yellow	
	Phase C	Blue	
	Neutral	White or Gray	
	Equipment Grounding Conductor	Green (or bare)	
208Y/120 Vac, 3-phase systems	Phase A	Black	
	Phase B	Purple	
	Phase C	Brown	
	Neutral	White or Gray	
	Equipment Grounding Conductor	Green (or bare)	
120/240 Vac, 1-phase systems	Hot No. 1	Black	
	Hot No. 2	Brown	
	Neutral	White or Gray	
	Equipment Grounding Conductor	Green (or bare)	
1. Paint or pressure-sensitive tape may be used for coding conductors instead of colored insulation on No. 8 AWG and larger conductors for phase (ungrounded) conductors and No. 4 AWG and larger conductors for neutral (grounded) conductors and equipment grounding conductors			
2. Conductor sizes No. 10 and No. 12 AWG may be solid or stranded copper. Conductors sizes No. 8 and larger shall be stranded copper.			

3.3.1.5.3 Wire/Cable Markers

Conductors shall be identified with white heat shrink tubing with indelible black typed on letters. Hand lettered labels shall not be used.

3.3.1.5.4 Junction Boxes

Junction boxes shall be NEMA rated for the expected environmental conditions per NEC®, unless otherwise noted.

3.3.1.5.5 Electrical Components

All electrical components, such as contactors, motor starters, power controllers, shall be UL or other nationally recognized testing laboratory (NRTL) listed . Motor starters and contactors shall be NEMA rated for the service that they perform.

3.3.1.6 Instrumentation and Installation

In general, all instrument transmitters shall provide an isolated 4-20mA signal to the DCS, all pneumatic control valves shall accept a 4-20mA control signal from the DCS and provide position indication to the DCS. Interface connections shall be through wire termination points on the instruments. Instruments, tubing, piping, and wiring shall be installed in accordance with the instrument manufacturer's recommendations and the best practice for the industry. Purchasing and installation of the DCS input/output modules are not included in this contract. Locally indicating instruments/sensors shall be installed such that they are easily readable by an operator standing on the floor at the entry access point to the ISO container. The Buyer shall provide guidance with positioning based on best available knowledge of the configuration.

Certificates of calibration shall be provided with all instruments in the final data package and shall include the instrument accuracy and drift. Seller shall provide Instrument types and manufacturer to the Buyer for approval prior to purchase of the instrument. Recommended field re-calibration procedures shall also be provided in the final data package along with a list of special tools required for recalibration.

3.3.1.7 Mechanical Assembly Requirements

All equipment shall be assembled to the structural frame observing the equipment Manufacturer's recommended assembly instructions. During fabrication, the Seller shall submit all fabrication red-line changes to the Buyer for review and approval before implementation of the change with the exception of any minor red-line changes that do not affect form, fit, or function of the equipment. The Seller shall submit as-built drawings as well as final red-lined fabrication drawings to the Buyer with delivery. The Seller shall denote mounting configuration and details on the red-lined fabrication drawings.

Equipment shall be checked to assure that it is provided with adequate amounts of fresh lubricants of the proper selection.

Piping attached to equipment shall be installed with fasteners made finger-tight until alignment is achieved, at which time all fasteners shall be tightened. Tightening torque shall be that which is recommended by ASME B31.3 or gasket Manufacturer recommended torque values for the gasket system used. Flange assembly and bolting shall be performed in accordance with ASME PCC-1. Inspection documentation shall be provided as evidence of proper bolt torquing.

3.3.1.8 Electrical Assembly Requirements

3.3.1.8.1 General

Install conduit, duct, wiring, cables, connectors, instrumentation, and devices in accordance with manufacturer's written instructions, applicable requirements of the NEC® and National Electrical Contractor Association's "Standard of Installation," and with recognized industry practices. All electrical panels shall meet UL 508A listings, when required.

3.3.1.8.2 Routing

The Seller shall select the routing of conduits between devices and the power and instrumentation and control enclosures. Care shall be taken to run conduit along the frame members where they can be mounted. Care shall be taken to select routes where conduit does not interfere with maintenance or replacement access

to devices such as pumps or valves. Sketches of the routing locations shall be submitted to the Buyer for review and approval before proceeding with the work.

3.3.1.8.3 Grounding

a. All power circuits shall include a ground wire that serves as the equipment grounding conductor, independent from the neutral wire, to the extent allowed by the NEC®. All powered devices shall be connected to the ground circuit wire. In addition, the skid frame, enclosures, raceways, covers and enclosure doors shall be attached to the electrical ground. This may be accomplished by means of a screw, lock washer, and ring connector attachment at a spot where all paint and surface corrosion has been cleaned from the frame. The frame shall not be used as a current carrying conductor between devices.

b. Ground wires shall be green-insulated, stranded copper wire.

c. Ground conductors shall be unspliced and continuous between termination points. Ground distribution shall be through terminal blocks or a ground bus. Wire nuts or butt splices are not acceptable.

d. The resistance between the main ground connection to the skid and any point in the ground circuit shall be less than 0.1 ohm as measured with a calibrated ohm meter.

e. The instrument ground circuit shall be separate and isolated from the power ground circuit to the extent allowed by the NEC®. The requirements for the instrument ground circuit installation are the same as the power ground requirements given above.

3.3.1.8.4 Conduit Fill

The sum of the cross sectional areas of all contained conductors shall not exceed the interior cross-sectional area of the raceway as calculated in the tables in Chapter 9 of the NEC® for raceway fill.

3.3.1.8.5 Strain Relief

Strain relief shall be provided for all cables. The strain relief device shall comply with the following:

Strength - The device shall be capable of withstanding a 35 lb pull for one minute (from any direction) without allowing movement of the raceway or cable that could damage the conductor insulation or strain the conductor terminations.

3.3.1.8.6 Conduit Support

Conduit shall be supported by attachment to the frame. The Seller shall provide rigid brackets or additional frame members for attaching conduit when frame members are not in a convenient location. Attachment shall be on regular intervals per NEC®. Attachment shall be made using "U" clips which may be connected to the frame using either weld studs and nuts or bolts or approved NEC® method.

3.3.1.8.7 Segregation of Control and Power Wiring

Power circuit wiring and control circuit signal wiring shall be run in separate conduits. Signal wiring that transmits ac signals shall be run in separate conduits from signal wiring that transmits dc signals.

3.3.1.8.8 Splicing

No splicing is allowed. The Seller shall provide junction boxes with terminal blocks for connection of devices such as valves and instrument sensors that are provided with pigtail leads.

3.3.1.8.9 Electrical Enclosure Wiring

All enclosure wiring shall be routed, harnessed, appropriately laced or in plastic wiring ducts.

3.3.1.9 Materials

The Seller shall select materials based upon acceptable lifetime performance of materials subjected to the chemical and radiation exposures described in this specification. All parts and materials shall be new. No aluminum or "yellow" metals are to be used. No beryllium shall be present. Exposed polymer materials shall be constructed of anti-static materials. No lead shall be used in the design unless it is fully encapsulated and identified with a permanent tag. No equipment

shall use or require the use of polychlorinated biphenyls (PCBs). Material selection shall be identified in the Seller documents to the Buyer.

Material type and grade shall be clearly identified on the bill of materials. Certified Material Test Reports (CMTRs) are required for all materials coming in contact with the waste. The Seller shall identify any materials that do not have CMTRs for review and approval.

3.3.1.9.1 Metal Products

3.3.1.9.1.1 Stainless-Steel Products

All stainless steel used in fabrication shall be 300 series, Type 304, 304L, 316, or 316L and shall meet the following material requirements of this section. All grades of stainless steel may be substituted for one another depending upon availability and providing the substitution still complies with the following specifications and has prior approval of the Buyer.

3.3.1.9.1.2 Stainless-Steel Sheet and Plate

Stainless-steel sheet shall meet the chemical and physical requirements of ASTM A240 and ASTM A480.

Stainless-steel plate shall meet the chemical and physical requirements of ASTM A240. The plate shall be provided with a cleaned finish.

3.3.1.9.1.3 Stainless-Steel Forgiings and Wrought Piping Fittings

All stainless-steel forged couplings, forged pieces, and flanges used in the fabrication shall be Series 300 stainless steel. All forgings, including flanges, shall be listed components as stated in ASME B31.3 and shall meet the requirements of ASTM A182. All stainless-steel wrought piping fittings used in the fabrication shall be Series 300 stainless steel. All wrought piping fittings shall be listed components as stated in ASME B31.3 and shall meet the requirements of ASTM A403 Grade WP.

3.3.1.9.1.4 Stainless-Steel Bars and Shapes

Parts made from stainless-steel bars and shapes shall be Series 300 stainless steel. Stainless-steel bars and shapes shall meet the chemical and physical requirements of ASTM A276.

3.3.1.9.1.5 Stainless-Steel Pipe

All stainless-steel pipe shall be seamless schedule 40 and shall meet the chemical and physical characteristics given in ASTM A312. Piping shall be a listed component as stated in ASME B31.3.

3.3.1.9.1.6 Carbon-Steel Plate and Sheet

All carbon-steel plate shall be general purpose, hot-rolled, low-carbon steel per ASTM A36 Carbon steel sheet shall be provided per ASTM A569.

3.3.1.9.1.7 Carbon Steel Shapes

Carbon-steel structural shapes shall conform to the requirements of ASTM A36.

3.3.1.9.1.8 Carbon-Steel Bars and Rods

Carbon-steel bars and rods shall conform to ASTM A108 with a minimum yield of 36,000 psi and maximum carbon content 0.35%.

3.3.1.9.1.9 Carbon-Steel Structural Rectangular Tube

Structural carbon-steel rectangular tubing shall conform to the requirements of ASTM A500 Grade B.

3.3.1.9.1.10 Weld Filler

The weld filler material shall be as specified in the approved Welding Procedure specification.

3.3.1.9.1.11 Weld Studs

Weld studs, if necessary, shall be metallurgically compatible with the material that they are welded to. Weld studs shall be made from stock material that meets the requirements of ASTM A108 for mild carbon steel.

3.3.1.9.1.12 Fasteners

No fasteners shall be capable of vibrating loose under operating conditions. All such joints should be tack welded or have some equivalent means of assurance of remaining intact. Double-nutting is not an acceptable method of securing fasteners. Loctite® threadlock may be used where applicable.

Stainless-steel bolts, cap screws, and washers shall be per ASTM A193 Grade B8, and nuts shall be heavy hex nuts per ASTM A194 Grade 8 or better. Bolts and cap screws shall be grade marked or better. Carbon-steel bolts shall be per ASTM A307 or better, nuts per ASTM A563, Grade C Heavy Hex.

All graded fasteners shall conform to ASME B18.2.1, Society of Automotive Engineers (SAE) J429, and ASTM A354.

The Seller shall ensure the fasteners used are not suspect in accordance with the U.S. Department of Energy *Control of Suspect/Counterfeit Items* provided in Appendix C. Suspect fasteners can be identified by the following inspection methods:

(i) Head markings are marred, missing, or appear to have been altered,

(ii) Threads show evidence of dressing or wear (threads should be of uniform color and finish), and

(iii) Head markings are inconsistent with a heat lot.

The Seller shall select fasteners where they are not specifically called out in this specification using the following guidance:

a. Anti-galling compound (e.g., Loctite® 8013 or 8009) shall be applied where stainless-steel bolts are used.

b. Stainless-steel bolts, nuts, and washers shall be used when the mating parts are stainless steel.

c. Carbon-steel bolts, nuts, and washers shall be used where mating parts are not stainless steel.

3.3.1.9.2 Gaskets/Seals

Pipe flange connections shall use PSI Inc., Line Backer™ sealing gaskets with stainless steel as the retainer material and Viton® as the sealing element, as available from PSI, Inc. Line Backer™ Type F sealing gaskets shall be used for raised face flanges and Line Backer™ Type E sealing gaskets shall be used for flat face flanges. All elastomeric seals shall have radiation resistance for the radiation dose levels shown in this specification. Viton or other radiation resistant material approved by the Buyer shall be used where Line Backer™ gaskets are not available.

3.3.1.10 Stainless-Steel Handling Requirements

The Seller shall submit a Material Control procedure to be used in the execution of the work. The Material Control procedure shall address procurement controls, segregation, and traceability of materials including weld filler rod from receipt at the shop through processing.

3.3.1.10.1 Exposure of Stainless Steel to Chloride Materials

Stainless steel shall not be in contact with materials containing more than 250 ppm chlorine. Low chloride markers shall be used. Chlorinated solvents shall not be used to clean stainless steel.

3.3.1.10.2 Contact with Carbon Steel

Contact between carbon steel and stainless steel shall be avoided during fabrication. Temporary carbon steel clamps, supports, braces, and fixtures shall not come into direct contact with stainless-steel surfaces. Galvanized steel clamps or fixtures may not be used on stainless steel piping or components. Wire brushes shall be stainless steel. Grinding wheels and wire brushes shall be new or used previously on stainless steel only.

3.3.1.11 Welding

Welding of all pressure piping shall be performed in accordance with ASME B31.3, normal service at a minimum. Welding of all pressure vessels shall be performed in accordance with ASME B&PV Section VIII. Certified welders shall perform welding of all structural steel in accordance with American Welding Society (AWS) D1.1 or AWS D1.6 (depending on material). Welding Procedures, Procedure Qualification Records, and Welder Procedure Qualification Records shall be submitted for review and approval to the Buyer before welding commences.

3.3.1.11.1 Allowable Welding Methods

Welding of all stainless steel, including but not limited to structural shapes, rectangular tubing, plate, and sheet shall be performed in accordance with AWS D1.6 non-tubular, statically-loaded conditions. Welding of stainless steel piping shall be performed in accordance with ASME B31.3. Automatic pipe welding equipment and techniques may be used. Fabrication of tanks shall be in accordance with ASME Boiler and Pressure Vessel Code, Section VIII.

Welding of all carbon steel, including but not limited to structural shapes, rectangular tubing, plate, and sheet shall be performed in accordance with AWS D1.1 non-tubular, statically- loaded conditions. Welding of carbon steel portions of piping systems shall be as required in ASME B31.3.

3.3.1.11.2 Welding Procedure Requirements

All welding shall be performed in accordance with the Seller's approved Welding Procedure specification. Each Welding Procedure specification shall be qualified with a Procedure Qualification Record as required in ASME Section IX, AWS D1.1, and AWS D1.6 as applicable.

3.3.1.11.3 Welder Qualification

Welder Performance Qualification Records shall be submitted for all personnel performing welding, including tacking. Welders shall be qualified in accordance with ASME B&PV Code, Section IX, AWS D1.1, and AWS D1.6, as applicable. Welders and welding operators qualified in accordance with ASME B&PV Code,

Section IX may perform welding subject to the weld quality requirements of AWS D1.1 or AWS D1.6.

3.3.1.11.4 Weld Joints and Preparation

Weld joints are as permitted by the referenced standards.

3.3.1.11.5 Weld Repair

Weld defects shall be removed and repaired as allowed by the referenced standards. The original Welding Procedure specification shall be used for weld repair. Welds that fail inspection shall not be ground out and repaired more than twice before the section is abandoned and replaced.

3.3.1.11.6 Weld Inspection

Inspection shall be done in accordance with the Seller's standard practice. A certified dimensional drawing and weld map shall be produced from this inspection.

Weld joint design shall be sent to the Buyer for review and approval prior to fabrication. Prior to delivery, a weld map shall be produced and delivered to the Buyer. Welds shall be inspected per ASME B31.3, normal service at a minimum for pressure piping and per AWS D1.1 or D1.6 (depending on material) for structural steel. An AWS Certified Weld Inspector (CWI) shall perform visual inspections and inspectors certified to SNT-TC-1A shall perform NDEs. Visual and NDE weld inspection procedures shall be submitted along with the personnel certifications to the Buyer for review and approval, before performance of the inspections and examinations. Welded connections on the lifting components shall be 100% visual and 100% Dye-Penetrant Test or Magnetic Particle Test inspected. If a weld is in a radioactive material boundary (e.g., piping, vessel, etc), then these welds will require a minimum of a visual inspection and additional NDE (dye pen, mag particle, or x-ray as appropriate).

3.3.2 Industry and Government Standards

3.3.2.1 Design Loads

The DCRS equipment shall conform to allowable loading factors as defined by the American Institute for Steel Construction (AISC) for the five loads identified below. The structural analysis is to be submitted with the shipment.

3.3.2.1.1 Dead Loads

Dead loads include the weight of all permanent materials and equipment, including the DCRS equipment weight and the weights of fluids and materials being handled.

The unit weights of material and construction assemblies shall be those given in ASCE 7. Where unit weights are neither established in that standard nor determined by test or analysis, the weights shall be determined from data in manufacturer drawings or catalogs.

3.3.2.1.2 Live Loads

Live loads are those loads produced by the use and occupancy of the unit and do not include construction and environmental loads such as wind load, snow load, rain load, earthquake load, flood load, or dead load. Live loads are produced by operations, maintenance workers and equipment.

- Live loads shall be not less than the minimum uniform load or concentrated load stipulated in ASCE 7.
- The minimum roof design live load shall be 20 lb/ft^2 (includes ashfall).
- The weight of service equipment that may be removed with change of use of a given area shall be considered as live load.

3.3.2.1.3 Earthquake Loads

Earthquake induced design loads, as a minimum, shall comply with the 1997-UBC Seismic Zone 2B for essential facilities.

3.3.2.1.4 Snow Loads

Snow loads for the equipment shall be in conformance with ASCE 7. A ground snow load, Pg of 15 lbf/ft^2 shall be used for calculating roof snow load. Unbalanced snow loads resulting from drifting or sliding shall be considered. Snow loads, full or unbalanced, shall be substituted for roof live loads where such loading results in larger members or connections.

3.3.2.1.5 Wind Loads

The equipment shall be designed to resist pressures from wind from any direction. Partial wind loading shall be considered if it produces a more severe effect. Wind load design shall comply with ASCE 7, using the 85 mph "three-second gust wind velocity" with an importance factor of 1.15 exposure category C.

3.3.2.1.6 Load Combinations and Stresses

Load combinations used in the analysis and the resulting stress levels in the DCRS equipment shall comply with 1997-UBC.

3.3.2.1.7 Hoisting and Rigging Loads

The lifting apparatus (eyebolts, hoist rings, and lifting bails) shall be designed in accordance with the AISC Manual for Steel Construction Allowable Stress Design and Load Resistance Factor Design. Equipment designed and fabricated by Seller shall have a factor of safety of 3 based on yield strength. Equipment purchased by Seller shall have a factor of safety of 5 based on ultimate strength. Documents shall be provided to the Buyer demonstrating incorporation of these safety factors. The Seller shall identify the total weight, the center of gravity, and the lift points and rigging methods necessary for lifting each component. Lift points shall be identified with yellow paint. Any special tooling, spreader bars or other recommended fabricated devices for lifting shall be provided by the Seller.

3.3.2.2 Design and Fabrication Codes and Standards

The components, piping, tubing, and structures shall be designed in accordance with the codes and standards described below.

3.3.2.2.1 Design Codes for the Pressure Vessels.

The required pressure vessels and jacketing shall be designed, fabricated, and stamped in accordance with the ASME B&PV Code, Section VIII with supplemental nozzle loads determined from the UBC (1997) UBC Zone 2B seismic criteria.

3.3.2.2.2 Design Codes for Process Piping and Tubing

All piping systems shall be designed, fabricated, inspected, and tested in accordance with ASME B31.3 piping code for "Normal Fluid Service". Piping systems include all piping components and supports.

3.3.2.2.3 Design Codes for Structures.

The assembly support structures shall be designed, fabricated, inspected, and tested in accordance with the design loads section of this specification.

3.3.2.2.4 General Electrical Codes

Conduit, duct, wiring, cables, connectors, and devices shall be installed in accordance with manufacturer's written instructions, applicable requirements of the NEC® (NFPA 70). The installation of these components shall comply with recognized industry practices.

3.3.3 Radiation

1. Electromagnetic. DCRS operations shall meet the requirements of IEEE 519-1992 and IEEE 141, for harmonics and flicker.

2. Nuclear. All materials of fabrication shall be evaluated to be able to operate without loss of service while exposed to the maximum estimated contact radiation dose of 4.5×10^5 Rad based on a five year design life.

3.3.4 Cleanliness

Before assembly, and before preparing for shipment, all components shall be cleaned by flushing clean water and/or blown clean and dry with compressed air

to the extent that extraneous materials, such as those listed below, are not present:

a. Metallic or other dusts (shop dust), chips, turnings, and weld splatter;

b. Abrasive particles;

c. Rust and other loose corrosion particles;

d. Magnetic/liquid penetrant residues, dye check, etc.;

e. Cutting oils;

f. Excess lubrication, grease, and oil; and

g. Marking dyes.

The fabrication traveler shall describe the cleaning and packaging steps taken.

The DCRS equipment ports and pipe openings shall be temporarily capped following cleaning and drying for shipment. Packaging requirements following cleaning are documented in Section 5.2.

3.3.5 Corrosion of Parts

Solvents and cleaning solutions used on stainless steel shall be chloride-free. Stainless-steel components do not require painting except as required for identification or other markings. Paint, if used, used on stainless steel shall be epoxy-phenolic.

All exposed surfaces of carbon steel parts shall be protected from corrosion by priming and painting

A carbon steel corrosion allowance is specified at 0.06 in. for all pressure boundary materials in contact with the waste for the design service life.

A stainless steel corrosion allowance is specified at 0.06 in. for all pressure boundary materials in contact with the waste for the design service life.

3.3.6 Protective Coatings

3.3.6.1 General

Protective coatings shall be used on equipment where specified in this document. Protective coatings shall be used on the appropriate equipment in order to meet the reliability and maintainability requirements, to protect equipment from the environmental conditions, and to provide a clean smooth surface for decontamination. The weldments shall be completed and painted entirely before installation of piping and components in the frames. Care shall be taken to protect the paint during equipment installation. Touch-up shall be performed to repair paint defects after the equipment installation is completed. Protective coating specifications shall be submitted to the Buyer for review and approval before fabrication. All exposed carbon steel surfaces shall be painted Manufacturer's standard color.

3.3.6.2 Primer

The Seller shall use Amercoat™ primer by Ameron Protective Coatings or approved equivalent.

3.3.6.3 Paint

The Seller shall use Amercoat™ 220 by Ameron Protective Coatings or approved equivalent for finish coats.

3.3.6.4 Painting Preparation

The Seller shall prepare all surfaces in accordance with the manufacturer's instructions. Painting shall be performed in a clean well-ventilated area separated from airborne particulates generated by shop operations.

3.3.6.5 Paint Application

a. Paint shall be stored, thinned, mixed, handled, applied, and cured to clean, dry, adequately prepared surfaces, in accordance with manufacturer's instructions

b. All coats shall be applied to produce a film of uniform smoothness in

accordance with the manufacture's recommendations for nominal thickness. Special attention shall be paid to crevices, weld lines, corners, and edges to obtain the required thickness.

3.3.7 Interchangeability

The Seller shall specify the assembly level at which components shall be interchangeable or replaceable, as a design consideration.

3.3.8 Identification and Marking

The equipment shall have a Manufacturer's nameplate The nameplate shall include: the project number, purchase order number, equipment name and number (provided by the Buyer), assembly weight; this specification number, latest revision, and other data to be supplied. Clearly mark and identify any components required for removal before equipment installation (e.g., shipping blocks).

The markings on all motors shall be in accordance with the NEC® and NEMA MG-1. Care should be taken when painting such that the motor nameplates, lifting eyes, or lifting swivel Manufacture nameplates are not painted.

3.3.8.1 Equipment Labeling

The Seller shall label all valves, instruments and mechanical equipment in accordance with this specification. Equipment to be labeled shall include, as a minimum:

- Valves or dampers;
- Instruments and gauges, pumps, motors, tanks, compressors, and filters; and
- Motor controllers, power panels, instrument enclosures, and switches.

Tags shall be 1 x 3 inches minimum and use 3/16" high black text on white background. The tags shall be plastic and have a 3/16" hole for attaching to components.

Tags shall be attached to components without a flat surface using a nylon tie wrap. Tags shall be attached to components with a flat surface using clear silicon

rubber adhesive. Equipment tags shall be located where they are readily visible and not subject to damage or accidental removal during equipment operation. Tags shall be suitable for the environment on which they are installed.

3.3.8.2 Piping Labeling

Piping shall be marked with arrows and fluid type to denote the direction and the fluid conveyed. The fluid conveyed shall be marked as "PROCESS", "Compressed Air", or "Filtered Water", etc. as applicable. Text shall be all capital letters. The label background and lettering colors shall be as follows:

- Process Fluid piping shall be yellow field with black letters,
- Compressed air piping shall be blue field with white letters,
- Filtered water piping shall be green field with white letters,
- Labels shall be made from self-sticking polyester or vinyl (Electromark® part number P400 series or approved equal). For pipes that are less than 3/4 inch in diameter, the label size and lettering shall be appropriately sized to the size of the pipe. Pipe that is greater than 3/4 inch in diameter lettering shall be sized in accordance with Table 3-4.
- The labels shall be placed on pipes in the location most readable from the operator's normal viewing position.
- Piping labels shall be placed before and after each valve and piping joint.

Table 3-4. Pipe Labeling Format.

Pipe O.D. Min.	Pipe O.D. Max.	Length of color for field for pipe marker	Size of letter for legend
0.75"	1.25"	8"	0.5"
1.5"	2"	8"	0.75"
2.5"	6"	12"	1.25"
8"	10"	24"	2.5"
10"	—	32"	3.5"

3.3.8.3 Wires and Cables

All wires and cables shall be labeled at both terminations with the identification specified on the Contract Drawings. Wire label material requirements and color coding are given in Table 3-3.

3.3.8.4 Terminals

Terminal block label tags shall be a durable plastic material. The tag color shall be white background with black lettering. Each terminal on the terminal block shall be labeled with a clearly visible terminal number. Numbered terminal block covers may be used for this purpose.

The tag may be mounted on a surface of the enclosure in close proximity of the terminal block. Tags shall be attached securely by means of durable stranded stainless steel cable, clamps or chains.

3.3.8.5 Conduits

a. All conduits shall be labeled with the identification tag on the Contract Drawings and the highest voltage contained in the conduit as in the following example:

E-123 - 110 VAC 1PH

b. The minimum letter height shall be 1/4 inch. The label length shall be as long as required to contain the required information. The label color shall be white background with black lettering. Text shall be all capital letters. The labels shall be a durable material that is permanently secured to the conduit by an adhesive or mechanical means. The label may be metallic or plastic. The label shall be affixed securely in place in a manner to prevent their loss, damage, slippage, or accidental removal. However, the means used to mount the label should permit its removal when necessary without damage to the surface to which it was attached.

3.3.8.6 Handling and Lifting Devices

All equipment that is designed to be mechanically lifted shall have lifting points, the center of gravity, and the lifting weight marked. Lift points shall be identified with yellow paint. All specialized lifting devices shall be marked in accordance with DOE/RL-92-36, as follows:

Structural and mechanical below-the-hook devices shall be provided with identification displaying the following data, as a minimum:

1. Rated load,
2. Manufacturer's name,
3. Lifting device weight (if over 100 pounds),
4. Drawing number (if applicable), and
5. Serial number (if applicable).

The identification data may be displayed on a nametag, nameplate, metal stamp, or other permanent marker. If the lifting device comprises several lifting devices that can be detached from the assembly, these individual lifting devices shall be marked with their individual load rating also.

3.3.9 Nameplates

Nameplates shall generally conform in size and material to RPP-8530 (details to be provided).

3.3.10 Human Engineering

Human factors engineering principles and criteria shall be integrated into the design of systems and the facilities that house and support these systems. Operator movements and accessibility of equipment and controls in the work area shall be considered, and practical access to each system component for operation and maintenance shall be provided.

3.3.11 Qualification

The drawings, calculations, and associated design media shall show full compliance with this specification (and the associated drawings/documents) or

note any exceptions. The Seller shall allow 10 working days for the Buyer to review and state the disposition of each submittal.

Equipment supplied by the Seller shall be subject to Factory Acceptance Testing. The Seller shall provide a FAT plan for operational testing and leak testing of their equipment in their proposal in accordance with the verification, inspection and test requirements specified in sections 4.2 and 4.3.

3.3.12 Document Submittal

Information to be supplied with the bid, for review and as final is shown on the Bidder's Drawing and Data Commitments sheet (Appendix B).

Each document submittal shall be identified with this specification number, item number, purchase order number, and Seller's identification number. Submittals shall be transmitted to the Buyer in accordance with the directions found in the Request for Quote.

Data shall be sufficiently clear to allow legible copies to be made on standard reproduction equipment after microfilming.

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

Submittals are divided into two types: (1) Those requiring "approval before proceeding" (i.e., weld procedures or pre-purchase evaluation data); and (2) Those requiring "approval before shipment" (i.e., vendor information data).

Submittals requiring approval before shipment will be reviewed to verify completeness and adequacy for their intended purposes.

Unacceptable items that require approval before proceeding will be handled as specified below.

A submittal requiring approval that is not approved by the Buyer will be dispositional as:

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

2. "Approved with Exception." Fabrication, procurement, and performance of procedures may proceed, and re-submittal is required to verify incorporation of the exception. Final acceptance of the item is contingent upon the Buyer's receipt and approval of the corrected submittal.

Submittals requiring approval before shipment that are determined to be incomplete or inadequate will be marked "Resubmit" and will be returned. An explanation of the deficiencies will be included for corrective action by the Seller.

The Seller shall provide fabrication traveler(s) for the fabrication and testing of the above described DCRS equipment. The fabrication traveler(s) shall include detailed procurement, fabrication, assembly, testing, shipping, and handling steps required to properly fabricate, assemble, and test the equipment in accordance with the drawings and specifications.

A proposed schedule of fabrication, inspection, and testing of all DCRS equipment shall be submitted for review with the bid and approval with the submittal of the fabrication traveler(s).

The Buyer will insert witness/hold points in the fabrication traveler during their review and approval of the fabrication traveler. Witness points can be waived by the Buyer but must be document in writing. Hold points require the Buyer personnel to be present during the fabrication, inspection, or test step.

3.3.13 Personnel and Training

The Seller's equipment and systems shall be designed so that they are operable and maintainable by the Buyer's operations and maintenance personnel. If specialized technical education or training is required by the Buyer's personnel the Seller shall advise in their proposal.

4.0 QUALITY ASSURANCE REQUIREMENTS

This procurement has been classified as a Enhanced Quality-Low Project Risk per TFC-ESHQ-Q_ADM-C-01, Graded Quality Assurance, CH2M HILL Hanford Group, Inc. The Seller must have, as a minimum, a QA Program that implements the requirements of ASME NQA-1-1994 Edition, *Quality Assurance Requirements for Nuclear Facility Applications*, Basic Requirements 1-18 and selected supplemental requirements. In addition, the Seller's QA Program must implement the requirements of 10 CFR 830, Subpart A, *Management Assessments*. ASME NQA-1 Subpart 2.7, *Quality Assurance Requirements of Computer Software for Nuclear Facility Applications, would be applicable should computer programs be used for design.*

The Seller is required to implement their QA Program for work associated with this specification. If the Seller makes changes to the QA Program or the procedures associated with its implementation, Seller shall submit the changed documents to the Buyer for review.

The Seller shall identify whether they intend to subcontract portions of the design work described in this specification. Further, if any portion of the work described in the specification is to be subcontracted by the Seller, the Seller's QA Program and implementing procedures must be evaluated by the Buyer for ASME NQA-1-1994, Basic Requirements 4 and 7 and Supplements 4S-1 and 7S-1, or equivalency. When subcontracting any portion of the scope described in this specification, the Seller is required to flow-down the QA Program requirements within their subcontract to sub-tier subcontractors and suppliers through appropriate procurement documents.

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

All conditions adverse to quality (nonconformances) identified by the Seller shall be documented and resolved in accordance with the Seller's QA Program. The Seller shall provide the Buyer with an information copy of all documented conditions adverse to quality. Any conditions adverse to quality that the Seller

proposes to disposition as "accept-as-is" or "repair" shall be submitted to the Buyer for the purpose of approving the Seller's "accept-as-is" or "repair" disposition before it is implemented by the Seller.

All documentation submitted by the Seller for information, review, or approval shall be traceable to the originating procurement document. The Seller shall verify that all deliverables meet contract requirements. The offering of the item or service is evidence of the Seller's verification that all contract requirements have been satisfied.

4.1 GENERAL

The verification requirements, in terms of responsibility for verification, qualification provisions, classification of verification methods, and all other quality assurance provisions, shall be as follows:

4.1.1 Responsibility for Verification

The Seller has responsibility for verification of the equipment and system functions. All test procedures and data sheets prepared for the verification will be submitted to the Buyer for approval.

4.1.2 Verification Methods

The Seller shall perform verification tests appropriate for the qualifications listed in Section 4.2

4.1.3 Requirements Flow Down

The Seller shall assure flow down of these QA requirements and the requirements listed in the QA Clauses identified in this specification's Request for Quote to its suppliers/sub-contractors for quality-affecting items and/or services procured for work performed under this contract.

The Buyer shall evaluate the Seller's QA program and ensure that Seller flows down these QA requirements to their sub-tier suppliers. The Buyer may perform evaluations of all suppliers unless a commercial-grade dedication process is performed.

4.1.4 10 CFR 830.120 Applicability

Flow down of 10 Code of Federal Regulations 830 Subpart A, Price-Anderson Amendments Act is applicable to this specification.

4.1.5 Right of Access

All equipment procured under this specification shall be subject to factory inspection by the Buyer or Buyer's Representative during design, fabrication, construction, and testing of equipment. In addition, procured equipment shall be subject to receipt inspection upon arrival at the Hanford Site.

4.1.6 Certificate of Conformance

A Certificate of Conformance (CoC) is required to be submitted by the Seller according to the applicable Buyer QA Clauses that included in the contract document.

The Seller shall provide a legible and reproducible CoC. The Seller's authorized representative responsible for quality shall sign the CoC. The CoC shall contain, as a minimum, the following items:

a. Identification of the Buyer's contract number under which the equipment or testing service is being purchased; and

b. Traceability by means of positive identification from the material, equipment, component or testing service to the CoC.

The Seller shall identify the specific procurement requirements met by the material, item, equipment, component, or service supplied such as codes, standards, or the applicable specification. The procurement requirements identified shall include any approved changes, waivers, or deviations applicable to the subject materials, equipment, component, or service.

4.1.7 Nonconformance Reporting

The Seller shall submit all Nonconformance Reports (NCRs) with dispositions of "Accept-As-Is" and/or "Repair" for review and approval by the Buyer before corrective measures being implemented.

4.2 QUALIFICATION VERIFICATION

Qualification verification will be performed through review of records submittals.

Test and inspection plans shall be submitted to the Buyer for review and approval a minimum of 10 working days before testing. The Buyer reserves the right to witness all tests and shall be given a minimum of 10 working days written notice before each test date.

The results of these inspections and tests shall be documented and submitted to the Buyer for review and approval.

Key items to be verified include but are not limited to the mechanical and electrical function of all DCRS equipment and components.

4.3 INSPECTIONS AND TESTS

Factory Acceptance testing of the DCRS equipment is required. All temporary electrical equipment including wiring and instruments necessary to allow component testing will be provided by the Seller.

Water used for hydrostatic testing shall be tested for chlorides before use. The chloride content of the test medium shall not exceed 250 ppm for water temperatures of 149°F or less.

Dated calibration labels shall be visible on all test equipment. Measuring and test equipment used for acceptance inspections and tests shall be controlled in accordance with the Seller's QA Program and shall meet the requirements of NQA-1 Basic Requirement 12 "Control of Measuring and Test Equipment," and shall be traceable to a national measurement standard.

4.3.1 Manufacturer Test

Satisfactory operational testing of the dryer is required before release. All temporary electrical equipment, including wiring and instruments necessary to allow component testing shall be by the Seller. Operational testing may be limited to those described as standard and customary for run-off testing.

4.3.2 Electrical Testing

The following sections detail the requirements for electrical testing.

4.3.2.1 Motor Test

All motors shall be given a routine test to demonstrate that the motors are free from mechanical and electrical defects. Motor tests shall be performed in accordance with the Seller's standard practice. The Seller shall provide motor test data that include, but are not limited to:

a. Rated load readings of current, power, and speed at rated voltage and frequencies;

b. No load readings of current, power, and speed at rated voltage and frequencies;

c. Mechanical vibration and motor balance test shall meet NEMA MG 1-12.06 and NEMA MG 1-12.07;

d. High potential test in accordance with NEMA MG 1-12.03; and

4.3.2.2 Wiring and Breaker Test

All wiring and breakers shall be given routine tests to demonstrate that they are free from mechanical and electrical defects. Wiring and breaker tests shall be performed in accordance with the Seller's standard practice. The Seller shall provide wiring and breakers test data that include, but are not limited to:

a. Megger tests are required for all electrical power wiring;

b. Continuity testing is required for all electrical power and instrumentation wiring; and

c. Circuit breakers are to be inspected for proper size, correct installation, manual operation of handles, and suspect/counterfeit parts.

4.3.3 Hydrostatic Test

The DCRS equipment shall be hydrostatically tested in accordance with ASME B31.3 or ASME B&PV Code, Section VIII as applicable for code vessels and ASME B31.3 for piping systems and other components. Results shall be

recorded. A record of the hydrostatic tests shall be submitted to the Buyer with test records/documents.

4.3.4 Acceptance Criteria

Acceptance criteria will be defined after process testing at the Seller's facilities. It is expected that a standard factory acceptance test will be used to accept dryer at point of shipment from the factory. The dryer, condensate skid, and filter will be shipped to Washington, at a location near the Hanford Site to be determined by the Buyer, where it will be installed by the Buyer in an ISO Container with mating piping and assembled connections, tested for functionality and then tested, with simulant, for total system integration functionality. The Seller shall witness this test and provide support.

4.3.5 Inspections

Specific inspections by the Buyer or Buyer representative that may take place at the Seller's facilities include a suspect fasteners inspection prior to shipment of equipment. Electrical equipment installation and wiring practices will be subject to review by CH2M HILL NEC® inspectors.

5.0 PREPARATION FOR DELIVERY

5.1 GENERAL

Every item that is shipped shall arrive at the job site in the same condition when it passed all quality control inspections and tests.

5.1.1 Packaging and Shipping Instruction Manual

The Seller shall prepare an instruction manual(s) that includes packaging information, handling information, shipping information, storage information, operational procedures, maintenance procedures, and special assembly procedures. The instruction manual(s) shall be submitted to the Buyer for approval before shipment.

A recommended spare parts list shall be prepared and provided to the Buyer.

5.2 PRESERVATION AND PACKAGING

Before packaging, all residual water present in the systems from acceptance testing shall be thoroughly drained and dried by purging oil-free dry air through the system. All open pipe ends shall be sealed to prevent ingress of debris and vermin into the system. The assembly shall be thoroughly cleaned to remove any dirt or dust that may have accumulated on the equipment during testing. Defects in the paint shall be touched-up. Moving parts shall be secured to prevent movement during shipping.

5.3 PACKING

The Seller shall package equipment to protect items during shipping. Bracing structures shall be installed where items could be damaged or vibrate loose during transportation. All bracing must be clearly identified both in the unpacking instructions and by labeling on the outside of the DCRS equipment.

Rigging sketches or a handling procedure shall be prepared by the Seller for items that require special handling. These sketches will identify weights, sling locations, balance points, methods of attachment, and other information necessary for safe handling.

Packaging and/or preservative coatings shall be visually inspected after loading. Damaged areas shall be repaired. Items shipped with desiccants shall be inspected after loading to verify that seals are intact.

Cushioning shall be used where protection from shock and vibration is required. Cushioning materials shall have sufficient strength to provide the required protection, shall exhibit no corrosive effect when in contact with the item being cushioned, and shall not readily support combustion.

Blocking and bracing used for protection of the load shall prevent item movement and withstand thrust and impact applied in any direction. Blocking and bracing used in direct contact with the item being blocked shall not have a corrosive effect on the item.

Instrumentation, electrical and electronic equipment, motors, and other electrical assemblies and equipment shall be packaged in a waterproof enclosure. This may be the enclosure the item will operate in. For items without waterproof enclosures, a vapor barrier shall be placed around the enclosure. In either case, the enclosure shall be able to exclude dirt and facilitate handling and marking of the item. Barrier materials shall be non-halogenated if used in contact with austenitic stainless steels, shall be non-corrosive, shall not readily support combustion, and shall not be otherwise harmful to the item being packaged. Desiccants may be used inside the enclosure or vapor barrier.

5.4 MARKING

Packages shall be properly and clearly marked. At a minimum, the required information shall include the contract number, the name and equipment number of the item within the package, the actual weight of the package and its contents, and the orientation of the equipment within the crate. Each package shall be labeled as part of the entire shipment, such as "Crate 1 of 2."

5.5 HANDLING

The Seller shall lift equipment using a forklift or crane, utilizing the lifting points designed for that purpose.

5.6 SHIPPING

The Seller's truck driver shall carry bills of lading for each shippable unit that is delivered to the Buyer.

The Seller shall obtain approval to ship from the Buyer before the equipment is prepared for shipment.

6.0 NOTES

None.

7.0 APPENDICES

The following appendices make up part of this specification:

Appendices	Description
A	Data Sheets
B	Bidder's Drawing and Data Commitments
C	TFC-ESHQ-Q_C-C-03, Revision B, *Control of Suspect/Counterfeit Items*

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TECHNICAL SPECIFICATION

PROJECT:	**Task 6 Initial DBVS Design**	**143643-D-SP-001**	**REV. 1**
PROJECT NO.:	**143643**	**DRYER AND CONDENSATE RECOVERY SYSTEM**	
CLIENT:	**AMEC E&E – Richland, WA**		

APPENDIX A

Data Sheets

Title	Number of Pages
Cover	1
14363-D-DS-001.1	2
Total Data Sheet Pages:	3

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TECHNICAL DATA SHEETS

PROJECT:	**Task 6 Initial DBVS Design**	**143643-D-DS-001.1**	**REV. 1**
PROJECT NO.:	**143643**	**Waste Dryer and Condensate Recovery System**	
CLIENT:	**AMEC E&E - Richland Washington**	**EQ. NO.: 33-D25-006**	

No. Required	1	**Area**	33
PFD #		**Stream No.**	
Reference Specification:	143643-D-SP-001	**Quality Assurance Level**	Full

Data sheet 1 of 2

Operating Conditions			**Rev**				**Rev**
Location (Indoors/Outdoors)		Outdoors		Operation	- Days per year	365	
Environmental conditions					- Hours per day	24	
Ambient temperature	(°F)	-25 to 115	1	Availability	% *		C
Operation	(continuous/intermittent)	Continuous	C	Elevation	ft ASL	663	C
				Environment	- Radioactive	Yes	
					- Toxic	Yes	
Dryer Data					- Corrosive	Yes	
Batch process time	Hr	8	C		- Flammable	No	
Operating Pressure Drum	(in Hg)	-26 or better	C				
Design Pressure Drum Min/Max	(psig) *		C				
Nominal OpTemp Drum	(°F)	140	C	**Dryer Inlet Conditions**			
Maximum Op Temp Drum	(°F) *			Phase		Liquid and Solid	
Water removal rate nominal	lb/hr	1550		Design liquid batch size	(gal)	1646	C
Estimated Heat Rate	(BTU/hr)	2,500,000	C	Liquid temp (max)	(°F)	82	C
Recommended Heat Rate	(BTU/hr) *			Liquid SG	SG	1.29	C
Recommended steam flow rate	(lb/hr) *			Liquid Viscosity (max @ 77 F)	cp	10	C
Heating method		Stm Jacket	C	Sodium Conc.	Molar	5	C
Steam pressure available	(psig)	15-75	C	Liquid pH range	pH	9-13	C
Jacket operating pressure	(psig) *		C	Liquid Composition		See Spec.	C
Jacket Design Press. min/max	(psig) *		C	Design soil addition batch size	(lb)	10430	C
Filter Nozzle Dia.	(in) *		C	Soil Composition		See Spec	
Steam/Cond Nozzles No./size	(No./in) *		C				
Filter Data				**Filter Cleaning Data**			
Max. Operating Pressure drop	(in WG) *			Type		Back pulse	
Sintered filter type	(fibers / mesh / powder) *			Manufacturer	*		
Filter material		SS		Volts/Phase/Hertz		120/1/60	C
Material layering	(Layered / Homogeneous) *			Maximum Circuit Amps (A)	*		C
Solids removal efficiency	(%)	99.97		PLC Compatible (Yes/No)		Yes	
Filter size	(micron)	0.6		Control Voltage		(4-20mA)	C
Air Vol. Req'd	(cfm) *		C				
Air Press. Req'd	(psig) *		C	Water Flush line flow rate	(gpm) *		C
Outlet Nozzle Size	(in) *		C	Water Flush line pressure	(psig) *		C
Discharge Valve Data							
Air requirements	(psig) *		C	Valve Vendor	*		
	(cfm) *		C				
Dryer Motor Data				**Chopper Motor Data**			
Type (hydraulic/VFD/single speed)	*	Hydraulic	C	Type (hydraulic/VFD/single speed)	*		
Number of electric motors required	*		C				
Motor Size (each elec. motor)	(hp) *		C	Actual Motor Size	(hp) *		
Volts/Phase/Hertz		460 / 3 / 60		Volts/Phase/Hertz		460 / 3 / 60	
Maximum Circuit Amps (A)	*		C	Minimum Circuit Amps (A)	*		
PLC Compatible (Yes/No)		Yes		PLC Compatible (Yes/No)	*		
Control Voltage		(4-20mA)		Control Voltage	(4-20mA) *		
Insulation Class (NEMA MG-1)		F		Insulation Class (NEMA MG-1)		F	
Minimum Service Factor		1.15		Minimum Service Factor		1.15	

Date	20-Feb-04	13-Apr-04	28-May-04	10-Jun-04	8-Apr-05	
By	KM	FWS	KM	FWS	KJM	
Chked	-	-		-		
Rev.	A	B	C	0	1	

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TECHNICAL DATA SHEETS

Data sheet 2 of 2

Condenser Data				**Condensate Pump**			
Inlet Flow Phase		gas/vapor	C	Type	*		C
Nominal Inlet Vol.	(cfm) *		C	NPSHR	(ft) *		C
Gas inlet temp (max)	(° F) *		C	Pumping rate	(gpm) *		C
Chilled Water Inlet Temperature	(° F)	50					
Chilled Water Temp Rise	(° F)	20	C				
Chilled Water Flow Rate	*						
Condensed Water disch. Temp	(° F)	<100					
Nominal outlet Vol.	(cfm) *		C				
Nominal outlet temp	(° F) *		C				
Weights				**Vacuum Pump**			
Dryer	(lb) *		C	Type	Liq ring/Dry *		C
Filter	(lb) *		C	HP	hp *		C
Hydraulic Drive Unit	(lb) *		C	Discharge Nozzle Size	in *		C
Hydraulic pump/motors	(lb) *		C	Flow rate	(cfm) *		C
Vacuum Pump/motor	(lb) *		C	Seal purge rates	(cfm/gpm) *		C
Condenser	(lb) *		C	Coolant flow	(gpm) *		C
Condensate Receiver Tank	(lb) *		C	Coolant pressure	(psig) *		C
Condensate Pump/motor	(lb) *		C				

Comments

* Denotes data to be supplied by vendor C

Steam Heat tracing for filter required

Motors <250 hp shall be 480 VAC, 3 phase, 60 hz

Minimum motor size is 1 hp

Motor sizes shall be determined during preliminary testing at Sellers facility

Condenser shall be TEMA C standard

Condensate Recovery System wetted component material shall be 300 series SS

Structural design of dryer and condensate recovery system shall be per UBC-1997 for Seismic Zone 2B for essential facilities

Equipment numbers for all items to come. C

Date	20-Feb-04	13-Apr-04	25-May-04	10-Jun-04			
By	KM	FWS	KM	FWS			
Chked	-	-	-	-			
Rev.	A	B	C	0			

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TECHNICAL SPECIFICATION

PROJECT:	Task 6 Initial DBVS Design	143643-D-SP-001	REV. 1
PROJECT NO.:	143643	DRYER AND CONDENSATE RECOVERY SYSTEM	
CLIENT:	AMEC E&E – Richland, WA		

APPENDIX B

Bidder's Drawing and Data Commitments

(5 pages including cover)

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TECHNICAL DATA SHEETS

PROJECT:	Task 6 Initial DBVS Design	143643-D-DS-001.1	REV. 1
PROJECT NO.:	143643	Waste Dryer and Condensate Recovery System	
CLIENT:	AMEC E&E - Richland, Washington	EQUIPMENT NO.: 33-D25-006	

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dba DMJM Technology
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Phone: (509) 375-7856
Fax: (509) 375-5331

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	Review	Required before ordering or start of fabrication			
		Final	Required within 7 days prior to shipment and before final payment		
PROPOSAL	REVIEW	FINAL	DESCRIPTION	(DAYS)	(DAYS)
E+3			Proof of NQA-1 or equivalent QA program		
E+3			Experience list and maintainability information		
E+3			Completed data sheet		
E+3			Subcontractor list		
E+3	E+3		Design, fabrication & delivery schedule	PO+7	
E+3	E+3	E+6	Single line block diagram	PO+7	
E+3	E+3	E+6	Outline drawing including weights and dimensions	PO+21	
E+3	E+3	E+1	Mechanical shaft seal drawing and any proposed alternatives	PO+21	
E+3	E+3	E+1	List of pump materials of construction (with wetted parts noted)	PO+21	
E+3	E+3	E+1	Test plan	PO+21	
E+3	E+3	E+6	Technical brochures on purchased components	PO+21	
	E+3	E+3	Dryer mass and energy balance calculation	PO+21	
	E+3	E+3	Interface drawing	PO+21	
	E+3	E+3	Equipment Dimensional drawings	PO+21	
	E+3	E+3	Electrical wiring diagrams	PO+21	
	E+3	E+3	Control wiring diagrams	PO+21	
	E+3	E+3	Pipe support detail drawings	PO+21	
	E+3	E+3	Pipe support calculations	PO+21	
	E+3	E+1	Preliminary condensate pump performance curve	PO+21	
	E+3	E+3	Pump sizing calculation	PO+21	
	E+3	E+3	Pipe sizing calculation	PO+21	
	E+3	E+3	Motor starting calculation	PO+21	
	E+3	E+3	Motor sizing calculation	PO+21	

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TECHNICAL DATA SHEETS

PROJECT:	**Task 6 Initial DBVS Design**	**143643-D-DS-001.1**	**REV. 1**
PROJECT NO.:	**143643**	**Waste Dryer and Condensate Recovery System**	
CLIENT:	**AMEC E&E - Richland, Washington**	**EQUIPMENT NO.: 33-D25-006**	

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		Final	Required within 7 days prior to shipment and before final payment		
PROPOSAL	**REVIEW**	**FINAL**	**DESCRIPTION**	**(DAYS)**	**(DAYS)**
	E+3	E+3	Motor specifications and datasheet	PO+21	
	E+1	E+1	NDE personnel certifications	PO+21	
	E+1	E+1	NDE procedures	PO+21	
	E+3	E+3	Bill of materials	Fab-10	
	E+3	E+6	System assembly instructions	Fab-14	
	E+3	E+3	Structural analysis for hoisting and rigging	Fab-14	
	E+3	E+3	Gearbox maintenance	Fab-14	
	E+3	E+3	Operation and maintenance manuals	Fab-14	
	E+3	E+1	Welding procedures, procedure qualification records, and welder procedure qualification records	Fab-10	
	E+3	E+1	AWS CWI certificate	Fab-10	
	E+3	E+3	Insulation system	Fab-10	
	E+3	E+3	Protective coating specifications	Fab-10	
	E+3	E+1	Fabrication travelers	Fab-10	
	E+3	E+1	Cleaning procedures	Fab-10	
	E+1	E+1	Visual weld examination procedure/weld map	Fab-10	
	E+3	E+1	NCR's	When identified +3	
	E+3	E+3	Fabrication red-line changes	When identified	
	E+3	E+3	Recommended spare parts and frequency of replacement	Del-28	
	E+3	E+3	Rigging sketches	Del -21	
	E+3	E+1	Final Test results (document and video records)	Del +14	
		E+1	Packing list and identification of shipping supports	Del	

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TECHNICAL DATA SHEETS

PROJECT:	**Task 6 Initial DBVS Design**	**143643-D-DS-001.1**	**REV. 1**
PROJECT NO.:	**143643**	**Waste Dryer and Condensate Recovery System**	
CLIENT:	**AMEC E&E - Richland, Washington**	**EQUIPMENT NO.: 33-D25-006**	

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	Review	Required before ordering or start of fabrication			
		Final	Required within 7 days prior to shipment and before final payment		
PROPOSAL	**REVIEW**	**FINAL**	**DESCRIPTION**	**(DAYS)**	**(DAYS)**
		E+3	Certified material test reports	Del +14	
		E+3	Bolt torque inspection	Del -5	
		E+3	CoC's and MTR's	Del -5	
		E+3	As-Built drawings	Del +14	
		E	Request For Information	When Identified +3	
		E+3	P.O. Terms and Conditions		
		E+3	Changes to P.O.	When Identified +3	
		E+3	Bill of Lading	Del -5	
		E+3	Nonconformance Reports	When Identified +3	
		E+3	Source Inspection Reports	When Identified +3	
		E+3	Receipt Inspection Reports (if applicable)	When Identified +3	
		E+3	Warranty Information	Del +14	
		E+3	Surveillance Reports	When Identified +3	
		E+3	NEC inspection certificate	Del -10	
		E+3	Final Data Package	Del +14	

Legend
E = Electronic Copy PO +/- = Due within +/- calendar days of P.O. issuance Del +/- = Due within +/- calendar days of delivery COM +/- = Due within +/- calendar days of commissioning

THE TIMELY RECEIPT OF THE VENDOR DOCUMENTS IS CRITICAL TO THIS PROJECT.

Buyer commits to a 10 working day turnaround cycle after reciept of approval documents.

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TECHNICAL DATA SHEETS

PROJECT:	**Task 6 Initial DBVS Design**	**143643-D-DS-001.1**	**REV. 1**
PROJECT NO.:	**143643**	**Waste Dryer and Condensate Recovery System**	
CLIENT:	**AMEC E&E - Richland, Washington**	**EQUIPMENT NO.: 33-D25-006**	

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Proposal	Bidder shall include this data for each item			**REVIEW ITEMS DUE WITHIN (DAYS)**	**VENDOR COMMITMENT (DAYS)**
	Review	Required before ordering or start of fabrication			
		Final	Required within 7 days prior to shipment and before final payment		
PROPOSAL	**REVIEW**	**FINAL**	**DESCRIPTION**		

I agree to provide the listed documentation and data and the dates shown above.

Vendor Signature _____ Date _____

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TECHNICAL SPECIFICATION

PROJECT:	**Task 6 Initial DBVS Design**	**143643-D-SP-001**	**REV. 1**
PROJECT NO.:	**143643**	**DRYER AND CONDENSATE RECOVERY SYSTEM**	
CLIENT:	**AMEC E&E – Richland, WA**		

APPENDIX C

TFC-ESHQ-Q_C-C-03, Revision B, Control of Suspect/Counterfeit Items

(53 pages including cover)

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USQ #03-1456-S

CH2M HILL Hanford Group, Inc.	**Manual**	**ESHQ**
	Document	**TFC-ESHQ-Q_C-C-03, REV B**
CONTROL OF SUSPECT/ COUNTERFEIT ITEMS	**Page**	**1 of 52**
	Issue Date	**December 31, 2003**
	Effective Date	**December 31, 2003**

APPROVAL AUTHORITY: **R. L. Higgins**

DOCUMENT OWNER: **J. L. Logston**

TABLE OF CONTENTS

1.0 PURPOSE AND SCOPE 2
2.0 IMPLEMENTATION 2
3.0 RESPONSIBILITES 2
- 3.1 Procurement Personnel 2
- 3.2 Inspection Personnel 2
- 3.3 Quality Assurance Engineer 2
- 3.4 S/CI Coordinator 2
- 3.5 Assigned Engineering Personnel 3
- 3.6 Responsible Managers and Supervisors 3

4.0 PROCEDURE 3
- 4.1 Introduction 3
- 4.2 Procurement 3
- 4.3 Inspection for Potential S/CI 4
- 4.4 Control of Material Identified as S/CI 4
- 4.5 Reporting of S/CI 5
- 4.6 Acceptance, Removal, and Disposition of S/CI 5
- 4.7 Surplus/Excess Material 7
- 4.8 Assessments 7
- 4.9 Training 7

5.0 DEFINITIONS 8
6.0 RECORDS 9
7.0 SOURCES 9
- 7.1 Requirements 9
- 7.2 References 9

TABLE OF FIGURES

Figure 1. Management of Suspect/Counterfeit Items. 11

TABLE OF ATTACHMENTS

ATTACHMENT A - SUSPECT COMPONENTS LIST 12
ATTACHMENT B - CLASSIFICATION OF POTENTIALLY SUSPECT/COUNTERFEIT ITEMS 30
ATTACHMENT C - SUSPECT/COUNTERFEIT ITEMS INFORMATION SOURCE LIST 32
ATTACHMENT D - CHARACTERISTICS THAT MAY MAKE PRODUCTS VULNERABLE TO MISREPRESENTATION, FRAUDULENT PRACTICES, AND COUNTERFEITING 34
ATTACHMENT E - WHERE TO LOOK FOR SUSPECT/COUNTERFEIT ITEMS 35
ATTACHMENT F - SUSPECT/COUNTERFEIT PARTS DETECTION 36
ATTACHMENT G - FASTENERS 41
ATTACHMENT H - DOE HEADMARK LIST 45
ATTACHMENT I - REFURBISHED MOLDED CASE CIRCUIT BREAKERS 47
ATTACHMENT J - ASSESSMENT/SURVEILLANCE LINES OF INQUIRY 51

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1.0 PURPOSE AND SCOPE
(7.1.1, 7.1.2, 7.1.3, 7.1.4)

This procedure describes the process for the identification, prevention, evaluation, notification, and disposition of suspect/counterfeit items (S/CIs) at CH2M HILL. This procedure applies to items that are:

- In the procurement cycle
- In source or receiving inspection
- In inventory at warehouses and staging areas
- Installed
- In operation.

This procedure applies to:

- Company ordered material
- Material supplied by subcontractors
- Material and test equipment supplied by test sponsors
- Construction
- Fabrication shops
- Laboratory work and experiments
- Surplus/excess property
- Government property
- Material obtained from U.S. Department of Energy (DOE) sources.

2.0 IMPLEMENTATION

This procedure is effective on the date shown in the header.

3.0 RESPONSIBILITES

3.1 Procurement Personnel

Maintain awareness of S/CI and support S/CI program implementation.

3.2 Inspection Personnel

Perform inspections for conformance or acceptance of material including verifications that the item(s) being inspected do not exhibit indications attributed to potential suspect/counterfeit items.

3.3 Quality Assurance Engineer

1. Ensures appropriate procurement controls are implemented to preclude entry of S/CI to the site through review of procurement documents.

2. Notifies the S/CI coordinator of nonconformance reports (NCRs) associated with S/CI.

3.4 S/CI Coordinator

Apprises company, DOE, and DOE local Office of the Inspector General personnel of S/CI status and final disposition.

3.5 Assigned Engineering Personnel

1. Evaluate S/CI information for applicability to design and procurement specifications, system configuration, and operating conditions.

2. Provide technical specifications, critical characteristics, and acceptance methods in support of procurement and inspection activities to prevent introduction of S/CI.

3.6 Responsible Managers and Supervisors

1. Maintain awareness of S/CI.

2. Control potential S/CI.

3. Evaluate training needs based on job classification and ensure individuals receive training in S/CI awareness, prevention, detection, and reporting, as appropriate, to respective assignments.

4.0 PROCEDURE

4.1 Introduction

The two most common S/CIs found at DOE facilities have been threaded fasteners fraudulently marked as high-strength bolts, and refurbished electrical circuit breakers sold and distributed under false certifications. Purchasers have also been misled into accepting S/CIs that do not conform to specified requirements by falsified documentation.

NOTE: Questions about a specific item should be referred to the S/CI coordinator. Attachment A provides a historical listing of suspect components. Equipment/material types or classes have been established to identify those specific items which are classified as potentially misrepresented or S/CI. Attachment B provides a listing of those classifications and items subject to S/CI control at tank farm facilities.

4.2 Procurement

CH2M HILL Personnel

1. Ensure material requirements are specified in subcontracts to preclude the purchase or introduction of S/CI. Use the information in Attachments A, B, C, D, E, F, G, H, and I to identify specific components, characteristics, precautions, and other considerations that are to be addressed during the procurement process to prevent introduction of S/CI.

2. Ensure material requests for quality level 1, 2, and 3 items and services include appropriate technical specifications, procurement quality clauses, documentation, and inspection requirements to prevent introduction of S/CI.

3. In maintenance and construction/fabrication subcontracts, specify appropriate requirements to preclude the purchase or introduction of S/CI.

Quality Assurance Engineer	4.	Review procurement documents to ensure they contain the appropriate procurement controls to preclude entry of S/CI to the site.
Procurement Personnel	5.	Ensure vendor selection complies with qualification requirements for the quality level of the items and services and is based on the vendor's ability to demonstrate the capability of delivering acceptable items.

4.3 Inspection for Potential S/CI

Bill of Material Preparers	1.	For quality level 0 and P-Card items listed in Attachment B, designate an S/CI inspection in the special instruction of the Bill of Material (BOM) in accordance with the requirements of TFC-BSM-FPM_MC-C-01.
	2.	Ensure quality level 0 and P-Card items are inspected prior to material issuance.
First Line Manager	3.	Obtain on-site S/CI inspection for quality level 0 and P-Card items prior to material issue and use.
Engineering Personnel	4.	Provide technical specifications, critical characteristics, and acceptance methods to facilitate inspection planning for S/CI prevention and detection.
Quality Assurance Engineer	5.	Ensure S/CI detection criteria is incorporated into QA inspection planning activities.
Assigned Inspection Personnel	6.	Use Attachments G, H, and I as resources for detecting S/CIs during walkdowns and inspections. Specific items are subject to inspection.
	7.	Verify and document that the items being inspected do not exhibit indications attributed to potential S/CIs as described in Attachments G through J.
	8.	If an S/CI is detected during inspection activities, document and control the S/CI in accordance with TFC-ESHQ-Q_ADM-C-02.

4.4 Control of Material Identified as S/CI

Responsible Manager or Delegate	1.	Ensure items identified as potential S/CI are documented as nonconforming and controlled in accordance with TFC-ESHQ-Q_ADM-C-02. Non conformances identified as S/CI shall be reviewed and processed within four working days to determine whether or not the items are S/CI.
	2.	Transfer tagged S/CIs to 2101-HV for storage.
Cognizant Quality Engineer	3.	Notify the S/CI coordinator of all NCRs associated with the S/CI.

4.5 Reporting of S/CI

Assigned Company Personnel

1. Report all items identified as potential S/CI in accordance with TFC-OPS-OPER-C-24. (7.1.1)

   NOTE: Reporting of S/CIs is required regardless of safety class, where the S/CIs are located (receiving inspection, inventory/storage areas, fabrication and maintenance areas, installed, etc.), or their operating status.

S/CI Coordinator

2. Notify the DOE S/CI coordinator of all occurrence reports associated with S/CIs. As appropriate, transmit copies of NCRs and applicable documentation.

3. Notify the DOE local Office of Inspector General of all S/CIs. Notification should be e-mailed to the DOE local Office of Inspector General points of contact providing information in the following format:

   - NCR number
   - Date NCR was written
   - Purchase order/job control number (if known)
   - End use of product
   - Name of manufacturer, distributor, supplier
   - Safety class (if known)
   - Occurrence report number
   - Value of item(s)
   - Point(s) of contact
   - Description of item(s)
   - Quantity
   - Description of nonconformance
   - Any other pertinent information that would help the DOE local Office of Inspector General.

4.6 Acceptance, Removal, and Disposition of S/CI

S/CI Coordinator

1. Notify responsible company personnel that S/CI may not be destroyed or disposed of without written release from the DOE local Office of Inspector General.

2 Prior to destroying or disposing of S/CIs, consult the Inspector General to determine if there is a need to retain the items as evidence for potential litigation. Based on the Office of Inspector General's decision, either:

   a. Retain S/CI material as evidence for potential litigation, or

   b. Release S/CI material for final disposition and/or disposal as directed by the S/CI coordinator.

Engineering Personnel	3.	Evaluate S/CI to determine if its use could create a safety hazard in its current/proposed application.
Assigned Company Personnel	4.	If the engineering evaluation of the S/CI has determined that its use could not create a safety hazard in its current/proposed application:

a. Disposition the S/CI to remain in place.

NOTE: Criteria for dispositioning S/CI is by acceptance, removal, or replacement after an engineering evaluation. This should be based on the deficient characteristic of the particular item.

b. Identify the accepted S/CI by marking with orange paint or other appropriate methods and note its location.

c. In areas where operating temperatures are 500°F and above or are subject to cyclic loading where fatigue failure is likely to occur, replace all grades 8 and 8.2 S/CI fasteners prior to further use of the equipment.

d. Engineering must also identify a way to prevent its reuse in an application it may not be suitable for.

e. If removed, prepare the S/CI for disposal.

5. If the engineering evaluation of the S/CI has determined that its use could create a safety hazard in its current/ proposed application:

a. Contact Waste Feed Operations (WFO) Shift Operations to secure the equipment.

b. Remove the S/CI as soon as practical.

c. Tag, segregate, or otherwise control the S/CI to prevent inadvertent use.

d. Prepare the S/CI for disposal.

S/CI Coordinator

6. Ensure that all S/CI material dispositioned for disposal is properly controlled and arranged for the material to be permanently and irrevocably altered so that it cannot be used. Examples of alterations include:

- Melting
- Shredding
- Destroying the threads on fasteners.

7. If the DOE/Office of Inspector General has approved disposal, arrange for pick-up and disposal of the altered S/CI material on a yearly basis. Burying S/CIs may be acceptable if they do not contain hazardous material or material prohibited by federal, state, or local regulations.

4.7 Surplus/Excess Material

Responsible Personnel

1. Remove S/CI from surplus/excess material before they are released for sale or transfer of accountability.

2. Ensure surplus items received from DOE or other facilities are inspected for S/CI prior to installation.

4.8 Assessments

Quality Assurance

1. Conduct assessments of the effectiveness of the S/CI program.

   NOTE: The assessment should be performance based and designed to determine if company activities are conducted in accordance with this procedure, DOE 414.1A, DOE O 440.1A, DOE G 440.1-6, and 10 CFR 830, Subpart A.

2. Lines of inquiry will be used as appropriate during assessments in areas that interface with the S/CI process. See Attachment J.

4.9 Training

Managers and Supervisors

1. Evaluate individual training needs of assigned personnel to ensure they are proficient in S/CI identification and control procedures within their areas of responsibility.

2. All personnel involved in the following specific areas will receive S/CI process and hands-on training, whether it be formal, continuing training, or required reading. The formal training course that is available is Module #1, Course 170720, "Suspect/Counterfeit Items."

   - Quality Assurance/technicians
   - Engineers (design, systems, etc.) who procure materials/equipment
   - Maintenance personnel (electricians, pipefitters, millwrights, instrument technicians)
   - Warehouse personnel who handle and process materials/equipment
   - Tool Crib attendants.

5.0 DEFINITIONS

Counterfeit part. A part made or altered so as to imitate or resemble an "approved part" without authority or right, and with the intent to mislead or defraud by passing the imitation as original or genuine. (Source: U. S. Department of Transportation Federal Aviation Administration Advisory Circular 21-29B, Detecting and Reporting Suspected Unapproved Parts).

Fastener (regardless of the safety classification). (Source: Fastener Quality Act, Public Law 101-592 as amended by Public Law 104-113).

- A screw, nut, bolt, or stud with internal or external threads or a load-indicating washer with a nominal diameter of 5 millimeters or greater in the case of such items described in metric terms; or 1/4 inch or greater in the case of such items in terms of the English system of measurement which contains any quantity of metal and held out as meeting a standard or specification which requires through-hardening; or

- A screw, nut, bolt, or stud having internal or external threads which bears a grade identification marking required by a standard or specification; or

- A washer to the extent that it is subject to a standard or specification applicable to a screw, nut, bolt, or studs described above, except that such term does not include any screw, nut, bolt, or stud that is produced and marked as American Society for Testing and Materials (ASTM) A 307 Grade A or produced in accordance with ASTM F432.

Grade identification. Any symbol appearing on a fastener purporting to indicate that the fastener's base material, strength properties, or performance capabilities conform to a specific standard of a consensus standards organization or government agency.

Graded classifications. System used to determine minimum requirements for structures, systems and components (e.g., design, operation, procurement, and maintenance requirements). The graded classifications in order of precedence are safety class, safety significant, and enhanced quality general services.

High strength graded fastener. Fasteners having a minimum tensile strength of 75 ksi, including those produced and procured in accordance with the Society of Automotive Engineers Standard J429, Grades 5, 5.2, 8, and 8.2; ASTM Standard A325, Types 1, 2, and 3; ASTM A490, ASTM A354, ASTM A449 (I&II), and some ASTM F468.

Item. An all-inclusive term used in place of any of the following: appurtenance, assembly, component, equipment, material, module, part, structure, subassembly, subsystem, system, or unit. (Source: ASME-NQA-1-1989, Quality Assurance Requirements for Nuclear Facilities).

An all-inclusive term used in place of any of the following: appurtenance, facility, sample, assembly, component, equipment, material, module, part, structure, subassembly, subsystem, system, unit, documented concept, or data. (Source: DOE G 440.1-6, Implementation Guide for use with Suspect/Counterfeit Items Requirements of DOE O 440.1, Worker Protection Management; 10 CFR 830.120; and DOE 5700.6C, Quality Assurance).

Substantial safety hazard. A loss of safety function to the extent that there is a major reduction in the degree of protection to the public or employee health and safety. (Source: U.S. Department of Energy (DOE) M 232.1-1A, "Occurrence Reporting and Processing of Operations Information").

Suspect/counterfeit items. A suspect item is one in which there is an indication by visual inspection, testing, or other information that it may not conform to established Government or industry-accepted specifications or national consensus standards. A counterfeit item is a suspect item that is a copy or substitute without legal right or authority to do so or one whose material, performance, or characteristics are knowingly misrepresented by the vendor, supplier, distributor, or manufacturer. An item that does not conform to established requirements is not normally considered S/CI if the nonconformity results from one or more of the following conditions, which should be controlled by site procedures as nonconforming items:

- Defects resulting from inadequate design or production quality control
- Damage during shipping, handling, or storage
- Improper installation
- Deterioration during service
- Degradation during removal
- Failure resulting from aging or misapplication, or
- Other controllable causes.

(Source: DOE G 440.1-6, Implementation Guide for use with Suspect/Counterfeit Items Requirements of DOE O 440.1, "Worker Protection Management;" 10 CFR 830.120; and DOE 700.6C, "Quality Assurance").

6.0 RECORDS

No records are generated during the performance of this procedure.

7.0 SOURCES

7.1 Requirements

1. DOE-O-232.1A Part 4.f. (1), "Occurrence Reporting and Processing of Operations Information." (S/RID)

2. DOE O 414.1A, "Quality Assurance."

3. 10 CFR 830, Subpart A, "Quality Assurance Requirements."

4. DOE O 440.1A, "Worker Protection Management for DOE Federal and Contractor Employees."

7.2 References

1. HNF-SD-MP-SRID-001, "Standards/Requirements Identification Document for the Tank Farm Contractor."

2. DOE G 440.1-6, "Implementation Guide for use with Suspect/Counterfeit Items Requirements of DOE O 440.1, Worker Protection Management; 10CFR830.120; and DOE5700.6C, Quality Assurance."

3. NRC Information Notice 89-70: "Possible Indications of Misrepresented Vendor Products."

4. NRC Information Notice 89-70, Supplement 1: "Possible Indications of Misrepresented Vendor Products."

5. TFC-BSM-CP_CPR-C-01, "Purchasing Card (P-Card)."

6. TFC-BSM-CP_CPR-C-03, "Buyer's Technical Representative Process."

7. TFC-BSM-CP_CPR-C-06, "Procurement of Items (Materials)."

8. TFC-BSM-CP_CPR-C-09, "Supply Chain Process."

9. TFC-BSM-CP_CPR-C-11, "Acquisition Planning."

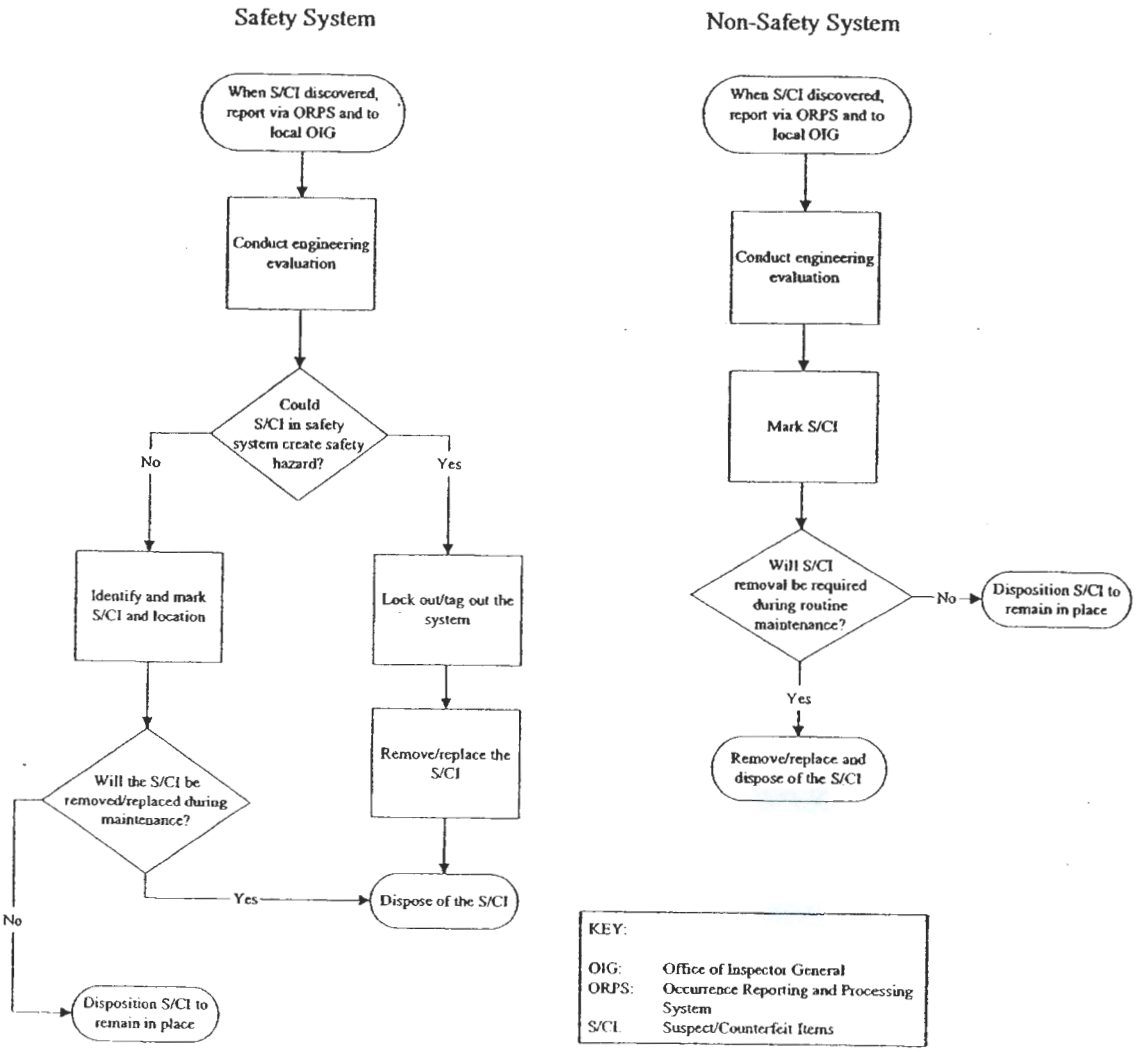
10. TFC-BSM-FPM_MC-C-01, "Material Receipt, Storage, Issuance, Return, and Excess Control."

11. TFC-ESHQ-Q_ADM-C-02, "Nonconforming Item Reporting and Control."

12. TFC-OPS-OPER-C-24, "Occurrence Reporting and Processing of Operations Information."

13. TFC-PLN-03, "Engineering Program Management Plan."

Figure 1. Management of Suspect/Counterfeit Items.



ATTACHMENT A - SUSPECT COMPONENTS LIST

This list was extracted from the U.S. Department of Energy Quarterly Reports on the "Analysis and Trending of Suspect/Counterfeit Items at Department of Energy Facilities," July 1997.

NOTE: It is not necessarily a negative reflection on a supplier or manufacturer if S/CIs are reported regarding its particular product. Reputable manufacturers and suppliers have a vital interest in preventing the manufacture or distribution of S/CI associated with themselves. It may be that the supplier or manufacturer was victimized and is pursuing S/CI associated with its products in an aggressive, prudent, and professional manner in order to get such items off the market. Therefore, each particular case regarding the manufacture or supply of S/CI must be examined on its own merit without making premature conclusions regarding fault or culpability of the manufacturer or supplier whose name is associated with the S/CI. In short, what follows is a "suspect components list" and not a "suspect manufacturer or supplier list." The manufacturer or supplier identified in the following table should not be considered to have engaged in any wrongdoing without additional information.

ATTACHMENT A - SUSPECT COMPONENTS LIST (cont.)

Component	Manufacturer/Type	Description	Supplier	References
Circuit Breakers	General Electric (Component Examples) • AKF-2-25 • EC Trip Types, E-C-1, E-C-2A • AK All Types	Metal clad, low voltage, DC	Satin America & Circuit Breaker Systems Inc.	NRC I.N. 89-45, Supplements and Attachments SENS Report ID #6 5/23/89
Circuit Breakers	General Electric (Component Examples) • AK-3A-25 • KHL-36 125 • THEF 136050 • AK-2-75-3 • AK-2 • AK-1-50 • AK-1-75 • B • TDQ • TCVVFS • TFJ • TEB122015-WL • TEB132090-WL • TE111015 • TED134060-WL • TEB124050-WL • THED136100 WL • TED126050 • THED136060 WL • THGB2120 • TEF134015 • THEF136M1100 • TED 134030-WL • AK2A25 • THED-136100-WL • THED-136050-WL • THED-136045-WL • THFK-236070-WL • TE-122070 • THED-136150-WL • THED-13600-WL • TED-113020 • TEC-360S0 • THED-124015-WL	1, 2, & 3 pole, various amperages	Bud Ferguson's Industrial Control & Supply, Inc., General Circuit Breaker & Electrical Supply HLC Electric Supply NSSS, Inc. California Breakers, Inc. Rosen Electric Equipment PENCON International (DBA) General Magnetics/ Electric Wholesale Lakeland Engineering Equipment Co. ANTI THEFT Systems, Inc. (DBA) ATS Circuit Breakers and AC Circuit Breaker Electrical Supply California Breakers Voyter Electric Co.	NRC I.N. 88-46 Supplements and Attachments NRC I.N. 90-46 Office of Nuclear Safety 93-5 (#11)

ATTACHMENT A - SUSPECT COMPONENTS LIST (cont.)

Component	Manufacturer/Type	Description	Supplier	References
Circuit Breakers	Westinghouse (Component Examples) • TF136090 • TF361050WL • TED1130020			
	• Not Provided	Commercial Grade	Westinghouse Electric Supply Co. (WESCO)	NRC I.N. 91-48
	• DB-25 & DS-416	Low Voltage	Satin America & Circuit Breaker Systems, Inc.	NRC I.N. 89-45 & Supplement #2
	• FSN-5925-628-0641 • DB-25 • DB-50 • HKB3150T • FB3020 • FB3070 • FB3050 • EHB3025 • LBB3125 • HKA31250 • JA3200 • EHB2100 • 225N	Trip units; Navy Trip units; 1, 2, & 3 pole various amp. ratings	General Circuit Breaker & Electrical Supply HLC Electrical Supply California Breakers, Inc. PENCON International (DBA) General Magnetics/Electric Wholesale	NRC I.N. 88-46, Supplements and Attachments Office Of Nuclear Safety 93-9
	• EB 1020 • HDEA 2030 • MCP331100R • MCP431550CR • BAB3060H • 656D14 8G03 • FA-2100 • EH-2050 • HFB-3050 • HFD(B)-3020 • MA3600 • F2020 • EH2100 • EB3050 • HMC3800F • EA2090 • FA3125 • HMCP 150		ANTI THEFT Systems, Inc. (DBA) ATS Circuit Breakers and AC Circuit Breaker - Electrical Supply Molded Case Circuit Breakers NSSS, Inc. Spectrum, Tech. Rosen Electric Luckow Circuit Breaker	

ATTACHMENT A - SUSPECT COMPONENTS LIST (cont.)

Component	Manufacturer/Type	Description	Supplier	References
Circuit Breakers	Westinghouse (cont.) (Component Examples) • HFD • EH2070 • FA2050 • JA2225 • JL3B125 • JL3B070 • JL3B150 • JL3B200 • JL3B090 • JL3B100 • HLM3800T • F3100N • MA3500 • EH2015 • FA3035 • FA2100 • HLA2125OTM • EH2070 • JB3100 • EB2030 • 8MC800 • CAH3200 • EHB3040 • JL3-B150 • JL3-B200 • JL3-B090 • JL3-B1000 • HFA, HFB, FA • JL3-(B)8070 • JL3-B125 • EH-2020 • FA-3035 • EH-2050 • FA-2100 • FA-2050 • HFB-3050 • JA-2225 • HLM3800T • F3100N • MA3500 • EH2015 • LA3200WL • HLA3200T • 2602D58U9	Shunt Trips Aux. Contacts 2 & 3 pole circuit breakers of various amperages	General Circuit Breaker & Electrical Supply HLC Electrical Supply PENCON International (DBA) General Magnetics/ Electric Wholesale ANTI THEFT Systems, Inc. (DBA) ATS Circuit Breakers and AC Circuit Breaker - Electrical Supply Molded Case Circuit Breakers Co. (MCCB)	NRC I.N. 88-46 Supplements and Attachments

ATTACHMENT A - SUSPECT COMPONENTS LIST (cont.)

Component	Manufacturer/Type	Description	Supplier	References
Circuit Breakers	Westinghouse (cont.) (Component Examples)			
	• HLB3200T • 262156G19 • 1A & 1B			NRC I.N. 88-46 Supp. & Attach.
	• HL300T • HLA2400TM • HMA3600T • HMA3700T • HKA3225T • HNB2700T	225 amp, 3 pole 3 pole, 20 amp 3 pole, 30 amp 1 pole, 20 & 30 amp 2 pole, 20 & 30 amp 3 pole, 60 amp	Not Provided	
	• MDL#KAF • QNB3020 • QNB3030			SENS ID #10 3-17-89 SENS ID #11 3-3-89
	• BA • BA • BA • E3060 • F3020	3 pole, 20 amp	Not Provided	SENS Report ID #12 10-19-88 NRC I.N. 88-46
Circuit Breakers	ITE (Component Examples)			
	• Model - E43B015	3-phase 480 volt	Cal. Breakers/Elect. Wholesale Supply Co.	SENS Report ID #8, 5-5-89
	• EQ-B • EE-3B030	1 pole, 20 amp 3 pole, 30 amp	Not Provided	SENS ID #10 3-17-89 SENS ID #11 3-3-89
	• EF3B070 • EF3B050 • EF3B125 • EF3B040 • E42B020 • QJ2B200 • JL3B400	2 & 3 pole various amperages	General Circuit Breaker & Electrical Supply HLC Electrical Supply	NRC I.N. 88-46, Supplements and Attachments

ATTACHMENT A - SUSPECT COMPONENTS LIST (cont.)

Component	Manufacturer/Type	Description	Supplier	References
Circuit Breakers	ITE (cont.) (Component Examples) • HE9B040 • EE3B050 • BQ2B030 • EE3B070 • EE2B100 • EE2B050 • EE2B030 • FJ3B225 • ET • KA • EH-313015 • JL-3B070 • JL-3B150 • E43B015 • EF2-B030 • EH3B100 • QP1B020 • QJ3B200 • EF3B100 • 1193		California Breakers, Inc. PENCON International (DBA) General Magnetics/ Electric Wholesale ATS Circuit Breakers, Inc. Panel Board Specialties Rosen Electric Equipment	
Circuit Breakers	ITE, Gould & ITE Imperial Brown Boveri Elect. (BBE) ASEA Brown Boveri (Component Examples) • Type HK • 5 HK • 7.5 HK • 15 HK • 38 HK • ITE 62-6	Not Provided ID-4KV Not Provided Not Provided Not Provided	Brown Boveri ASEA Brown Boveri	NRC I.N. 89-86 NRC I.N. 87-41 Office of Nuclear Safety, 92-25
Circuit Breakers	Square "D" Co. Component Examples • KHL 36125 (Any Type)	Molded Case	General Circuit Breaker & Electrical Supply HLC Electric Supply California Breakers, Inc. PENCON International (DBA) General Magnetics/Electric Wholesale	NRC I.N. 8[illegible]-46 Supp. & Attach. NRCB 88-10 NRC I.N. 90-46

ATTACHMENT A - SUSPECT COMPONENTS LIST (cont.)

Component	Manufacturer/Type	Description	Supplier	References
Circuit Breakers	Square "D" Co. Component Examples (cont.)		ANTI THEFT Systems Inc. (DBA) ATS Circuit Breakers and AC Circuit Breaker - Electrical Supply	
	• QOB220	1 pole, 15 amp	Not Provided	SENS ID #10 3-17-89
	• QO220 • LO-3	2 & 3 pole 20 & 50 amp breakers	General Circuit Breaker & Electrical Supply	NRC I.N. 89-45 & Supplement #2
	• SBW-12 • 989316 • FAL3650-16M or • FAL36050-16M • KA36200	3 pole - 200 amp breaker 30A/600V	HLC Electric Supply California Breakers, Inc.	
	• 999330	Not Provided	PENCON International (DBA) General Magnetics/Electric Wholesale	
	Manufacturer not Provided • EHB3025	Not Provided	Stokely Enterprises Molded Case Circuit Breakers	DOE Letter 8-26-91 Reprinted NuVEP: Bulletin 7-26-91
Circuit Breakers	Fed. Pacific (Component Examples)		General Circuit Breaker & Electrical Supply	
	• NEF431020R • NE111020 • NE	3 pole, 20 amp 1 pole, 20 amp 1 pole, 15 amp	HLC Electric Supply California Breakers, Inc.	
			PENCON International (DBA) General Magnetics/Electric Wholesale	SENS ID. #10 3-17-89

ATTACHMENT A - SUSPECT COMPONENTS LIST (cont.)

Component	Manufacturer/Type	Description	Supplier	References
Circuit Breakers	Fed. Pacific (Component Examples) (cont.) • NF63-1100 • NE22-4060 • NE22-4100 • NEF-433030 • 2P125	1, & 3 pole - 30, 60 & 100 amp breakers	ANTI THEFT Systems, Inc. (DBA) ATS Circuit Breakers and AC Circuit Breaker - Electrical Supply General Circuit Breaker & Electrical Supply HLC Electric Supply California Breakers, Inc.	SENS ID. #11 3-3-89 NRC I.N. 88-46, Supp. & Attach.
	Jefferson (Component Examples)	Not Provided	PENCON International (DBA) General Magnetics/electric Wholesale ANTI THEFT Systems, Inc. (DBA) ATS Circuit Breakers and AC Circuit Breaker - Electrical Supply Mid West Co.	NRC I.N. 88-46, Supp. & Attach.
Circuit Breakers	Superior (Component Examples) • 246U-3	Not Provided	General Circuit Breaker & Electrical Supply Rosen Electric HLC Electric Supply California Breakers, Inc. PENCON International (DBA) General Magnetics/Electric Wholesale ANTI THEFT Systems, Inc. (DBA) ATS Circuit Breakers and AC Circuit Breaker - Electrical Supply	NRC I.N. 88-46 Supp.& Attach.

ATTACHMENT A - SUSPECT COMPONENTS LIST (cont.)

Component	Manufacturer/Type	Description	Supplier	References
Circuit Breakers	Manufacturer Not Provided (Component Examples) 50DHP250	 2 pole - 50 amp	General Circuit Breaker & Electrical Supply HLC Electric Supply California Breakers, Inc. PENCON International (DBA) ATS Circuit Breakers and AC Circuit Breaker - Electrical Supply	NRC I.N. 88-46, Supp. & Attach.
Circuit Breakers Heaters	Cutler Hammer (Component Examples) • 10177H13 • 10177H21 • 10177H32 • 10177H036 • 10177H1049	 Not Provided	 AAKER General Circuit Breaker & Electrical Supply HLC Electrical Supply California Breakers, Inc. PENCON International (DBA) General Magnetics/Electric Wholesale ANTI THEFT Systems, Inc. (DBA) ATS Circuit Breakers and AC Circuit Breaker - Electrical Supply	 NRC I.N. 88-46, Supp. & Attach.

ATTACHMENT A - SUSPECT COMPONENTS LIST (cont.)

Component	Manufacturer/Type	Description	Supplier	References
Switches	(Component Examples) Crouse Hinds #EDSC2129 Sq. D Type G. Class 9012, 9025, 9016	Tumbler, ft. op	Platt Electric Supply Co. Gen. Motors, Electro-Motive Design	SENS ID #16 1-27-92 Office of Nuclear Safety 93-24 & 93-27
Transmitters	Rosemount	(Component Examples) • Model 1151 GP • Model 1151 DP	Venetech	E.L. Wilmot letter dated 8-1-91 H. Richardson letter HR-81-91 dated 8-15-91
Motors	Siemen & Allis (Component Examples) INP 143 T 215 T	10 H.P.	General Circuit Breaker & Electrical Supply HLC Electric Supply California Breakers, Inc. PENCON International (DBA) General Magnetics/Electric Wholesale ANTI THEFT Systems, Inc. (DBA) ATS Circuit Breakers and AC Circuit Breaker - Electrical Supply Rosen Electric Equipment	NRC I.N. 88-46, Supplements and Attachments

ATTACHMENT A - SUSPECT COMPONENTS LIST (cont.)

Component	Manufacturer/Type	Description	Supplier	References
Relays	Potter & Brumfield (Component Examples) MDR-138, 173-1 134-1, 142-1	Not-latching rotary	Stokely Enterprises Spectronics, Inc. Nutherm International The Martin Co.	NRC I.N. 90-57 & Attach.
	Teledyne	All qualified to MIL-R-28776 and MIL-R-39016	Not Provided	DOE-ID Wilmot letter, 7-16-91
	G.E. & Exide (Component Examples) • 12HGA-11S52 • NX 400	Overload & Aux.	General Circuit Breaker & Electrical Supply HLC Electric Supply California Breakers, Inc. PENCON International (DBA) General Magnetics/Electric Wholesale ANTI THEFT Systems, Inc. (DBA) ATS Circuit Breakers and AC Circuit Breaker - Electrical Supply	NRC I.N. 88-46, Supp. & Attach.
	Manufacturer not provided • FSC-5945	Not Provided	Stokely Enterprises	DOE Letter 8-26-91 Reprinted NuVEP: Bulletin 7-26-91
	Amerace (or Agastat) (Component Examples) Models: E7024 E7022 A through L Series Model 7032	Electro Pneumatic Timing Relays PRB	Amerace Control Components Supply	SENS ID #1 11-1-91 NRC I.N. 92-24

ATTACHMENT A - SUSPECT COMPONENTS LIST (cont.)

Component	Manufacturer/Type	Description	Supplier	References
Fuses	Bussman Co. (Component Examples) REN 15 & NOS-30	15A-250V & 30A-600V	General Circuit Breaker & Electrical Supply HLC Electric Supply California Breakers, Inc. PENCON International (DBA) General Magnetics/Electric Wholesale ANTI THEFT Systems, Inc. (DBA) ATS Circuit Breakers and AC Circuit Breaker - Electrical Supply	NRC I.N. 88-46, Supp. & Attach.
	Class 1E	All Supplied by PMS	Preventive Maintenance Systems (PMS)	NRC I.N. 88-19
Controllers	Manufacturer Not Listed (Component Examples)	Motor Controllers	Stokely Distributors & Stokely Enterprises, Inc.	DOE letter 8-26-91 & NUVEP Bulletin 7-26-91
Starters	Westinghouse (Component Examples) 626B187G17 626B187G13	Not Provided	General Circuit Breaker & Electrical Supply HLC Electric Supply California Breakers, Inc. PENCON International (DBA) General Magnetics/Electric Wholesale ANTI THEFT Systems, Inc. (DBA) ATS Circuit Breakers and AC Circuit Breaker - Electrical Supply	NRC I.N. 88-45 Supp. & Attach.
Resistors	Unknown	All	Impala Electronics	NRC I.N. 91-01

ATTACHMENT A - SUSPECT COMPONENTS LIST (cont.)

Component	Manufacturer/Type	Description	Supplier	References
Semiconductors	Solid State Devices Inc. (SSDI) SFF 9140	P-Channel MOSFET	SSDI	DOE Albuquerque Letter, 06-25-96 to DOD Inspector General
	SPD 1511-1-11	Pin Diode (SA3059)		
	2A14/18 or 2A14/52	Ion Implanted Diode		
	SSR4045CTTXV	SCHOTTKY Diodes		
	SFF9140TWX	Power Transistors		
	SPMF106ANH	Special Pack MOSFET Switch		
	SPD 5818 or IN5858JTXV	Axial Leaded SCHOTTKY Diode		
	2N797	Transistor		
	Unknown	Diode (SA 3436)		
Starter Controls	Westinghouse (Component Examples)	Not Provided	General Circuit Breaker & Electrical Supply	NRC I.N. 88-48
	• A200MICAC		HLC Electric Supply	
	• A201KICA		California Breakers, Inc.	
	• A201L2CA			
	• AN13A		PENCON International (DBA) General Magnetics/Electric Wholesale	
			ANTI THEFT Systems, Inc. (DBA) ATS Circuit Breakers and AC Circuit Breaker - Electrical Supply	

ATTACHMENT A - SUSPECT COMPONENTS LIST (cont.)

Component	Manufacturer/Type	Description	Supplier	References
Gauge Glasses	Siemen & Allis (Component Examples) #00-737-637-118 215 T	Not Provided	Rosen Electric Co.	NRC I.N. 88-46 Supp. & Attach.
Mercury Lamps	Spectro Inc. (Component Examples) V00014	Not Provided	General Circuit Breaker & Electrical Supply HLC Electric Supply California Breakers, Inc. PENCON International (DBA) General Magnetics/Electric Wholesale ANTI THEFT Systems, Inc. (DBA) ATS Circuit Breakers and AC Circuit Breaker - Electrical Supply	NRC I.N. 88-46
Electrical Frames	Westinghouse (Component Examples) LA2600F LA3600F MA2800F	Not Provided	General Circuit Breaker & Electrical Supply HLC Electric Supply California Breakers, Inc. PENCON International (DBA) General Magnetics/Electric Wholesale ANTI THEFT Systems, Inc. (DBA) ATS Circuit Breakers and AC Circuit Breaker - Electrical Supply	NRC I.N. 88-46
Push button station	Crouse Hinds (Component Examples) #00-737-637-118	Single gang, pushbutton	Platt Electric Supply Co.	SENS Report ID #16 1-27-92

ATTACHMENT A - SUSPECT COMPONENTS LIST (cont.)

Component	Manufacturer/Type	Description	Supplier	References
Overload Relay Thermal Unit	Square D (Component Examples) B19.5, B22	Not Provided	Not Provided	NRC I.N. 88-46
Piping, Fittings Flanges, and Components	Tube-line Corp. Ray Miller, Inc.	Subassemblies, fittings, flanges, & other components (Carbon and Stainless Steel components)	Tube-line Ray Miller, Inc.	NRC IEB 83-06 NRC I.N. 89-18 NRC IEB 83-07 NRC I.N. 83-01
Piping, Fittings, Flanges, and Components	Piping Supplies, Inc. & West Jersey Mfg. & Chews Landing Metal Mfg.	Carbon and Stainless Steel Fittings and Flanges	Piping Supplies, Inc. & West Jersey Mfg. & Chews Landing Metal Mfg.	NRC Bulletin 88-05 & Supplements
Valves	VOGT	Full port design 2-inch Model SW-13111 & 1023	CMA International IMA Valve Refurbisher	NRC I.N. 88-48 & Supplements
	Crane	4"-1500psi, pressure sealed	Southern Cal. Valve Maintenance co., Amesse Welding Service & CMA Int.	NRC I.N. 91-09
	ITT Grinnell Valve Co., Inc	Diaphragm valves	ITT Grinnell Valve Co. Inc. Div. of Diaflo & ITT Engineered Valves	NRC Comp. Bulletin 87-02
	Crane, Pacific, Powell, Walworth & Lunkenheimer	Gate Valves	Coffeyville Valve Inc.	NRC I.N. 92-56
	Pacific	8" & 3" Globe Valve	CMA & IMA Valve Refurbisher	NRC I.N. 88-48, Supp. & Attach.
	Crane Chapman	24" Check Valve	CMA & IMA Valve Refurbisher	NRC I.N. 88-48, Supp. & Attach.
	Pacific	Check Valve	CMA & IMA Valve Refurbisher	NRC I.N. 88-48, Supp. & Attach.

ATTACHMENT A - SUSPECT COMPONENTS LIST (cont.)

Component	Manufacturer/Type	Description	Supplier	References
Valves	Kerotest	8" Valve	CMA & IMA Valve Refurbisher	NRC I.N. 88-48 Supp. & Attach.
	Pacific	4" Gate Valve	CMA & IMA Valve Refurbisher	NRC I.N. 88-48 Supp. & Attach.
	Lukenheimer	6" Model 1542 20" Model 3013	CMA & IMA Valve Refurbisher	NRC I.N. 88-48 Supp. & Attach.
	Crane	All	CMA & IMA Valve Refurbisher	NRC I.N. 88-48 Supp. & Attach.
Flanges	China Ding Zinang Nan Xi Li Flange Co. Shou Gang Mach. Eng. Co.	Flanges, ASTM A105, ASME SA105	Billiongold Co. LTD. Tain Gong Co. Sanxi Province Overseas Trading Corp	NRC I.N. 92-68 and Attachments Office of Nuclear Safety 92-25, 93-23, and 92-35 National Board of Boiler and Pressure Vessel Inspectors (NBBI) Bulletin: Special Report, 1992, Volume 48, Number 2, The Chinese Flange Investigation
Valve Replacement Parts	Masoneilian-Dresser Industries	Plug stem, stem to plug anti-rotation pin, seat ring, valve plugs, bushings, cages & packing box components	Cor-Val, Control Valve Specialists, H.H. Barnum & M.D. Norwood, Sample Webtrol Controls, Inc.	NRC I.N. 88-97 Supp. & Attach.
Pumps & Replacement Parts	Hayward Tyler Pump Co.	HTPC ASME Nuclear Code	Hayward Tyler Pump Co.	IEB 83-05 & Attachments
Channel Members	Unistrut Corporation	Continuously slotted channels, structural framing members, fasteners, nuts, fittings, pipe clamps	Unistrut Corporation	NRC I.N. 91-25
Fire Barriers	Thermal Science Inc.	Thermo-Log 330	None Listed	ES&Q Update #8 NRC I.N. 92-55
Valve Actuator	Limitorque	Eyebolts on housing cover	None Listed	Office of Nuclear Safety 93-25 NRC I.N. 93-37

ATTACHMENT A - SUSPECT COMPONENTS LIST (cont.)

Component	Manufacturer/Type	Description	Supplier	References
Steel	Alloy & Carbon Steel Co. Inc., Atlantic Steel Co., Levingston Steel Co., & Copperweld Steel co.	Plate Angle Flat Bar Bar	Meredith Corporation Pressure Vessel Nuclear Alloy & Carbon Steel Co., Inc.	NRC I.N. 89-56, Attachments and Supplements
Fasteners (Bolts, Screws, Nuts, and Washers)	(parentheses designated headmark) Asahi (A) Daiichi (D) Daiei (E) Fastener Co. of Japan (FM) Hinomoto Metal (H) Jin Her (J) Kyowa (K) Kosaka Kogyo (KS) Kyoei Minamida Seiybo (M) Mnato Kogyo (MS) Nippon (NF) Takai (RT) Tsukimori (S) Unytte (UNY) Yamadai (Y) Ivaco, Infasco (hollow triangled)	• Those with suppliers or manufacturers • Those that are improperly marked • Those of foreign manufacture that do not meet Public Law 101-592. Fastener Quality Act	Note: Listed suppliers may also be manufacturers Lawrence Engineering & Supply Co. Metal Building Bolts Nichimin Corporation UNICO Ace Corporation E. K. Fasteners, Inc. H. Y. Port Fasteners Co. Kobayashi Metals, LTD. Takai Screw Mfg. Co. LTD. Yamaguchi Sesakusho Co. LTD. Highland Bolt & Nut Porteous Fastener Co. Northwest Fasteners Ziegler Bolts & Parts Co. Edgewater Fasteners, Inc. Reynolds Fasteners A & G Engineering	Commercial Carrier Journal Articles for: 6/88, 1/90, 2/90, 3/90, 4/90, 6/90, 7/90, 12/90 INEL Suspect Headmark List SENS Report #5 2/6/91 SENS Report #13 2/6/91 HR 3000, U.S. House of Representatives, July 1988 J. A. Jones, Ltr, 9/23/92 Memo from L. Kubicek, 3/28/91 Memo from D. Sanow, 3/8/91 "Fastener Technology International," Feb., April, and June 1993 Rep. J. Dingell Ltr to Comm. Dept. & NRC June 18, 1993 Office of Nuclear Safety 93-26, 93-22, 93-11 DOE Quality Alert, Bulletin, Issue No. 92-4, August 1992 FDH Hanford Suspect Headmark List

ATTACHMENT A - SUSPECT COMPONENTS LIST (cont.)

Component	Manufacturer/Type	Description	Supplier	References
Fasteners (Bolts, Screws, Nuts, and Washers)	NUCOR	1-1/4" x 2" Zinc Chromate plated surface Hexhead cap screws	Cordova Bolt, Inc.	SENS ID #13 11-6/91
	Any	Any	Aircom Barnett Bolt Works Bolts & Nuts, Inc. Glasser & Assoc. Knoxville Bolt & Screw Metal Fastener Supply Phoell Mfg. Co. Service Supply Co. Southeastern Bolt & Screw Sure Loc Victory Bolt	NRC Compliance Bulletin 87-02 NRC I.N. 89-59

ATTACHMENT B - CLASSIFICATION OF POTENTIALLY SUSPECT/COUNTERFEIT ITEMS

A. ELECTRICAL ITEMS

- Molded Case Circuit Breakers
- Motor Control Centers
  - Complete Units
  - Components
  - Starters
  - Starting coils
  - Contactors
  - Overload relays
  - Starter control relays
  - Overload heaters
- Protective/control relays
- DC power supplies/chargers
- AC inverters
- Current/potential transformers
- Exciters/regulators
- Bus transfers/auto bus transfers
- Motor generator sets
- Generators
- Rewindable motors
- Printed circuit boards
- Bulk commodity items
  - Fuses
  - Splices
  - Electrical connectors
- Indicators/controllers
- Panel lights/switches
- Transmitters/instrument switches
- Isolation devices.

The following items are excluded unless required by the applicable program/project: 600V or less: motors; outlets, switches, and plugs; boxes, conduit (i.e., bodies and covers, nipples, fittings, EMT, flex, liquid tight, rigid); wire; miscellaneous wire connections #10 and below; fixtures; lights.

B. MECHANICAL ITEMS

- Welding materials
  - Rod
  - Wire
  - Flux
- Structural members (pipe supports)
- Channel members

ATTACHMENT B - CLASSIFICATION OF POTENTIALLY SUSPECT/COUNTERFEIT ITEMS (cont.)

- Sheet
- Plate
- Bars
- Round stock
- Other raw material which requires an ASTM or national standard
- All lifting/rigging gear (wire rope shall be made in the United States by a member of the Wire Rope Technical Board (WRTB) or the Associated Wire Rope Fabricators (AWRF) (except stainless steel, and unless recommended otherwise by a crane or hoist manufacturer); stainless steel wire rope shall be made in the United States and shall be 302 or 304 grade stainless steel unless otherwise recommended by a crane or hoist manufacturer)
- Ratchet tie-downs/strapping devices and come-a-longs, with fasteners.

The following materials are excluded unless required by the applicable program/project: ASTM-A36, brass, copper, sheet metal 7 GA or less, and aluminum.

C. PIPING - which requires an ASTM or ASME standard
- Fittings
- Flanges
- Valves
- Pipe
- Components.

The following materials are excluded unless required by the applicable program/project: ASTM-A-53, Swagelock; cast iron, galvanized, copper, bronze, and brass; PVC; and gaskets.

D. FASTENERS - All fasteners 1/4" and above in diameter
- Bolts
- Studs
- Cap screws
- High-strength washers
- Nuts
- Anchors.

NOTE: Attachment I identifies headmarkings for stainless steel and carbon steel high strength fasteners that are considered counterfeit. Fasteners exhibiting these headmarks are counterfeit and no further testing is required.

The following items are excluded, unless required by the applicable program/project: sheetmetal screws, wood screws, stove bolts, pan heads, machine screws, lag bolts, threaded rod, rivets, and carriage bolts.

ATTACHMENT C - SUSPECT/COUNTERFEIT ITEMS INFORMATION SOURCE LIST

A wide variety of industry and Government sources publish information relative to suspect/counterfeit products. The following sources provide information which is available on a continuing basis:

Industrial Fasteners Institute (IFI)

The following information is available from IFI via subscription:

- "Fastener Application Advisory" (Published Monthly)
- "North American Manufacturers Identification Markings for Fasteners"
- Fastener-related video cassettes.

The National Board of Pressure Vessel Inspectors (NBBI)

The NBBI publishes "National Board Bulletins" to alert manufacturers and users of misrepresented products as they are discovered.

National Highway Traffic Safety Administration (NHTSA)

The NHTSA's Office of Defects Investigation issued a "Suspect Bolt List" in late 1990 identifying numerous fasteners, which they determined to be misrepresented.

Trade Journals and Magazines

There are numerous trade-oriented magazines which have carried articles identifying incidents of failure of substandard parts in industry applications which have caused personal injury and death, as well as serious property damage.

Newspaper and Television Reports

Another good source of information are news reports, which provide current accounts of problems encountered as a result of misrepresented products.

U.S. Nuclear Regulatory Commission (NRC)

The NRC issues bulletins, notices, and regulatory guidance on a continuing basis to alert nuclear power utilities of potential intrusion of misrepresented products into the operations environment of operating nuclear power plants.

U.S. Department of Defense (DOD) and U.S. Department of Commerce publications are also monitored by the DOE to assure that the deficiencies identified do not contaminate DOE facilities.

ATTACHMENT C - SUSPECT/COUNTERFEIT ITEMS INFORMATION SOURCE LIST (cont.)

Government Industry Data Exchange Program (GIDEP)

The mission of this program, established by the Office of Management and Budget, is to support government systems readiness, logistics effectiveness, productivity, and cost reduction through timely retrieval, storage, and distribution of data among government and industry organizations.

U.S. Department of Energy

The following documents are issued by the DOE to provide information and guidance relative to the suspect/counterfeit parts issue:

- DOE Orders
- Letters of Direction
- Bulletins and Quality Alerts

(In addition, the DOE periodically sponsors seminars/workshops relative to the detection and control of suspect/counterfeit parts).

U.S. Customs Service

The U.S. Customs Service has published the Suspect Headmark List (Figure 1) identifying graded fasteners determined to be of indeterminate quality, which has been adopted by DOE and, ultimately, Project Hanford, as a formal guide for use when evaluating currently installed and newly procured graded fasteners to assure their fitness for use on the Hanford Site.

ATTACHMENT D - CHARACTERISTICS THAT MAY MAKE PRODUCTS VULNERABLE TO MISREPRESENTATION, FRAUDULENT PRACTICES, AND COUNTERFEITING

The following information has been extracted from the NRC Information Notice 89-70, Supplement 1, Attachment 3:

- High-turnover usage rate.
- No easy or practical way to uniquely mark the component itself.
- Critical characteristics, including environmental qualification not easily discernable in external visual inspection, or characteristics that are difficult to verify through receipt testing.
- May be widely used in non-critical and critical applications.
- Use may not result in used appearance.
- Often marketed through a supplier and dropped shipped from locations other than that of the original supplier.
- Special processes for ASME materials may be subcontracted (heat treating, testing, and inspections).
- Easily copied by secondary market suppliers.
- Viable salvage market.
- Reduced number of original equipment manufacturers.
- Obsolete or hard-to-get components.
- Components manufactured by a company that is no longer in business.
- Items with documentation from a plant where construction has been suspended, canceled, or deferred.
- Moderate or low cost.
- High potential for profit (rejected heats of material are purchased and decertified).

ATTACHMENT E - WHERE TO LOOK FOR SUSPECT/COUNTERFEIT ITEMS

The following areas should receive increased scrutiny to assure that suspect/counterfeit items are not evident:

Items in Supply

- Company supply stock
- Wagon stock
- Other sources of supply contamination.

Items in Use

- Plant facilities, components, and systems
- Equipment
- Operations and maintenance.

Items Being Procured

- "Known" critical items
- Critical equipment and assemblies
- Non-critical "known" purchases.

Operations Decisions

- Major disaster risks
- Personnel safety risks
- Program/mission risks (cost and schedule).

Cost of Implementation

- Potential consequential costs
- Management risk assessment
- Cost of focusing established controls
- Impact on schedule and program mission.

Cost of Focus on Known Suspect/Counterfeit Parts

- Uses existing procurement program
- Focuses on "known parts first"
- Reduction in major disaster potential
- Program costs low/benefits high.

ATTACHMENT F - SUSPECT/COUNTERFEIT PARTS DETECTION

It is very important to remember that just because an item is identified as being "suspect/counterfeit" it may not be appropriate to simply reject it. A review should be performed prior to formal disposition of the item to assure that it is indeed unfit for the intended application.

DETECTION METHODS

Visual Inspection

Items may be substandard or fraudulent when:

- Nameplates, labels, or tags have been altered, photocopied, painted over, are not secured well, show incomplete data, or are missing (e.g., preprinted labels normally show typed entries).
- Obvious attempts at beautification have been made, e.g., excess painting or wire brushing, evidence of hand painting (touch-up), or stainless steel is painted.
- Handmade parts are evident, gaskets are rough cut, shims and thin metal part edges show evidence of cutting or dressing by hand tools (filing, hacksaw marking, use of tin snips or nippers).
- Hand tool marks on fasteners or other assembly parts (upset metal exists on screw or bolt heads) or dissimilar parts are evident (e.g., seven or eight bolts are of the same material and one is a different material).
- Poor fit between assembled items.
- Configuration is not consistent with other items from the same supplier or varies from that indicated in supplier literature or drawings.
- Unusual box or packing of component or item.
- The supplier is not a factory-authorized distributor.
- Dimensions of the item are inconsistent with the specifications requested on the purchase order and/or those provided by the supplier at the time of shipment.
- The item or component matches the description of one that is on a suspect items list (e.g., U.S. Customs Service "Suspect Headmark List," National Board of Boiler and Pressure Vessel Inspectors (NBBI) "Special Bulletin," etc.).

ATTACHMENT F - SUSPECT/COUNTERFEIT PARTS DETECTION (cont.)

Documentation

Documents may be suspect/counterfeit when:

- The use of correction fluid or correction tape is evident. Type or pitch change is evident.
- The document is not signed or initialed when required, is excessively faded or unclear (indicating multiple, sequential copying), or data are missing.
- The name or title of the document approved cannot be determined.
- Technical data is inconsistent (e.g., chemical analysis indicates one material and physical tests indicate another).
- Certification or test results are identical between items when normal variations should be expected.
- Document traceability is not clear. The document should be traceable to the item(s).
- Technical data are not consistent with code or standard requirements (e.g., no impact test results provided when impact testing is required or CMTRS physical test data indicate no heat treatment and heat treatment is required).
- Documentation is not delivered as required on the purchase order or is in an unusual format.
- Lines on forms are bent, broken, or interrupted indicating data has been deleted or exchanged (cut and paste).
- Handwritten entries of data are on the same document where typed or preprinted data exists.
- Data on a single line located at different heights indicate the possibility of retyping.

ATTACHMENT F - SUSPECT/COUNTERFEIT PARTS DETECTION (cont.)

Fasteners

- Headmarkings are marred, missing, or appear to have been altered.
- Threads show evidence of dressing or wear (threads should be of uniform color and finish).
- Headmarkings are inconsistent with a heat lot.
- Headmarkings matching one of those identified on the U.S. Customs Service, "Suspect Headmark List" (Figure QP 3.2-1).
  - Headmarkings which depict both raised and hand-stamped markings, such as those described in WHC Quality Assurance Bulletin # 94-01, "Discrepant Dual Head Stamped Stainless Steel Bolts." This bulletin documents the results of internal inspections and independent testing of stainless steel bolts purchased to ASTM A193, Grade B8, which were found to be substandard.
  - Only manufacturers listed on the "Suspect Fastener Headmark List" (Figure QP 3.2-1) are known to produce substandard graded fasteners. If graded fasteners are discovered which exhibit headmarks matching those on the Suspect/Fastener Headmark List, they shall be considered to be defective without further testing, unless traceable manufacturer's certifications are received which provide documented evidence that the fasteners were not produced by the manufacturer listed on the Suspect Fastener Headmark List.
  - Interpretation of headmark/manufacturers listed on the "Suspect Fastener Headmark List," including newly discovered variations thereto, shall only be provided by the designated S/CI coordinator based on guidance received from the DOE.

Electrical Devices

- Connections show evidence of previous attachment (metal upset or marring).
- Connections show arcing or discoloration.
- Fasteners are loose, missing, or show metal upset.
- Molded case circuit breakers are not consistent with manufacturer-provided checklists for detecting substandard/fraudulent breakers.
- Missing or photocopied Underwriters Laboratories (UL) labels on products requiring such.

ATTACHMENT F - SUSPECT/COUNTERFEIT PARTS DETECTION (cont.)

Rotating Machinery and Valve Internal Parts

- Shows marring, tool impressions, wear marks, traces of Prussian blue or lapping compound, or other evidence of previous attempts at fit up or assembly.
- Heat discoloration is evident.
- Evidence of erosion, corrosion, wire-drawing or "dimples" (inverted cone-shaped impressions) on valve discs, seats, or pump impellers.

Valves

- Paint
  - Valve appears to be freshly painted and valve stem has paint on it
  - Wear marks on any painted surface
  - Valve stem is protected, but protection has paint on it
  - Paint does not match standard Original Equipment Manufacturer (OEM) color.
- Valve Tags
  - Tags attached with screws instead of rivets
  - Tags attached in a different location than normal
  - Tags appear to be worn or old
  - Tags with paint on them
  - Tags that look newer than the valve
  - Tags with no part numbers
  - Tags with irregular stamping.
- Hand Wheels
  - Old looking hand wheels on new looking valves
  - Hand wheels that look sand blasted or newer than the valve
  - Different types of hand wheels on valves of the same manufacturer.
- Bolts and Nuts
  - Bolts and nuts have a used appearance (excessive wrench marks on flats)
  - Improper bolt/nut material (e.g., a bronze nut on a stainless stem).

ATTACHMENT F - SUSPECT/COUNTERFEIT PARTS DETECTION (cont.)

- Valve Body
  - Ground off casting marks with other markings stamped in the area (OEM markings are nearly always raised, not stamped)
  - Signs of weld repairs
  - Incorrect dimensions
  - Freshly sand-blasted appearance, including eye bolts, grease fittings, stem, etc.
  - Evidence of previous bolt head scoring on backsides of flanges, or evidence that this area has been ground to remove such marks
  - On a stainless valve, a finish that is unusually shiny indicates bead-blasting. A finish that is unusually dull indicates sand-blasting. The finish on a new valve is in-between.

Manufacturer's Logo

- Missing.
- Logo plate looks newer than the valve.
- Logo plate shows signs of discoloration from previous use.

Other

- Foreign material inside the valve (e.g., metal shavings).
- Valve stem packing that shows all the adjustments have been run out.
- In gate valves, a gate that is off-center when checked through the open end of the valve.
- Obvious differences between valves in the same shipment.

Price

- Price is significantly less than that of the competition.

ATTACHMENT G - FASTENERS

1.0 Counterfeit/Substandard High-Strength Bolts

1.1 General Background

Counterfeit bolts have been found in military and commercial aircraft, surface ships, submarines, nuclear weapon production facilities, bridges, buildings, and the space shuttle. These bolts often do not possess the capabilities of the genuine bolts they counterfeit and can threaten the reliability of industrial and consumer products, National Security, or lives. At Congressional hearings in 1987, the Army testified that they had purchased bolts that bore the headmarks of Grade 8 high-strength bolts, but that were actually inferior Grade 8.2 bolts.

The International Fasteners Institute (IFI) reported finding substandard, mis-marked, and/or counterfeit high-strength Grade 8 bolts in the United States commercial marketplace. In 1988, IFI reported that counterfeit medium- strength Grade 5 bolts had also been found.

Foreign bolts dominate the American marketplace due to their price advantage, and the majority of suspect/counterfeit bolts are imported. Identifying, testing, and replacing these bolts has proven expensive and difficult, both mechanically and technically. Not finding and replacing these bolts, however, has proven fatal in some instances.

1.2 Headmarks

Attachment I may be removed and photocopied, as needed, for use as a poster and reference to known suspect fastener headmarks. Bolts with the headmarkings shown have a significant likelihood of being found to be inferior to standards. Generally, the cost of replacement of these bolts is less than the cost of chemical, hardness, and tensile strength testing. Note also that counterfeit bolts can be delivered with counterfeit certificates. Documentation alone is insufficient to demonstrate compliance with standards.

1.3 Consensus Standards

There are several consensus organizations that have published standards for the properties of fasteners. One of these is the Society of Automotive Engineers (SAE). The SAE grade (or alleged grade on a suspect item) of a bolt is indicated by raised or indented radial lines on the bolt's head, as shown in Attachment I. These markings are called headmarks. DOE is currently concerned with two different grades of fasteners: one has three equally spaced radial lines on the head of a bolt which indicate that it should meet the specifications for a Grade 5 bolt; the other has six equally spaced radial lines which indicate a Grade 8 bolt. Letters or symbols on the head of a bolt indicate the manufacturer.

ATTACHMENT G - FASTENERS (cont.)

Attachment I is a Suspect/Counterfeit Headmark List that was prepared by the United States Customs Service after extensive testing of many samples of bolts from around the nation. Any bolts anywhere in the DOE community that are currently in stock, in bins, or installed that are on the Customs Headmark List should be considered suspect/ counterfeit. The headmarks on this list are those of manufacturers that have often been found to have sold bolts that did not meet the indicated consensus standards. Sufficient testing has been done on the bolts on this list to presume them defective without further testing.

1.4 Precautions: Selective Testing

Some facilities (manufacturers, distributors, etc.) perform selective testing of sample bolts rather than have an independent testing laboratory run all the tests required by consensus standards. In many cases, a new counterfeit bolt has roughly the same physical strength as the graded bolt it mimics, but does not have either the chemical composition or the heat treatment specified by the consensus standards. As a result, it will stretch, exhibit metal fatigue, or corrode under less harsh service than the genuine bolt. Simple tensile strength tests cannot be used to identify substandard high-strength fasteners and should not be solely relied upon in performing acceptance test.

1.5 Using Suspect/Counterfeit Grade 5 Bolts in Grade 2 Applications

Some sites use suspect/counterfeit Grade 5 bolts in applications that only call for Grade 2 bolts. Eventually, the suspect/counterfeit Grade 5 bolts may find its way into an application that requires a genuine Grade 5 bolt and that application may fail. In some cases, cheap imported graded bolts have been purchased in place of upgraded bolts because the small price differential made the extra quality seem to be a bargain. Given the expense of removing suspect bolts from DOE facilities, the practice of using suspect bolts for any application should be discontinued.

1.6 Keep Bolts in Original Packages

All bolts purchased should be kept in the original packages, not emptied into bins. The packages should have labels or other markings that would permit them to be associated with a particular procurement action and a specific vendor. Approved supplier lists should be checked to assure that fastener suppliers on that list have been recently qualified/audited for adequacy of their quality programs.

ATTACHMENT G - FASTENERS (cont.)

2.0 Stainless Steel fasteners

2.1 Purpose

To provide follow-up information to the previous notification sent to the DOE field and contractor organizations in late 1996.

2.2 Background

In November 1993, the Industrial Fastener Institute (IFI) issued a Fastener Advisory regarding 18-8 stainless steel bolts. The advisory warned about a "bait and switch" tactic in which a distributor takes an 18-8 bolt (indicated by two radial lines 90 degrees apart), but no manufacturer's marking, and sells them as ASTM A320 Grade B8 bolts after hand-stamping B8 on to the heads.

As a result of this IFI Advisory, DOE sites conducted a search of facility stores for stainless steel fasteners with hand-stamped B8 grade marks. Hundreds of stainless steel bolts with hand-stamped B8 grade markings, along with a variety of other raised and depressed head and manufacturer's markings were identified in facility stores throughout the DOE complex.

For example, an inspection of shop stock at a Hanford Site facility revealed bolts with three different raised grade markings, 18-8, 304, and F593C, along with raised manufacturer's identifications of CK, H, HP, C, SO, CS, PMC, TH, THE, and a STAR. The majority of the remaining samples found at Hanford exhibited raised grade markings of 18-8 and 304, with a B8 grade marking and manufacturer's identification hand-stamped into the head of the bolt.

Finally, a few samples did not display any manufacturer's markings. Most of the bolts discovered were purchased with the specification to meet a national consensus standard, American Society for Testing and Materials (ASTM) A193, B8 Class 1 rather than the ASTM A320 standard discussed in the IFI warning.

The Savannah River Site also conducted a site-wide search of facility stores with similar results. A total of 159 stainless steel fasteners with hand-stamped B8 grade marks and raised or hand-stamped manufacturer's symbols were found. Fifteen stainless steel fasteners that had no manufacturer's symbol were also found.

ATTACHMENT G - FASTENERS (cont.)

2.3 Issue

The requirements of the ASTM A193 standard regarding fastener marking and certification are very similar those required by the ASTM A320 standard discussed in the IFI advisory. The ASTM A193 standard requires that grade and manufacturer's identification symbols be applied to the heads of bolts that are larger than 1/4" in diameter. The standard, however, does not specifically differentiate between raised and depressed headmarkings, but states only that "for the purposes of identification marking, the manufacturer is considered the organization that certifies the fastener was manufactured, sampled, tested, inspected in accordance with this specification." In other words, the standard allows for some of the required markings to be formed into the head of the bolt (either raised or lowered) during manufacturing, and the rest to be applied later on via hand-stamping.

Since ASTM A193 does not differentiate between raised and depressed markings, these fasteners can be counterfeited in the same way as the ASTM A320 fasteners discussed in the November 1993 IFI warning. For example, distributors can procure 18-8 stainless steel bolts that were manufactured by an anonymous party, and without conducting the necessary upgrading process or certification testing, a second party could hand-stamp B8 and a manufacturer's marking into the heads to indicate that the fasteners exhibit the mechanical and chemical properties required of ASTM A193Grade B8 Class 1.

Unless the certification documentation is specifically requested, and in most cases it is not, there is no way to determine by visual inspection whether these fasteners were properly certified and tested to meet the requirements of the ASTM standard.

ATTACHMENT H - DOE HEADMARK LIST

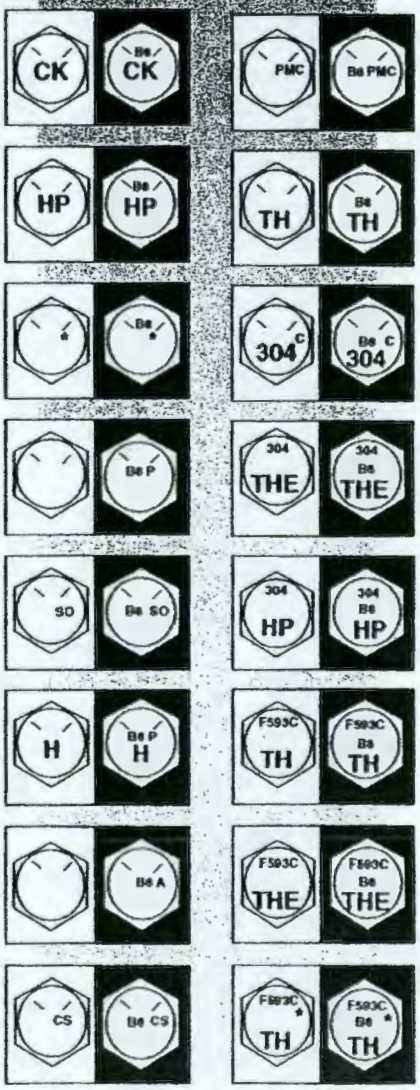
Help Stamp Out Suspects/Counterfeits

Suspect Stainless Steel Fastener Headmark List

Examples of stainless steel fasteners that have been upgraded from 18-8 to ASTM A320 or ASTM A193 Grade B8 after hand stamping. The last three examples show samples of fasteners to indicate conformance to two non-competible standards, ASTM A193 and ASTM F 593C.

Any bolt on this list should be treated as defective without further testing and process in accordance with HNF-PRO-301. Note: This list was originally Published by DOE /EH-0196, Issue No. 97-6

If any of these fasteners are located, contact your facility S/CI Point of Contact (POC) for instructions. The POC list is on the Hanford Intranet at: http://docs.ri.gov/han.info/hlanscl/hlanscl.doc. Scroll to the end of the document for the list.



ATTACHMENT H - DOE HEADMARK LIST (cont.)

Help Stamp Out Suspects/Counterfeits

Suspect Fastener Headmark List

All Grade 5 and Grade 8 fasteners of foreign origin which do not bear any manufacturers' headmarks:

Grade 5 Grade 8

Grade 5 fasteners with the following Manufacturers' headmarks:

Mark	Manufacturer	Mark	Manufacturer
J	Jinn Her (TW)	KS	Kosaka Kogyo (JP)

Grade 8 fasteners with the following Manufacturers' headmarks:

Mark	Manufacturer	Mark	Manufacturer
A	Asahi Mgf (JP)	KS	Kosaka Kogyo (JP)
NF	Nippon Fasteners (JP)	RT	Takai Ltd (JP)
H	Hinomoto Metal (JP)	FM	Fastener Co. of Japan (JP)
M	Minamida Sieybo (JP)	KY	Kyoei Mfg (JP)
MS	Minato Kogyo (JP)	J	Jinn Her (TW)
Hollow Triangle	Infasco (CA, TW, JP, YU) (Greater than 1/2-inch diameter Grade 8 Hollow Triangle only)		
E	Daiei (JP)	UNY	Unybite (JP)

Grade 8.2 fasteners with the following headmarks:

Mark	Manufacturer
KS	Kosaka Kogyo (JP)

Grade A325 fasteners (Bennett Denver target only) with the following headmarks:

	Mark	Manufacturer
Type 1	A325 KS	Kosaka Kogyo (JP)
Type 2		
Type 3		

Key: CA-Canada, JP-Japan, TW-Taiwan, YU-Yugoslavia

Any bolt on this list should be treated as defective without further testing.

ATTACHMENT I - REFURBISHED MOLDED CASE CIRCUIT BREAKERS

Investigations thus far of electrical components at DOE facilities uncovered over 700 suspect/ counterfeit molded-case circuit breakers that were previously used, refurbished and sold to DOE contractors.

1. Recognition Factors

The following factors should be recognized regarding suspect or refurbished circuit breakers:

A. The quality and safety of refurbished molded-case circuit breakers is questionable since they are not designed to be taken apart and serviced or refurbished. There are no electrical standards established by Underwriters Laboratory (UL) for the refurbishing of molded-case electrical circuit breakers, nor are there any "authorized" refurbishes of molded case circuit breakers. Therefore, "refurbished" molded-case circuit breakers should not be accepted for use in any DOE facility.

B. One source of refurbished molded-case circuit breakers is from the demolition of old buildings. Some refurbishes are junk dealers who may change the amperage labels on the circuit breakers to conform to the amperage ordered and then merely clean and shine the breakers.

This situation was brought to DOE's attention by the Nuclear Regulatory Commission (NRC), which, in turn, had been informed of the practice by the company that manufactures circuit breakers. In early 1988, a sales representative identified "refurbished" circuit breakers at Diablo Canyon Nuclear Power Plant. A subsequent investigation confirmed that circuit breakers sold to the power plant as new equipment were actually refurbished. The managers of the two firms that refurbished and sold these breakers have been convicted of fraud and have paid a substantial fine.

C. NRC published information Notice No. 88-46 dated July 8, 1988, on the investigation findings and circulated it to all applicable government agencies, including DOE. On July 20, 1988, DOE notified all field offices that refurbished circuit breakers may have been installed in critical systems. Shortly thereafter, DOE established the Suspect Equipment Notification System (SENS), a sub-module of ES&H Events and News on the Safety Performance Measurement System (SPMS). SENS has since been replaced by the Supplier Evaluation and Suspect Equipment (SESE) sub-module which includes Suspect Equipment Reports.

D. Some of DOE's older sites have circuit breakers in use that are no longer manufactured. According to the Nuclear Management and Resources Council (NUMARC), examples of such breakers are Westinghouse breakers with frames E, EA, F, and FA. If a DOE contractor has an electrical box that requires a breaker with one of these frame sizes, that contractor would not have been able to purchase it from Westinghouse for several years. If the contractor were to order a replacement breaker from an authorized Westinghouse dealer, the dealer could not get a new replacement breaker from the manufacturer. To fill the order, the dealer had to turn to the secondary or refurbished market.

ATTACHMENT I - REFURBISHED MOLDED CASE CIRCUIT BREAKERS (cont.)

Dealing with an authorized distributor does not preclude ending up with refurbished circuit breakers. Westinghouse has announced that it is considering satisfying this market by manufacturing circuit breakers that will fit in these applications.

The solution, as recommended by NUMARC, is not to focus on the credentials of the distributor but on the traceability of the circuit breaker itself. A purchaser can be assured of having a new circuit breaker only if the breaker can be traced back to the original manufacturer.

2. Indicators of Refurbished Breakers

Typically, refurbished circuit breakers sold as new equipment have one or more of the following characteristics:

- The style of breaker is no longer manufactured.
- The breakers may have come in cheap, generic-type packaging instead of in the manufacturer's original boxes.
- Refurbished circuit breakers are often bulk-packaged in plastic bags, brown paper bags, or cardboard boxes with handwritten labels. New circuit breakers are packed individually in boxes that are labeled with the manufacturer's name, which is usually in two or more colors, and are often date stamped.
- The original manufacturer's labels and/or the Underwriter's Laboratory (UL) or Factory Mutual (FM) labels may have been counterfeited or removed from the breaker. Refurbishing operations have been known to use copying machines to produce poor quality copies of the original manufacturer's and the certifying body's labels.
- Breakers may be labeled with the refurbisher's name rather than the label of a known manufacturer.
- The manufacturer's seal (often multicolored) across the two halves of the case of the breaker is broken or missing.
- Wire lugs (connectors) show evidence of tampering.
- The surface of the circuit breaker may be nicked or scratched yet have a high gloss. Refurbishers often coat breakers with clear plastic to produce a high gloss that gives the casual observer the impression that the breaker is new. The plastic case of new circuit breakers often have a dull appearance.
- Some rivets may have been removed and the case may be held together by wood screws, metal screws, or nuts and bolts.

ATTACHMENT I - REFURBISHED MOLDED CASE CIRCUIT BREAKERS (cont.)

- Contradictory amperage ratings may appear on different parts of the same refurbished breaker. On a new breaker, the amperage rating is stamped into, raised from, or machine-painted on the handle of the circuit breaker. In order to supply a breaker with a hard-to-find rating, refurbishers have been known to file down the surface of the handle to remove the original rating and hand-paint the desired amperage rating.

3. Testing

In a news release dated February 6, 1989, the National Electrical Manufacturers Association (NEMA) announced the cancellation of its Publication AB-2-1984 entitled, "Procedures for Field Inspection and Performance Verification of Molded-Case Circuit Breakers used in Commercial and Industrial Applications," and stated the following:

"These procedures were intended for use with breakers that had been originally tested and calibrated in accordance with NEMA Standards Publication AB 1 or Underwriters Laboratories Standard UL 489, and not subsequently opened, cleaned or modified...Therefore, the Standards Publication contained none of the destructive test procedures...necessary to verify the product's ability to withstand such conditions as full voltage overload or short circuit. Without such tests, even if a rebuilt breaker had passed the tests specified in AB-2, there would be no assurance that it would not fail under overload or short circuit conditions. It is NEMA's position that regardless of the results of electrical testing, refurbished electrical circuit breakers are not reliable and should not be used."

4. Precautions

Follow these precautions regarding suspect or refurbished circuit breakers.

A. Require that molded-case breakers be new and unaltered. Proof that they are new and unaltered requires the vendor to show traceability back to the original manufacturer.

B. Do not rely completely on dealing with authorized dealers for protection from purchasing refurbished molded-case circuit breakers.

C. Approve formal procedures for inspecting circuit breakers that are received and installed according to the indicators of refurbished breakers listed above.

D. Contact the original manufacturer if any indication of misrepresentation is encountered. There are many original manufacturers of molded-case circuit breakers whose products are being refurbished and sold as new. These manufacturers have the most specific information about how to ensure that their products have not been refurbished.

ATTACHMENT I - REFURBISHED MOLDED CASE CIRCUIT BREAKERS (cont.)

5. Disposition

A. Segregate and retain all circuit breakers found with indications that they may be refurbished. These will be retained as potential evidence until specifically released by the Office of Inspector General and the Office of Nuclear Safety for Price Anderson Enforcement. Circuit breakers that may be refurbished may only be disposed of when the above organizations no longer need them as evidence.

B. Report suspect electrical components to Occurrence Reporting and Processing System (ORPS). The ORPS categorization group should be identified as "Cross-Category items, Potential Concerns or issues." The description of cause section in the ORPS report should included the text "suspect counterfeit parts."

C. Witness and document the destruction of all suspect/counterfeit circuit breakers when approval is given for disposal.

ATTACHMENT J - ASSESSMENT/SURVEILLANCE LINES OF INQUIRY

1. S/CI processes and other S/CI related processes are effective in addressing the safety-related aspects of S/CI.

2. Formal supplier qualification and re-qualification processes are established and implemented, including routine collection of evaluations of feedback on vendor performance.

3. Controls are established on a graded basis that considers the risks involved and historical experience with S/CIs.

4. Controls are implemented for segregation and separate storage of material identified as suspect/counterfeit

5. Subcontractors have established and implemented sufficient controls to preclude an introduction or use of S/CIs. These controls address construction materials, maintenance or modification equipment and components, and the use subcontractor owned or rented equipment (cranes, hoists, etc.) on site.

6. S/CI processes, requirements, and controls are fully integrated into Integrated Safety Management (ISM) and quality assurance programs and procedures, e.g, training, procurement, maintenance, and assessment) to ensure adequate linkage to S/CI elements.

7. Expectations are established for timeliness in determining whether nonconforming items are S/CI.

8. Protocols are established for clearly identifying S/CIs that are determined to be acceptable for use

9. Inspections for S/CI materials are incorporated into routine maintenance activities, and clear guidance is provided for the disposition of installed S/CI materials identified during routine inspections and maintenance activities.

10. Expectations for S/CI controls are integrated within existing processes, such as routine and special inspections for S/CIs in site procedures, and guidance is provided for performing such inspections.

11. Roles and responsibilities and interfaces for management of S/CIs are clearly assigned, including provisions for the handling of sensitive information and interfacing with the local Office of the Inspector General (IG), to ensure effective, consistent, and timely communication of S/CI information.

12. S/CI reporting requirements are effectively integrated into the site contractors' processes for disposition of non-conforming items, such as NCR processes, as required by appropriate DOE directives.

13. Lessons learned processes are evaluated to determine whether all available and relevant information resources, such as the Government Industry Data Exchange Program (GIDEP), are being utilized for screening S/CI and other relevant information for potential applicability to site activities.

ATTACHMENT J – ASSESSMENT/SURVEILLENCE LINES OF INQUIRY (cont.)

14. Lessons learned processes are evaluated to ensure that significant requirements and performance expectations have been established for the documentation of applicability reviews, needed actions, and actions taken for lessons learned that require line management attention and action.

15. Lessons learned requiring line management actions are integrated with the site's corrective action management processes to ensure formal tracking, feedback, and closure of actions taken.

16. Corrective actions and management procedures include formal linkage to S/CI reporting requirements for the site office, Occurrence Reporting System (ORPS), contractor General Counsel, and the IG.

17. Site mechanisms, such as a controlled product list, are established and used to maintain current and accurate information on S/CIs. Provisions are available for making this list readily available to site personnel who have S/CI responsibilities for procurement, inspection, and other areas associated with the implementation of S/CI controls.

18. S/CI training programs include the identification of positions and associated personnel required to receive training, the processes for designating those personnel who must receive initial and refresher training, and the required frequencies for refresher training.

19. All personnel involved in design, system engineering, procurement, inspection, maintenance, and other functions involving potential S/CI materials receive S/CI process and hands-on training.

20. Training programs place special emphasis on ensuring that system engineers involved in the design, procurement, and inspection of materials and components with the potential for S/CI receive such training.

21. Subcontractors involved in the procurement or handling of potential S/CI materials and components receive initial and refresher training and are knowledgeable of site S/CI processes, procedures, requirements and controls.

22. S/CI training addresses site-specific processes and procedures for identifying, dispositioning, and reporting S/CIs, including reporting to the IG.

23. S/CI processes are subject to regular self-assessment, consistent with site self-assessment protocol.

24. Assessments are performed for S/CI processes to evaluate significant changes to the S/CI processes and to establish a baseline for implementation where appropriate. Based on that baseline review, further assessments are tailored to the maturity of the S/CI processes.

25. S/CI lines of inquiry are considered and evaluated, as appropriate, during assessments of areas that interface with S/CI processes (procurement process, NCR process, etc.).

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TECHNICAL SPECIFICATION

The document revision number is indicated below. Please replace all revised pages of this document and destroy the superseded copies.

PROJECT:	Final DBVS Design	145579-D-SP-006	REV. 2
PROJECT NO:	145579	DRYER AND CONDENSATE RECOVERY SYSTEM SKID	
CLIENT:	AMEC E&E - Richland, Washington		

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Date: 12/17/2004

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Project Manager: [illegible]

Date: 12/30/04

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Original Approvals On File

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Date: 12/16/04

Discipline Lead: [illegible]

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Date:		Date:	
Q.A. Rep.:		Discipline Lead:	
Date:		Date:	
CLIENT APPROVAL (CH2M HILL)		Originator:	
Project Manager:		Date:	
Date:			

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TECHNICAL SPECIFICATION

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PROJECT NO.:	145579	DRYER AND CONDENSATE RECOVERY SYSTEM SKID	
CLIENT:	AMEC E&E - Richland, Washington		

TABLE OF CONTENTS

Page

1 SCOPE 8
1.1 INCLUDED IN SCOPE 8
1.2 NOT INCLUDED IN SCOPE 11

2 APPLICABLE DOCUMENTS 12
2.1 GOVERNMENT DOCUMENTS 12
2.2 NON-GOVERNMENT DOCUMENTS 12

3 TECHNICAL REQUIREMENTS 20
3.1 ITEM DEFINITION 20
3.1.1 Item Diagram 21
3.1.2 Interface Definition 23
3.2 CHARACTERISTICS 33
3.2.1 Functional Characteristics 33
3.2.2 Physical Characteristics 39
3.2.3 Reliability 39
3.2.4 Maintainability 40
3.2.5 Environment 41
3.2.6 Transportability and Storage 43
3.2.7 Safety 44
3.3 DESIGN AND CONSTRUCTION 45
3.3.1 Components/Materials/Processes 45
3.3.2 Industry and Government Standards 100
3.3.3 Radiation 103
3.3.4 Cleanliness 104
3.3.5 Corrosion of Parts 105
3.3.6 Protective Coatings 105
3.3.7 Interchangeability 107
3.3.8 Identification and Marking 107
3.3.9 Nameplates 111
3.3.10 Human Engineering 111
3.3.11 Qualification 111
3.3.12 Document Submittal 112
3.3.13 Personnel and Training 116

4 QUALITY ASSURANCE REQUIREMENTS 117
4.1 GENERAL 117
4.1.1 Design 117
4.1.2 Procurement Document Control 117
4.1.3 Instructions, Procedures, and Drawings 120
4.1.4 Identification and Control of Items 120

TECHNICAL SPECIFICATION

PROJECT:	Final DBVS Design	145579-D-SP-006	REV. 1
PROJECT NO.:	145579	DRYER AND CONDENSATE RECOVERY SYSTEM SKID	
CLIENT:	AMEC E&E - Richland, Washington		

4.1.5 Control of Processes 121
4.1.6 Verification and Verification Methods 122
4.1.7 Test Control 123
4.1.8 Control of Measuring and Test Equipment 124
4.1.9 Handling, Storage, and Shipping 125
4.1.10 Inspection, Test, and Operating Status 125
4.1.11 Control of Nonconforming Items 125
4.1.12 Corrective Action 126
4.1.13 Quality Assurance Records 127
4.1.14 Control of Graded Fasteners 127
4.2 INSPECTIONS AND TESTS 127
4.2.1 General Requirements 128
4.2.2 Nondestructive Examinations 128
4.2.3 Leak Test 129
4.2.4 Equipment Test 129
4.2.5 Instrument Testing Requirements 130
4.2.6 Final Test and Inspection 131
4.2.7 Factory Acceptance Testing 131
4.2.8 Electrical Test 132
4.2.9 Lift Test 135
4.2.10 Filter Housing Testing 136
4.2.11 Exhaust Duct Testing 137
4.2.12 Heat-Trace Check 138
4.2.13 Inspections 138

5 PREPARATION FOR DELIVERY 139
5.1 GENERAL 139
5.1.1 Packaging and Shipping Instruction Manual 139
5.1.2 Operation and Maintenance Manual 139
5.2 PRESERVATION AND PACKAGING 140
5.3 PACKING 140
5.4 MARKING AND LABELING 143
5.5 HANDLING 143
5.6 SHIPPING 143
5.7 RECEIVING 143

6 NOTES 145

7 APPENDICES 146

TECHNICAL SPECIFICATION

PROJECT:	Final DBVS Design	145579-D-SP-006	REV. 1
PROJECT NO.:	145579	DRYER AND CONDENSATE RECOVERY SYSTEM SKID	
CLIENT:	AMEC E&E - Richland, Washington		

APPENDICES

A Drawings and Sketches

B Dryer and Condensate Recovery System Hydraulic Model Information

C Data Sheets

D TFC-ESHQ-Q_C-C-03, Revision B, *Control of Suspect/Counterfeit Items*

E Request for Information

F Bidder's Drawing and Data Commitments

G Instrumentation Naming and Tagging Convention

FIGURES

Figure 3-1: Dryer and Condensate System Interface Diagram 22

Figure 3-2: Interface Panel Wiring to Instrument/ Component Drawing (Example) 90

TABLES

Table 2-1: Government Documents 12

Table 2-2: Non-Government Documents 12

Table 3-1: Dryer and Condensate Recovery System Skid Connection Point Descriptions 24

Table 3-2: Assembled System Environmental Conditions 42

Table 3-3: Waste Stream Properties at the Dryer and Condensate Recovery System Skid Assembly 42

Table 3-4: Chemical Composition of the Waste 43

Table 3-5: Insulating Material Specifications 55

Table 3-6: Heat Trace 76

Table 3-7: Wire Color Coding Requirements 85

Table 3-8: Major Equipment Approximate Dead Loads 92

Table 3-9: Operating Loads 93

Table 3-10: Standard Drawing Dimension Tolerances 100

Table 3-11: Secondary Confinement Enclosure Hose-In-Hose Transfer Line Connector Design Loads 101

Table 3-12: Skid Assembly Hose-In-Hose Transfer Line Connector Design Loads 102

Table 3-13: Pipe Labeling Format 109

ABBREVIATIONS AND ACRONYMS

AATCC	American Association of Textile Chemists and Colorists
AISC	American Institute for Steel Construction
AISI	American Iron and Steel Institute
ANSI	American National Standards Institute, Inc.
ARI	Air-Conditioning and Refrigeration Institute
ASCE	American Society of Civil Engineers
ASHRAE	American Society of Heating, Refrigeration, and Air Conditioning Engineers
ASME	American Society of Mechanical Engineers
ASNT	American Society of Nondestructive Testing
ASTM	American Society for Testing and Materials
AWG	American wire gauge
AWS	American Welding Society
B&PV	Boiler and Pressure Vessel
Btu	British thermal unit
CFR	*Code of Federal Regulations*
CH2M HILL	CH2M HILL Hanford Group, Inc.
CMTR	Certified Material Test Report
CoC	Certificate of Conformance
CWI	Certified Welding Inspector
DBVS	Demonstration Bulk Vitrification System
DCRS	Dryer and Condensate Recovery System
DOE	U.S. Department of Energy
ERDA	Energy Research and Development Administration
FAT	Factory Acceptance Test
HEPA	High-Efficiency Particulate Air
HIHTL	hose-in-hose transfer line

IEEE	Institute of Electrical and Electronics Engineers, Inc.
IESNA	Illuminating Engineering Society of North America
ISO	International Organization for Standardization
MCS	Monitoring and Control System
MSS	Manufacturing Standardization Society of the Valve and Fittings Industry, Inc.
NCR	nonconformance report
NDE	Nondestructive Examination
NEC®	*National Electric Code*
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
NIST	National Institute of Standards and Technology
NRTL	Nationally Recognized Testing Laboratory
OGTS	Off-Gas Treatment System
P&ID	Piping And Instrumentation Diagram
QA	quality assurance
SAE	Society of Automotive Engineers
SMACNA	Sheet Metal and Air Conditioning Contractors National Association
UBC	Uniform Building Code
UL	Underwriters Laboratories, Inc.

TRADEMARKS

Armaflex	Registered trademark of Armacell UK Limited Corporation.
AutoCAD	Registered trademark of AutoDesk, Inc.
Buna N	Registered trademark of Buna Werke Huls G.m.b.h.
Chromalox	Registered trademark of Emerson Electric Company [Edwin L Wiegand Company Corporation (Registrant)].
Dixon	Registered trademark of Dixon Valve and Coupling Company.
Electromark	Registered trademark of Permar Systems, Incorporated dba Electromark Company.
Flanders BF Series	Trademark of Flanders Corporation

TECHNICAL SPECIFICATION

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CLIENT:	AMEC E&E - Richland, Washington		

Flanders G Series	Trademark of Flanders Corporation.
Flanders GG-F Fluid Seal	Trademark of Flanders Corporation.
Hansen	Registered trademark of Tuthill Corporation [Hansen Manufacturing Company (Registrant)].
Keystone	Trademark of Tyco Industries.
LineBacker	Registered trademark of Professional Services Industries, Inc.
Loctite	Registered trademark of Henkel Loctite.
Mini Power-Zone	Registered trademark of Square D Company Corporation.
NEC	Registered trademark of the National Fire Protection Association.
Raychem	Registered trademark of Raychem Corporation.
Ruskin	Registered trademark of Ruskin Manufacturing Company.
Square D	Registered trademark of Square D Company Corporation.
Sta-kon	Registered trademark of Thomas & Betts Corporation.
Teflon	Registered trademark of E.I. Du Pont De Nemours and Company.
Thermon	Registered trademark of Thermon Manufacturing Company.
Viton	Registered trademark of DuPont DOW Elastomers.
W. E. Anderson	Registered trademark of Dwyer Instruments, Inc. (Registrant).
Weidmüller	Registered trademark of C. A. Weidmüller K.G. Company.

1 SCOPE

The Dryer and Condensate Recovery System (DCRS) skid assembly is a collection of equipment, instrumentation, valving, and piping connecting the DCRS to other external systems in the Demonstration Bulk Vitrification System (DBVS). The DBVS will receive radioactive liquid waste from underground storage tanks, mix the waste with glassformers while drying in the DCRS, then transport the dried waste to an in-container vitrification process where the dried waste will be melted into glass creating a stable waste form impermeable to leaching. The condensate recovered from the DCRS will be shipped to a liquid effluent treatment facility where it will be disposed.

This specification provides the minimum requirements for the design, fabrication, assembly, inspection, and testing of a DCRS skid assembly along with any special handling equipment required for shipping and deployment. The DCRS piping and instrumentation diagram (P&ID) for the DCRS is provided to the Seller for details of the DCRS assembly design. The Seller shall provide all labor, equipment, materials, and components necessary to fabricate one complete, fully functional, DCRS skid assembly.

1.1 INCLUDED IN SCOPE

The dryer, sintered metal filter, hydraulic power pack, and condensate recovery system will be delivered to the Seller as four individual components or skids complete with fabrication, inspection, testing, installation, and operation documentation. The purpose of this specification is for the Seller to design, procure, fabricate, install, inspect, and test the interconnecting piping, electrical and instrumentation wiring, and components between the individual dryer components and skids inside a Seller-provided enclosure known as the DCRS skid assembly. The Buyer will be responsible for piping and electrical components external to connect to the DCRS skid assembly.

The DCRS skid assembly, as provided by the Seller, shall include installation and/or fabrication of the following piping and components:

1. Custom International Organization for Standardization (ISO)-qualified enclosure with electrical and instrumentation junction cabinets and lighting;

2. Commercialy derived dryer (Buyer provided);

3. Sintered metal filter (Buyer provided);

4. Condensate recovery skid with condenser, condenser tank, and vacuum pump (Buyer provided);

5. Miscellaneous system piping including: Liquid salt waste inlet piping, dried waste discharge piping, liquid salt waste recycle piping, hydraulic supply and return piping, steam supply and return piping, chilled water supply and return piping, filtered water piping, compressed air piping, and off-gas piping;

6. Hose-in-hose transfer line (HIHTL) penetrations;

7. Pneumatic and manual valves;

8. Pressure instrumentation and calibration records;

9. Flow instrumentation and calibration records;

10. Field junction boxes for monitoring and control system connections;

11. Dryer vent high-efficiency particulate air (HEPA) filters;

12. Enclosure inlet and exhaust ventilation HEPA filters;

13. Steam traps, steam condensate collection tanks, and return pumps;

14. Pressure control and safety relief valves;

15. Dryer internal closed-circuit television camera installation;

16. Local pushbutton stations (motor starters are located remotely and are not in scope);

17. Disconnect switches shall be supplied in accordance with this specification, and they may be used for skid testing purposes, but final installation in the field shall be by the Buyer;

18. Fixed head air sampler: fixed head air sampling equipment shall be provided in accordance with this specification, but will be installed by the Buyer;

19. Air conditioning units;

20. Instrument termination panel; and

21. Hoisting/rigging plan and special tools apparatus.

The following work is included in this specification:

1. Develop DCRS skid assembly fabrication drawings and design documentation;

2. Perform fabrication, assembly, examination, inspection, testing, packaging, and shipping of one DCRS skid assembly; and

3. Develop a complete quality assurance (QA) data package for design and assembly of one DCRS skid assembly including, but not limited to, all required quality assurance/quality control inspection, testing, and delivery/inspection documentation as required by this specification. A complete documentation package as outlined in this specification must be provided with each shipment at time of delivery to the Hanford Site.

Drawings and sketches provided with this specification represent a minimum set of Buyer expectations for the assembled system. The Seller shall use this information, along with additional material in the specification, to generate a set of design and fabrication drawings with sufficient detail for construction. Examples of information to be developed by the Seller includes, but is not limited to, dimensioning and associated tolerances, mounting and weld details, and material types and quantities.

Component information provided on data sheets with this specification contain the critical characteristics identified by the Buyer for the assembled system. The Seller shall use this information, along with performance requirements, either in the specification or generated from Seller-prepared calculations, to generate a completed set of data sheets for components of the assembled system. Form, fit, and function shall be evaluated by the Seller in the course of design work and development of the design and fabrication drawings.

Unless otherwise stated, alternative equipment designs are permissible, if proven to be effective in meeting the requirements in this specification. Any alternative design must be thoroughly explained with text supplemented by drawings or sketches and proposed with the original bid. Buyer approval is required before proceeding with an alternative equipment design.

Any discrepancies noted in this specification, or between this specification and other documentation, shall be noted and referred to the Buyer for resolution before proceeding with design or fabrication of the item in question.

1.2 NOT INCLUDED IN SCOPE

Work not included in the scope of this specification is the fabrication and testing of the dryer, condensate recovery skid, dryer filter assembly, and the hydraulic power pack. These will be delivered to the Seller from the Buyer or Buyer's representative for Seller installation into the Seller-provided enclosure (see Section 1.1, Paragraph 1).

The DCRS requires an elevated platform to interface with systems underneath the dryer. This platform and the mounting of the DCRS skid assembly to its elevated platform is not included in the scope of this work.

Testing of this DCRS skid assembly is included in the scope of this specification, but the testing of the DCRS integrated with the DBVS is not.

The DCRS skid assembly leak detection and emergency lighting is not including in the scope of this specification. These items will be purchased and installed by the Buyer when the DCSR skid assembly arrives at the final destination.

2 APPLICABLE DOCUMENTS

The codes, standards, and other documents listed in Table 2-1 and Table 2-2 are of the latest issue and addenda in effect at the time of procurement (unless otherwise specified). These documents form a part of the basis of design for this procurement to the extent specified in the applicable sections of this specification. In the event of a conflict between documents referenced herein and the requirements of this specification, the requirements of this specification shall take precedence when the specification is more stringent. All conflicts, alternative standards, or omissions shall be brought, in writing, to the attention of the Buyer for resolution. Significant sections noted are not meant to negate the remainder of the specification, but to emphasize sections of greater importance.

2.1 GOVERNMENT DOCUMENTS

Table 2-1: Government Documents

Government Documents	Title
10 CFR 830	"Nuclear Safety Management," *Code of Federal Regulations*, as amended.
10 CFR 835	"Occupational Radiation Protection," Subpart K, *Code of Federal Regulations*, as amended.
29 CFR 1910	"Occupational Safety and Health Standards," *Code of Federal Regulations*, as amended.
47 CFR 15	"Radio Frequency Devices," *Code of Federal Regulations*, as amended.
DOE/RL-92-36	*Hanford Site Hoisting and Rigging Manual*, U.S. Department of Energy, Richland, Washington.

2.2 NON-GOVERNMENT DOCUMENTS

Table 2-2: Non-Government Documents (8 sheets)

Code/Standard	Title
AATCC Test Method 27	*Water Resistance: Hydrostatic Pressure Test*, American Association of Textile Chemists and Colorists, Research Triangle Park, North Carolina
AISC	*Manual of Steel Construction—Allowable Stress Design*, Ninth Edition, American Institute of Steel Construction, Chicago, Illinois.

Table 2-2: Non-Government Documents (8 sheets)

Code/Standard	Title
AISC	*Manual of Steel Construction—Load and Resistance Factor Design*, Third Edition, American Institute of Steel Construction, Chicago, Illinois.
AISI SG-2000-1	*Specification for the Design of Cold Formed Steel Structural Members with Commentary (Supplement No. 1 of the 1996 Specification)*, American Iron and Steel Institute, Washington, D.C.
ARI Standard 410	*Forced-Circulation Air-Cooling and Air-Heating Coils*, Air-Conditioning and Refrigeration Institute, Arlington, Virginia.
ANSI/AWS D1.3	*Structural Welding Code—Sheet Steel*, American Welding Society, Miami, Florida.
ANSI/IESNA RP-7	*Lighting Industrial Facilities*, Illuminating Engineering Society of North America, New York, New York.
ANSI C63.16	*American National Standard Guide for Electrostatic Discharge Test Methodologies and Criteria for Electronic Equipment*, American National Standards Institute, Washington, D.C.
ANSI Y14.1	*Drawing Sheet Size and Format*, American National Standards Institute, Inc., New York, New York.
ANSI Y14.5M	*Dimensioning and Tolerancing*, American National Standards Institute, New York, New York.
ASCE 4-98	*Seismic Analysis of Safety-Related Nuclear Structures*, American Society of Civil Engineers, Reston, Virginia.
ASCE 7-98	*Minimum Design Loads for Buildings and Other Structures*, American Society of Civil Engineers, Reston, Virginia.
ASHRAE Fundamentals Handbook	*2001 ASHRAE Handbook -- Fundamentals*, American Society of Heating, Refrigerating, and Air Conditioning Engineers, Atlanta, Georgia.
ASHRAE Standard 52.2	*Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size (ANSI approved)*, American Society of Heating, Refrigerating, and Air Conditioning Engineers, Atlanta, Georgia.
ASME B&PV Code	*ASME Boiler and Pressure Vessel Code*, American Society of Mechanical Engineers, New York, New York. Section VIII, "Rules for Construction of Pressure Vessels" Section IX, "Welding and Brazing Qualifications"

Table 2-2: Non-Government Documents (8 sheets)

Code/Standard	Title
ASME B16.5	*Pipe Flanges and Flanged Fittings*, American Society of Mechanical Engineers, New York, New York.
ASME B16.9	*Factory-Made Wrought Steel Buttwelding Fittings*, American Society of Mechanical Engineers, New York, New York.
ASME B16.11	*Forged Fittings, Socket Welding and Threaded*, American Society of Mechanical Engineers, New York, New York.
ASME B18.2.1	*Square and Hex Bolts and Screws Inch Series*, American Society of Mechanical Engineers, New York, New York.
ASME B18.2.2	*Square and Hex Nuts*, American Society of Mechanical Engineers, New York, New York.
ASME B30.20	*Below-the-Hook Lifting Devices*, American Society of Mechanical Engineers, New York, New York.
ASME B30.20a	*Addenda to Below-the-Hook Lifting Devices*, American Society of Mechanical Engineers, New York, New York.
ASME B31.1	*Power Piping*, American Society of Mechanical Engineers, New York, New York.
ASME B31.3	*Process Piping*, American Society of Mechanical Engineers, New York, New York.
ASME NQA-1, 1994*	*Quality Assurance Program Requirements for Nuclear Facilities*, American Society of Mechanical Engineers, New York, New York.
ASME N509	*Nuclear Power Plant Air-Cleaning Units and Components*, American Society of Mechanical Engineers, New York, New York.
ASME N510	*Testing of Nuclear Air Treatment Systems*, American Society of Mechanical Engineers, New York, New York.
ASME PCC-1	*Guidelines for Pressure Boundary Bolted Flange Joint Assembly*, American Society of Mechanical Engineers, New York, New York.
ASNT SNT-TC-1A	*Recommended Practice*, American Society of Nondestructive Testing, Columbus, Ohio.
ASTM A 36/A 36M	*Standard Specification for Carbon Structural Steel*, American Society of Testing and Materials, New York, New York.
ASTM A 53/A 53M	*Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless*, American Society of Testing and Materials, New York, New York.

Table 2-2: Non-Government Documents (8 sheets)

Code/Standard	Title
ASTM A 105/A 105M	*Standard Specification for Carbon Steel Forgings for Piping Applications*, American Society for Testing and Materials, West Conshohocken, Pennsylvania.
ASTM A 106	*Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service*, American Society for Testing and Materials, West Conshohocken, Pennsylvania.
ASTM A 108	*Standard Specification for Steel Bars, Carbon, Cold-Finished, Standard Quality*, American Society for Testing and Materials, West Conshohocken, Pennsylvania.
ASTM A 182/A 182M	*Standard Specification for Forged or Rolled Alloy-Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service*, American Society for Testing and Materials, West Conshohocken, Pennsylvania.
ASTM A 193/A 193M	*Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service*, American Society for Testing and Materials, West Conshohocken, Pennsylvania.
ASTM A 194/A 194M	*Standard Specification for Carbon and Alloy Steel Nuts for Bolts for High Pressure and High Temperature Service, or Both*, American Society for Testing and Materials, West Conshohocken, Pennsylvania.
ASTM A 234/A 234M	*Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service*, American Society for Testing and Materials, West Conshohocken, Pennsylvania.
ASTM A 240/A 240M	*Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications*, American Society for Testing and Materials, West Conshohocken, Pennsylvania.
ASTM A 269	*Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service*, American Society of Testing and Materials, New York, New York.
ASTM A 276	*Standard Specification for Stainless Steel Bars and Shapes*, American Society of Testing and Materials, New York, New York.

Table 2-2: Non-Government Documents (8 sheets)

Code/Standard	Title
ASTM A 307	*Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength*, American Society for Testing and Materials, West Conshohocken, Pennsylvania.
ASTM A 312/A 312M	*Standard Specification for Seamless and Welded Austenitic Stainless Steel Pipes*, American Society for Testing and Materials, West Conshohocken, Pennsylvania.
ASTM A 325	*Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength*, American Society for Testing and Materials, West Conshohocken, Pennsylvania.
ASTM A 403/A 403M	*Standard Specification for Wrought Austenitic Stainless Steel Piping Fittings*, American Society for Testing and Materials, West Conshohocken, Pennsylvania.
ASTM A 500	*Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes*, American Society for Testing and Materials, West Conshohocken, Pennsylvania.
ASTM A 563a	*Standard Specification for Carbon and Alloy Steel Nuts*, American Society for Testing and Materials, West Conshohocken, Pennsylvania.
ASTM A 569	*Standard Specification for Steel, Carbon (0.15 Maximum, Percent), Hot-Rolled Sheet and Strip Commercial*, American Society for Testing and Materials, West Conshohocken, Pennsylvania.
ASTM C 177	*Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded Hot-Plate Apparatus*, American Society for Testing and Materials, West Conshohocken, Pennsylvania.
ASTM C 518	*Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus*, American Society for Testing and Materials, West Conshohocken, Pennsylvania
ASTM D 1621	*Standard Test Method for Compressive Properties of Rigid Cellular Plastics*, American Society for Testing and Materials, West Conshohocken, Pennsylvania.
ASTM D 1622	*Standard Test Method for Apparent Density of Rigid Cellular Plastics*, American Society for Testing and Materials, West Conshohocken, Pennsylvania

Table 2-2: Non-Government Documents (8 sheets)

Code/Standard	Title
ASTM E 84	*Standard Test Method for Surface Burning Characteristics of Building Materials*, American Society for Testing and Materials, West Conshohocken, Pennsylvania.
ASTM E 96	*Standard Test Methods for Water Vapor Transmission of Materials*, American Society for Testing and Materials, West Conshohocken, Pennsylvania.
ASTM E 285	*Standard Test Method for Oxyacetylene Ablation Testing of Thermal Insulation Materials*, American Society for Testing and Materials, West Conshohocken, Pennsylvania.
ASTM F 436	*Standard Specification for Hardened Steel Washers*, American Society for Testing and Materials, West Conshohocken, Pennsylvania.
AWS D1.1/D1.1M	*Structural Welding Code—Steel*, American Welding Society, Miami, Florida.
AWS D1.6	*Structural Welding Code—Stainless Steel*, American Welding Society, Miami, Florida.
AWS D14.1	*Industrial & Mill Crane & Other Material*, American Welding Society, Miami, Florida.
AWS QC-1	*Standard for AWS Certification of Welding Inspectors*, American Welding Society, Miami, Florida.
ERDA 76-21	*Nuclear Air Cleaning Handbook*, Energy Research and Development Administration, Washington, D.C.
HNF-SD-GN-ER-501	*Natural Phenomena Hazards, Hanford Site, Washington*, Revision 1B, Westinghouse Hanford Company, Richland, Washington.
IEC 61000-4-2	*Electromagnetic Compatibility (EMC) – Part 4-2: Testing and Measurement Techniques – Electrostatic Discharge Immunity Test*, International Engineering Consortium, Chicago, Illinois.
IEEE C62.41.1	*IEEE Guide on the Surge Environment in Low-Voltage (1000 V and Less) AC Power Circuits*, Institute of Electrical and Electronics Engineers, New York, New York.
IEEE C62.41.2	*IEEE Recommended Practice on Characterization of Surges in Low Voltage (1000 V and Less) AC Power Circuits*, Institute of Electrical and Electronics Engineers, New York, New York.

Table 2-2: Non-Government Documents (8 sheets)

Code/Standard	Title
IEEE Std C37.90.2	*IEEE Standard for Withstand Capability of Relay Systems to Radiated Electromagnetic Interference from Transceivers*, Institute of Electrical and Electronics Engineers, New York, New York.
IEEE Std 43	*Recommended Practice for Testing Insulation Resistance of Rotating Machinery*, Institute of Electrical and Electronics Engineers, New York, New York.
IEEE Std 141	*IEEE Recommended Practice for Electric Power Distribution for Industrial Plants*, Institute of Electrical and Electronics Engineers, New York, New York.
IEEE Std 142	*IEEE Recommended Practice for Grounding of Industrial and Commercial Power Systems*, Institute of Electrical and Electronics Engineers, New York, New York.
IEEE Std 242	*IEEE Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems*, Institute of Electrical and Electronics Engineers, New York, New York.
IEEE Std 519	*Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems*, Institute of Electrical and Electronics Engineers, New York, New York.
IESNA HB-9	*IESNA Lighting Handbook*, 9th Edition, Illuminating Engineering Society of North America, New York, New York.
ISO 668	*Series 1 Freight Containers Classification, Dimensions and Ratings*, International Organization for Standardization, Geneva, Switzerland.
ISO 1161	*Series 1 Freight Containers -- Corner Fittings -- Specification*, International Organization for Standardization, Geneva, Switzerland.
ISO 1496-2	*Series 1 Freight Containers –Specification and Testing – Part 2: Thermal Containers*, International Organization for Standardization, Geneva, Switzerland.
MSS SP-67	*Butterfly Valves*, Manufacturing Standardization Society of the Valve and Fittings Industry, Inc., Vienna, Virginia.
NEMA MG-1	*Motors and Generators*, National Electrical Manufacturers Association, Rosslyn, Virginia.
NFPA 70	*National Electrical Code*, 2002 Edition, National Fire Protection Association, Quincy, Massachusetts.

Table 2-2: Non-Government Documents (8 sheets)

Code/Standard	Title
SMACNA	*Rectangular Industrial Duct Construction Standards*, Sheet Metal and Air Conditioning Contractors' National Association, Inc., Chantilly, Virginia. *Round Industrial Duct Construction Standards*, Sheet Metal and Air Conditioning Contractors' National Association, Inc., Chantilly, Virginia.
UBC, 1997	*1997 Uniform Building Code*, International Conference of Building Officials, Whittier, California.
UL-listed	*Electrical Appliance and Utilization Equipment Directory*, Underwriters Laboratories, Inc., Northbrook, Illinois.
UL 508A	*Standard for Industrial Control Panels*, Underwriters Laboratories, Inc., Northbrook, Illinois.
* NQA-1 (the relevant requirements of NQA-1 are included in Section 4).	

3 TECHNICAL REQUIREMENTS

The following sections and subsections provide the item definition, critical characteristics of the item, design, and construction requirements for the system and components.

3.1 ITEM DEFINITION

The DCRS skid assembly is comprised of four major elements: (1) the dryer, the sintered metal filter, and the condensate recovery skid (all Buyer provided); (2) a piping system with pumps, tanks, piping, valves, and instrumentation; (3) a custom insulated freight container or enclosure into which the dryer, sintered metal filter, condensate recovery skid and interfacing piping system will be mounted and secured; and (4) a buyer-provided hydraulic power pack. Functionally, the DCRS skid assembly will provide the waste dewatering and condensate collection for the DBVS process. The DCRS skid assembly contains instruments to monitor the flow, pressure, and other physical characteristics of the processes and processed fluids. The functions of the enclosure include secondary confinement for the liquid and dried waste, primary support for transportation and movement, and interface connections between the DCSR skid assembly and other DBVS systems.

The DCRS receives waste solution from the liquid waste pump skid through a HIHTL connected to the DCRS skid assembly and into a circulation manifold internal to the DCRS skid assembly. The manifold will provide a waste solution bleed to be directed into the dryer waste feed ports. The manifold returns the non-bleed or full circulation liquid waste flow to an outlet HIHTL connection point and back to the waste staging tanks. The DCRS also accepts additives from the soil and glassformer impingement tanks and mixes the waste solution/additive mixture in the dryer and dries the mixture to a predetermined moisture content and particle size. The DCRS skid assembly then discharges the dried waste through a hemispherical valve (provided by the Buyer as an integral part of the dryer) to the waste transfer feed silo. The process condensate is pumped from the condensate recovery skid to the secondary waste pump skid through double-contained piping or HIHTLs. The DCRS interfaces with many subsystems in the DBVS and cannot operate without support systems such as:

1. Chilled Water System to supply cool water to the DCRS condenser and enclosure air conditioning unit;

2. Steam Supply System for supplying steam to the dryer and getting steam condensate returned from the DCRS skid assembly;

3. Compressed Air System for filter back pulsing and pneumatic valve operation;

4. Filtered Water System for decontamination and system clean out;

5. Off-Gas Treatment System (OGTS) for handling the exhaust of the vacuum pump and ventilation of the DCRS enclosure to maintain a reasonable temperature for instrument operation;

6. Electrical Distribution System for system electrical power;

7. Leak Detection System for liquid leak detection; and

8. Monitoring and Control System (MCS) to provide system monitoring and control.

3.1.1 Item Diagram

Figure 3-1 provides a basic item and interface diagram. More detailed drawings are provided in Appendix A for specific connection point interfaces along with those interfaces defined in Section 3.1.2.

The DCRS skid assembly shall be designed in accordance with Drawings F-145579-00-A-0099 and F-145579-00-A-0100 and Sketches DBVS SK-P004 and DBVS-SK-P005 (Appendix A).

Drawings 056-001-2-010, 2004195-D[1] and F-145579-00-B-0008, F-145579-00-B-0009, and Sketches DBVS-SK-E003, DBVS-SK-M103, and DBVS-SK-M109 are provided for use as specified herein and for design concept information only (Appendix A). The DCRS skid assembly design shall not be constrained by these drawings, except for critical mechanical and electrical interfaces and critical dimensions

[1] This system is described in this specification as the Condensate Recovery System.

TECHNICAL SPECIFICATION

PROJECT:	Final DBVS Design	145579-D-SP-006	REV. 2
PROJECT NO.:	145579	DRYER AND CONDENSATE RECOVERY SYSTEM SKID	
CLIENT:	AMEC E&E - Richland, Washington		

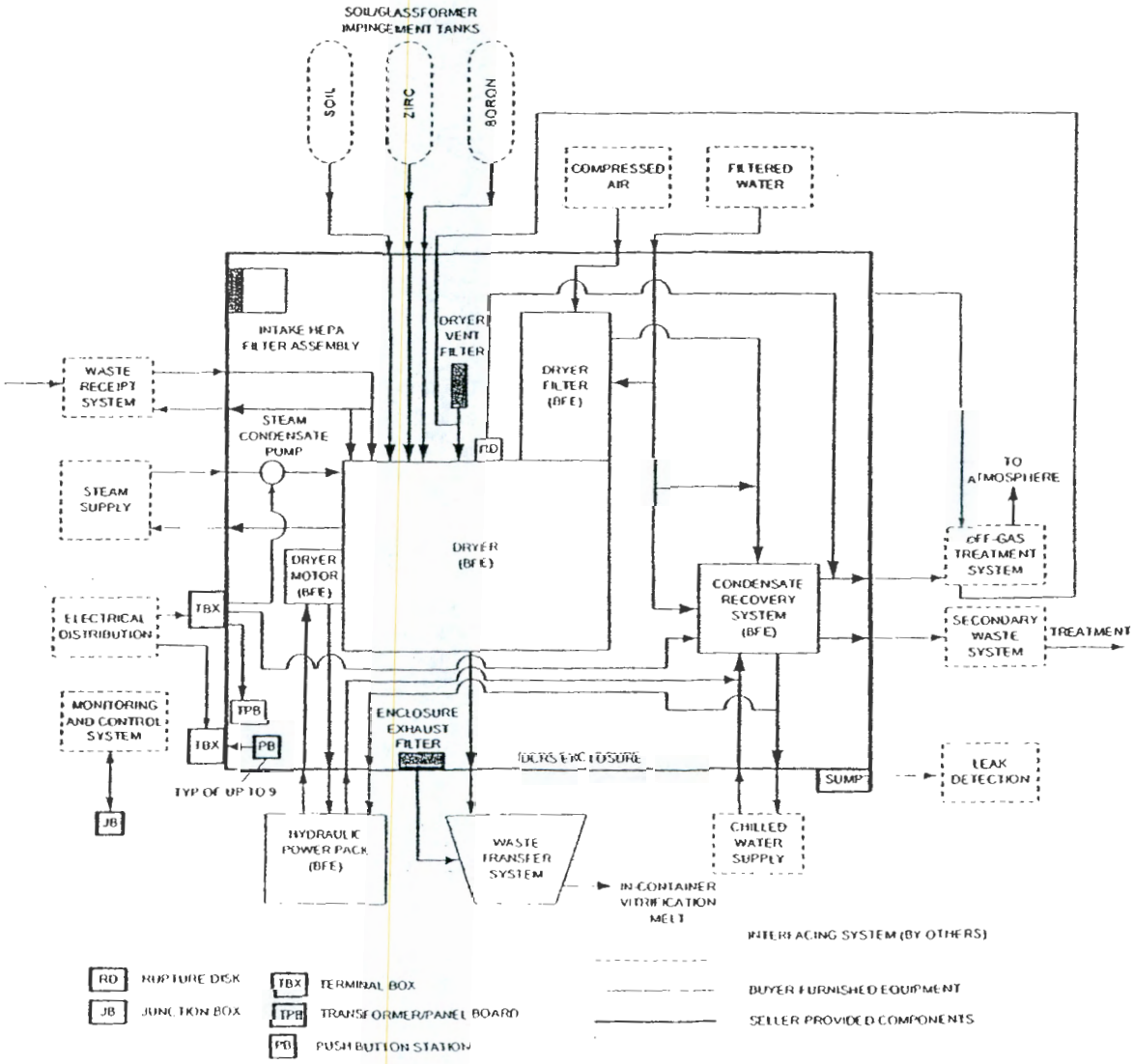

Figure 3-1: Dryer and Condensate System Interface Diagram

3.1.2 Interface Definition

The DCRS interfaces with many of the systems in the DBVS project including liquid waste pump skid, Secondary Waste System, soil and glassformer impingement tanks, Waste Transfer System feed silo, Off-Gas Treatment System, Compressed Air System, Filtered Water System, Chilled Water System, and Steam Supply System, along with several interface points internal to the DCRS skid assembly. Drawing 056-001-2-010 (Appendix A), provides the details of the dryer mating connections and mounting details for the appropriate interfaces.

The DCRS skid assembly shall also incorporate the capabilities to accommodate all interface requirements for the process, Electrical Distribution System, and Monitoring and Control System as defined in the following sections.

3.1.2.1 Process Connection Interfaces

Table 3-1 defines the various connection points and each physical interface, which constitutes the primary interfaces between the outside systems with the enclosure and process piping and equipment inside the DCRS skid assembly. Section 3.3 establishes the design parameters for these interfaces and the piping internal to the DCSR skid assembly.

3.1.2.2 Electrical Distribution Interface

Seller-supplied drawings showing equipment layout and wiring diagrams shall be provided in accordance with Appendix A. Sketch DBVS-SK-E003 is a preliminary one-line diagram for reference purposes.

Table 3-1: Dryer and Condensate Recovery System Skid Connection Point Descriptions (8 Sheets)

Connection Point Number	System Interface	Description	Connection Type and Design Conditions
CP-301	LWPS and DCRS	Waste solution recirculation inlet line	Connection Type: 2-in. HIHTL connection River Bend Part No. JBW6-8 [refer to Sketches DBVS-SK-M103 (Type I) for fabrication and DBVS-SK-M109 for location (Appendix A)]. Design Conditions: • Maximum normal condition of 70 gal/min. • Design pressure of 125 psig at 150 °F.
CP-302	LWPS and DCRS	Waste solution recirculation outlet line	Connection Type: 2-in. HIHTL connection River Bend Part No. JBW6-8 [refer to Sketches DBVS-SK-M103 (Type I) for fabrication and DBVS-SK-M109 for location (Appendix A)] Design Conditions: • Maximum normal condition of 70 gal/min. • Design pressure of 125 psig at 150 °F.
CP-303 and CP-303A	DCRS and SWS	Secondary waste pump out line	Connection Type: CP-303 – 2-in. HIHTL connection River Bend Part No. JBW6-8 [refer to Sketches DBVS-SK-M103 (Type I) for fabrication and DBVS-SK-P005 for location (Appendix A)] CP-303A – 1-1/2-in. 150-lb RF ASME B16.5[(a)] flange. Note: This requires modification of the Buyer-provided equipment from threaded flange connection to a welded flange connection Design Conditions: • Maximum normal condition of 25 gal/min at 15 psig and 100 °F. • Design pressure of 125 psig at 150 °F.

Table 3-1: Dryer and Condensate Recovery System Skid Connection Point Descriptions (8 Sheets)

Connection Point Number	System Interface	Description	Connection Type and Design Conditions
CP-309	SSS and DCRS	Steam supply inlet line	Connection Type: 6-in. 150-lb RF ASME B16.5[a] flange [refer to Sketches DBVS-SK-P004 and DBVS-SK-M109 for location (Appendix A)]. Design Conditions: • Maximum normal condition of 2,000 lb/h at 15 psig and 250 °F • Design pressure of 75 psig at 300 °F.
CP-310	SSS and DCRS	Steam condensate return line	Connection Type: 1-in. 150-lb RF ASME B16.5[a] flange [refer to Sketch DBVS-SK-P004 for location (Appendix A)]. Design Conditions: • Maximum normal condition of 5 gal/min at 15 psig and 250 °F • Design pressure of 125 psig at 300 °F.
CP-311A and CP-311B	SGIT and DCRS	Glassformer addition port	Connection Type: 4-in. 150-lb RF ASME B-16.5[a]. Design Conditions: • Design pressure 15 psig to full vacuum.
CP-312	SGIT and DCRS	Soil addition port line	Connection Type: 16-in. 150 lb RF ASME B16.5[a] flange [refer to Sketches DBVS-SK-P004 and DBVS-SK-M109 for location (Appendix A)]. Design Conditions: • 16 in. diameter (minimum) • Design pressure of 15 psig to full vacuum.

Table 3-1: Dryer and Condensate Recovery System Skid Connection Point Descriptions (8 Sheets)

Connection Point Number	System Interface	Description	Connection Type and Design Conditions
CP-314	DCRS and OGTS	Skid assembly exhaust ventilation	Connection Type: 6-in. plate flange drilled to ASME B16.5[a] 150-lb hole pattern [refer to Sketch DBVS-SK-P004 for location (Appendix A)]. Design Conditions: • Design pressure of minus 5 psig.
CP-315	DCRS and OGTS	OGTS filter dust return	Connection Type: 3-in. 150-lb RF ASME B16.5[a] flange [refer to Sketch DBVS-SK-P004 for location (Appendix A)] 6-in secondary containment flange. Design Conditions: • 3 in. diameter (minimum). • Design pressure of 15 psig to full vacuum.
CP-316 and CP-316A	DCRS and WTS	Dried waste discharge line	Connection Type: 20-in. 150-lb RF ASME B16.5[a] flange [refer to Sketch DBVS-SK-P004 for location (Appendix A)]. Design Conditions: • Design pressure of 15 psig to full vacuum.
CP-318 and CP-318A	DCRS and OGTS	Vacuum pump discharge line	Connection Type: CP-318 – 1-1/2 in. 150-lb RF ASME B16.5[a] flange [refer to Sketch DBVS-SK P005 for location (Appendix A)]. CP-318A – 1-1/2-in. 150-lb RF ASME B16.5[a] flange. Note: This requires modification of the Buyer-provided equipment from threaded flange connection to a welded flange connection. Design Conditions: • Maximum normal condition of 35 scfm. • Design pressure of 125 psig at 150 °F

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TECHNICAL SPECIFICATION

PROJECT:	Final DBVS Design	145579-D-SP-006	REV. 2
PROJECT NO.:	145579	DRYER AND CONDENSATE RECOVERY SYSTEM SKID	
CLIENT:	AMEC E&E - Richland, Washington		

Table 3-1: Dryer and Condensate Recovery System Skid Connection Point Descriptions (8 Sheets)

Connection Point Number	System Interface	Description	Connection Type and Design Conditions
CP-324	DCRS and CWS	Chilled water return line	Connection Type: 4-in. 150-lb RF ASME B16.5[a] flange [refer to Sketch DBVS-SK-P005 for location (Appendix A)]. Design Conditions: • Maximum normal condition of 300 gal/min. • Design pressure of 125 psig at 150 °F.
CP-325 A, B, C, D, E, and F	DCRS and CWS	Internal Connections	Connection Type: 150-lb RF ASME B16.5[a] flange sized to interface with internal lines [refer to Sketch DBVS-SK-P005 for size and location (Appendix A)]. Design Conditions: • Maximum normal condition of 300 gal/min. • Design pressure of 125 psig at 150 °F.
CP-326	DCRS and CWS	Chilled water supply line	Connection Type: 4-in. 150-lb RF ASME B16.5[a] flange [refer to Sketch DBVS-SK-P005 for location (Appendix A)]. Design Conditions: • Maximum normal condition of 300 gal/min. • Design pressure of 125 psig at 150 °F.

Table 3-1: Dryer and Condensate Recovery System Skid Connection Point Descriptions (8 Sheets)

Connection Point Number	System Interface	Description	Connection Type and Design Conditions
CP-330A and CP-330B	DCRS	Condensate Recovery System Inlet Connection point on dryer unit and DCRS	Connection Type: CP-330A – 14-in. 150-lb RF ASME B16.5[a] flange [refer to Sketch DBVS-SK-P004 for location (Appendix A)]. CP-330B – 12-in. 150-lb RF ASME B16.5[a] flange [refer to Sketch DBVS-SK-P005 for location (Appendix A)]. Design Conditions: • Maximum normal condition of 7,000 acfm steam at full vacuum and 250 °F. • Design pressure of full vacuum and 250 °F.
CP-331	DCRS and FWS	Internal Connections	Connection Type: 1/2-in RF ASME B16.5[a] flange [refer to Sketch DBVS-SK-P005 for location (Appendix A)]. Design Conditions: • Maximum normal condition of 100 gal/min at 180 psig and 115 °F. • Design pressure of 125 psig at 150 °F.
QD-301	DCRS and CAS	Compressed air supply inlet line	Connection Type: 1-in. male Hansen®[c] or Dixon® [refer to Sketch DBVS-SK-P004 for location (Appendix A)]. Design Conditions. • Maximum normal condition of 20 cfm air at 100 psig and 125 °F. • Design pressure of 125 psig at 150 °F.

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TECHNICAL SPECIFICATION

PROJECT:	Final DBVS Design	145579-D-SP-006	REV. 2
PROJECT NO.:	145579	DRYER AND CONDENSATE RECOVERY SYSTEM SKID	
CLIENT:	AMEC E&E - Richland, Washington		

Table 3-1: Dryer and Condensate Recovery System Skid Connection Point Descriptions (8 Sheets)

Connection Point Number	System Interface	Description	Connection Type and Design Conditions
QD-302 QD-303 QD-304 QD-305 QD-306 QD-307	DCRS and FWS	Filtered water supply inlet line	Connection Type: Male Dixon® Camlok [refer to Sketch DBVS-SK-P004 and DBVS-SK-P005 for location and size (Appendix A)]. Design Conditions: • Maximum normal condition of 100 gal/min at 180 psig and 115 °F. • Design pressure of 125 psig at 150 °F.
QD-321	DCRS and HPP	Hydraulic motor pressure line	Connection Type: High pressure connection [refer to Sketch DBVS-SK-P004 for location (Appendix A)]. Design Conditions: • Maximum normal condition of 255 gal/min at 4,300 psig and 150 °F. • Design pressure of 5,000 psig at 200 °F.
QD-322	DCRS and HPP	Hydraulic motor suction line	Connection Type: High-pressure connection (flanged) [refer to Sketch DBVS-SK-P004 for location (Appendix A)]. Design Conditions: • Maximum normal condition of 255 gal/min at 4,300 psig and 150 °F. • Design pressure of 5,000 psig at 200 °F.
N/A Seller-provided louver through enclosure wall	DCRS	Skid assembly ventilation inlet	Connection Type: 24-in. by 24-in. louver. Design Conditions: • 650 scfm – 10-in. water. • Ambient conditions. Atmospheric pressure and temperature.

Table 3-1: Dryer and Condensate Recovery System Skid Connection Point Descriptions (8 Sheets)

Connection Point Number	System Interface	Description	Connection Type and Design Conditions
N/A Connection point Internal to skid	DCRS	Dryer venting	Connection Type: 4-in. 150-lb RF ASME B16.5[a] flange [refer to Sketch DBVS-SK-P004 for location (Appendix A)]. NOTE: Required interface to container wall leads to CP-315. Design Conditions: • Maximum normal condition of 40 acfm at full vacuum to atmospheric and 150 °F. • Design pressure of full vacuum at 150 °F.
N/A Connection point on dryer unit	DCRS	Rupture disk and rupture disk discharge line	Connection Type: 6-in. 150-lb RF ASME B16.5[a] flange [refer to Sketch DBVS-SK-P004 for location (Appendix A)]. Design Conditions: • Maximum normal condition of 5 psig and 250 °F. • Design pressure of 15 psig and 250 °F.
N/A Connection point on dryer unit	DCRS	Waste addition manifold to dryer waste charging ports	Connection Type: Three or four typical, 4-in. 150-lb RF ASME B16.5[a] flange [refer to Sketch DBVS-SK-P004 for location (Appendix A)]. Design Conditions: • Maximum normal condition of 20 gal/min at 65 psig and 125 °F, with a pump shutoff head of 100 psig (intermittent) • Design pressure of 125 psig at 150 °F.

Table 3-1: Dryer and Condensate Recovery System Skid Connection Point Descriptions (8 Sheets)

Connection Point Number	System Interface	Description	Connection Type and Design Conditions
N/A	Electrical connection to DCRS (480V ac power)	Dryer off-gas condensate pump Dryer off-gas vacuum pump Steam condensate pump Inlet heater Six dryer chopper motors Lighting transformer	Connection Type: External terminal box [see Sketch DBVS-SK-E003 (Appendix A)].
N/A	Motor control connection (120V ac)	Local pushbutton stations for: Dryer off-gas condensate pump Dryer off-gas vacuum pump Steam condensate pump Six dryer chopper motors	Connection Type: External terminal box.

CAS = Compressed Air System.
CP = Connection Point.
CWS = Chilled Water System.
DCRS = Dryer and Condensate Recovery System.
FNPT = female national pipe thread.
FWS = Filtered Water System.
HIHTL = hose-in-hose transfer line.
HPP = Hydraulic Power Pack.
LWPS = Liquid Waste Pump Skid.
OGTS = Off-Gas Treatment System.
RF = raised-face.
SGIT = soil/glassformer impingement tank.
SSS = Steam Supply System.
SWS = Secondary Waste System.
w.g. = water gauge.
WTS = Waste Transfer System.

[a]ASME B16.5, *Pipe Flanges and Flanged Fittings*, American Society of Mechanical Engineers, New York, New York.

[b]Dixon is a registered trademark of Dixon Valve and Coupling Company.

[c]Hansen is a registered trademark of Tuthill Corporation [Hansen Manufacturing Company (Registrant)]

3.1.2.2.1 DCRS Container 480V Power Connection

The DCRS container shall potentially receive eleven sources of 480V ac power from an external source (six are future sources). The point of interface shall be an exterior power terminal box mounted approximately 1 ft 0 in. from the bottom of the container, preferably near a corner (to facilitate future cable/raceway routing on structural supports). The Seller may provide a single terminal box or multiple terminal boxes to satisfy this function. All terminals in terminal boxes shall be rated for 194 °F (90 °C). 25 percent spare terminals shall be provided in all terminal boxes.

The container is expected to be mounted at an elevation of approximately 12 ft (because of process connections required), and it is expected to be completely surrounded by a 24-in.-thick concrete shielding wall (because of the radiation dose rate) with an opening for personnel access. As such, disconnect switches inside or outside the container would not be located safely or accessibly to maintenance personnel or emergency response personnel. Disconnect switches shall be provided by the Seller for these circuits, temporarily mounted as required during testing, and then installed by the Buyer to a location outside of the concrete wall as a part of a separate contract. The CH2M HILL Hanford Group, Inc. (CH2M HILL) electrical code inspector and the Buyer are in agreement that this configuration and approach meets the requirements of the *National Electric Code* (NEC®) (NFPA 70, Article 685).

3.1.2.2.2 Grounding Connections

A grounding lug shall be provided on the outside frame of each skid to facilitate attachment of the skid to the grounding electrode. The location of the grounding lugs shall be shown on the shop drawings. See Section 3.3.1.8.5 and Sketch DBVS-SK E003 (Appendix A) for grounding requirements.

3.1.2.3 Monitoring and Control Interface

The MCS connection to the DCRS skid assembly shall be capable of operating the contained process and utility equipment from either a 24V dc (preferable) or 120V ac termination. The MCS interfaces are identified as instruments or components shown on the P&ID, Sketches DBVS-SK-P004 and DBVS-SK-P005 (Appendix A). Twisted shielded pair shall be used for analog instrument signal wiring.

The MCS is not part of this contract; therefore, interfacing will be provided through the use of Seller-provided wiring and routing to a control panel internal to the DCRS skid assembly. Instrument, control components (flow and pressure transmitters, air-operated valves, leak detectors, etc.), cables shall be routed to the enclosure via conduit or by cable secured by cable ties.

Seller-supplied drawings showing equipment layout and wiring diagrams shall be provided.

3.2 CHARACTERISTICS

The characteristics (e.g., functional and physical) that the DCRS skid assembly must comply with, to satisfy the requirements of this specification, are described in the following sections. The DCRS skid assembly must comply with the codes and standards listed in Section 2, except as modified by this specification if deemed more stringent.

3.2.1 Functional Characteristics

The DCRS skid assembly has several functional characteristics, depending on the particular DBVS interfacing system (Waste Receipt, Soil and Glassformer Impingement, Waste Transfer, Secondary Waste, Off Gas Treatment, Compressed Air, Filtered Water, Chilled Water, Steam Supply, Monitoring Control, Electrical Distribution, Confinement, Dryer Venting, Or Hydraulic Power Pack Systems). This section establishes the functional characteristics of each of these interfacing systems.

3.2.1.1 Waste Receipt System Interface

The waste liquid salt-solution piping shall be recirculated through the DCRS skid assembly from the waste receipt system at a rate of 70 gal/min to the feed transfer penetrations (the waste enters at Connection Point CP-301 inlet and exits at CP-302 recirculation return). The waste properties are given in Section 3.2.5. The minimum design pressures must be met at the prescribed flows throughout the duration of the project. The Seller is responsible for providing a detailed design of the piping layout so the waste receipt pump sizing can be verified.

A waste solution bleed system is also required in the DCRS skid assembly as shown on Sketch DBVS-SK-P004 (Appendix A). The waste solution bleed is to

be delivered from the recirculation piping to the dryer at a rate of 20 gal/min (maximum) into two manifolds connecting the three or four dryer waste feed ports (one waste feed port may be used as a glassformer addition port). The manifolds shall be designed to gravity drain into the dryer with no low points downstream of the system bleed valve. The bleed valve shall be located as close as possible to the main recirculation line to prevent buildup and dead legs in the line that will promote settling.

3.2.1.2 Soil/Glassformer Impingement Tank Discharge Interface

The functional characteristics of the piping and components connecting the soil/glassformer impingement tanks to the dryer are to provide isolation as close to the dryer as possible, to minimize the amount of dried waste building up in the impingement tank discharge chute into the dryer, and to direct additives into the top of the dryer.

The Seller shall provide a flange to interface to tank discharge and a spool piece to connect to the dryer.

3.2.1.3 Waste Transfer System Interface

The functional characteristics of the components and piping connecting the dryer to the box feed silo are to direct the dried waste using gravity from the dryer hemispherical valve (provided with the dryer) to the inlet of the box feed silo. This interface provides the piping and the connection point on the exterior of the enclosure.

The box feed piping and components shall be designed to empty dried waste from the dryer without bridging or plugging. The dried waste material properties including bulk densities, packed densities, angle of repose will be provided by the Buyer following tests that are to be conducted during October 2004. A sample of the simulated dried waste can be provided on request.

3.2.1.4 Secondary Waste System Interface

The functional characteristics of the components and piping are to provide containment of potentially radioactive condensate from the condensate recovery skid at a rate of 25 gal/min and monitor the flow from the condensate recovery discharge pump. Sketch DBVS-SK-P005 (Appendix A) identifies the minimum instruments and components necessary in this piping.

3.2.1.5 Off-Gas Treatment System Interface

The primary functions of the piping and components connecting the DCRS components to the OGTS is to contain and direct flow from the vacuum pump exhaust to the OGTS; to direct flow from the dryer rupture disk (provided by the Seller) in the unlikely event of a dryer chamber over-pressurization; and ventilate the DCRS skid assembly. The dryer steam jacket is operating near 250 °F. Even though the dryer is insulated, the heat transfer into the dryer container will eventually become steady state allowing the DCRS skid assembly to heat up internally and that heat is required to be removed from the container to provide optimum operation of the equipment and instrumentation. Inlet air and cooling shall be provided to assist with cooling. The system for this is depicted on Sketches DBVS-SK-P004 and DBVS-SK-P005 (Appendix A).

The OGTS will be connected to the DCRS skid assembly through two separate connections, one directly connected to the DCRS skid assembly for ventilation and the other is connected to the exhaust of the vacuum pump. The DCRS container exhaust shall be HEPA filtered and sized for up to 1,000 cfm. The exhaust of the vacuum pump shall be sized for up to 150 cfm. The DCRS container also requires inlet air to support cooling of the DCRS container. The inlet air into the container shall also be HEPA filtered in the unlikely event of loss of exhaust fan(s) flow and an over-pressurization of the container. The dryer also requires a rupture disk to protect the dryer from pressurizing beyond 5 psig at 250 °F. The rupture disk must also be rated for full vacuum. If the rupture disk fails, the discharge shall be piped down stream of the vacuum pump exhaust.

3.2.1.6 Compressed Air System Interface

The functional characteristics of the Compressed Air System in the DCRS skid assembly is to provide instrument quality air to the back-pulse system for the sintered metal filters and for the pneumatic-actuated valves.

Compressed air will be provided to the DCRS skid assembly at 20 ft^3/min and 100 psig at the Compressed Air System inlet penetrations (Connection Points QD-301M and QD-311M).

3.2.1.7 Filtered Water System Interface

The functional characteristics of the filtered water components are mainly to provide a location where manual connections can be made inside the confinement container with hoses to provide flushing capability at various points in the piping system as shown on Sketch DBVS-SK-P004 (Appendix A). A connection hose with the appropriate end connectors shall be provided to reach the various internal connection points from the Filtered Water System delivery point inside the DCRS skid assembly. The design of the special tool and interfacing connectors shall be to minimize the different type of connectors.

Filtered water will be provided to the DCRS skid assembly up to 100 gal/min and 180 psig at the Filtered Water System inlet penetration. The water connections internal to the skid shall be located in accordance with Sketches DBVS-SK-P004 and DBVS-SK-P005 (Appendix A). The filtered water will be used for flushing the dryer and will be plumbed to the sintered metal filter and the camera lens washdown systems (as necessary) for routine cleaning.

3.2.1.8 Chilled Water System

The main function of the Chilled Water System piping and components internal to the DCRS skid assembly is to provide chilled water to the condensate recovery system condenser, vacuum pump cooling, hydraulic power pack unit, and the OGTS inlet air cooling coils. Sketches DBVS-SK-P004 and DBVS-SK-P005 (Appendix A) identifies the minimum instruments and components necessary in this piping.

The Chilled Water System will be providing 300 gal/min to the DCRS skid assembly for distribution to condensate recovery skid condenser (210 gal/min), vacuum pump (less than 5 gal/min), hydraulic power pack unit (25 gal/min), and the OGTS inlet air cooling coils (10 gal/min). Hydraulic losses within the DCRS skid assembly are not included in the minimum pressures.

3.2.1.9 Steam Supply System

The function of the piping and components is to provide steam to the dryer and sintered metal filter housing inside the enclosure, provide steam condensate collection and steam condensate return pumps along with steam traps or a liquid condensate level system from both the filter and dryer. Sketch DBVS-SK-P004 (Appendix A) identifies the minimum instruments and components necessary in this piping. The pressure regulators and pressure reliefs for the steam supply shall be located external to the skid to eliminate the possible spread of contamination inside the container during a steam release Allowing the pressure control valve to be located externally provides an opportunity for local temperature control of the dryer, if necessary.

The steam supply will be providing 2,000 lb/h of saturated steam at a minimum of 15 psig to the steam jacket around the dryer and sintered metal filter. The steam will be condensed in the dryer steam jacket and returned to the Boiler Feed Water System. The pump shall be designed to transfer condensate at a nominal flow rate of 4.5 gal/min. The total head loss shall be determined by the Seller, given the interfacing transfer line characteristics provided by the Buyer (Appendix B). The pump shall be designed to prevent cavitation during the transfer of the hot water from the dryer to the boiler. Gravity return may also be possible.

3.2.1.10 Monitoring and Control System

The MCS interface in the DCRS skid assembly provides a single set of connection points located in a junction box where all the instrumentation and controls are routed from inside the dryer and can be connected to the MCS, by others, which will allow remote monitoring and control of the entire DBVS. The MCS equipment shall be provided by others.

3.2.1.11 Electrical Distribution System

The function of the Electrical Distribution System is to provide a single local power connection point on the outside of the DCRS skid assembly and provide electrical distribution to the major components inside the DCRS skid assembly. These major DCRS components include, but are not limited to:

1. dryer off-gas vacuum pump;

2. dryer off-gas condensate pump;

3. steam condensate pump (to be sized by the Seller);

4. inlet heater (see Section 3.3.1.6); and

5. 480-120/240V ac transformer and distribution panel (to supply lighting, heat tracing, unit heaters, air conditioning, instrumentation power, etc.).

3.2.1.12 Dryer and Condensate Recovery System Skid Assembly Confinement

The functional characteristics of the DCRS skid assembly confinement system (enclosure) is to provide secondary confinement for the dryer, sintered metal filter, and condensate recovery skid. The DCRS enclosure also provides a leak detection sump so the leak detector (provided by others) can sense a minimal amount of liquid waste in the unlikely event of a leak. The sump shall have a pump-out port that is valved and capped (or plugged) for removal of any liquid contained in the DCRS skid assembly. The confinement requirements are defined in Section 3.3.1.5.

3.2.1.13 Dryer Venting Interface/Off-Gas Filter Dust Return

The dryer venting function is necessary to vent the dryer during dried waste discharge. The design parameters of this system are provided in Section 3.3. Sketch DBVS-SK-P004 (Appendix A) identifies the minimum instruments and components necessary in this piping.

The dryer is designed to be operated at full vacuum and will be required to vent the vacuum before discharging the dried waste product. The proposed breather filter has a maximum flow rate of 40 acfm; therefore, the piping of the venting system shall be designed to limit the flow through the filter at the maximum pressure differential (atmospheric to full vacuum).

3.2.1.14 Hydraulic Power Pack

The dryer hydraulic motor power pack unit comprises three 200-hp motors and pumps (provided by the Buyer) and provides hydraulic fluid for the dryer hydraulic motor at the rate of 255 gal/min (maximum) at 4,300 psig. The power

pack will be located externally to the DCRS skid assembly, but the pressure and suction lines from the power pack skid will connect to the DCRS skid assembly, which will have the hydraulic lines routed with piping (of appropriate size), to and from the dryer hydraulic motor. The piping and components shall be designed to ASME B31.3, piping code for "Normal Fluid Service."

3.2.2 Physical Characteristics

The DCRS skid assembly is an integral part of the DBVS as shown in Drawing F-145579-00-D-0002. Concrete foundations and structural steel are currently in final design, so the outlining dimensions and approximate weights of the DCRS skid assembly are set. The DCRS skid assembly is also intended to be transported by truck over public roads and lifted by crane for installation. The Buyer anticipates that the finished DCRS skid assembly configuration will be taller than standard U.S. Department of Transportation regulations, therefore, the system shall have a modular design, broken down to the largest possible sizes, to facilitate quick disassembly, relocation to the final destination, and set-up at the Hanford Site.

The lower DCRS skid assembly shall have nominal outside dimensions of 48 ft 4 in. long by 11 ft 6 in. wide by a maximum of 11 ft 6 in. high over the feed material port. The upper module, containing the dryer filter, can be removed separately from the filter and the lower module. The upper module shall have nominal outside dimensions of 20 to 24 ft long by 8 ft to 11 ft-6 in. wide by a maximum of 8 ft high. The gross weight of the completed skid shall not exceed 130,000 lb when in operation.

The proposed DCRS skid assembly final configuration is shown on the reference Sketch DBVS-SK-M109 (Appendix A). The DCRS skid assembly piping penetrations are to be located within plus or minus 1 in. of the dimension depicted on the DCRS skid assembly drawings contained in Appendix A.

3.2.3 Reliability

The assembled system and individual components shall have a minimum service life of 2 years. Documentation to demonstrate this requirement is met shall be collected and prepared by the Seller. The design life of the equipment shall be 5 years.

3.2.4 Maintainability

Maintainability characteristics that affect the design (lubrication, parts replacement and repair, spares, modular construction, test points, etc.), shall be identified by the Seller and include, but are not limited to, the following:

1. Maintenance and Repair Cycles. Specify frequency or availability requirements for maintenance of the components (e.g., scheduled maintenance every 40-operating hours).

2. Spares and Spare Parts. Develop a list of recommended spares and spare parts. The spare parts lists shall be based on equipment mean time between failures and long lead procurement items (long lead defined as longer than four weeks from order placement to delivery).

3. Service and Access. Specify requirements for ease of service (e.g., access openings/spacing, self-test capability, inspection windows, test fixtures, sealed bearings). Include requirements for service (e.g., remove and replace only, bench repair, special tools, remote handling/maintenance). Include requirements for breakdown and storage of the system (e.g., drainage of piping, pressure relief before disconnect of fittings, de-energizing system). For routinely maintainable items, such as bearings or dryer shaft seals that require routine greasing, these items shall have grease ports extended to the exterior of the DCRS skid assembly container and properly labeled to reduce personnel entry requirements.

4. Special Tools. The system shall facilitate maintenance with commercially available tools wherever possible. The Seller shall furnish all special tools unique to the Seller's equipment that are necessary for installation, startup, operation, maintenance, and adjustment of the equipment and accessories furnished by the Seller. The special tools become the property of the Buyer. If supplied, the Seller shall also provide a list of all special tools furnished, identifying the function of each tool and the specific item(s) for which the tool is used. The Seller shall indicate if the tool is required for assembly, disassembly, installation, startup, operation, maintenance, or adjustment. The Seller shall provide detailed drawings and procurement information for the special tools.

5. Decontamination. All components in contact with processing fluids must be capable of being ultimately decommissioned, dismantled, and disposed of

as radioactive waste. Components shall be installed to facilitate routine removal and cleaning as recommended by the component manufacturer. Attention shall be paid to eliminating crevices and obtaining smooth weldments through the entire process flow stream.

6. Maintenance Considerations. The design of the assembled system shall follow a minimum maintenance philosophy (i.e., selection of components should take into consideration potential maintenance in addition to other considerations). Components shall be designed to allow handling and maintenance by personnel outfitted in protective clothing, self-contained breathing apparatus, and gloves. Components shall also be designed so they can be removed and replaced in a modular manner.

7. Lock and Tag. Both mechanical and electrical systems shall be designed to be locked out and tagged out during maintenance actions. Where applicable, the Seller shall identify on fabrication drawings those components which have a built in feature that supports the application of a lock and tag.

8. Standardization. To the extent practical, common components shall be used to minimize spare parts, tools, and procedures. Fastener sizes, drive size, and type shall also be standardized to effect maintenance with a minimum number of tools.

3.2.5 Environment

The assembled system shall be designed to operate and be stored in the climatic and environmental conditions listed in Table 3-2.

The radioactive fluid to be pumped is DBVS waste diluted with water. Properties of the waste stream are shown in Table 3-3 and Table 3-4.

The DCRS equipment shall be capable of processing supernate liquid salt solution with little to no solids. The chemical composition of the waste is shown in Table 3-4. The liquid salt solution is a nominal 5 molar sodium concentration.

The properties of the condensate is expected to be those of filtered water with no particulate larger than 0.6 micron

Table 3-2: Assembled System Environmental Conditions

Parameter	Environmental Condition
Ambient air temperature range[a]	-25 to 115 °F with a maximum 24-h differential of 52 °F
Relative humidity range[a]	Near 0 to 100%
Sand and dust concentrations[a]	1.10×10^{-5} lbm/ft^3 with a size of 150 µm or less
Solar radiation[a]	900 langleys, distributed over a 12-h period
Equipment load	4,730 Watts
Heating and cooling basis wind factors other than those noted above	Derive from ASHRAE Fundamentals Handbook[b] for the Hanford Site

[a]HNF-SD-GN-ER-501, *Natural Phenomena Hazards, Hanford Site, Washington*, Revision 1B, Westinghouse Hanford Company, Richland, Washington.

[b]*2001 ASHRAE Handbook – Fundamentals*, American Society of Heating, Refrigerating, and Air Conditioning Engineers, Atlanta, Georgia.

Table 3-3: Waste Stream Properties at the Dryer and Condensate Recovery System Skid Assembly

Properties	Data
Supernate Liquid Density:	1.2 to 1.3 g/mL
Viscosity:	10 cP Maximum at 77 °F (25 °C)
Range of fluid pH:	8 to 13
Temperature (as received):	55 to 88 °F
Temperature (as staged):	40 to 150 °F

Table 3-4: Chemical Composition of the Waste

Analyte	Average Analyte to Na Mole Ratio
Al^{+3}	9.32E-03
Ca^{+2}	2.43E-04
Cl^{-1}	1.50E-03
Cr (TOTAL)	2.96E-03
F^{-1}	1.13E-03
Fe^{+3}	9.57E-04
K^{+}	8.73E-04
Mn^{+4}	2.85E-05
Ni^{+2}	2.13E-05
NO_2^{-1}	1.31E-02
NO_3^{1-}	9.29E-01
Pb^{+2}	2.78E-05
PO_4^{-3}	1.16E-02
Si^{+4}	1.13E-03
SO_4^{-2}	7.79E-03
Sr^{+2}	6.53E-06
TIC as CO_3^{-2}	3.58E-02
Total Organic Carbon (TOC)	5.26E-03
U (Total)	2.34E-05

3.2.6 Transportability and Storage

The Buyer anticipates that the finished DCRS skid assembly configuration will be taller than standard U.S. Department of Transportation regulations, therefore, the system shall have a modular design, broken down to the largest possible size, to facilitate quick disassembly, relocation to the final destination, and set-up at the Hanford Site.

1. The assembled system shall be capable of being moved by crane or truck without modifications.

2. Lift points, gross weight, and approximate module center of gravity shall be provided for the lifting and handling of equipment and components in accordance with Section 3.3.8.6.

3. The assembled system packaging shall support the contained equipment so it can withstand a 0.75-gravity (forward), hard-braking stop, and a rearward acceleration of 0.25 gravity, as well as, shock and vibration loads associated with transportation.

4. The assembled system and any accessories shall be sized for transport using local roadways and freeways. Due to the physical size of this unit, described in Section 3.2.2, this equipment may be delivered in a minimum number of loads. Additional permitting maybe required for transporting oversized loads.

5. Appurtenances that exceed transportation height, width, or length requirements should be removed following the Factory Acceptance Test and packaged and shipped separately within a suitable protective device or packaged and shipped within the skid enclosure.

6. The Seller shall be advised that the DCRS skid assembly shall be stored and operated outside for an extended period of time, five years maximum, and will be exposed to the environmental conditions found at the Hanford Site as identified in Table 3-2.

3.2.7 Safety

The DCRS skid assembly shall be designed to maintain the safety of operators, equipment, and the general public. The piping, equipment, and mounting shall comply with the codes and standards called out in Section 3.3.2.2 for the appropriate piping code. Structural and seismic requirements are called out in Section 3.3.2.4. Known interlocks, failure positions for equipment and valves, and pressure control and relief valve settings are indicated on P&ID Sketches DBVS-SK-P004 and DBVS-SK-P005 (Appendix A).

For industrial safety, the Seller shall provide all necessary guards, lockouts, and other safety equipment for safe operation and design the DCRS skid assembly in accordance with 29 CFR 1910. All high temperature surfaces (above 120 °F) shall be insulated in accordance with Section 3.3.1.6.5, Number 3. For nuclear safety, the DCRS skid assembly container shall be rated for spray knock down and confinement. The associated leak detection will be provided and installed by the Buyer at the final destination. Specific leak rate criteria for DCRS skid assembly is discussed in Sections 3.3.1.5.8 and 3.3.1.5.9.

3.3 DESIGN AND CONSTRUCTION

The following section provides the design and construction details for the DCRS skid assembly.

3.3.1 Components/Materials/Processes

Given the complexity of this specification, this section is broken up into general guidelines and discipline specific parts or components, materials, and processes for the skid's mechanical piping; mechanical heating, ventilation, and air conditioning; enclosure; electrical; and structural requirements.

3.3.1.1 Design and Construction General Requirements

This sections provide general requirements for components, materials, and design drawings. Specific requirements for components, materials, and processes are provided in the following sections.

3.3.1.1.1 Components

It is the Seller's responsibility to develop a complete data sheet for the components identified in the Seller's design drawings. Completed data sheets, as well as vendor information (catalog cut sheets, vendor drawings, etc.) for components shall be developed by the Seller. The Seller shall provide data sheets and catalog cut sheets for all major components. The data sheet format shall be in conformance with the Buyer-supplied forms contained in Appendix C (electronic forms can be provided by the Buyer).

Component substitutions may be proposed by the Seller in the fabrication drawings for approval by the Buyer. Substitutions will be considered if a component is no longer available, or the proposed substitution improves the design, reduces cost, or improves the production schedule.

Only new parts and components shall be used for the assembly. Used, surplus, or reconditioned parts and components are prohibited.

All components shall be installed in accordance with manufacturer's instructions. If conflicts arise with the specified components or component interfaces (line

sizes, fittings, electrical requirements, etc.) during design and fabrication, they shall be brought to the attention of the Buyer for resolution.

3.3.1.1.2 Materials

Only new materials shall be used for the assembly. Used, surplus, or reconditioned materialls are prohibited. No suspect components shall be used for the assembly. A listing of suspect components is provided in Appendix D.

No aluminum (except where specifically called out in this specification) or "yellow" metals are to be used. No beryllium shall be present. Exposed polymer materials shall be constructed of anti-static materials.

Lead (Pb) shall not be used unless the lead is fully encapsulated and identified with a permanent tag. Polychlorinated biphenyls shall not be used in the design of the assembled system.

3.3.1.1.3 Drawings

The Seller shall develop drawings that detail how the specified parts and materials will be assembled to meet the requirements of this specification. The drawing package shall include detailed fabrication drawings, assembly drawings, arrangement drawings, general electrical drawings, electrical wiring and conduit schedule, and final as-built drawings. Drawings shall have a parts and materials list, as applicable, that clearly identifies quantity, manufacturer, the part or model number, material type and grade, electrical characteristics, size, and general descriptions. Drawings shall include dimensional layouts, dimensioned subassemblies, dimensioned component details (if not included on manufacturer's cut sheets), flow and electrical diagrams, material and fastener sizes, descriptions, weld symbols, and notes. The arrangement drawings shall provide weight and center of gravity locations for the overall assembly as well as for major subassemblies (e.g., skid-mounted equipment within a larger assembly or large equipment moved and mounted as a unit).

The assembled system shall be designed to comply with the P&ID and include all components specified on the P&ID provided in Appendix A. If conflicts arise between the proposed design and the P&ID, they shall be brought to the attention of the Buyer for resolution. Any changes from the approved drawings shall be identified to the Buyer using the Request for Information form (Appendix E) for review of the change. The change shall then be controlled by

the Seller to ensure the fabrication drawings are properly updated to incorporate the change. Final as-built drawings shall be prepared by the Seller at the conclusion of fabrication and testing.

Drawing size shall be per ANSI Y14.1. Parts and materials list shall include quantity, manufacturer, the part or model number, material type and grade, electrical characteristics, size, and general descriptions. All component parts shall refer to applicable material specifications, such as the military, ASME, ASTM, federal, or other specifications. As-built drawings shall be verified in accordance with QA Program Controls before submittal, and shall be in accordance with Buyer-supplied drawing procedures.

Drawings shall be prepared using AutoCAD® compatible drafting software. A copy of all as-built drawing files (one of which shall be an electronic AutoCAD® release 2000 or higher compatible file format) shall be included in the final drawing package. Drawings shall use the ROMANS AutoCAD® text font and the minimum text height shall be 1/8 in.

3.3.1.2 Mechanical Design Process

The mechanical design process consists of drawings and calculations necessary to detail the piping and mechanical design and interfaces in accordance with this specification.

3.3.1.2.1 Mechanical Drawings

The Seller shall develop detailed mechanical equipment, piping arrangement, and fabrication drawings showing all mechanical equipment, components, inner-connected piping, and interfaces. Install equipment, piping, duct, and devices in accordance with manufacturer's written instructions and applicable requirements of ASME B31.3.

3.3.1.2.2 Mechanical Calculations

1. Piping. Mechanical calculations performed for the piping system shall be prepared in accordance with piping code requirements in ASME B31.3. As a minimum, calculation shall include the following subjects:

    a. Pipe wall thickness calculations for pressure (ASME B31.3, Paragraph 304.1).

b. Stress calculations for sustained loads because of pressure, dead load, and any other sustained loads (ASME B31.3, Paragraph 302.3.5).

c. Stress calculations for displacement stresses, such as thermal loads. Use Equation (16) in ASME B31.3 (Paragraph 319.4) for flexibility analysis on simple systems.

d. Stress calculations for occasional load such as pressure, dead weight, other sustained loads, and earthquake loads (ASME B31.3, Paragraph 302.3.6).

e. Hanger stress calculations for dead weight, thermal, and seismic loads (ASME B31.3, Section 321; ASCE 7-98; UBC (1997), and AISC *Manual of Steel Construction—Allowable Stress Design* for source reference, in addition use an Importance factor - I_p = 1.5 and Seismic coefficient - C_a = 0.34) Note: wind load is not required for this piping system because it is enclosed in a freight container.

As applicable, the Seller shall take into consideration the following corrosion allowances for all piping system calculations.

a. A carbon-steel corrosion allowance is specified at 0.18 in. for all pressure boundary materials in contact with the liquid waste for the design service life.

b. A carbon-steel corrosion allowance is specified at 0.06 in. for all pressure boundary materials not having contact with the waste for the design service life.

c. A stainless-steel corrosion allowance is specified at 0.18 in. for all pressure boundary materials in contact with the waste solution for the design service life.

d. A stainless-steel corrosion allowance is specified at 0.06 in. for all pressure boundary materials not having contact with the waste for the design service life.

2. Additional Calculations. Additional calculations that shall be performed, if applicable for the assembled system, include: head loss (for pump sizing),

valve actuator sizing, piping and equipment heat trace (for freeze protection), thermal expansion analysis for sizing of piping expansion joints and connections to the dryer, and heating and cooling loads for temperature controlled areas (calculated as prescribed in the ASHRAE Fundamentals Handbook).

3.3.1.2.3 Piping – Design

Piping systems shall be fabricated, inspected, and tested in accordance with ASME B31.3, Category D, piping code for nonwaste contacting piping and "Normal Fluid Service" for all waste contacting piping. The minimum design pressure for the DCRS skid assembly piping and components, including instrumentation, is 125 psig. The design temperature is 150 °F. If piping, piping components, and instrumentation do not meet or exceed design pressure and temperature, the Buyer shall be notified in writing. If there is a conflict between this portion of this specification and ASME B31.3, then ASME B31.3 shall be deemed to be correct. Anytime the requirements in this specification are more stringent, or are in addition to code requirements, the requirements in this specification shall be followed. Piping systems include all piping components and supports.

3.3.1.2.4 Piping – Line Routing

The Seller shall develop drawings showing pipe routing consistent with the requirements of this specification. Additional considerations for the pipe routing are listed as follows:

1. Elbows and pipe bends not manufactured in accordance with listed standards in ASME B31.3 (Table 326.1) may be provided in accordance with ASME B31.3 (Paragraphs 304.2 and 332).

2. The material shall be suitable for the bending process.

3. The finish shall be free of cracks and substantially free from buckling.

4. The wall thickness after bending shall not be less than minimum wall thickness considering corrosion-erosion and mill under-run tolerance.

5. The minimum wall thickness of the bend intrados and extrados shall not be less than that calculated by equations listed in ASME B31.3 (Paragraph 304.2).

6. Bend flattening (the difference between maximum and minimum diameters at any cross section) shall not exceed 8 percent of nominal outside diameter for internal pressure. Metal shall not be removed to achieve these requirements.

7. The proposed assembly layouts shall meet the requirements of ASME B31.3.

3.3.1.2.5 Piping – Vents and Drains

High-point vent(s) shall be installed as required for venting air in preparation for testing or operation. Low-point drain(s) shall be installed as required for draining the system before maintenance or lay-up. Eliminate low spots to minimize freestanding liquids in the piping. Gravity draining of the piping system is preferred. The Seller shall provide basis for draining method if other than gravity draining. Draining method must be designed to support complete drainage of piping during decommissioning.

3.3.1.2.6 Piping – Pipe and Equipment Supports

Piping and equipment shall be supported by pipe supports attached to a support frame using strut. The Seller shall develop detailed fabrication drawings of the required piping and equipment supports, including welding details. Location of frames members and supports shall be based on analyses performed by the Seller (see Section 3.3.11 for required analyses).

Pipe supports shall be capable of supporting the piping in all conditions of operation and shipment. The supports shall allow free expansion and contraction of the piping and prevent excessive stress resulting from transferred weight being introduced into the piping and connected equipment.

The Seller shall level-plumb piping using shims, etc., to support the pipe and to avoid forced piping deflections at support points.

3.3.1.3 Mechanical Components

Data sheets for the components shown on the arrangement drawings and P&IDs are provided in the Bidder's Drawing and Data Commitments sheet (Appendix F). Some data sheets also include the recommended vendor. Component substitutions may be proposed by the Seller in the fabrication drawings for approval by the Buyer. Only new parts and materials shall be used for the assembly. Used, surplus, or reconditioned parts and materials are prohibited.

3.3.1.4 Piping Materials

Piping components shall be listed components in accordance with ASME B31.3 (Table 326.1). All waste containing lines shall be buttwelded.

3.3.1.4.1 Screwed Pipe Fittings

Close or butt nipples are not permitted. For all male-tapered pipe threads, use Loctite® PST or equivalent. Care shall be taken to prevent introduction of the coating into the wetted portion of the piping system. Screwed fittings are acceptable for instrumentation taps, drains, and vents; but shall not be used for piping or piping components in the primary waste transfer lines or condensate lines. Screwed pipe fittings shall be in accordance with ASME B16.11.

3.3.1.4.2 Flanged Pipe Fittings

Flanges for pipe greater than 1/2 in. shall be standard 150-lb raised-face flanges in accordance with ASME B16.5 and shall be made from the same type of steel as the pipe in which it will be welded. Flanges shall be welded in the "two-hole" configuration. Flanges shall be in compliance with the ASME B16.5 rating tables for the piping design pressure and temperature. Flange assembly and bolting shall be performed in accordance with ASME PCC-1.

3.3.1.4.3 Flange Fasteners

No fasteners shall be capable of vibrating loose during transportation and during operation. All such joints should have some means to ensure they remain intact. Double nutting is not an acceptable means of providing this. Loctite® thread locker, wire ties, or disrupting threads are acceptable methods for securing nuts.

Pipe flange bolting components shall be listed in ASME B31.3 (Table 326.1) meeting the requirements of ASME B18.2.1 and ASME B18.2.2.

Stainless-steel bolts and cap screws shall be ASTM A 193/A 193M, Grade B8. Stainless-steel nuts shall be heavy hex nuts in accordance with ASTM A 194/A 194M, Grade 8. Washers shall be ASTM F436, Type 3. Carbon-steel bolts shall be ASTM A 307, or better, depending on strength and torque requirements. Carbon-steel nuts shall be ASTM A 563a. Bolts and cap screws shall be grade marked.

The Seller shall select fasteners, when they are not specifically called out in this specification, using the following guidelines:

1. Anti-galling compound (e.g., Loctite® 8009 or 8013) shall be applied where stainless-steel bolts are used;

2. Stainless-steel bolts, nuts, and washers shall be used when the mating parts are stainless steel;

3. Carbon-steel bolts, nuts, and washers shall be used where mating parts are not stainless steel; and

4. The Seller shall ensure that suspect or counterfeit fasteners and components are not used. Suspect fasteners can be identified by the following inspection methods:

   a. Head markings are marred, missing, or appear to have been altered;

   b. Threads show evidence of dressing or wear (threads should be of uniform color and finish);

   c. Head markings are inconsistent within a heat lot; and

   d. Head markings matching one of those identified on the *Control of Suspect/Counterfeit Items* (Appendix D).

3.3.1.4.4 Socket Welded Fittings

Socket welded fittings shall be in accordance with ASME B16.11. Socket welds shall not be used for waste contacting pipe lines.

3.3.1.4.5 Buttwelded Fittings

Buttwelded fittings shall be in accordance with ASME B16.9, except for 45° laterals shall be certified in accordance with ASME B31.3 piping code for "Normal Fluid Service."

3.3.1.4.6 Stainless-Steel Tubing

All stainless-steel tubing shall be seamless and shall meet the chemical and physical characteristics given in ASTM A 269. Tubing shall be a listed component as stated in ASME B31.3.

3.3.1.4.7 Stainless-Steel Tubing Fittings

Fittings for instrument air tubing may be Swagelok® compression fittings or approved equivalent, stainless steel, 300 series, per ASTM A 276 or ASTM A 182/A 182M. Copies of Certificates of Conformance (CoC) shall be provided.

3.3.1.4.8 Steel Forgings and Wrought Piping Fittings

All forgings, including flanges and wrought piping fittings, shall be listed components as stated in ASME B31.3 (Table 326.1), and shall meet the requirements of ASTM A 182/A 182M. All stainless-steel forgings and wrought piping fittings used in the fabrication shall be 300-series stainless steel and shall meet the requirements of ASTM A 403/A 403M, Grade WP-S. Carbon-steel pipe flanges and flanged fittings, and socket weld or screwed fittings shall be ASTM A 105/A 105M. Material for carbon-steel buttweld fittings shall be ASTM A 234/A 234M, Grade A WPB.

3.3.1.4.9 Piping Gaskets/Seals

Pipe flange connections shall use PSI Inc., LineBacker® sealing gaskets with stainless steel as the retainer material and Viton® as the sealing element. LineBacker® Type F sealing gaskets shall be used for raised-face flanges and LineBacker® Type E sealing gaskets shall be used for flat-face flanges.

1. All elastomeric seals shall have radiation resistance for the radiation dose levels shown in this specification. Viton® is acceptable for the radiation levels specified

2. No Certified Material Test Reports (CMTR) are required for gaskets or seals, copies of CoCs shall be provided.

3.3.1.4.10 Stainless-Steel Piping Materials

Stainless-steel pipe shall be ASTM A 312/A 312M, Schedule 40, Type 304L. Stainless-steel pipe flanges and flanged, socket weld, or screwed fittings shall be ASTM A 182/A 182M, Grade F, Type 304L. Stainless-steel buttwelded fittings shall be ASTM A 403/A 403M, WP-S, Type 304L.

3.3.1.4.11 Carbon-Steel Piping Materials

Carbon-steel pipe having a diameter of 1-1/2 in. and smaller shall be ASTM A 106, Grade B. Carbon-steel pipe having a diameter of 2 in. and greater shall be ASTM A53/A 53M, Type S, Grade B. Carbon-steel pipe flanges and flanged, socket weld, or screwed fittings shall be ASTM A 105/A 105M. Carbon steel buttwelded fittings shall be ASTM A 234/A 234M, Grade A WPB.

3.3.1.4.12 Expansion Joints

The dryer is expected to expand in length approximately 0.4 in. from room temperature to standard operating temperature of 250 °F and shrink approximately 0.07 in. from room temperature to the minimum freeze protection temperature of 40°F. These measurements are approximate in reference to the dryer drive end. The dryer is mounted on load cells and requires structural isolation from connected piping to provide accurate weight measurements. The expansion joints (also referred to as flex lines or flexible connections depending on applicable code) shall be designed to be in the relaxed position when the system is at normal operating condition described in Table 3-1. The expansion joints shall also be designed to the design conditions of the skid subsystem also stated in Table 3-1. Expansion joints shall be designed in accordance to the applicable piping code of the subsystem in the DCRS skid assembly or in accordance to the Expansion Joint Manufacturers Association if no code is applicable. Expansion joints shall also be designed to minimize hold-up of radioactive material between the dryer and the enclosure connection points.

3.3.1.5 Dryer and Condensate Recovery System Enclosure Materials

The DCRS enclosure shall meet the same requirements as a Series 1 freight container in accordance with ISO 668 and ISO 1161 except for the physical size which is detailed in Section 3.2.2. A Series 1 thermal freight container in accordance with ISO 1496-2 may be substituted if the insulation will not interfere with fabrication or space requirements needed for personnel access during operation and maintenance. If a Series 1 thermal freight container is used, the preferred thermal freight container classification is 46.

3.3.1.5.1 Enclosure Insulation

The inside of the freight container walls shall have a minimum 1 in. of insulation with the insulation meeting the requirements of Table 3-5. The insulation shall be applied only after substrate construction, penetration work related welding, and other hot work have been completed. Insulating board will be considered if it can be properly secured to the freight container walls and meets minimum requirements of Table 3-5. The insulation must be covered by a minimum 1/16-in.-thick sheet metal. The sheet metal shall be painted if stainless-steel sheet is not used. Care shall be taken to ensure that spray-on insulation, if used, does not cover the floor, piping components, or electrical panels. If a pre-insulated thermal freight container is used, at least 1 in. of insulation shall be foamed in place where insulation has been removed and covered with sheet metal. Low chloride/fluoride insulation (below 250 ppm) shall be used to prevent stainless-steel stress corrosion cracking.

Table 3-5: Insulating Material Specifications (2 sheets)

Property	Value	Units	Test Method
Core density	1.9–2.2	lb/ft^3	ASTM D 1622[a]
Water vapor transmission	< 1.0 @ 2 in. thick	perms	ASTM E 96[b]
R-value	7.0 (min) @ 1 in. thick	$h \cdot ft^2 \cdot °F/Btu$	ASTM C 518[c]
Compressive strength	25 (min)	psi	ASTM D 1621[d]
Flame spread	<25	--	ASTM E 84[e]
Smoke developed	≤50	--	ASTM E 84[e]
Air leakage	0 @ 6.24 psf	cfm/ft^2	ASTM E 285[f]

Table 3-5: Insulating Material Specifications (2 sheets)

Property	Value	Units	Test Method
Hydrostatic pressure resistance	No failure @ 184.9 cm head pressure	--	AATCC Test Method 127[g]

[a]ASTM D 1622, *Standard Test Method for Apparent Density of Rigid Cellular Plastics*, American Society for Testing and Materials, West Conshohocken, Pennsylvania.

[b]ASTM E 96, *Standard Test Methods for Water Vapor Transmission of Materials*, American Society for Testing and Materials, West Conshohocken, Pennsylvania.

[c]ASTM C 518, Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus, American Society for Testing and Materials, West Conshohocken, Pennsylvania.

[d]ASTM D 1621, *Standard Test Method for Compressive Properties of Rigid Cellular Plastics*, American Society for Testing and Materials, West Conshohocken, Pennsylvania.

[e]ASTM E 84, *Standard Test Method for Surface Burning Characteristics of Building Materials*, American Society for Testing and Materials, West Conshohocken, Pennsylvania.

[f]ASTM E 285, *Standard Test Method for Oxyacetylene Ablation Testing of Thermal Insulation Materials*, American Society for Testing and Materials, West Conshohocken, Pennsylvania.

[g]AATCC Test Method 127-1998, *Water Resistance: Hydrostatic Pressure Test*, American Association of Textile Chemists and Colorists, Research Triangle Park, North Carolina.

3.3.1.5.2 Enclosure Inlet and Outlet Pipe Connections

Pipe penetrations shall be installed in the walls of the container. Proximity of penetration points are shown in Appendix A and described in Section 3.1.2 and Table 3-1. Details of the HIHTL connection assemblies are provided on Sketches DBVS-SK-M103 and DBVS-SK-M109 (Appendix A).

3.3.1.5.3 Enclosure Drainage

The DCRS skid assembly container shall be designed to completely drain liquids from the walls to the floor and to drain any freestanding liquids in the container to a floor sump. The Seller is responsible for installing a floor drain and pipe near one corner of the container as shown in Sketch DBVS-SK-M109 (Appendix A).

3.3.1.5.4 Enclosure Personnel Door

A personnel door shall be installed on the opposite-end-corner of the container away from the double door. Proximity of the door is shown in Appendix A. The door shall be lockable, metal leak-tight, marine-type door with an insulating core. The door shall have an elastomeric gasket sealing the door to the container.

End loading doors shall be lockable, with cam-action; latch handles securing the top and the bottom of the door. Doors shall have a continuous waterproof door gasket. The seal shall prevent light from being visible from within the sealed module.

3.3.1.5.5 Enclosure Inner Walls and Ceiling

The interior walls, doors, and ceiling of the ISO container shall be lined 300-series stainless-steel sheeting. The liner seams shall be designed to prevent leakage into the walls and facilitate decontamination by water spray. Seams shall be fabricated to minimize contamination entrapment. The enclosure will have a spray shield wall erected between the hydraulic motor on the dryer and the dryer drum.

3.3.1.5.6 Enclosure Lid

The DCRS enclosure will include a removable top (lid) which will be used to cover the filter and vapor piping leading to the condenser. The lid shall be watertight closure and have welded lifting rings or eyes. Lifting rings or eyes shall have a safety factor in accordance with Section 3.3.1.12 and shall be clearly marked "To remove lid only, DO NOT LIFT entire module with this attachment" or like wording unless designed otherwise. The lid shall either have a secured (i.e., glued) gasket or a continuous sealing surface such that when the lid is seated on the main module, a continuous sealing surface between the lid or module contact surfaces is provided. The lid shall also be designed such that it is structurally able to support its own weight during lifting and when placed on the ground and not attached to the main module. Lid security closure devices shall be incorporated whereby the lid is locked to the module to prevent unauthorized entry into the module. The lid security closure must use a minimum of two security devices on opposite sides of the lid. Security devices do not replace devices otherwise needed to secure the lid to the module body. Lid closure devices shall be provided to securely close the module and attach the lid for movement incidental to transportation.

There shall be no attachments or penetrations; electrical, piping, or structural, located on the lid such that it will require removal of major components (other than module attachment devices) before lifting it from the module. The heating, ventilation, and air conditioning unit should be attached to the lid such that it will be removed with the lid. Electrical and piping connections that need to be removed before removing the lid shall be marked and attached using quick

disconnects and water tight electrical connections where possible. Warning notices should be posted near the lifting points identifying the electrical and piping connections that need to be verified before lifting the lid from the module. Locator pins, if used, should be attached on the module so they are not damaged when the lid is removed from the module and placed on the ground. See Sketch DBVS-SK-M109 for lid removal details.

3.3.1.5.7 Enclosure Floor

The DCRS enclosure shall be outfitted with a floor designed to carry the equipment loads as specified in this specification (see Section 3.3.1.12.2), including loads because of lifting, movement, and placement of the DCRS container assembly by crane. In no case shall the floor load rating be less than a standard ISO-series 1 freight container. Wood is not to be used as a floor material. The DCRS enclosure floor shall be outfitted with a stainless steel floor pan, extending to the walls of the DCRS container assembly, and to a height enabling the pan to hold 8 in. of water. The floor pan seams shall be seal welded and water tight. Optionally, the floor and floor pan may be one in the same.

3.3.1.5.8 Enclosure Air Leakage Requirements

An air-leak test shall be performed by the fabricator per ISO 1496-2 and shall meet the leakage requirement of ISO 1496-2 (Sections 8.13 and 8.14).

3.3.1.5.9 Enclosure Watertight Door Thresholds

Removable, metal, watertight thresholds shall be installed across the bottom of each door. The threshold shall be 8 in. high, not to exceed 8-1/4 in. The threshold shall be leaktight. A leak test shall be performed to verify leak tightness; the liquid level shall be 8 in. from the floor level. Components that may be harmed during this test may be removed or otherwise isolated during this test.

3.3.1.6 Enclosure Heating, Ventilation, and Air Conditioning

The outdoor design conditions for the heating and cooling load calculations are shown in Table 3-2.

The minimum indoor design temperature in all areas of the DCRS enclosure is 40 °F to prevent freezing. The maximum design temperature for equipment protection is 125 °F.

Ductwork design pressure shall be negative 12-in. w.g. Leak test pressure shall be negative 15-in. w.g., and the structural capability test shall be negative 30-in. w.g.

3.3.1.6.1 Container Ventilation

The DCRS container shall be ventilated to maintain a slight negative pressure within the dryer enclosure. Approximately 650 ft^3/min of outside air will be drawn into the freight container through a HEPA-filtered inlet assembly. Exhaust provisions will be required for the enclosure, through a HEPA filter to the OGTS.

3.3.1.6.2 Freeze Protection

Interior electrical resistance-type unit heaters shall be installed inside the container for freeze protection of piping and components and for personnel access. The unit heaters shall be sized based on an outside design temperature of minus 25 °F coincident with 40 °F inside design temperature with no equipment loads.

Unit heaters shall be 240V ac or 120V ac, single phase and shall include thermostats and accessories required by the manufacturer.

3.3.1.6.3 Cooling

Cooling shall be provided inside the container for instrumentation operation during hot weather. Cooling for the DCRS enclosure shall use a cooling coil in the inlet air system, as shown in Sketches DBVS-SK-P004 and DBVS-SK-P005 (Appendix A), supplied with chilled water from the chilled water supply to the DCRS condenser. The temperature shall be maintained at or below 100 °F with equipment heat load and maximum expected outdoor temperature and solar insolation values given in Table 3-2. (See Appendix C for cooling coil data sheets). Cooling for the remaining compartments of the container shall be provided with "ductless" split system air conditioners.

Equipment shall be selected so that no environmental condition (indoor or outdoor) exceeds the manufacturer's written maximum or minimum ambient requirements.

Condensate from the cooling coil and indoor air conditioning units shall be trapped and routed through a P-trap to be collected in a standard 5-gal carboy, provided by the Seller, located in the interior of the freight container. Flexible clear tubing may be used for makeup between P-trap and carboy. The carboy may be relocated outside of the enclosure during the field installation of the DCRS skid assembly.

3.3.1.6.4 Intake High-Efficiency Particulate Air Filter Assembly

1. Intake Louvers. Intake louvers shall be 5-in.-deep extruded aluminum frame with 0.081-in.-nominal wall thickness. Blades shall be double-drainable, sight-proof constructed of 0.081-in.-thick extruded aluminum. Louvers shall have a minimum free area of 44 percent. Louvers shall include insect screen. Ruskin® Model EME520DD Stationary Louver.

2. HEPA Filter Housings. The intake train assembly will require one HEPA filter housing. The filter housing shall be a Flanders BF Series™, 1 x 1, Type 1, filter access shall be as shown on the arrangement drawings, and shall be fabricated from 11 and 14 gauge, ASTM A 240/A 240M, 300-series stainless steel with a 2-B mill finish. All welded components shall be fabricated from 300-series stainless steel, Grade L. The filter housing shall be installed to enable side removal of the filter.

   a. Housing hardware material shall meet the requirements for 300-series stainless steel, excluding the access door knobs which shall be cast aluminum.

   b. The filter housings shall not exceed a nominal depth of 25 in. in the direction of airflow.

   c. The filter housings shall be adequately reinforced to withstand the system structural capability pressure as defined in ASME N509 (Section 4.6.6.1).

   d. All "pressure-retaining" weld joints and seams shall be 100 percent continuously welded. Welding shall meet the requirements of

ASME N509 (Section 7.3). Weld joints and seams shall be wire brushed or buffed before final nondestructive examination (NDE) and inspection as required to remove heat discoloration, oxidation, all burrs, slag, excessive splatter, soot, dirt, sharp edges, or residue from welding.

e. The housings shall each accommodate one Flanders GG-F (24-in. by 24-in. by 11-1/2-in.) Fluid Seal™, Type B (Nuclear Grade) HEPA element. Filter-to-housing seal shall be affected by means of a "knife-edge" frame in the housing that ends with a continuous perimeter channel on the face of a filter element that has been filled with a viscous, nondrying fluid. The filter elements shall not require any special attachments or devices to function correctly within the housings.

f. The housings shall be equipped with two static-pressure ports. The ports shall be located upstream and downstream of the filter elements on the top of the housing. The port fittings shall be 1/4-in., Schedule 40, seamless, stainless-steel pipe meeting the requirements of ASTM A 312/A 312M, 300-series stainless steel. All welded components shall be fabricated from 300-series stainless steel, Grade L.

g. The housings shall be equipped with a floor drain centered at the bottom of the housing. The drain shall be 1-in. Schedule 40, seamless, pipe meeting the requirements of ASTM A 312/A 312M, 300-series stainless steel. All welded components shall be fabricated from 300-series stainless steel, Grade L.

h. A toggle or over-center ("Davis-Lok") type filter element clamping assembly or locking tray shall be used to secure the filter elements in the housing. The clamping assembly shall apply a sealing force that is even and uniform across the top and bottom of the filter element. The clamping assembly or locking tray shall be replaceable.

i. The housings shall be equipped with an access port for the filter element.

j. The filter element clamping assembly or locking tray shall be accessible from the access port and shall be operable through any containment change-out bags.

k. The housings shall be equipped with filter removal rods to draw the filters to the change-out position. The removal rods shall be operated from inside the change-out bag, and the filters shall be removed by pulling against the bottom of the filter frame. There shall be no penetration through the housing for operation of the removal rod. All change-out operations shall be within the bag so there is a barrier between the worker and the filter at all times.

l. The access port shall be equipped with a containment change-out bag adapter. The adapter shall be welded to the housing. The welded joints and seams used to fabricate and secure the change-out adapter to the housing shall be considered "pressure-retaining" joints and shall be 100 percent continuously welded. The adapter shall be hemmed or rolled on its outer edge and include two continuous ribs. The ribs are required to hold the containment bag elastic cord or safety strap during filter element bag -in/bag-out procedures.

m. A containment change-out bag shall be provided for each access port. The bags shall be nominal 5 mils thick, translucent, and have an elastic O-ring (compatible with the maximum bag temperature) hemmed into the open end of the bag.

n. A nylon-safety strap shall be provided with the bag to prevent the bag from slipping off of the access port bag adapter during filter element bag-in/bag-out procedures.

o. A nylon-cinching strap shall also be provided with the bag to "tie-off" the bags slack when the housing door is installed and the unit is operational.

p. The access port shall include a removable door assembly that encloses the access port, the bag adapter, and the bag with its accessories.

q. The door shall include a minimum of four tie-down latches. The latches shall be designed in such a manner as not to impede the bag-in/bag-out process.

r. The door shall include a continuous rubber lip on its perimeter that affects a positive "compression" seal between the door and the housing.

s. The door shall interface with the housing in such a manner that the door cannot be closed or installed until the filter element is correctly installed in the housing and the clamping assembly or locking tray is fully ended.

t. CMTRs for all materials used shall be provided to the Buyer.

3. Ductwork. Ductwork sections shall be fabricated from 10, 11, or 12 gauge (as required), ASTM A 240/A 240M, 300-series stainless steel with a 2-B mill finish. All welded components shall be fabricated from 300-series stainless steel, Grade L.

a. Ductwork shall be adequately reinforced to withstand the system structural capability pressure as defined in ASME N509 (Section 4.6.6.1).

b. Ductwork shall be welded constructed and fabricated in accordance with the housing or test section manufacturer's standard fabrication processes.

c. All "pressure-retaining" weld joints and seams shall be 100 percent continuously welded. Welding shall meet the requirements of ASME N509 (Section 7.3). Weld joints and seams shall be wire brushed or buffed before final NDE and inspection as required to remove heat discoloration, oxidation, all burrs, slag, excessive splatter, soot, dirt, sharp edges, or residue from welding.

d. CMTRs for all materials used shall be provided to the Buyer.

4. Test Section

a. The inlet test section shall be a Flanders™ test "inlet" section, Type 1 arrangement for a Flanders BF Series™, 1 x 1, type 1, left-hand access filter housing. The inlet test section shall be located upstream of the first bank of HEPA-filter elements.

b. The test sections shall be fabricated from 11 and 14 gauge, ASTM A 240/A 240M, 300-series stainless steel with a 2-B mill finish. All welded components shall be fabricated from 300-series stainless steel, Grade L.

c. The test sections shall not exceed a nominal depth of 28 in. in the direction of airflow.

d. Test section hardware material shall meet the requirements for 300-series stainless steel.

e. The test sections shall be adequately reinforced to withstand the system structural capability pressure as defined in ASME N509 (Section 4.6.6.1).

f. The differential pressure drop across each of the test sections shall not exceed 0.75-in. w.g. at the rated capacity of the HEPA-filter assemblly.

g. All "pressure-retaining" weld joints and seams shall be 100 percent continuously welded. Welding shall meet the requirements of ASME N509 (Section 7.3). Weld joints and seams shall be wire brushed or buffed before final NDE and inspection as required to remove heat discoloration, oxidation, all burrs, slag, excessive splatter, soot, dirt, sharp edges, or residue from welding.

h. The test section shall be constructed in such a manner to allow HEPA filter "in-place" testing in accordance with the requirements of ASME N510 (Section 10), outside the system using apparatus and devices which are supplied as an integral part of the test section. Apparatus and devices shall include as a minimum:

i. Inlet test section - challenge aerosol inlets, mixing apparatus (diffusers) and upstream sample outlets.

ii. Apparatus and devices that make up the test sections shall meet the intent of the nonmandatory design guidelines of ASME N509 (Appendix C).

iii. Apparatus and devices that make up the test sections shall be designed to allow qualification testing of the apparatus and devices in accordance with ASME N510 (Section 9), as required.

i. The inlet and combination test sections shall be equipped with a floor drain centered at the bottom of the housing. The drain shall be 1-in., Schedule 40, seamless pipe meeting the requirements of ASTM A 312/A 312M, 300-series stainless steel. All welded components shall be fabricated from 300-series stainless steel, Grade L.

j. CMTRs for all materials used shall be provided to the Buyer.

5. Prefilter Section.

a. The exhaust train assembly will require one prefilter housing. This prefilter housing shall be a Flanders BF Series™, 1 x 1, Type 1, filter access shall be as shown on the arrangement drawings, and shall be fabricated from 11 and 14 gauge, ASTM A 240/A 240M, 300-series stainless steel with a 2-B mill finish. All welded components shall be fabricated from 300-series stainless steel, Grade L.

b. Housing hardware material shall meet the requirements for 300-series stainless steel

c. The prefilter housing shall not exceed a nominal depth of 14 in. in the direction of airflow.

d. The prefilter housing shall be adequately reinforced to withstand the structural capability pressure of the system as defined in ASME N509 (Section 4.6.6.1).

e. All "pressure-retaining" weld joints and seams shall be 100 percent continuously welded. Welding shall meet the requirements of ASME N509 (Section 7.3). Weld joints and seams shall be wire brushed or buffed before final NDE and inspection as required to remove heat discoloration, oxidation, all burrs, slag, excessive splatter, soot, dirt, sharp edges, or residue from welding.

f. The housing shall accommodate one 24-in. by 24-in. by 2-in. Underwriters Laboratories, Inc. (UL)-Class I prefilters, with a minimum efficiency of 45 percent (in accordance with ASHRAE Standard 52.2) and metal frames. The filter element shall not require any special attachments or devices to function correctly within the housings.

g. The housing shall be equipped with two static pressure ports. The ports shall be located upstream and downstream of the filter element on the top of the housing. The port fittings shall be 1/4-in., Schedule 40, seamless, stainless-steel pipe meeting the requirements of ASTM A 312/A 312M, 300-series stainless steel. All welded components shall be fabricated from 300-series stainless steel, Grade L. The ports shall extend a minimum of 1 in. above the insulation false panel and threaded to accept a 1/4-in. female national pipe thread fitting.

h. The housing shall be equipped with a floor drain centered at the bottom of the housing. The drain shall be 1-in., Schedule 40, seamless pipe meeting the requirements of ASTM A 312/A 312M, 300-series stainless steel. All welded components shall be fabricated from 300-series stainless steel, Grade L.

i. The housings shall be equipped with an access port for the filter element.

j. The housings shall be equipped with filter removal rods to draw the filters to the change-out position. The removal rods shall be operated from inside the change-out bag, and the filters shall be removed by pulling against the bottom of the filter frame. There shall be no penetration through the housing for operation of the removal rod. All change-out operations shall be within the bag so there is a barrier between the worker and the filter at all times.

k. The access port shall be equipped with a containment change-out bag adapter. The adapter shall be welded to the housing. The welded joints and seams used to fabricate and secure the change-out adapter to the housing shall be considered "pressure-retaining" joints and shall be 100 percent continuously welded and shall require NDE or inspection as required. The adapter shall be hemmed or rolled on its outer edge and include two continuous ribs. The ribs are required to hold the containment bag elastic cord or safety strap during filter element bag-in/bag-out procedures.

l. A containment change-out bag shall be provided for each access port. The bags shall be nominal 5 mils thick, translucent and have an elastic O-ring (compatible with the maximum bag temperature) hemmed into the open end of the bag.

m. A nylon-safety strap shall be provided with the bag to prevent the bag from slipping off the access port bag adapter during filter element bag-in/bag-out procedures.

n. A nylon-cinching strap shall also be provided with the bag to "tie-off" the bags slack when the housing door is installed and the unit is operational

o. The access port shall include a removable door assembly that encloses the access port, the bag adapter, and the bag with its accessories.

p. The door shall include a minimum of four tie-down latches. The latches shall be designed in such a manner as not to impede the bag-in/bag-out process.

q. The door shall include a continuous rubber lip on its perimeter that affects a positive "compression" seal between the door and the housing.

r. CMTRs for all materials used shall be provided to the Buyer.

6. Inlet Heater.

a. Provide an inlet heater sized to freeze protect the dryer enclosure. Heater shall be installed in the inlet before the cooling coil and prefilter. Heater shall include a remote control panel, with a minimum of two stages of electric heat; the first stage shall be silicon control rectifier controlled to modulate the heat output of the heater. Control panel shall include pilot lights for heater on, low airflow, and each stage on. Heater shall be UL-listed.

b. Heating elements shall be open coil, 80-percent nickel, 20-percent chromium, Grade A resistance wire. Coils shall be machine crimped into stainless-steel terminals extending at least 1 in. into the air stream and all terminal hardware shall be stainless steel. Coils shall be supported by ceramic bushings staked into supporting brackets.

c. Heater frames and terminal boxes shall be corrosion resistant steel. Terminal box shall be provided with a hinged, latching cover and multiple concentric knockouts for field wiring.

d. Heater shall include the following controls: airflow sensing switches (differential pressure-type), hi-limit thermostats, manual and automatic reset thermal cutouts, de-energizing magnetic contactors for each heater stage, safety magnetic contactors controlled by the automatic reset cutout. Control transformer including overcurrent protection required by UL or the NEC® (NFPA 70), a disconnect switch, and include electronic thermostat necessary to operate the heater silicon control rectifier and stages. The controller shall be chosen to minimize harmonics as much as possible.

7. Chilled Water Cooling Coil.

   a. Chilled water cooling coil shall be certified under ARI Standard 410. Coils shall be counter-flow air and water through the coil. Coils shall be tested to 350-psig dry air under water.

   b. Coil tubes shall be seamless copper with mechanically or hydraulically expanded into full length fin collars. Copper return bends and stub connections shall be brazed into expanded tube ends using high temperature brazing alloys.

   c. Coil headers shall be fabricated of seamless copper tubing, sized to minimize water pressure drop.

   d. Coil casing shall be mill galvanized-sheet metal with flanges for mounting.

   e. Provide condensate drain pan under cooling coil. Condensate shall be collected and drained from the coil housing. Condensate drain shall have a P-trap and be routed to a 5-gal carboy.

   f. Approximately 10 gal/min of chilled water (35-percent propylene glycol, 65-percent water) at 50 °F is available for use to cool the dryer enclosure.

   g. Temperature control valve: Provide reverse acting control valve providing for valve opening on rise in temperature. Valve body shall be bronze and trim shall be precision machined nickel alloy for durability and corrosion resistance. Valve shall be single seated and quick opening for fast response. Self-contained thermal system shall include 304 stainless-steel bulb with 18-in. flexible extension, 10 ft of 304 stainless-steel capillary with spirally wound armor and stainless-steel union connection with hub for installation flexibility. Self-acting temperature control valve shall be W. E. Anderson® Model No. 36RD, size shall be selected to provide 3-psig pressure drop at coil full flow conditions, temperature range shall be 70 to 145 °F.

8. Discharge Grille. Provide a stainless-steel, single-deflection, horizontal supply grille

3.3.1.6.5 Exhaust High-Efficiency Particulate Air Filter Assembly

1. HEPA-Filter Housings.

a. The exhaust from each dryer enclosure will require one HEPA-filter housing. The filter housing shall be a Flanders G Series™, filter access shall be as shown on the arrangement drawings, and shall be fabricated from 11 and 14 gauge, ASTM A 240/A 240M, 300-series stainless steel with a 2-B mill finish. All welded components shall be fabricated from 300-series stainless steel, Grade L.

b. Housing hardware material shall meet the requirements for 300-series stainless steel, excluding the access door knobs which shall be cast aluminum.

c. The filter housings shall be adequately reinforced to withstand the system structural capability pressure as defined in ASME N509 (Section 4.6.6.1).

d. All "pressure-retaining" weld joints and seams shall be 100 percent continuously welded. Welding shall meet the requirements of ASME N509 (Paragraph 7.3). Weld joints and seams shall be wire brushed or buffed before final NDE or inspection, as required to remove heat discoloration, oxidation, all burrs, slag, excessive splatter, soot, dirt, sharp edges, or any residue from welding.

e. The housings shall each accommodate one Flanders GG-F (24-in. by 24-in. by 11-1/2-in.) Fluid Seal™, Type B (Nuclear Grade) HEPA-filter element. Filter-to-housing seal shall be affected by means of a "knife-edge" frame in the housing that ends with a continuous perimeter channel on the face of a filter element that has been filled with a viscous, nondrying fluid. The filter elements shall not require any special attachments or devices to function correctly within the housings.

f. The housings shall be equipped with two static pressure ports. The ports shall be located upstream and downstream of the filter elements on the top of the housing pipe connections. The port fittings shall be 1/2-in., Schedule 40, seamless, stainless-steel pipe meeting the requirements of ASTM A 312/A 312M, 300-series stainless steel.

Housing shall include a capped 3/4-in. aerosol injection port, 3/4-in. upstream aerosol sample port, and a 3/4-in. downstream aerosol sample port. All welded components shall be fabricated from 300-series stainless steel, Grade L.

g. The housings shall be equipped with a drain centered at the bottom of the housing. The drain shall be 3/4-in., Schedule 40, seamless pipe meeting the requirements of ASTM A 312/A 312M, 300-series stainless steel and a ball valve. All welded components shall be fabricated from 300-series stainless steel, Grade L.

h. A toggle or over-center ("Davis-Lok") type filter element clamping assembly or locking tray shall be used to secure the filter elements in the housing. The clamping assembly shall apply a sealing force that is even and uniform across the top and bottom of the filter element. The clamping assembly or locking tray shall be replaceable.

i. The housings shall be equipped with an access port for the filter element. The access port shall be equipped with a containment change-out bag adapter. The adapter shall be welded to the housing. The welded joints or seams used to fabricate and secure the change-out adapter to the housing shall be considered "pressure-retaining" joints and shall be 100 percent continuously welded. The adapter shall be hemmed or rolled on its outer edge and include two continuous ribs. The ribs are required to hold the containment bag elastic cord or safety strap during filter element bag-in/bag-out procedures.

j. The filter element clamping assembly or locking tray shall be accessible from the access port and shall be operable through any containment change-out bags.

k. The housings shall be equipped with filter removal rods to draw the filters to the change-out position. The removal rods shall be operated from inside the change-out bag, and the filters shall be removed by pulling against the bottom of the filter frame. There shall be no penetration through the housing for operation of the removal rod. All change-out operations shall be within the bag so there is a barrier between the worker and the filter at all times.

l. The access port shall include a removable door assembly that encloses the access port, the bag adapter, and the bag with its accessories.

m. A containment change-out bag shall be provided for each access port. The bags shall be nominal 5 mils thick, translucent, and have an elastic O-ring (compatible with the maximum bag temperature) hemmed into the open end of the bag.

n. A nylon-safety strap shall be provided with the bag to prevent the bag from slipping off of the access port bag adapter during filter element bag-in/bag-out procedures.

o. A nylon-cinching strap shall also be provided with the bag to "tie-off" the bags slack when the housing door is installed and the unit is operational.

p. The access port shall include a removable door assembly that encloses the access port, the bag adapter, and the bag with its accessories.

q. The door shall include a minimum of four tie-down latches. The latches shall be designed in such a manner as not to impede the bag-in/bag-out process.

r. The door shall include a continuous rubber lip on its perimeter that affects a positive "compression" seal between the door and the housing.

s. The door shall interface with the housing in such a manner that the door cannot be closed or installed until the filter element is correctly installed in the housing and the clamping assembly or locking tray is fully ended.

t. Housing shall be equipped with a 10-in. diameter Schedule 10S stainless-steel inlet and outlet port. Each port shall be equipped with a slip on 150-lb raised-face flange. Inlet and outlet shall extend 9 in. from the housing.

u. CMTRs for all materials used shall be provided to the Buyer.

2. Ductwork.

a. The round duct sections shall be fabricated from Schedule 10S, straight-seam welded stainless-steel pipe meeting the requirements of ASTM A 312/A 312M, 300-series stainless steel. All welded components shall be fabricated from 300-series stainless steel, Grade L. The operating pressure of the system is minus 12-in. w.g. Rectangular duct sections shall be fabricated of minimum 14 gauge, 300-series stainless steel, Grade L, meeting the requirements of ASTM A 240/A 240M.

b. The duct sections shall be adequately reinforced, as necessary to withstand the system structural capability pressure, as defined in ASME N509 (Section 4.6.6.1), and to support 150 percent of its own weight. The system structural capability pressure is minus 30-in. w.g.

c. Duct fittings shall meet the requirements of ASTM A 403/A 403M, 300-series stainless steel, Grade L, Schedule 10S, buttweld fittings. All elbows shall be long radius.

d. The flanges for ductwork 6 in. and smaller shall be, at a minimum, 150-lb weldneck flanges meeting the requirements of ASTM A 182/A 182M. Bore of the weldneck flanges shall be bored to match the duct inside diameter.

e. Plate and sheet shall be ASTM A 240/A 240M, 300-series stainless steel, Grade L.

f. Balancing dampers and Isolation valves: Butterfly valves shall be used to balance and isolate the DCRS skid assembly enclosure and ductwork from the OGTS. Balancing and isolation valves shall meet the design requirements of ASME B31.1 and MSS SP-67. Isolation valves shall be Keystone™, F362, Bray Series 41 (with MSS SP-67 shell and seat testing) or approved equivalent, with 316 stainless-steel body, disc, and stem. Stem packing shall be Teflon® and the resilient seat shall be Buna N® or ultra-high molecular weight polyethylene. The stem bushing shall be reinforced polytetrafluoroethylene or fiberglass epoxy or 316 stainless steel with polytetrafluoroethylene/glass fabric liner. Valves shall meet the requirements of ASME N509 for leakage Class I (as defined in

Paragraph 5.9.1.4.) and shall be individually tested in accordance with ASME N509 (Section 5.9.7). The valves shall be manually actuated with locking lever actuators. Component data sheets and catalog cut sheets are provided in Appendix C.

g. Flange gaskets shall be minimum 1/8-in.-thick ethylene propylene diene monomer, 60 to 75 durometer.

h. CMTRs for all materials used shall be provided to the Buyer.

i. All "pressure-retaining" weld joints and seams shall be 100 percent visually inspected. Weld joints and seams shall be wire brushed or buffed before final NDE or inspection as required to remove heat discoloration, oxidation, all burrs, and sharp edges.

3. Insulation.

a. Insulation shall be a flexible, closed-cell elastomeric insulation in tubular or sheet form. Insulation shall be AP Armaflex®, with Armaflex® 520 contact adhesive, and WB Armaflex® finish.

b. Insulation shall have a flame spread index of 25 or less and a smoke developed index of 50 or less when tested in accordance with ASTM E 84. In addition, the product, when tested, shall not melt or drip flaming particles, the flame shall not be progressive, and all materials shall pass simulated end-use fire tests.

c. Materials shall have a minimum thermal conductivity of 0.27 Btu-in./h-ft^2-°F at a 75 °F mean temperature when tested in accordance with ASTM C 177 or ASTM C 518.

d. Install insulation after all testing is completed and heat trace has been installed. Insulation shall be installed to allow removal of piping spools at flanges to facilitate removal and relocation.

e. Provide 1-in.-thick insulation on all ductwork, pipe, and filter housings. Bond insulation to ductwork, pipe, or filter housings with Armaflex® 520 adhesive in accordance with the manufacturer's written instructions.

f. The low fluoride and chloride content of the insulation below 250 ppm shall be used to insulate the ductwork.

4. Heat Trace.

a. Provide self-regulating heating cable capable of maintaining process temperatures up to 100 °F and intermittent temperatures of up to 185 °F. Heat-trace cable and heat-trace accessories shall be Nationally Recognized Testing Laboratory (NRTL)-approved for ordinary areas. Heat-trace cable and accessories shall operate with 120V, single-phase, 60-Hz power. Heat-trace cable and accessories shall be supplied by the same manufacturer. Heat-trace cable may be as manufactured by Raychem®, Chromalox®, or Thermon®.

b. Accessories: Provide all necessary components, tape, labels, and clamps to install heat trace. Provide the following components for each heat-trace circuit:

i. Provide power connection kits with light,

ii. rovide pipe sensing thermostat,

iii. Provide end of circuit end seals above the insulation with light,

iv. Provide splices and splice kits at all flanges or flexible connections to facilitate removal and reinstallation of ductwork with heat trace intact. Provide additional length of heat-trace cable to allow splicing the heat-trace cable after removal and reinstallation of the ductwork.

c. Heat trace shall be applied to the ductwork shown in Table 3-6.

Table 3-6: Heat Trace

Duct Line number	Duct Size (in.)	Duct Maintenance Temperature (°F)	Minimum (watts/ft)	Approximate cable length (ft)	Cable nominal rating (watts/ft)	Cable Output (watts/ft)	Approximate Circuit (watts)
6 in.	6	100	11.75	25	10	6.5	300
6 in.	6	100	11.75	15	10	6.5	200

3.3.1.7 Dryer Vent Filter

The dryer vent filter shall be a Buyer-provided Flanders™ filter number 0-007-1-12-RF-NU-00-E3-Z04059 with a Flanders™ weather cap F0622997. A component data sheet for the dryer vent filter is provided in Appendix C The performance requirements of the dryer vent filter piping are discussed in Section 3.2.5.

3.3.1.8 Electrical Design Process

The following subsections provide the electrical design process requirements for this specification.

3.3.1.8.1 General

The electrical installation shall meet the requirements of the NEC® (NFPA 70), as administered by the CH2M HILL electrical inspector.

Electrical equipment shall be listed or labeled by a NRTL, such as UL, when a category exists. Note: NRTL's are listed on the Occupational Safety and Health Administration website at http://www.osha-slc.gov/dts/otpca/nrtl/index.html It is the Seller's responsibility to ensure the listing is appropriate for the equipment specified.

It is the Seller's responsibility to obtain a listing or label for equipment without a listing or label by a NRTL.

When a listing or label can not be obtained, it is the Seller's responsibility to provide equipment critical characteristics, engineering data, and test data for the Buyer's engineer to evaluate the acceptance of the product

Any component, equipment, assembly, or system without a NRTL listing or label shall be subject to the approval of the CH2M HILL electrical inspector.

Where NEC® inspection is required, the Seller shall arrange for a CH2M HILL NEC® inspection to occur at the Seller's facility before shipping any assembly not covered in whole by a NRTL listing or label. The Seller shall perform modifications as required by the NEC® inspector before shipping.

Cabinets containing assembled control systems shall be designed, constructed, and listed or labeled to UL 508A, as applicable.

Design and operation of the assembled system shall meet the requirements of IEEE Std 141, IEEE Std 142, IEEE Std 242, and IEEE Std 519.

3.3.1.8.2 Electrical Drawings

The Seller shall develop detailed electrical arrangement and fabrication drawings showing all electrical components and interfaces. Install conduit, duct, wiring, cables, connectors, and devices in accordance with manufacturer's written instructions and applicable requirements of the NEC® (NFPA 70).

3.3.1.8.3 Electrical Calculations

Electrical calculations shall be done in support of NEC® (NFPA 70) requirements, ANSI/IESNA RP-7 requirements, and requirements of this specification. Calculations shall include, but are not limited to:

1. Indoor and outdoor lighting calculations in accordance with IESNA HB-9, using input from this specification and ANSI/IESNA RP-7.

2. Electrical load calculation, with any assumptions regarding demand factors or load diversity clearly stated.

3. Wire sizing calculation for all power conductors, with all assumptions regarding duty cycle clearly stated.

4. Equipment sizing/selection calculation (transformers, panelboards, overcurrent protection, etc.), with any assumptions clearly stated.

5. Raceway sizing calculation, for all conduit and other raceways.

6. The Seller shall size motors independently and provide motor-sizing calculations. The Seller shall also provide calculations defining the mechanical gear ratio and safe operating range of the motor that meets the criteria in Section 3.3.1.9.4.

Care shall be taken to ensure that ambient temperature considerations and heat gain from direct sun are considered appropriately when performing calculations for wire and equipment size.

3.3.1.8.4 Electrical – Routing

The Seller shall select the routing of conduits between devices and the power and instrumentation and control enclosures. Care shall be taken to run conduit along the frame members where they can be mounted. Care shall be taken to select routes where conduit does not interfere with maintenance or replacement access to devices such as pumps or valves. Sketches of the routing locations shall be submitted to the Buyer for review and approval before proceeding with the work.

3.3.1.8.5 Electrical – Grounding

A Grounding Diagram is shown on Sketch DBVS-SK-E003 (Appendix A). In accordance with this diagram, the point of reference for the skid grounding system is the skid grounding lug.

1. All power circuits shall include a ground wire that serves as the equipment grounding conductor, independent from the neutral wire. All powered devices shall be connected to the ground circuit wire. In addition, the skid frame, enclosures, raceways, covers, and enclosure doors shall be attached to the electrical ground. This may be accomplished by means of a screw, lock washer, and ring connector attachment at a spot where all paint and surface corrosion has been cleaned from the frame. The frame shall not be used as a current carrying conductor between devices.

2. Ground wires shall be green-insulated or bare-stranded copper wire.

3. Ground conductors shall be unspliced and continuous between termination points. Ground distribution shall be through terminal blocks or a ground bus. Wire nuts or butt splices are not acceptable.

4. The resistance between the main ground connection to the skid and any point in the ground circuit shall be less than 0.1 ohm as measured with a calibrated ohm meter.

5. The instrument ground circuit shall be separate and isolated from the power ground circuit to the extent allowed by the NEC® (NFPA 70). The requirements for the instrument ground circuit installation are the same as the power ground requirements given above.

6. A grounding lug shall be provided on the outside frame of the skid to facilitate attachment of the skid grounding electrode. The location of the grounding lug shall be shown on the shop drawings.

3.3.1.8.6 Electrical – Conduit Fill

The sum of the cross-sectional areas of all contained conductors shall not exceed the interior cross-sectional area of the raceway as calculated in the tables in Chapter 9 of the NEC® (NFPA 70) for raceway fill.

3.3.1.8.7 Electrical – Strain Relief for Conductors

Strain relief shall be provided for all cables. The strain relief device shall comply with the following:

Strength - The device shall be capable of withstanding a 35 lb pull for one minute (from any direction) without allowing movement of the raceway or cable that could damage the conductor insulation or strain the conductor terminations.

3.3.1.8.8 Electrical – Conduit Support

Conduit shall be supported by attachment to the frame. The Seller shall provide rigid brackets or additional frame members for attaching conduit when frame members are not in a convenient location. Attachment shall be on regular intervals per NEC® (NFPA 70). Attachment shall be made using "U" clips which may be connected to the frame using either weld studs and nuts or bolts or approved NEC® (NFPA 70) method.

3.3.1.8.9 Electrical – Segregation of Control and Power Wiring

Power circuit wiring and control circuit signal wiring shall be run in separate conduits. Signal wiring that transmits alternating current signals shall be run in separate conduits from signal wiring that transmits direct current signals. Power and instrumentation wiring of different voltage levels shall be run in separate raceways.

3.3.1.8.10 Electrical – Splicing

No splicing is allowed.

3.3.1.8.11 Electrical – Enclosure Wiring

All enclosure wiring shall be routed, harnessed, appropriately laced, or in plastic wiring ducts. Where possible, all electrical penetrations into cabinets shall be from the bottom of the cabinet.

3.3.1.8.12 Electrical – Instrument Enclosures

Exposed live parts and contacts (greater than 50V) in enclosures shall be guarded to prevent unintentional contact during maintenance activities. Door-mounted equipment shall be constructed or shielded so that no live parts will be exposed to unintentional contact when the door is open.

3.3.1.9 Electrical Components

A clear insulating cover shall be placed over energized parts (e.g., terminal blocks, motor starters, and/or relay blocks) if the voltage is above 50V to ground. A "finger-proof" design is acceptable in lieu of a clear insulating cover. The purpose of the insulating cover is to prevent contact with energized parts. All electrical heaters shall be installed in accordance with the manufacturer's instructions and with proper clearances. All other components are to be installed in accordance with the manufacturer's instructions.

3.3.1.9.1 Transformer and Distribution Panel

A 480-120/240V ac single-phase transformer and associated distribution panel shall be installed inside the DCRS container. The distribution panel and

transformer may be combined as a single unit (e.g., Square D® Mini Power-Zone®). The distribution panel and transformer shall be sized to allow a minimum of 25 percent load growth and shall include spare one- and two-pole 20-amp breakers sized to accommodate this load growth. A detailed panel schedule listing breaker sizes and loads shall be located inside the panel door and provided as one of the shop drawings.

Electrical power shall be distributed to all electrical components (except those served by external sources of power) from this distribution panel. Circuit breakers serving convenience receptacles shall be protected by GFCI circuit breakers. GFPE circuit breakers shall be used to protect heat-trace circuits. Component data sheets for the distribution panel and transformer are provided in the Bidder's Drawing and Data Commitments sheet (Appendix F).

3.3.1.9.2 Interior Lighting

The Seller shall provide vapor-tight, high-impact fluorescent lighting fixtures to provide interior lighting. Interior lighting levels shall be in accordance with ANSI/IESNA RP-7 and shall be confirmed by approved calculation before fabrication and by light meter test before delivery. A minimum average illumination of 50 fc shall be provided at the floor level. Fixtures may be wall mounted or ceiling mounted, but if ceiling mounted the means of attachment (bolts, etc.) must not penetrate the DCRS container roof. Shadowing around areas requiring maintenance shall be avoided as practicable. A three-way light switch shall be located near each door on the inside of the DCRS container.

Component data sheets for the lighting fixtures are provided in the Bidder's Drawing and Data Commitments sheet (Appendix F).

3.3.1.9.3 Interior Receptacles

Convenience receptacles shall conform to NEMA 5-15R. Weatherproof duplex receptacles shall be installed on the inside of the freight container near each door for general purpose use.

3.3.1.9.4 Electrical Motors

1 The drive motor shall consist of a base-mounted speed reducer directly coupled to the equipment main shaft with drive motor on a separate mount.

Final selection of the motor shall be determined by the Buyer before approval of final design.

2. The motor horsepower shall be sufficient to continue operating without stalling at any point during the equipment operation.

3. Motors, 1 hp or greater, shall be rated at 480V ac, 3 phase, 60 Hz.

4. The motor(s) shall have a minimum service factor of 1.15.

5. The motor(s) shall have a minimum insulation class of F, as defined in NEMA MG-1.

6. The motor(s) shall be designed to operate in an outdoor environment under conditions described in Section 3.2.5 and Table 3-2, even though the majority of motors will be mounted internally to the dryer skid containment.

7. Motors shall be designed and tested by the manufacturer in accordance with NEMA MG-1. Certificates of compliance and/or certified test results shall be supplied for the following tests:

   a. Rated load readings of current, power, and speed at rated voltage and frequencies;

   b. No load readings of current, power, and speed at rated voltage and frequencies;

   c. Mechanical vibration and motor balance test results in accordance with NEMA MG-1-12.06 and NEMA MG-1-12.07;

   d. High potential test results in accordance with NEMA MG-1-12.03; and

   e. 1000V dc Megger test for one minute, phase to ground.

8. The Seller shall use the conditions described in Section 3.2.5 to determine the use of an open, drip-proof enclosure or a totally enclosed fan cooled enclosure.

9. The Seller shall provide the motor specifications and data sheet to the Buyer for approval before final selection.

3.3.1.9.5 Fixed Head Air Sampler Components

The fixed head air sampler components shall consist of the following components:

1. Portable constant air flow sampler,

2. Sample filter holder, and

3. Sample filters.

The Seller is responsible for supplying the components as specified (no substitutes), but the Buyer will install and test the components when the skid is delivered. Tubing, quick disconnects, and other miscellaneous components for the final installation will be furnished by the Buyer at the time of installation. Component data sheets for the fixed head air sampler components are provided in Appendix C.

To facilitate installation of the air sampler, two penetrations shall be made through the wall of the container, approximately 1 ft apart (vertical orientation), near the front access door (opposite side of the door swing). The penetrations shall be fitted with 3/8-in. tubing or pipe, and terminated on both ends with male 3/8-in. swaged tubing fittings. The swaged fittings shall be plugged for future use.

3.3.1.9.6 Pushbutton Stations

A wall mounted pushbutton station shall be provided for each motor (including future chopper motors), within sight of each motor, if possible. The Seller may combine the pushbutton stations into a single enclosure, providing that the orientation of the pushbuttons and lights remain the same for each motor, labeling is clear, and a terminal strip is provided in the enclosure. Each pushbutton station shall be labeled with its respective designator in accordance with Sketch DBVS-SK-E003 (Appendix A). Component data sheets for the Pushbutton Stations are provided in Appendix C.

Control wiring from pushbutton stations shall be routed to an external terminal box and labeled in accordance with Drawings F-145579-00-E-0103, F-145579-00-E-0127, F-145579-00-E-0168, and F-145579-00-E-0169 (see Appendix A).

3.3.1.9.7 Disconnect Switches

Nonfusible disconnect switches shall be supplied (but not permanently installed) for all 480V ac circuits as shown on Sketch DBVS-SK-E003 (see Appendix A). Disconnect switches shall be labeled with the load that they serve. Component data sheets for the nonfusible disconnect switches are provided in Appendix C.

All switches shall be designed to be locked and tagged out.

3.3.1.9.8 Electrical Enclosures

If a NEMA 4 (outdoor) or NEMA 12 (indoor) enclosure is not available because of equipment design or ventilation requirements, then a NEMA 3R (outdoor) or NEMA 1 (indoor) enclosure may be used, respectively.

3.3.1.10 Electrical Materials

The following subsections provide the electrical material requirements for this specification.

3.3.1.10.1 Conduit

1. Rigid galvanized steel (RGS) conduit or electrical metallic tubing shall be used in accordance with the NEC® (NFPA 70). The conduit shall be NRTL-approved, standard weight, 1/2 in. minimum size for control wiring and 3/4 in. minimum size for power wiring.

2. Liquid-tight flexible metallic conduit shall be installed where flexible conduit is required or where connecting to vibrating loads. Liquid-tight flexible metallic conduit shall be grounding-type with a polyvinyl chloride jacket.

3. Conduit fittings shall be standard steel threaded, liquid-tight-type, rigid galvanized steel or electrical metallic tubing fittings.

3.3.1.10.2 Wire and Cable

1. Conductors shall be stranded copper for all sizes of wire and cable unless specifically designated otherwise on the drawings.

2. Wire insulation shall be Type THHN (heat-resistant thermoplastic)/THWN (moisture and heat-resistant thermoplastic) for all 600V conductors unless specifically noted otherwise on the drawings.

3. Minimum size of power conductors, 600V and below shall be No. 12 American wire gauge (AWG).

4. Conductors for control circuits shall be No. 14 AWG minimum, except that remote control circuits, signaling circuits, instrumentation, and power limited circuits may be sized smaller in accordance with the NEC® (NFPA 70).

5. Power wiring shall have color-coded insulation as indicated in Table 3-7.

Table 3-7: Wire Color Coding Requirements

Service, Feeder, or Branch Circuit	Conductor	Insulation Color	Insulation Type
480Y/277V ac, 3-phase systems	Phase A	Red	THWN/THHN or XHHW
	Phase B	Yellow	
	Phase C	Blue	
	Neutral	White or Gray	
	Equipment Grounding Conductor	Green (or bare)	
208Y/120V ac, 3-phase systems	Phase A	Black	
	Phase B	Purple	
	Phase C	Brown	
	Neutral	White or Gray	
	Equipment Grounding Conductor	Green (or bare)	
120/240V ac, 1-phase systems	Hot No. 1	Black	
	Hot No. 2	Brown	
	Neutral	White or Gray	
	Equipment Grounding Conductor	Green (or bare)	

6. Instrumentation cable shall be 600V, multipair 4-20-mA signals, multiconductor for discrete signals, flame retardant, jacketed cable suitable for installation in wet or dry locations. Conductors shall be No. 18 AWG stranded, copper, in twisted pairs or triads with ethylene propylene insulation. Each pair or triad shall be shielded with a drain wire and metallic tape. Multipair cables shall have an individual shield and an overall shield of metallic tape and drain wire. Conductor color coding shall be black, white, and red if triad. Temperature rating shall be 90 °C. Each pair or triad shall be numbered for simplified termination.

7. Control and power multiconductor cable shall be 600V, flame resistant, jacketed cable suitable for wet or dry locations. Conductors shall be stranded copper with ethylene propylene insulation with a temperature rating of 90 °C.

3.3.1.10.3 Connectors

1. Where possible, terminal blocks shall be the push-in cage clamp-type and shall be performed in accordance with the manufacturer's recommendations.

2. Crimp-on, flat, loop connectors (i.e., Sta-kon®) shall be used. Crimp-on connections shall be performed in accordance with the manufacturer's recommendations.

3. Flat-spade connectors shall not be permitted.

3.3.1.11 Instrumentation and Control

The following sections describe the instrumentation and Monitoring Control System requirements for the DCRS skid assembly.

3.3.1.11.1 Instrumentation

For all instrumentation, the design pressure for the instrumentation chosen shall meet or exceed the system design pressure If the instrumentation does not meet these requirements, written notification shall be given to the Buyer Isolation valving shall be provided for sensors to isolate a component during maintenance or testing.

Instrumentation connections shall be of a compatible material with respect to the attached piping. Power supplied to instruments shall be either 24V dc loop powered instruments (preferable) or 120V ac, when 24V dc is not practical. Components using different voltages shall be separated and clearly identified in junction boxes.

Appendix C provides initial instrument data sheets with the critical characteristics for that particular instrument and the preferred vendor, along with a model series for consistency with other portions of the project. Final instrument selection and final model number determination is the responsibility of the Seller, to meet the particular design application for form, fit, and function. Changes from the stated manufacturer or model can be made with Buyer's approval.

All instruments shall be factory-calibrated in accordance with the instrument data sheets (Appendix C). Calibration records shall be provided with all instruments and shall include the instrument accuracy and drift. Recommended field recalibration procedures shall be provided by the Seller along with a list of any special tools required for recalibration. One copy of the calibration documentation, unless otherwise specified, shall accompany the applicable item(s) shipped.

3.3.1.11.2 Monitoring and Control System

The MCS is not part of this contract; therefore, the Seller shall provide a termination panel that the Buyer will use to access components on the assembled system. The termination panel shall be located on the outside of the container (skid), be rated for outside environmental condition, shall be easily accessible for maintenance (approximately 60 in. high from the floor); and shall meet NEC® (NFPA 70) requirements for working clearances. The exact location of the panel will be determined based on minimization of wiring, internal skid interferences, and external connection routing The preferred location is on the skid side with the personnel access doors.

Only local instruments and components are required to be wired and terminated to the termination panel[2]. The local instruments and components shall be routed in conduit and terminated at the local termination panel. Terminations shall be

[2] Instruments shown on the P&ID drawings with a box around the symbol are Monitoring and Control System virtual displays or controls, and require no action by the Seller.

tension-clamp terminals capable of individual replacement (i.e., DIN rail-mounted). An example is a Weidmüller® type WDU. Alternating current power and alternating current/direct current inputs shall be physically separated.

The normal field voltages from or to the MCS is 24V dc, which enhances personal safety during maintenance. Over 50V represent hazardous voltage which should be avoided unless authorized by the Buyer. This does not apply to equipment that requires 120V ac, but with low voltage interfaces to the MCS.

The Seller shall prepare an interface panel wiring to instrument/component drawing. See Figure 3-2 as an example. See Appendix G for wire and cable tagging.

Twisted Shielded Pair shall be used for analog instrument signal wiring. Individual wires shall be labeled for the destination with the cable being labeled with both FROM and TO information (see Appendix G).

3.3.1.11.3 Instrument Calibration and Characteristics

All instrument transmitters shall provide an isolated 4-20-mA signal to the MCS, unless a different output is required for the process. Justification shall be clearly indicated on the completed Component Data Sheet. All pneumatic control valves shall accept a 4-20-mA control signal from the MCS and provide position indication to the MCS. Interface connections shall be through wire termination points on the instruments. Instruments, tubing, piping, and wiring shall be installed in accordance with the instrument manufacturer's recommendations and the best practice for the industry. Purchasing and installation of the MCS input/output modules are not included in this contract. Locally indicating instruments/sensors shall be installed such that they are easily readable by an operator standing on the floor of the DCRS skid assembly. The Buyer shall provide guidance with positioning based on best available knowledge of the configuration.

All instruments shall be factory-calibrated and a Calibration Data Package shall be provided including a Certificate of Calibration traceable to the National Institute of Standards and Technology (NIST), for each article contracted. In addition, the actual Calibration Records for each instrument, shall also be included containing the instrument identification, accuracy requirements and results, and the as-found and as-left data.

Each calibration certificate shall be signed by the Seller's representative responsible for calibration, attesting to its authenticity and shall be identified with the:

1. Buyer's contract number,

2. Identification of the article to which the certificates applies, and

3. Standards used for calibration.

The Certificates of Calibration will be held on file by the Buyer's Records Management as objective evidence to support the actual test results and attest to the fact that the calibrated item(s) met requirements.

Certification stating the equipment furnished to the contract requirements has been calibrated using standards whose calibration is traceable to the NIST or other documented evidence, must be submitted stating the basis of the calibration. In addition, the Seller shall submit a report of actual calibration results. The report shall be identifiable to the acceptance criteria of the items submitted and shall meet contract requirements. The report shall contain the signature of the authorized representative of the agency verifying compliance. One copy of the documentation, unless otherwise specified, shall accompany the applicable item(s) shipped.

The Seller shall provide Instrumentation types and manufacturer to the Buyer for approval before purchase of the instrument. Recommended field recalibration procedures shall also be provided in the final data package along with a list of special tools required for recalibration.

Data sheets for the process instrumentation are provided in the Bidder's Drawing and Data Commitments sheet (Appendix F)

3.3.1.12 Structural Design Process

The following sections detail the structural design process including details for structural drawings and calculations.

TECHNICAL SPECIFICATION

PROJECT:	Final DBVS Design	145579-D-SP-006	REV. 2
PROJECT NO.:	145579	DRYER AND CONDENSATE RECOVERY SYSTEM SKID	
CLIENT:	AMEC E&E - Richland, Washington		

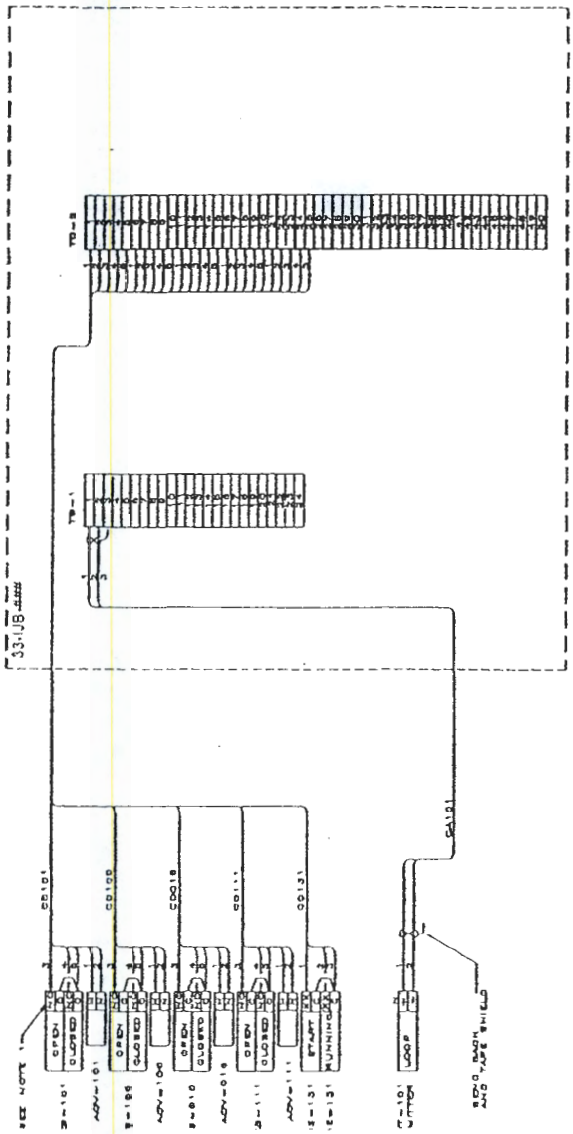

Figure 3-2: Interface Panel Wiring to Instrument/ Component Drawing (Example)

3.3.1.12.1 Structural Drawings

The Seller shall develop detailed structural arrangement and fabrication drawings showing all structural interfaces, mechanical equipment and piping anchorages, and/or support layouts including hoisting and rigging load paths, rigging angles, and other special requirements for installation. Drawings F-145579-00-B-0008 and F-145579-00-B-0008 are provided to the Seller with locations of the interfacing structural design of the system.

3.3.1.12.2 Structural Calculations

In general, equipment and structures shall be analyzed and designed in accordance with UBC (1997) and ASCE 7-98, as the minimum requirements for a Hanford Performance Category 2 (PC-2) system. The loads and load combinations used in the analysis shall be as defined in UBC (1997) or other national codes and standards, as referenced in this section or as otherwise defined in this specification. In addition, the Hanford Site-specific design requirements are included as part of this specification and shall be incorporated in the analysis, as applicable, in determining the loads, load combinations, and allowable stresses to which the equipment or structures shall be designed. The DCRS skid assembly piping and supports and confinement system shall meet all the requirements per UBC (1997) requirements for Seismic Zone 2B for essential facilities.

Calculations shall demonstrate that equipment will withstand applied loads without loss of integrity or release of radioactive/hazardous material.

1. Dead Loads. Dead loads include the weight of all permanent materials and equipment, including the assembled system equipment weight, with and without the weights of fluids and materials being handled. See Table 3-8 for major equipment approximate dead loads.

   The unit weights of material and construction assemblies shall be those given in ASCE 7-98. Where unit weights are neither established in that standard nor determined by test or analysis, the weights shall be determined from data in Seller design and fabrication drawings or from catalog cut sheets.

Table 3-8: Major Equipment Approximate Dead Loads

Equipment	Dry Weight (lb)	Operational Weight (lb)
Filter	1,500	1,500
HPU	10,000	16,000
Dryer	45,000	90,000
CRS	6,000	12,000

CRS = Condensate Recovery System.

HPU = Hydraulic Power Unit.

2. Live Loads. Live loads are those loads produced by the use and occupancy of the unit and do not include construction and environmental loads such as wind load, snow load, rain load, earthquake load, flood load, or dead load. Live loads are produced by operations, maintenance workers and equipment.

   a. Live loads shall be not less than the minimum uniform load or concentrated load stipulated in ASCE 7-98.

   b. The minimum roof design live load shall be 20 lb/ft^2 (includes ashfall).

   c. The weight of service equipment that may be removed with change of use of a given area shall be considered as live load.

3. Earthquake Loads. Earthquake induced design loads, as a minimum, shall comply with the UBC (1997) Seismic Zone 2B for essential facilities. The structural response may be determined using the methods of UBC (1997) or ASCE 4-98.

4. Snow Loads. Snow loads for the equipment shall be in conformance with ASCE 7-98. A ground snow load, Pg of 15 lbf/ft^2 shall be used for calculating roof snow load. Unbalanced snow loads resulting from drifting or sliding shall be considered. Snow loads, full or unbalanced, shall be substituted for roof live loads where such loading results in larger members or connections.

5. Wind Loads. The equipment shall be designed to resist pressures from wind from any direction. Partial wind loading shall be considered if it

produces a more severe effect. Wind load design shall comply with ASCE 7-98, using the 85 mph "3-second gust wind velocity" with an importance factor of 1.00 and Exposure Category C.

6. Ash Loads. An ash loading of 5 lb/ft^2 shall be considered in the design of equipment or support structures exposed to the elements. The ash loading shall be evaluated using the load combination, S = D + L + A in addition to other load combinations, defined by the referenced codes and standards in determining the governing loads for design and analysis.

7. Operating Loads. The operating loads associated with the dryer that the DCRS enclosure needs to accommodate are shown in Table 3-9.

Table 3-9: Operating Loads (2 sheets)

Load Direction	Dynamic Loading Reactions (lbf)	Static Loading Reactions (lbf)
X1	± 5,830	--
Y1	± 10,065	- 30,213
Z1	± 4180	--
X2	± 9,630	--
Y2	± 16,865	- 31,813
Z2	± 7,980	--

Where,

X1, Y1, and Z1 are reactions at the dryer stub end

X2, Y2, and Z2 are reactions at the dryer drive end

Dryer plow speed for calculation is at 100 rpm

Values based on Calculation 04-017 Revision A

8. Load Combinations and Stresses. Load combinations, allowable stresses, and strength requirements as defined in UBC (1997) and ASCE 7-98 shall be used in determining the governing load combination(s), acceptability of the design, and stability of the equipment or structure.

The stability of the equipment or structure against overturning and sliding shall be determined and the stability maintained, based on a safety factor of 1.5. Anchorage of the equipment components to the support structure(s) shall be designed using the methods in UBC (1997) for life-safety systems (importance factor, I = 1.5).

Anchorage shall comply with UBC (1997). Acceptable types of concrete anchorages include cast-in-place anchors satisfying the requirements of UBC (1997), and industry-standard wedge-type expansion-type anchors having capacities published by the International Conference of Building Officials. Anchor size shall be a minimum diameter of 12 mm (1/2 in.) regardless of calculated anchorage requirements. Alternative anchorage methods or types may be proposed for Buyer consideration.

9. Hoisting and Rigging Loads. The lifting apparatus (eyebolts, hoist rings, and lifting bails) shall be designed in accordance with the AISC *Manual of Steel Construction—Allowable Stress Design*, the AISC *Manual of Steel Construction—Load and Resistance Factor Design*, and ASME B30.20. Equipment designed and fabricated by the Seller shall have a safety factor of 3 based on yield strength. Equipment purchased by the Seller shall have a safety factor of 5 based on ultimate strength. Documents shall be provided to the Buyer demonstrating incorporation of these safety factors. The Seller shall identify the total weight, the center of gravity, and the lift points and rigging methods (plans) necessary for lifting each component. Lift points shall be identified with yellow paint. Any special tooling, spreader bars, or other recommended fabricated devices for lifting shall be provided by the Seller.

10. Below-the-Hook Lift Equipment. The DCRS skid assembly enclosure shall be supplied with below-the-hook lift equipment. The lifting fixtures shall be designed in accordance with ASME B30.20 and welding shall be in accordance with AWS D14.1. Magnetic-particle weld examinations shall be performed after proof-load testing per AWS D14.1. Proof-load testing and NDE tests shall be performed before painting. The lifting equipment shall be shipped to the Buyer with a stress report demonstrating appropriate safety factors (three on yield strength or five on ultimate strength), proof-load testing certification, and subsequent weld examination documentation stamped by a certified-weld examiner. As a minimum, the lifting equipment shall be permanently labeled with the load rating, manufacture's name, date, and drawing number. Stress report, testing certification, and examination documentation is required.

3.3.1.13 Structural Materials

The following sections describe, but are not limited to, structural materials that are applicable to the DCRS skid assembly.

3.3.1.13.1 Weld Studs

Weld studs shall be metallurgically compatible with the material in which they are welded. Weld studs shall be made from stock material that meets the requirements of ASTM A 108 for mild carbon steel.

3.3.1.13.2 Carbon-Steel Plate and Sheet

All carbon-steel plate shall be general purpose, hot-rolled, low-carbon steel in accordance with ASTM A 36/A 36M. Carbon-steel sheet shall be provided in accordance with ASTM A 569.

3.3.1.13.3 Carbon-Steel Shapes

Carbon-steel structural shapes shall conform to the requirements of ASTM A 36/A 36M.

3.3.1.13.4 Carbon-Steel Bars and Rods

Carbon-steel bars and rods shall conform to ASTM A 108 with a minimum yield of 36,000 psi and maximum carbon content 0.35 percent.

3.3.1.13.5 Carbon-Steel Structural Rectangular Tube

Structural carbon-steel, rectangular tubing shall conform to the requirements of ASTM A 500, Grade B.

3.3.1.13.6 Structural Fasteners

No fasteners shall be capable of vibrating loose during transportation and during operation. All such joints should have some means to ensure they remain intact. Double nutting is not an acceptable means of securing nuts. Loctite® thread locker, wire ties, or disrupting threads are acceptable methods for securing nuts.

Pipe flange bolting components shall be listed in ASME B31.3 (Table 326.1) meeting the requirements of ASME B18.2.1 and ASME B18.2.2.

Stainless-steel bolts and cap screws shall be ASTM A 325, Grade B8. Stainless-steel nuts shall be heavy hex nuts in accordance with ASTM A 563a, Grade 8. Washers shall be ASTM F 436, Type 3. Carbon-steel bolts shall be

ASTM A 307, or better, depending on strength and torque requirements. Carbon-steel nuts shall be ASTM A 563a. Bolts and cap screws shall be grade marked.

The Seller shall select fasteners, when they are not specifically called out in this specification, using the following guidelines:

1. Anti-galling compound (e.g., Loctite® 8009 or 8013) shall be applied where stainless-steel bolts are used;

2. Stainless-steel bolts, nuts, and washers shall be used when the mating parts are stainless steel;

3. Carbon-steel bolts, nuts, and washers shall be used where mating parts are not stainless steel; and

4. The Seller shall ensure that suspect or counterfeit fasteners and components are not used. Suspect fasteners can be identified by the following inspection methods:

   a. Head markings are marred, missing, or appear to have been altered;

   b. Threads show evidence of dressing or wear (threads should be of uniform color and finish);

   c. Head markings are inconsistent with a heat lot; and

   d. Head markings matching one of those identified on the *Control of Suspect/Counterfeit Items* (Appendix D).

3.3.1.14 Welding Process

Welding of all piping shall be performed in accordance with ASME B31.3, piping code for "Normal Fluid Service." Welding of all structures and supports shall be performed in accordance with AWS D1.1/D1.1M for carbon steel or AWS D1.6 for stainless steel. Certified welders shall perform welding of all structural steel in accordance with ASME B&PV Code, Section IX and AWS D1.1/D1.1M for carbon steel or AWS D1.6 for stainless steel. Welding for sheet steel shall be in accordance with ANSI/AWS D1.3. Visual and NDE procedures shall be prepared by the Seller.

3.3.1.14.1 Welding Procedure Requirements

All welding shall be performed in accordance with the Seller's approved Welding Procedure Specifications. Each Welding Procedure Specification shall be qualified with a Procedure Qualification Record as required in ASME B&PV Code, Section IX; AWS D1.1/D1.1M; AWS D1.6; or ANSI/AWS D1.3, as applicable.

Welding of all stainless steel including, but not limited to, structural shapes, rectangular tubing, plate, and sheet shall be performed in accordance with AWS D1.6 nontubular, statically-loaded conditions. Welding of stainless-steel or carbon-steel piping shall be performed in accordance with the ASME B31.3 piping code for "Normal Fluid Service." Automatic pipe welding equipment and techniques may be used.

Welding of all carbon steel including, but not limited to, structural shapes, rectangular tubing, plate, and sheet shall be performed in accordance with AWS D1.1/D1.1M nontubular, statically-loaded conditions.

Welded connections on the lifting components shall be 100 percent visual and 100 percent Dye-Penetrant Test or Magnetic-Particle Test inspected. If a weld is in a radioactive material boundary (e.g., process piping), then these welds will require a minimum of a visual inspection and additional NDE (dye penetrant, magnetic particle, or x-ray, as appropriate).

3.3.1.14.2 Weld Joints and Preparation

Weld joints shall be noted on the fabrication drawings in accordance with applicable welding standards.

3.3.1.14.3 Weld Repairs

Weld defects shall be removed and repaired as allowed by the referenced welding standards. The original Welding Procedure Specification shall be used for weld repair. Welds that fail examination, shall not be ground out and repaired more than twice before the section is abandoned and replaced.

3.3.1.14.4 Post-Weld Heat Treatment

All primary liquid salt-solution transfer piping pressure boundary welds fabricated from carbon steel shall undergo a post-weld heat treatment to relieve residual stresses. No post weld heat treatment is required for stainless-steel piping. Post-weld heat treatment shall be conducted in accordance with the ASME B31.3.

3.3.1.14.5 Weld Filler

The weld filler material shall be as specified in the approved Welding Procedure Specification.

3.3.1.14.6 Weld Map

All welds (including typical welds) shall have unique numbering listed on a weld map(s). The weld map(s) shall include the weld number, weld procedure number, filler material control number, welder identification, NDE procedure number, and examiner identification. Individual weld maps are to be provided per component when multiple components are produced.

Weld identification shall be performed as follows:

1. Prepare weld identification drawings, isometric or spool, which show relative position of pressure containing welds and attachment welds to pressure-retaining components.

2. Assign weld numbers to pressure-containing welds and attachment welds to pressure-retaining components as made. Record weld numbers on weld identification drawings as welds are made.

3. Place the welder bonder identification symbol and weld number adjacent to welds on completion. Place the identification symbol approximately every 3 ft on long seams or large welds.

4. Do not reuse weld numbers. If a weld is completely replaced, assign a new number.

5. Show heat and lot numbers on weld identification drawings for materials requiring CMTRs.

3.3.1.15 Material Control Process

The Seller shall develop a material control procedure to be used in the execution of the work. The material control procedure shall address procurement controls, segregation, and traceability of materials including weld filler rod from receipt at the shop through processing.

3.3.1.15.1 Exposure of Stainless Steel to Chloride Materials

Stainless steel shall not be in contact with materials containing more than 250-ppm chlorine. Low-chloride markers shall be used. Chlorinated solvents shall not be used to clean stainless steel.

3.3.1.15.2 Contact of Stainless and Carbon Steel

Contact between carbon steel and stainless steel shall be avoided during fabrication. Temporary carbon-steel clamps, supports, braces, and fixtures shall not come into direct contact with stainless-steel surfaces. Galvanized-steel clamps or fixtures may not be used on stainless-steel piping or components. Wire brushes shall be stainless steel. Grinding wheels and wire brushes shall be new or used previously on stainless steel only.

3.3.1.16 Fabrication Travelers

The Seller shall prepare fabrication traveler(s) for the fabrication and testing of the assembled system. The fabrication traveler(s) shall include detailed procurement, fabrication, assembly, cleaning, examination, inspection, testing, packaging, shipping, and handling steps required to properly fabricate, assemble, and test the equipment in accordance with the drawings and specifications.

3.3.1.17 Workmanship

General: Remove all burrs and break all sharp edges.

1. Drawings:

    a. Dimensioning and tolerancing shall be interpreted per ANSI Y14.5M and

b. Tolerances not specified on drawings shall be as shown in Table 3-10.

Table 3-10: Standard Drawing Dimension Tolerances

Dimension	Tolerance
One Decimal Place	± 0.1
Two Decimal Places	± 0.06
Three Decimal Places	± 0.030
Angular	± 2°

2. Welding to ball valves:

   a. Ball valves shall be disassembled before welding to the valve body.

3. Piping and components:

   a. Pipe flange, man-way, and flange faces shall be within ± 2° of vertical or horizontal, whichever is appropriate;

   b. Pipe flange bolt holes shall straddle centerlines;.

   c. Material and debris shall be removed from piping and components before welding/assembly; and

   d. Secondary containment housing flanges shall be flat.

3.3.2 Industry and Government Standards

The codes, standards, and source documents that provide the design fabrication and testing requirements are listed in Section 2. Sections within this specification provide specific details or reference for application of the codes and standards documents. Conflicts found between the referenced codes and standards will be referred to the Buyer for resolution.

The following sections provide the necessary codes for the design and fabrication of any necessary pressure vessels, piping and tubing, ventilation systems, and structural systems associated with the DCRS enclosure assembly.

3.3.2.1 Design Codes for the Pressure Vessels

The DCRS steam condensate tank (33-D74-022) and/or any other deemed pressure vessels shall be designed, fabricated, and stamped in accordance with the ASME B&PV Code, Section VIII with supplemental nozzle loads determined from the UBC (1997) Zone 2B seismic criteria for essential facilities.

Loads on the HIHTL connectors are shown in Table 3-11.

Table 3-11: Secondary Confinement Enclosure Hose-In-Hose Transfer Line Connector Design Loads

Nozzle (Inner Pipe Size)	Dead Weight Load (-y)	Axial Seismic (±z)	Horizontal Seismic (±x)	Vertical Down Seismic (-y)
2- inch	100 lb	100 lb	100 lb	100 lb

All flanges shall be standard 150-lb raised-face flanges, unless otherwise specified in this specification or the receipt tank interface control drawing, and per ASME B16.5, and shall be made from steel compatible with the pressure vessel nozzle to which they are being welded. All flange bolts shall be tightened to the values specified by the gasket manufacturer.

All pressure vessel welding and inspections shall be performed in accordance with ASME B&PV Code, Sections VIII and IX using personnel certified in accordance with the applicable design codes.

Post-weld heat treatment of carbon steel (if used) shall be performed in accordance with the ASME B&PV Code, Section VIII, Article UW-40 for Division 1 or Article F-4 for Division 2.

An ASME B&PV Code, Section VIII nameplate shall be affixed to the side of each pressure vessel. The pressure vessels shall be labeled in accordance with Section 3.3.8.

3.3.2.2 Process Piping and Tubing Design Codes

All piping and supports shall be designed, fabricated, inspected, and tested in accordance with ASME B31.3 piping code for "Normal Fluid Service" except for chilled water, compressed air, filtered water, steam supply, condensate recovery which will be classified as ASME B31.3 Category D piping. For additional

structural supports, they shall be designed in accordance with Section 3.3.1.12. If there is a conflict between this specification and these codes, the more stringent shall apply unless waived by the Buyer. Loads on the interface connectors are shown in Table 3-12.

Table 3-12: Skid Assembly Hose-In-Hose Transfer Line Connector Design Loads

Nozzle (inner pipe size)	Dead Weight Load (-y)	Axial Seismic (±z)	Horizontal Seismic (±x)	Vertical Down Seismic (-y)
2 in.	100 lb	100 lb	100 lb	100 lb

All flanges shall be at a minimum of standard class 150, raised-face flanges per ASME B16.5, unless otherwise specified in this specification or ASME B31.3 depending on the respective system pressures. The flanges shall be made from steel compatible with the piping to which they are being welded. All flange bolts shall be tightened in accordance with the torque values and sequence specified by the gasket manufacturer.

All piping welding and inspections shall be performed in accordance with ASME B&PV Code, Section IX, using personnel certified in accordance with the applicable design codes.

3.3.2.3 Ventilation Design Codes

All ventilation equipment, ducting, and supports shall be designed, fabricated, inspected, and tested in accordance with SMACNA. Filter housings shall be Flanders™ designed and fabricated in accordance with manufacturer's standard practices.

3.3.2.4 Structural Design Codes

The equipment support structures shall be designed and fabricated in accordance with AISC *Manual of Steel Construction—Allowable Stress Design* and AISI SG-2000-1.

The equipment support structures shall be designed, fabricated, inspected, and tested in accordance with all the requirements in Section 3.3.1.12.

Personnel certified per requirements of AWS D1.1/D1.1M shall perform all secondary confinement enclosure welding and examinations shall be in accordance with AWS D1.1/D1.1M.

3.3.3 Radiation

The following sections detail the requirements for electromagnetic radiation interference and nuclear radiation exposure.

3.3.3.1 Electromagnetic Interference/ Electromagnetic Compatibility

The equipment shall be designed in accordance with the limits summarized in the following subsections.

3.3.3.1.1 Unintentional Radiators

Equipment shall comply with the emission limits specified in 47 CFR 15, Subpart B. The Seller must provide certification that the emissions from equipment or the device are within the limits specified in 47 CFR 15 or an Federal Communications Commission-accepted international standard.

3.3.3.1.2 Radio Frequency Interference Susceptibility

Applicable equipment shall be tested and evaluated for the immunity to radio frequency interference from portable communications equipment. The testing method and procedure for testing process instrumentation are found in IEEE Std C37.90.2.

Since the frequencies of interest are in the bands of 120 to 190 MHz and 420 to 480 MHz, the equipment shall be evaluated from 20 MHz to 1,000 MHz. The electric field intensity of 30V/m shall be used for testing.

3.3.3.1.3 Equipment Alternating Current Mains Surge Protection

Applicable equipment shall be designed to withstand the surge waves specified in IEEE C62.41.1 and IEEE C62.41.2. The equipment shall be type tested by the manufacturer in accordance with this standard, and certification provided by the Seller.

3.3.3.1.4 Electrostatic Discharge Protection

The system or individual parts of the system shall not be damaged and shall continue to function after being subject to electrostatic discharge on operating panels and other controls normally available to operating personnel. The manufacturer shall provide certification that Electrostatic Discharge Testing was performed according to the methodologies found in ANSI C63.16 or IEC 61000-4-2. The test voltage should be at least 4 kV. ANSI C63.16 provides additional references to selecting the proper voltage ranges to be used.

3.3.3.2 Nuclear Radiation

The maximum estimated contact radiation dose based on a five-year design life is 4.5×10^5 Rad. The maximum estimated noncontact radiation dose based on a five-year design life is 9.2×10^3 Rad.

3.3.4 Cleanliness

Before assembly, and before preparing for shipment, all components shall be cleaned by flushing with clean water (or just air if deemed appropriate by the Seller) and blown clean and dry with compressed air to the extent that extraneous materials, such as those listed below, are not present:

1. Metallic or other dusts (shop dust), chips, turnings, and weld splatter;
2. Abrasive particles;
3. Rust and other loose corrosion particles;
4. Magnetic and liquid penetrant residues, dye check, etc.;
5. Foreign material (i.e., paper, tape, plastic, sand, and wood);
6. Cutting oils;
7. Excess lubrication, grease, and oil; and
8. Marking dyes.

3.3.5 Corrosion of Parts

Stainless-steel components do not require painting except as required for identification or other markings. If used, paint on stainless steel shall be epoxy-phenolic. Solvents and cleaning solutions used on stainless steel for paint preparation shall be chloride free.

All exposed surfaces of carbon steel shall be protected from corrosion by priming and painting (see Section 3.3.6 for protective coating requirements).

Corrosion allowances for piping and tanks are described in Section 3.3.1.2.2.

To the extent practical, connections between dissimilar metals shall be avoided.

3.3.6 Protective Coatings

Protective coatings shall be used on equipment where specified in this specification and shall be compatible with the process fluid streams. Protective coatings shall be used on equipment in order to meet reliability and maintainability requirements, to protect equipment from environmental conditions, and to provide a clean, smooth surface for decontamination. The weldments shall be completed and painted entirely before installation of piping and components on the frames.

Care shall be taken to protect the paint during equipment installation. Touch-up shall be performed to repair defects after the equipment installation is completed. Protective coating specifications shall be prepared by the Seller. All exposed carbon-steel surfaces shall be painted manufacturer's standard color.

Special attention shall be paid to crevices, weld lines, corners, and edges to obtain film thicknesses to meet manufacturer recommendations. Care shall be taken when painting so that motor nameplates, lifting eyes, or lifting swivel nameplates are not covered.

3.3.6.1 Painting Preparation

The Seller shall prepare all surfaces in accordance with the manufacturer's instructions. Painting shall be performed in a clean, well-ventilated area separated from airborne particulates generated by shop operations.

3.3.6.2 Paint Application

1. All exposed carbon-steel surfaces shall be prepared and painted with a minimum of one coat of primer and a minimum of two finish coats.

2. Paint shall be applied to dry, clean, and adequately prepared surfaces in accordance with manufacturer's instructions. Each coat of paint shall be properly cured according to manufacturer's instructions before applying additional coats.

3. All paint containers shall remain closed until required for use. Paint shall be mixed before use in accordance with manufacturer's instructions. Agitation during application must be provided where specified by the manufacturer.

4. Paint may be applied with a brush or sprayer according to manufacturer's instructions.

5. All coats shall be applied in such a manner as to produce a film of uniform smoothness. Special attention shall be paid to crevices, weld lines, corners, and edges to obtain the required thickness.

6. The manufacturer's instructions for thinning, mixing, handling, and applying the products shall be considered to be part of this specification.

7. All coats shall be applied to produce a film of uniform smoothness and nominal thickness of not less than 3 mils with a total minimum thickness (with primer and top coat) of 5 mils. Special attention shall be paid to crevices, weld lines, corners, and edges to obtain the required thickness.

3.3.6.3 Primer

The Seller shall use standard zinc-rich primer for carbon-steel structures or piping. Precoated or stainless-steel pipe support components do not require painting.

3.3.6.4 **Paint**

1. The Seller shall use a standard top coat compatible with the primer for finish coats on carbon-steel structures or piping.

2. Precoated or stainless-steel pipe support components do not require painting.

3. The freight container external top coat shall be white to minimize solar heat load.

3.3.7 **Interchangeability**

The Seller shall specify the assembly level at which components shall be interchangeable or replaceable. This is a design consideration to be reflected on the design drawings and/or supporting documents (such as calculations and analyses).

3.3.8 **Identification and Marking**

Clearly mark and identify any components that are required to be removed before installation of the assembly at the Buyer location (e.g., shipping blocks). The markings on all motors shall be in accordance with the NEC® (NFPA 70) and NEMA MG-1.

3.3.8.1 **Equipment Labeling**

The Seller shall label all equipment in accordance with this specification. Equipment to be labeled shall include, as a minimum:

1. Valves and dampers;

2. Label external valves;

3. Instruments and gauges, pumps, motors, tanks, compressors, and filters;

4. Transformers, distribution panels, and, instrument enclosures; and

5. Junction boxes shall follow the labeling convention consistent with Appendix G below:

   a. Instrument (24V dc): 33-IJB-###

   b. Electrical (110V ac): 33-EJB-###

   c. Power (110V ac): 33-PJB-###

Only the Equipment Identification Number is required to be on the tag. Tags shall be 1-3/8 in. by 2-3/4 in. minimum and use 3/16-in.-high black text on white background. The tags shall be plastic and have at least a single hole for attaching to components.

Tags shall be attached to components without a flat surface using a nylon tie wrap. Tags shall be attached to components with a flat surface using clear silicon rubber adhesive. Equipment tags shall be located where they are readily visible and not subject to damage or accidental removal during equipment operation. Tags shall be suitable for the environment on which they are installed.

3.3.8.2 Piping Labeling

1. Piping shall be marked with arrows to denote fluid flow direction and text to denote fluid type conveyed. The fluid conveyed shall be marked as "PROCESS," "COMPRESSED AIR," or "FILTERED WATER," as applicable.

2. Text shall be all capital letters. The label background and lettering colors shall be per the following list.

   a. Process fluid piping shall be yellow field with black letters,

   b. Compressed air piping shall be blue field with white letters, and

   c. Filteredwater piping shall be green field with white letters.

3. Labels shall be made from self-sticking polyester or vinyl (Electromark® part number P400 series of Buyer-approved equal). For pipes that are less than 3/4 in. in diameter, the label size and lettering shall be appropriately

sized to the size of the pipe. For pipe that is greater than 3/4 in. in diameter, lettering shall be in accordance with Table 3-13.

4. The labels shall be placed on pipes in the location most readable from the operator's normal viewing position.

5. Piping labels shall be placed before and after each valve and piping joint.

Table 3-13: Pipe Labeling Format

Pipe Outside Diameter (minimum) (inch)	Pipe Outside Diameter (maximum) (inch)	Length of Color for Field for Pipe Marker (inch)	Size of Letter for Legend (inch)
0.75	1.25	8	0.5
1.5	2	8	0.75
2.5	6	12	1.25
8	10	24	2.5
10	—	32	3.5

3.3.8.3 Wire and Cable Labeling

All wires and cables shall be labeled at both terminations with the identification shown on the Seller developed fabrication drawings. Labels for instrumentation wire and cabling shall follow the convention in Appendix G. Conductors shall be identified with heat-shrink tubing with black typed-on letters. Hand-lettered labels shall not be used.

3.3.8.4 Terminal Labeling

Terminal block label tags shall be a durable plastic material. The tag color shall be white background with black lettering. Each terminal on the terminal block shall be labeled with a clearly visible terminal number. Numbered terminal block covers may be used for this purpose

The tag may be mounted on a surface of the enclosure in close proximity of the terminal block. Tags shall be attached securely by means of durable stranded stainless-steel cable, clamps, or chains.

3.3.8.5 Conduit Labeling

1. All conduits shall be labeled with the identification tag on the contract drawings and the highest voltage contained in the conduit as in the following example:

E-123 - 110 VAC 1PH

2. The minimum letter height shall be 1/4 in. The label length shall be as long as required to contain the required information. The label color shall be white background with black lettering. Text shall be all capital letters. The labels shall be a durable material that is permanently secured to the conduit by an adhesive or mechanical means. The label may be metallic or plastic. The label shall be affixed securely in place in a manner to prevent their loss, damage, slippage, or accidental removal. However, the means used to mount the label should permit its removal when necessary without damage to the surface to which it was attached.

3.3.8.6 Labeling of Handling and Lifting Devices

All equipment that is designed to be mechanically lifted shall have marked lifting points and be marked with the lifting weight. Lift points shall be identified with yellow paint. All specialized lifting devices shall be marked in accordance with DOE/RL-92-36, as follows.

Structural and mechanical below-the-hook devices shall be provided with identification displaying the following data, as a minimum:

1. Rated load,
2. Manufacturer's name,
3. Lifting device weight (if over 100 lb),
4. Drawing number (if applicable), and
5. Serial number (if applicable).

The identification data may be displayed on a nametag, nameplate, metal stamp, or other permanent marker. If the lifting device comprises several lifting devices that can be detached from the assembly, these individual lifting devices shall be marked with their individual load rating also.

3.3.8.7 Electric Motor Labeling

The markings on all motors shall be in accordance with the NEC® (NFPA 70) and NEMA MG-1.

3.3.9 Nameplates

The assembled system shall have a Seller-provided nameplate with the following minimum information: project number, purchase order number, assembly name and number (provided by the Buyer), assembly weight, and this specification number (including revision).

3.3.10 Human Engineering

Human factors engineering principles and criteria shall be integrated into the design of systems and the facilities that house and support these systems. Operator movements and accessibility of equipment and controls in the work area shall be considered, and practical access to each system component for operation and maintenance shall be provided.

3.3.11 Qualification

The drawings, calculations, and associated design media shall show full compliance with this specification and Buyer-approved exceptions or modifications. The Seller's design media (drawings and specifications associated with life, safety, or waste containing boundaries) shall be prepared by, or under the supervision of, a Professional Engineer licensed in the State of Washington. The responsibilities of the assigned Professional Engineer for preparation and control of each deliverable shall be in accordance with the engineering practice laws and regulations of the State of Washington. Portions of drawings originated by others, such as as-built vendor information on P&IDs, shall be clearly identified. If the Seller cannot meet these requirements through utilization of existing registered Washington State Professional Engineers or certifying Professional Engineers through comity in the State of Washington, the Seller shall inform the Buyer so that a resolution can be reached.

To obtain approval for the design of the fabricated system the Seller shall perform the following:

1. Prepare calculations required by this specification and document how the results of the calculations were incorporated into the design and fabrication drawings (e.g., adequacy of pump to meet calculated demand, selection of weld size to meet structural requirement).

2. Identify those materials and/or components that require a CMTR or CoC. At a minimum, CMTRs are required for process piping and all material that provides a structural support function (e.g., struts, plate, pipe fasteners).

3. Prepare complete data sheets and obtain vendor cut sheets for major components of the assembled system. At a minimum, the set of major components shall be those shown on the P&ID (valves, instruments, equipment, etc.). This information package will be used to evaluate how the Seller has evaluated the form, fit, and function of components for their intended use as shown on drawings and in supporting calculations.

3.3.12 Document Submittal

The following subsections provide the minimum document requirement submittals.

3.3.12.1 General Requirements

Information to be supplied with the bid, for review, and as final is shown on the Bidder's Drawing and Data Commitments sheet (Appendix F). The submittals presented on this sheet shall be delivered as the delineated packages for review and approval.

Each document submittal shall be identified with this specification number, item number, purchase order number, and Seller's identification number. Submittals shall be transmitted to the Buyer in accordance with the directions found in the Request for Quote.

Data shall be sufficiently clear to allow legible copies to be made on standard reproduction equipment after microfilming.

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

Submittals are divided into two types: (1) those requiring "approval before proceeding" (i.e., weld procedures or prepurchase evaluation data) and (2) those requiring "approval before shipment" (i.e., vendor information data).

Submittals requiring approval before shipment will be reviewed to verify completeness and adequacy for their intended purposes.

Unacceptable items that require approval before proceeding will be handled as specified below.

A submittal requiring approval that is not approved by the Buyer will be dispositional as:

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

2. "Approved with Exception." Fabrication, procurement, and performance of procedures may proceed, and resubmittal is required to verify incorporation of the exception. Final acceptance of the item is contingent on the Buyer's receipt and approval of the corrected submittal.

Submittals requiring approval before shipment that are determined to be incomplete or inadequate will be marked "Resubmit" and will be returned. An explanation of the deficiencies will be included for corrective action by the Seller.

3.3.12.1.1 Design Documentation

The Seller shall provide all shop fabrication drawings that detail how the specified parts and materials will be assembled to meet the requirements of this specification. Shop fabrication drawings shall clearly identify the material type and grade on the Bill of Material. The Seller shall include a Bill of Material and submit to the Buyer for review and approval. Final as-built drawings shall be provided by the Seller at the conclusion of fabrication and testing. An arrangement drawing (Sketch DBVS-SK-M109) is provided in Appendix A. Modifications to the arrangement drawing can be proposed by the Seller to

improve the fabrication of the total assembly; however, modifications and the detailed fabrication drawings are to be approved by the Buyer before procurement of material or initiation of fabrication.

The Seller shall fabricate the equipment according to the approved design drawings submitted to the Buyer.

The Seller shall submit design questions and request design changes in writing to the Buyer for resolution or concurrence.

The Seller shall maintain designated full-size drawing sets for incorporating design changes concurred with the Buyer. The Seller shall incorporate all redline changes on the drawings and submit both paper and electronic copies of the as-built drawings to the Buyer.

All design calculations required for the ASME piping, support structure, and lifting and handling shall be included in reports that have undergone independent review by the Seller's qualified personnel. Design calculation reports shall be submitted to the Buyer for review and approval before the start of fabrication.

3.3.12.1.2 As-Built Drawings

The Seller shall deliver to the Buyer three hard copies and one electronic copy of the final fabrication level as-built drawings and specifications accurately depicting the product delivered. Drawings shall include dimensional layouts, dimensioned subassemblies, dimensioned component details (if not included on manufacturer's cut sheets), flow and electrical diagrams, material and fastener sizes, descriptions, weld symbols, and notes. The designer's name, responsible engineer's name, Bill of Materials, and drawing numbers shall appear on the index (cover sheet).

3.3.12.2 Fabrication Traveler Submittal

The Buyer will insert witness/hold points in the fabrication traveler during the review and approval of the fabrication traveler. Witness points can be waived by the Buyer, but must be documented in writing. Hold points require the Buyer personnel to be present during the fabrication, examination, inspection, or test step. Final fabrication traveler shall include final hold point for Buyer walkdown for final article acceptance before shipment.

3.3.12.3 Schedule and Component Lead Time

A proposed schedule of fabrication, inspection, and testing of all DCRS skid assembly equipment shall be submitted for review with the bid and approval with the submittal of the fabrication traveler(s).

A proposed schedule shall be provided showing the discrete steps and schedule to complete all work described in this specification. The schedule shall identify fabrication drawings, engineering, parts procurements, fabrication, examination, inspection, and testing activities. A list of components and lead time delivery for each component shall be provided to the Buyer. Component substitutions can be proposed by the Seller to improve the fabrication, schedule, or cost; provided such substitutions are approved by the Buyer.

The schedule shall allow two weeks for review and approval of structural calculations and one week for review and approval of all other documents. The Buyer shall provide a calculation review sheet identifying requirements for the calculations.

3.3.12.4 Spare Parts List and Special Tool Requirements

The Seller shall provide the following, as required for installation, maintenance, and operation of the assembly:

1. Recommended spare parts list for Buyer concurrence. The spare parts lists shall be based on equipment mean time between failures and long lead procurement items (long lead defined as longer than four weeks from order placement to delivery).

2. List of required special tools.

3. Special tools manufactured during fabrication shall also be provided on delivery.

4. List of required lubricants.

5. Lubricant required for startup and operations shall be delivered with Material Safety Data Sheets and shall be provided on delivery of related equipment

Submit spare parts, special tool, and supporting vendor data for review and approval.

3.3.12.5 Final Data Package

The Seller shall not ship the skid assembly and ancillary hardware until all tests and inspections have been performed and the final data package is complete and approved by the Buyer. The Seller shall notify the Buyer three weeks before the intended shipping date, and shall allow the Buyer one week after receiving the package, and before shipment, to review the data package. The final data package shall include all items specified on the Bidder's Drawing and Data Commitments sheet (Appendix F).

3.3.13 Personnel and Training

Records for the following areas shall be prepared and made available for the Buyer. Review of the qualifications may be subject to a surveillance or source inspection by the Buyer.

3.3.13.1 Welder Qualification

Welder shall be qualified in accordance with ASME B&PV Code, Section IX and AWS D1.1/D1.1M, as applicable. Documentation for personnel performing welding, including tacking, shall be submitted to the Buyer before welding work being performed and maintained in a Welder Performance Qualification Record.

3.3.13.2 Weld Examination

Welds shall be examined per ASME B31.3 at a minimum for piping and pipe supports and per AWS D1.1/D1.1M for structural steel. A ASME B31.3 weld examiner shall meet the code requirements. Welded connections on the lifting components and radioactive service boundaries shall be 100 percent visual and 100 percent Dye-Penetrant Test or Magnetic-Particle Test inspected.

3.3.13.3 Electrical Inspection

An NEC® Electrical Inspector shall inspect equipment fabricated under this contract. All deficiencies found shall be corrected or dispositioned before shipment. Certification documentation for the electrical inspector and inspection report shall be prepared by the Seller.

4 QUALITY ASSURANCE REQUIREMENTS

The following subsections provide the minimum QA requirements for this specification.

4.1 GENERAL

The Seller shall document, implement, and maintain a QA Program that is based on a national standard and identifies the activities and items to which it applies. The QA Program must address each of the areas discussed within this QA requirements flowdown. The Seller must submit the QA Program to the Buyer for review before award of contract.

The Seller shall assess its QA Program regularly to ensure its effective implementation.

The QA Program shall provide for indoctrination and training, as necessary, of personnel performing activities affecting quality to ensure that suitable proficiency is achieved and maintained. Personnel who conduct inspection and test activities shall be qualified to conduct those activities and certification of the qualification must be submitted to the Buyer on request.

4.1.1 Design

The Seller must define, control, and verify designs developed for this contract. Design inputs must be specified on a timely basis and correctly translated into design documents. Design interfaces must be identified and controlled. Persons who did not design the item must be used to verify design adequacy. Design changes, including field changes, must be reviewed and approved by the same personnel who reviewed and approved the initial designs.

4.1.2 Procurement Document Control

Procurement documents must include or reference sufficient quality and technical requirements in order to describe the items and services requested. Procurement documents must be reviewed and approved by the authorized personnel within the Seller's organization, and changes must be reviewed and approved by the same individuals who reviewed and approved the original procurement documents.

The Seller must have a process for accepting procured items. This process must include one or a combination of the following: Certificate of Conformance, source verification, receiving inspection, and post-installation testing.

The Seller shall provide a legible and reproducible CoC. The CoC shall be signed by the Seller's authorized representative responsible for quality assurance.

The CoC shall contain, as a minimum, the following information:

1. Identification of the Buyer's contract or purchase order number under which the materials, equipment, component, or service is being purchased.

2. Provide traceability by means of positive identification from the material, equipment, component, or service to the CoC.

3. Identify the specific procurement requirements met by the material, equipment, component, or service supplied (i.e., codes, standards, or other applicable specification). The procurement requirements shall include any approved changes, waivers, or deviations applicable to the subject materials, equipment, component, or service.

4. Identify any procurement requirements that have not been met, together with an explanation and the means for resolving the nonconformance.

The Seller's certification system, including the procedures to be followed in filling out a certificate and the administrative procedures for review and approval of the certificates, shall be described in the Seller's QA Program.

The certification system shall provide a means to verify the validity of the Seller's certificates and the effectiveness of the certification system (i.e., during the performance of audits of the Seller or independent inspection or test of the items). The Buyer shall conduct this verification at intervals commensurate with the Seller's past quality performance.

The Seller is required to flowdown all QA requirements from this contract to any subtier subcontractor/suppliers. Any access to the subtier subcontractor/suppliers' facilities for verification activities will be requested through the Seller before access, and verification activities may be performed jointly.

The Seller shall warrant that all items furnished under the contract are genuine (i.e., new; not refurbished and/or counterfeit) and match the quality, test reports, markings, and/or fitness for intended use as required by the contract. Any materials furnished as part of the contract that the government or other duly recognized agency had been previously found to be suspect/counterfeit shall not be used.

All items are subject to inspection at the Seller's facility or lower-tier subcontractor's facility. The Seller shall notify the Buyer, at least seven working days in advance, of the time when such items or activities will reach the Buyer's identified inspection hold points. As a minimum, final inspection before packaging for shipment shall be considered such a hold point, unless specifically waived by the Buyer.

The Seller shall obtain all materials to be delivered under the contract directly from the original manufacturer or an authorized manufacturer's representative. The Seller shall provide legible and reproducible documentation, with the materials, that provides objective evidence that the items were provided by the original manufacturer. Such documentation may include a copy of the purchase order to the manufacturer and shipping documentation or manufacturer invoice (each of which would identify that the materials were obtained from the original manufacturer).

The Seller shall submit, with or prior to item shipment, a recommended spare parts list. The list shall provide the name and address of the original supplier of the replacement part, and the part's drawings, specification, or catalog identity including applicable change or revision information.

All items and/or services procured under this specification shall be subject to inspection by the Buyer or Buyer's representative throughout the contract. Additionally, procured items and/or services shall be subject to inspection for acceptance.

The Seller shall grant access to the Seller's facilities and records for inspection or audit by the Buyer, his designated representative, and/or other parties authorized by the Buyer.

4.1.3 Instructions, Procedures, and Drawings

The Seller must document and implement appropriate instructions, procedures, and drawings. Instructions and procedures must include or reference appropriate quantitative or qualitative acceptance criteria for determining that prescribed activities have been satisfactorily accomplished.

4.1.4 Identification and Control of Items

The Seller shall establish controls to ensure that only correct and accepted items are used or installed.

All items shall be identified with the applicable part number, model number, or other identifier prescribed in this specification. Identification shall be on the item or the package containing the item. When the identification is on the item, such marking shall not impair the service of the item or violate dimensional, chemical, or physical requirements.

The Seller shall submit a legible and reproducible copy of the product data sheet (e.g., drawing, catalog cut sheet, brochure) that provides adequate information to enable the Buyer to verify the form and function of the articles procured. One copy of such documentation, unless otherwise specified, shall accompany the item.

The Seller shall identify each item, assembly, package, container, or material, having limited shelf life, with the cure date or date of manufacture and the expiration date. The Seller shall specify any storage temperatures, humidity and environmental conditions that should be maintained. Material shall not be furnished having less than 75 percent of the total shelf life available at the time of shipment.

Certified Material Test Reports containing actual chemical analysis and mechanical properties of the material being supplied shall be submitted before or with each shipment of material. Each CMTR shall contain the following information as a minimum:

1. Product description [e.g., specification(s), codes, type of material];

2. Actual results of chemical analysis/mechanical testing in accordance with the provisions of the code, standard, and/or specification;

3. The specification and material grade;

4. Traceability to the item tested (e.g., heat number, lot number);

5. Name and address of manufacturer (may be identified by letterhead, logo, etc.);

6. Manufacturer's ASME certificate number and expiration date;

7. Buyer's contract number and item number to which the report applies; and

8. The report shall be signed by an authorized representative of the manufacturer.

In addition to the ASTM/ASME marking, the Seller shall physically identify each item/part furnished to the Buyer with the heat number (or identification number that is traceable to the heat number) and the contract number. Methods and materials used to accomplish required markings shall be compatible with the material being marked. Small items shall be bagged/wrapped and tagged.

4.1.5 Control of Processes

The Seller shall have processes to control processes, including special processes that control or verify quality (e.g., welding, heat treating, and NDE). Special processes must be performed by qualified personnel using qualified procedures in accordance with specified requirements.

Seller personnel performing weld inspections shall be certified as a Certified Welding Inspector (CWI) in accordance with the requirements of AWS QC-1. The following documentation shall be submitted for Buyer approval before the start of fabrication:

1. Current AWS CWI certification;

2. Current/valid visual acuity examination (must be given every three years); and

3. Visual weld inspection procedure(s).

Welding procedures and personnel shall be qualified in accordance with applicable AWS or ASME requirements specified in the contract. The Seller shall submit copies of all welding procedures, procedure qualification records, and welder qualification records to be employed. Buyer review and approval of these documents is required before start of fabrication.

Nondestructive examination personnel shall be qualified and certified in accordance with the recommended guidelines of ASNT SNT-TC-1A. The Seller is not authorized to begin fabrication until the following documentation has been approved by the Buyer:

1. NDE personnel qualification and certification procedure;

2. Level I, II, and/or III personnel qualification and certification records, including objective evidence of NDE training, formal education, examination, experience, date of hire, and current visual acuity exam; and

3. NDE method procedure(s) compliant with the applicable requirements of the Buyer's contract.

Nondestructive examination reports and radiographs shall be traceable to the item examined, shall include all essential examination parameters, and shall be signed and dated by a qualified/certified NDE examiner. All NDE reports and radiographs shall accompany or preceded shipment of the item or component. Radiographs and radiographic technique and examination reports shall be subject to approval by the Buyer before shipment.

These requirements shall be passed to lower-tier subcontractors.

4.1.6 Verification and Verification Methods

The Seller shall have a process to plan and execute inspections to verify conformance of an item or activity to specified requirements. The process shall document the characteristics to be inspected and inspection methods to be employed. The Seller shall document the results of inspections. Inspections for acceptance shall be performed by persons other than those who performed or directly supervised the work being inspected.

The Seller shall submit, as required by the contract, legible, reproducible copies of inspection and/or test reports. The reports shall include, as a minimum, the following information:

1. Identification of applicable inspection and/or test procedure;

2. Resulting data for all characteristics evaluated, as required by inspection or test procedures, including reference to information on action taken in connection with nonconformances;

3. Traceability to the item inspected/tested (e.g., serial number, part number, lot number), date of inspection, name of inspector, type of observation; and

4. Signature of the Seller's authorized representative or agency performing the inspection or test.

Key items to be verified include, but are not limited to, the mechanical and electrical function of all equipment and components.

4.1.7 Test Control

The Seller shall have a process (to plan and execute tests) to verify conformance of an item or activity to specified requirements. The process shall document the characteristics to be tested and test methods to be employed. Tests required to collect data, such as for siting or design input, shall be evaluated.

The Seller shall prepare a detailed test plan. Before starting work, the plan shall be submitted to the Buyer for approval and insertion of Buyer's designated source inspection and witness notification points. The test plan shall provide the following, at a minimum:

1. Traceability to the Buyer's purchase/contract order document number;

2. Name or description of the item to be tested (e.g., components, assemblies, subassemblies);

3. Method/procedure to be used during test; and

4. Subsequent revisions/modifications to the test plan require review and approval by the Buyer before implementation of the changes.

The Seller shall provide test reports that include, as a minimum:

1. Item tested,
2. Date of test,
3. Tester or data recorder,
4. Type of observation,
5. Results and acceptability,
6. Action taken in connection with any deviations noted, and
7. Person evaluating test results.

Test plans and test reports must be submitted to the Buyer for the project records.

4.1.8 Control of Measuring and Test Equipment

The Seller shall control tools, gauges, instruments, and other measuring and testing equipment used for activities affecting quality, and shall calibrate at specified periods and adjust to maintain accuracy within necessary limits.

The Seller shall maintain legible, reproducible copies of the Certificates of Calibration, traceable to the NIST, for each article contracted. Each Certificate of Calibration shall be signed by the Seller's representative responsible for calibration, attesting to its authenticity, and shall be identified with the following information:

1. Buyer's contract number,
2. Identification of the article to which the Certificate of Calibration applies, and
3. Standards used for calibration

In addition, the Seller shall submit a report of actual calibration results. The report shall be identifiable to the acceptance criteria of the items submitted and

shall meet the contract requirements. The report shall contain the signature of the authorized representative of the agency verifying compliance. One copy of the documentation, unless otherwise specified, shall accompany the applicable item(s) shipped.

The Certification of Calibration will be held on file by the Buyer as objective evidence to support the actual test results and attest to the fact that the calibrated item(s) met requirements.

4.1.9 Handling, Storage, and Shipping

The Seller shall prepare and submit for Buyer review and approval, before use, procedure(s) or plan(s) for the packaging and shipping of materials, equipment, or components to be furnished under the contract. The procedure(s) or plan(s) shall include, as appropriate, cleanliness inspection before packaging, use of preservatives and coatings, descriptions of specially designed shipping containers, handling and rigging data, final inspections, and the type of transfer and shipping vehicles.

4.1.10 Inspection, Test, and Operating Status

The Seller shall have a process to identify the status of inspection and activities on items or in documents traceable to the items, and to ensure that items which have not passed the required inspections and tests are not inadvertently installed, used, or operated. Status shall be maintained through indicators (i.e., physical location) and tags, markings, shop travelers, stamps, inspection records, or other suitable means. The Seller must specify the authority for application and removal of tags, markings, labels, and stamps.

4.1.11 Control of Nonconforming Items

The Seller must have a process to control items that do not conform to specified requirements to prevent inadvertent installation or use. These controls must provide for identification, documentation, evaluation, segregation (when practical), and disposition of nonconforming items, and for notification to affected organizations.

All nonconforming conditions identified at the Seller's facility, with a proposed disposition of "Accept-As-Is" or "Repair," as defined below, shall be approved by

the Buyer before supplier implementation of the nonconformance report (NCR) disposition:

1. Accept-As-Is: Nonconforming materials will perform its intended function.

2. Repair: Nonconforming item can be corrected so that its characteristics meet requirements of the contract.

Nonconforming items identified as "Repair" or "Rework" shall be re-examined in accordance with applicable procedures and with the original acceptance criteria, unless the nonconforming item disposition has established alternate acceptance criteria.

Nonconformances shall be documented by the Seller on their own nonconformance form or one provided by the Buyer. After documenting the nonconformance and providing a proposed disposition and technical justification, the report shall be submitted to the Buyer.

After the proposed disposition has been evaluated, and approved or rejected by the Buyer, the form shall be returned to the Seller. Corrective action may only take place after Buyer approval. Copies of completed, Buyer-approved, NCRs shall be shipped to the Buyer with the affected item.

4.1.12 Corrective Action

The Seller shall have a process to promptly identify conditions adverse to quality, and to correct them as soon as practical. The identification, cause, and corrective action for conditions adverse to quality shall be documented and reported to appropriate levels of management. Follow-up action shall be taken to verify implementation of this corrective action.

During the period of performance of work for this contract, the Seller shall provide, to the Buyer, copies of all documents that constitute reports of conditions adverse to quality (e.g., deficiencies, weaknesses, nonconformances, or noncompliances with established requirements) related to items or services provided to the Buyer.

In addition, the Seller shall ensure flowdown of these requirements to its subtier subcontractors/suppliers of quality-affecting items and/or services procured for work performed for the Seller.

4.1.13 Quality Assurance Records

The Seller shall have a process to specify, prepare, and maintain records that furnish documentary evidence of quality. Records shall be legible, identifiable, retrievable, and protected against damage, deterioration, or loss. The process shall establish and document responsibilities and requirements for records transmittal, distribution, retention, maintenance, and disposition.

4.1.14 Control of Graded Fasteners

The following are minimum requirements for high strength graded fasteners produced in compliance with national consensus standards (i.e., SAE, ASTM, ASME):

1. Fasteners shall exhibit grade marks and manufacturers identification symbols (headmarks) as required in the specifications referenced in the contract.

2. When requested by the Buyer, the Seller shall provide legible and reproducible copies of the manufacturers CMTRs. These CMTRs shall report the values of the actual chemical and physical tests performed on the represented fastener lot and material heat. Fastener packaging and labeling shall be traceable by lot number or other means to the CMTR.

3. Fasteners shall be inspected and documented to verify compliance with this QA Clause. Additionally, fasteners may also be subject to destructive testing by the Buyer to verify compliance.

4.2 INSPECTIONS AND TESTS

Factory Acceptance Testing of the equipment is required. All temporary electrical equipment including wiring and instruments necessary to allow component testing will be provided by the Seller.

Water used for cleaning or hydrostatic testing (if used) shall be tested for chlorides before use. The chloride content of the test medium shall not exceed 250 ppm for water temperatures of 149 °F or less.

4.2.1 General Requirements

The examination, inspection, and test plans, procedures, and specifications shall be submitted to the Buyer for review and approval. The Buyer reserves the right to witness all tests and shall be given a minimum of ten working days written notice before each test date.

Dated calibration labels shall be visible on all test equipment. Measuring and test equipment used for acceptance inspections, examinations, and tests shall be controlled in accordance with the Seller's QA Program and shall be traceable to a national measurement standard.

Before item acceptance, results of the examinations, inspections, and tests described below shall be documented and submitted to the Buyer.

For the Pressure-Leak Test and Lift Test described in Sections 4.2.3 and 4.2.8.4, respectively, a video record shall be submitted to the Buyer with test records or documents.

4.2.2 Nondestructive Examinations

All NDEs shall be performed in accordance with the Seller's standard practices. An AWS-Certified Welding Inspector, with current certification in accordance with AWS QC-1, shall perform visual examinations: and examiners, certified to ASNT SNT-TC-1A, shall perform NDEs. Visual and NDE weld examination procedures shall be submitted, along with the personnel certifications, to the Buyer for review and approval before performance of the inspections and examinations as indicated in the Bidder's Drawing and Data Commitments sheet (Appendix F). All welds shall be inspected.

Pipe and pipe support welds shall be examined in accordance with ASME B31.3 piping code for "Normal Fluid Service." Welds to be radiographed shall be selected by the Buyer and noted on the shop drawings as described previously. The Seller shall assume 10-percent radiograph of pipe welds for purposes of bidding. Any welds found to have failed to meet the acceptance criteria for radiographic and ultrasonic examination as stated in ASME B31.3, shall be ground out and rewelded in accordance with the original Welding Procedure Specification and 100 percent re-examined in accordance with ASME B31.3. No more than two weld repairs shall be made on any given weld before the section is abandoned and replaced.

The structural steel welds shall be examined in accordance with AWS D1.1/D1.1M or AWS D1.6 and shall meet the acceptance criteria stated in AWS D1.1/D1.1M. Welded connections on rigging attachments (except ISO-container corner fittings) or below-the-hook lifting devices shall be 100-percent visual and 100-percent Dye-Penetrant Tested or Magnetic-Particle Tested.

4.2.3 Leak Test

All piping shall be pressure-leak tested in accordance with ASME B31.3 piping code for "Normal Fluid Service, Paragraph 345." Components that could be damaged during the test shall be isolated or removed and the outlet flanged, caped, or plugged. Pressure test results shall be recorded and submitted to the Buyer.

Methods for performing all inspection, examination, and testing shall comply with those requirements outlined in the code including, but not limited to, visual examination, visual weld examination, and leak testing. Performance of the leak test shall be in accordance with the code using the line pressures indicated in Table 3-1 to calculate test pressures. Procedures shall be submitted by the Seller to the Buyer for all testing required by the code before testing.

Results of the pressure-leak test, including a video record, shall be documented and submitted to the Buyer.

4.2.4 Equipment Test

The Seller shall write a check-out test procedure including the following sequences:

1. The check-out test procedure shall be submitted for approval by the Buyer before testing,

2. The Buyer shall review and approve the check-out test procedure before check-out testing is begun, and

3. Test reports shall be prepared for each test specified below and submitted to the Buyer.

Each component, instrument, sensor, and valve shall be tested to verify that it is functional. In order to complete these functional check-out tests, the Seller shall provide temporary power and switches for each valve activation and component activation circuit in the system. Compressed air or bottled nitrogen is also required for pneumatically-actuated valves. All electrical devices shall be tested from the skid junction box to the end device and all instrumentation shall be tested from the skid junction box termination.

The Seller shall activate each valve to verify that the valve functions and that valve-position-switch-contacts are properly made (using an ohmmeter). The Seller shall activate valve from the skid junction box and verify limit-switch-contacts change state at the skid junction box. The Seller shall make a checklist that indicates all contacts checked. The valve-test checklist shall be submitted to the Buyer for review and approval before testing. The checklist shall include all contacts where application of voltage would fire a solenoid, actuate a air-operated valve, and change positions between switch contacts.

The Seller shall jog the pump motors and verify that the rotation direction is correct. If it is not, the Seller shall reverse two of the temporary connection leads

4.2.5 Instrument Testing Requirements

Each instrument will be tested for proper operation. This may require applying temporary power, a 4-20-mA loop with indicators, or other methods to verify proper indication and function. All signals that are fed to the termination panel shall be verified at the termination panel. The device should be tested with fluid to physically activate the devices for detecting level, pressure, flow, etc., as applicable.

For control loops provided by the MCS, no testing will be required except the individual sensors/switches and starters Example: A level switch feeds the Programmable Logic Controller which controls the feed pump. The level switch shall be tested, but the shutdown signal to the pump cannot be verified without the MCS hardware and program, provided later.

For local control function, the system shall be provided with the normal fluid, where practical, to operationally test the control loop. Example: Level interlock to the feed pump shutdown will be tested by filling the tank above the level switch position and verifying the pump shuts down.

For all instrumentation, the design pressure for the instrumentation chosen shall meet or exceed the system design pressure. If the instrumentation does not meet this requirement, the Seller shall provide written notification to the Buyer. Isolation valving shall be provided for sensors to isolate a component during maintenance or testing.

4.2.6 Final Test and Inspection

Inspection shall be done in accordance with the approved Seller's QA Program. The Buyer reserves the right to witness all tests and inspections and shall be given a minimum of ten working days written notice before each test date. The results of these tests shall be documented in a test report

As a minimum, and not limited to, the Seller shall verify that the critical dimensions of the DCRS skid assembly are within the specified tolerances. Final dimensional examinations shall be performed on critical dimensions identified in the fabrication travelers and included on the shop drawings. The DCRS skid assembly as-built drawings shall be produced from this inspection. As-built drawings shall be provided to the Buyer five working days after delivery to the Hanford Site.

4.2.7 Factory Acceptance Testing

Before testing, Factory Acceptance Test procedure shall be submitted to the Buyer for review and approval ten working days before scheduled testing. The Buyer reserves the right to witness all tests and shall be given a minimum of ten working days written notice before each test date. The results of these inspections and tests shall be documented and submitted to the Buyer for review and approval before item acceptance.

As a minimum, and not limited to, the Seller shall perform the tests listed below:

1. Verify all electrical circuits operate properly. All electrical devices shall be tested from the skid junction box to the end device and all instrumentation shall be tested from the skid junction box termination.

2. Each instrument will be tested for proper operation. This may require applying temporary power, a 4-20-mA loop with indicators, or other methods to verify proper indication and function. All signals that are fed to the termination panel shall be verified at the termination panel. The device

should be tested with fluid to physically activate the devices for detecting level, as applicable.

3. Each valve shall be activated/operated to verify that the valve functions, that valve-position-switch-contacts are properly made (using an ohmmeter) and valves achieve their specified fail position on loss of compressed air and loss of electric power. Remote-operated valves shall be activated from the skid junction box. The Seller shall make a checklist that indicates all contacts checked. The checklist shall include all contacts where application of voltage would fire a solenoid, actuate an air-operated valve, and change positions between switch contacts.

4. Verify heating and cooling system is operational and functions properly.

5. The secondary confinement shall be static-leak tested by filling the secondary confinement enclosure with water to 8 in. from the floor level and left standing for a period of 24 hours. No visible drop in water level or other signs of leakage shall be evident. Equipment, wiring, insulation, or other materials that may be damaged by the water shall be removed before the test, or protected from damage.

6. Verify weight and center of gravity of the overall assembly.

4.2.8 Electrical Test

Electrical continuity testing shall be undertaken after all wiring and labeling activities have been completed. An ohmmeter shall be used to determine that all power, control, instrumentation, and grounding circuits are complete and properly identified. The Seller shall verify the resistance between the main-ground connection to the DCRS skid assembly and any point in the ground circuit is less than 1 ohms. The Seller shall verify instrument ground is separate and isolated from the power ground circuit to the extent allowed by the NEC® (NFPA 70) and that no unintentional electrical grounds exist.

The Seller shall prepare a test data sheet of circuits tested and provide certification documentation for electrical personnel qualified to perform electrical tests.

All deficiencies found shall be corrected or dispositioned before shipment

Electrical test report, inspection reports, and certification documentation shall be submitted to the Buyer.

4.2.8.1 Electrical Inspections

1. Inspection of torque values against NEC® (NFPA 70) and manufacturer's requirements.

2. Inspection of physical location, anchorage, and grounding.

3. Inspect bolted connections for high resistance.

4. Inspections for motors:

   a. Correct application of lubricant,

   b. Insulation-resistance testing in accordance with IEEE Std 43, and

   c. Perform stator resistance test phase to phase.

5. Inspections for cables and breakers:

   a. Inspect for physical damage,

   b. Inspect for correct identification and arrangement, and

   c. Inspect jacket insulation and condition

6. Circuit breakers are to be inspected for proper size, correct installation, manual operation of handles, and suspect/counterfeit parts per Appendix A.

4.2.8.2 Motor Test

All motors shall be given a routine test to demonstrate that the motors are installed correctly and free from mechanical and electrical defects. Motor tests shall be performed in accordance with the Seller's standard practice. Tests with the exception of Buyer-provided motors shall include, but are not limited to:

1. Motors shall be designed and tested by the manufacturer in accordance with NEMA MG-1. Certificates of Conformance and/or certified test results shall be supplied for the following tests:

   a. Rated load readings of current, power, and speed at rated voltage and frequencies;

   b. No load readings of current, power, and speed at rated voltage and frequencies;

   c. Mechanical vibration and motor balance test results in accordance with NEMA MG 1-12.06 and NEMA MG 1-12.07 for motors greater than 25 hp;

   d. High potential test results in accordance with NEMA MG 1-12.03; and

   e. 1000V dc Megger test for one minute, phase to ground.

2. Motors shall be checked for correct rotation.

3. Motor starters shall be tested for functionality.

4.2.8.3 Wiring and Breaker Test

All wiring and breakers shall be given routine tests to demonstrate that they are free from mechanical and electrical defects. Wiring and breaker tests shall be performed in accordance with the Seller's standard practice. The Seller shall provide wiring and breakers test data that include, but are not limited to:

1. Megger tests are required for all electrical power wiring;

2. Continuity testing is required for all electrical power and instrumentation wiring; and

3. Perform insulation resistance test on each conductor with respect to ground and adjacent conductors,

4. Perform continuity tests to ensure correct connection, and

5. Verify uniform resistance of parallel runs.

4.2.8.4 Instrumentation Testing

Each instrument will be tested for proper operation. This may require applying temporary power, a 4-20-mA loop with indicators, or other methods to verify proper indication and function. All signals that are fed to the termination panel shall be verified at the termination panel. The device should be tested with fluid to physically activate the devices for detecting level, pressure, flow, etc., as applicable.

For control loops provided by the MCS, no testing will be required (except to verify the field device and wiring) and the individual sensors/switches and starters. Example: A level switch feeds the Programmable Logic Controller which controls the feed pump. The level switch shall be tested, but the shutdown signal to the pump can not be verified without the MCS hardware and program, provided later.

For local control function, the system shall be provided with the normal fluid, where practical, to operationally test the control loop. Example: Level interlock to the feed pump shutdown will be tested by filling the tank above the level switch position and verifying the pump shuts down.

4.2.9 Lift Test

The fully assembled DCRS skid assembly shall be lifted from a horizontal position, holding for 10 minutes without incurring any damage such as deformed lifting eyes, pulled threads, elongated lifting points, or pulled pins. Damaged paint is acceptable, but shall be touched-up following the test. The lifting points shall be shown to account for the offset loads, such that the DCRS skid assembly hangs with its vertical axis within ten degrees of vertical. All lifting accessories or components shall be load tested to 125 percent of the rated load capacity.

Results of the lift test, including a video record, shall be submitted to the Buyer.

4.2.10 Filter Housing Testing

The following sections detail the requirements necessary for HEPA-filter housing tests.

4.2.10.1 Visual Inspections

The filter housing assembly, including inlet and outlet transitions, shall be visually inspected in accordance with the requirements of ASME N510 (Section 5). Observed deficiencies shall be documented on the inspection checklist and as a NCR, if needed. A corrective action disposition (Accept As Is, Repair, Rework or Reject) shall be identified and re-inspection results documented on the inspection checklist and on the NCR disposition. The Seller shall submit an NCR to the Buyer. The Seller shall submit (Accept As Is and Repair) dispositioned NCR's to the Buyer for review and approval. All other NCR's shall be submitted to the Buyer for information only.

4.2.10.2 Airflow Distribution Testing

The filter housings/test sections shall be tested for airflow distribution in accordance with the requirements of ASME N510 (Section 8). If similar equipment (duplicate in design, layout, and fabrication) has previously been qualified by this test, the results of this testing may be used to demonstrate airflow distribution qualification. Acceptance criteria shall be as given in ASME N510 (Section 8).

4.2.10.3 Air-Aerosol Mixing Uniformity Testing

The filter housings/test sections shall be tested for air-aerosol mixing uniformity in accordance with the requirements of ASME N510 (Section 9). Qualification testing of sampling manifolds shall be conducted in accordance with ASME N509 (Appendix D). Qualification testing of challenge aerosol injection manifolds shall be performed in accordance with ASME N510 (Section 9). If similar equipment (duplicate in design, layout, and fabrication) has previously been qualified by these tests, the results of this testing may be used to demonstrate manifold and air-aerosol mixing uniformity qualification. Acceptance criteria shall be as given in ASME N510 (Section 9).

4.2.10.4 Structural Capability Testing

The filter housings shall undergo a structural capability test in accordance with ASME N510 (Section 6). The structural capability pressure shall be as defined in Section 3.3.1.6.

4.2.10.5 Pressure Decay Leak Testing

The HEPA filter element holding frames at each filter position shall be pressure decay leak tested in accordance with the requirements of ASME N510 (Section 7) and the *Nuclear Air Cleaning Handbook* (ERDA 76-21, Table 4-5). The leak rate shall not exceed 0.1 percent of the housing volume per hour at the system leak test pressure identified in Section 3.3.1.6 and as defined in ASME N509 (Section 4.6.4).

The filter housings shall be pressure decay leak tested before prefilter and HEPA filters are installed. Tests shall be conducted to meet the requirements of ASME N510 (Section 6) and ERDA 76-21 (Table 4-5). The leak rate shall not exceed 0.1 percent of the housing volume per hour at the system leak test pressure identified in Section 3.3.1.6 and as defined in ASME N509 (Section 4.6.4).

A Buyer's representative may be present to witness the decay leak test of the housings. The Seller shall provide advance notice consistent with Section 4.2.7 before performing the test(s).

4.2.11 Exhaust Duct Testing

The following sections detail the requirements necessary to verify the ductwork integrity tests to be performed in accordance with SMACNA.

4.2.11.1 Structural Capability Testing

The Seller shall perform a structural capability test on each duct spool in accordance with SMACNA at the test pressure specified in Section 3.3.1.6.

4.2.11.2 Ductwork Leakage Testing

The Seller shall perform ductwork leakage testing after the structural capability test has been successfully completed. Leakage testing shall be in accordance with SMACNA. Leakage testing and allowable leakage rate of duct sections shall be in accordance with SMACNA.

4.2.12 Heat-Trace Check

The Seller shall perform a heat-trace check to verify that the heat-trace functions properly and in a safe manner. The steady-state current draw for the heat trace shall be measured.

4.2.13 Inspections

Specific inspections by the Buyer or Buyer's representative that may take place at the Seller's facilities include a suspect fasteners inspection before shipment of equipment. Electrical equipment installation and wiring practices will be subject to review by NEC® inspectors.

5 PREPARATION FOR DELIVERY

The following subsections provide the minimum requirements for packaging, labeling, handling, shipping, and receiving.

5.1 GENERAL

Every item that is shipped shall arrive at the jobsite in the same condition as when it passed all quality control inspections and tests.

5.1.1 Packaging and Shipping Instruction Manual

The Seller shall prepare an instruction manual(s) that includes packaging information, handling information, shipping information, storage information, operational procedures, maintenance procedures, and special assembly procedures. The instruction manual(s) shall be submitted to the Buyer for review and approval before shipment to the Hanford Site.

A recommended spare parts list shall be prepared and provided to the Buyer.

5.1.2 Operation and Maintenance Manual

Provide an Operation and Maintenance Manual containing all information and procedures necessary to operate and maintain the assembled system. Component manuals and other vendor data such as the following shall be provided, as applicable:

1. One-line diagram, layout drawings, schematic and wiring diagrams;
2. Illustrated parts lists with manufacturer catalog numbers;
3. Certified copy of factory test results;
4. Recommended maintenance schedule;
5. Maintenance procedures; and
6. Operating procedures.

Submit Operation and Maintenance Manual, component manuals, and other vendor data to the Buyer for approval before shipment.

5.2 PRESERVATION AND PACKAGING

Before packaging for shipment, all residual water present in the systems from acceptance testing shall be thoroughly drained and dried by purging oil-free dry air through the system. All open pipe ends shall be sealed to prevent ingress of debris and vermin into the system. The assembly shall be thoroughly cleaned to remove any dirt or dust that may have accumulated on the equipment during testing (see Section 3.3.4 for cleanliness). Defects in the paint shall be touched-up. Moving parts shall be secured to prevent any movement during loading, shipping, and offloading.

5.3 PACKING

1. The Seller shall package equipment to protect items during shipping. Bracing structures shall be installed where items could be damaged or vibrate loose during transportation. All bracing must be clearly identified, both in the packaging instruction and by labeling on the outside of the receipt tanks.

2. Rigging sketches or a handling procedure shall be prepared by the Seller for items that require special handling. These sketches will identify weights, sling locations, balance points, methods of attachment, and other information necessary for safe handling.

3. Packaging or preservative coatings shall be visually inspected after loading. Damaged areas shall be repaired. Items shipped with desiccants shall be inspected after loading to verify that seals are intact.

4. Cushioning shall be used where protection from shock and vibration is required. Cushioning materials shall have sufficient strength to provide the required protection, shall exhibit no corrosive effect when in contact with the item being cushioned, and shall not readily support combustion.

5. Temporary cushioning, blocking, bracing, or anchoring placed within an item for shipping protection that shall be removed before operation of the item, shall be identified by a warning(s) placed in a conspicuous manner to effect proper removal of the packing material.

6. Blocking and bracing used for protection of the load shall prevent item movement and withstand thrust and impact applied in any direction. Blocking and bracing used in direct contact with the item being blocked shall not have a corrosive effect on the item.

7. The weight, lifting points, or center of gravity indicated on the crate, skid, or package of major components shall be used to ensure proper handling during loading.

8. Written instructions covering the location and stacking limits of the crates or boxes on the transport vehicle shall be specified, as appropriate. These instructions should be marked on the container.

9. Precautions shall be taken to minimize marring of the finish of painted surfaces during handling and shipping, as practicable.

10. Cables, slings, chain falls, etc., shall not be placed where they can cause damage to any component part. Mating surfaces, machined areas, etc., shall be avoided.

11. All items shall be protected from the deleterious effects of shock, vibration, physical damage, moisture, salt spray, condensation, and weather during shipping, as applicable.

12. Items shall be inspected for cleanliness before packaging. Dirt, oil, residue, metal chips, or other forms of contamination shall be removed in accordance with Section 3.3.4. Any entrapped water shall be removed.

13. All openings into items shall be capped, plugged, and sealed with materials which perform their intended function without causing deleterious effects on the equipment or its operation.

14. Nonmetallic plugs and caps shall be brightly colored. Clear plastic caps or plugs are not to be used except when specified.

15. Plugs or caps shall be prevented from falling into, or being pushed into, openings after installation and shall be secured to prevent accidental removal.

16. Items subject to corrosion, either internal or external, shall be suitably protected.

17. Items packed in containers shall be blocked, braced, or cushioned to prevent physical damage.

18. Instrumentation, electrical and electronic equipment, motors, and other electrical assemblies and equipment shall be packaged in a waterproof enclosure. This may be the enclosure the item will operate in. For items without waterproof enclosures, a vapor barrier shall be placed around the enclosure. In either case, the enclosure shall be able to exclude dirt and facilitate handling and marking of the item. Barrier materials shall be nonhalogenated if used in contact with austenitic stainless steels, shall be noncorrosive, shall not readily support combustion, and shall not be, otherwise, harmful to the item being packaged. Desiccants may be used inside the enclosure or vapor barrier.

19. "Anchoring" of the item within a crate or on a skid means to adequately fasten the item during shipment and protect the item from potential damage as a result of rough handling. Bolting is preferred. When bolts are used for anchoring, the following criteria shall apply:

    a. If precision holes in the item are used for anchoring, properly fitting bolts shall be used to prevent marring or elongation of the holes.

    b. Items shall be marked to preserve identity during shipping, receiving, and storage per the following requirements:

        i. Identification shall be stamped, etched, stenciled, or otherwise marked on the item or on tags affixed to the item.

        ii. The marking shall not be deleterious to the material nor violate any other section of this specification.

        iii. When tags are employed, they shall be of material that will retain the marking and withstand weathering deterioration and other normal shipping and handling effects.

20. Items not specifically covered by these requirements shall be handled in accordance with sound material handling practices.

5.4 MARKING AND LABELING

Packages shall be properly and clearly marked and labeled. At a minimum, the required information shall include the contract number, the name and equipment number of the item within the package, the actual weight of the package and its contents, and the orientation of the equipment within the crate. Each package shall be labeled as part of the entire shipment, such as "Crate 1 of 2."

5.5 HANDLING

The Seller shall lift equipment using a properly rated forklift and/or crane, using the lifting points designed for that purpose.

5.6 SHIPPING

The Seller's designated carrier shall carry bills of lading for each shippable unit that is delivered to the Buyer.

The Seller shall obtain approval to ship from the Buyer before the equipment is prepared for shipment. At a minimum, the Seller shall provide the Buyer a copy of the completed bills of lading, CoCs, and any unique certifications (i.e., ASME Code Certificates) before transport release. At the time of shipment release from the Seller's facility, the Seller shall contact the Buyer by telephone and relay to the Buyer, or his designated representative, the anticipated Estimated Time of Arrival of each shipment to the Hanford Site.

5.7 RECEIVING

The Buyer's agent will perform a receipt inspection on receipt of the equipment at the Buyer's specified site.

This receipt inspection shall consist of the following:

1. Verify all parts are present and not damaged during shipping.

2. Documentation review—determine that documentation required by contract to accompany equipment is present and traceable to the equipment shipped as required by the Bidder's Drawing and Data Commitments sheet (Appendix F).

The Seller is responsible for accommodating the receipt inspection process by:

1. Designing and using packaging that allows for easy opening or disassembly to reveal the item(s) for inspection, then reclosing to permit the same packaging to be used for post-receipt transportation on the Hanford Site.

2. Selecting locations on equipment for identification numbers that promotes easy identification without extensive disassembly of packaging materials. It is preferred that packaging be marked to indicate the approximate position of identification numbers on equipment within the packaging.

3. Ensuring that all required documentation accompanying the equipment is present and obvious on, or within, the packaging.

6 NOTES

1. Unless otherwise specified, equipment furnished under this section shall be fabricated and installed in compliance with the instructions of the manufacturer.

2. The Seller shall ensure that all equipment, accessories, and installation materials comply with the specification and that adequate provision is made in the DCRS skid assembly design and fabrication for mounting the specified system equipment and accessories.

3. The Seller is solely responsible for construction means, methods, techniques, sequences, procedures, and safety precautions and programs.

4. The Seller shall provide all labor, equipment, and material required to provide a complete and functional system.

5. To avoid delays in construction, the Seller shall ensure that all components of the system are available to meet the required schedule.

6. The Seller shall obtain necessary permits, arrange for inspections, and obtain approval of the appropriate Seller's local "Authority Having Jurisdiction" over the work described.

7 APPENDICES

The following appendices make up part of this specification:

Appendices	Description
A	Drawings and Sketches
B	Dryer and Condensate Recovery System Hydraulic Model Information
C	Data Sheets
D	TFC-ESHQ-Q_C-C-03, Revision B, *Control of Suspect/Counterfeit Items*
E	Request for Information
F	Bidder's Drawing and Data Commitments
G	Instrumentation Naming and Tagging Convention

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TECHNICAL SPECIFICATION

PROJECT:	Final DBVS Design	145579-D-SP-006	REV. 2
PROJECT NO.:	145579	DRYER AND CONDENSATE RECOVERY SYSTEM SKID	
CLIENT:	AMEC E&E - Richland, Washington		

Appendix A

Drawings and Sketches

Drawing or Sketch	Revision	Sheet	Title
056-001-2-010	0	1 and 2	RNC CD-10,000 Demonstration Bulk Vitrification (DBV) Dryer General Arrangement
2004195-D	0	1	Water Recovery Vacuum System[3]
F-145579-00-A-0099	E	1	Bulk Vitrification P&ID "Typicals" Legend
F-145579-00-A-0100	G	1	Bulk Vitrification P&ID Symbol Legend
F-145579-00-B-0008	B	1	Bulk Vitrification Dryer Structural Steel Plans & Details
F-145579-00-B-0009	B	1	Bulk Vitrification Dryer Structural Steel Elevations & Details
F-145579-00-D-0002	F	1	Bulk Vitrification Site Layout Plan
F-145579-00-E-0103	A	1	Bulk Vitrification Dryer Off-Gas Vac Pump Schematic Diagram
F-145579-00-E-0103	A	2	Bulk Vitrification Dryer Off-Gas Vac Pump Wiring Diagram
F-145579-00-E-0127	A	1	Bulk Vitrification Waste Dryer Chopper Schematic Diagram
F-145579-00-E-0127	A	2	Bulk Vitrification Waste Dryer Chopper Wiring Diagram
F-145579-00-E-0168	A	1	Bulk Vitrification Waste Dryer Condensate Schematic Diagram
F-145579-00 E-0168	A	2	Bulk Vitrification Waste Dryer Condensate Wiring Diagram
F-145579-00 E-0169	A	1	Bulk Vitrification Dryer Offgas Condensate Schematic Diagram
F-145579-00 E-0169	A	2	Bulk Vitrification Dryer Off-Gas Condensate Wiring Diagram
DBVS SK E003	A	1 and 2	DCRS One-Line and Grounding Diagrams
DBVS-SK M103	B	1	Bulk Vitrification HIHTL Penetration Details

[3] This system is described in this specification as the Condensate Recovery System.

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TECHNICAL SPECIFICATION

PROJECT:	Final DBVS Design	145579-D-SP-006	REV. 2
PROJECT NO.:	145579	DRYER AND CONDENSATE RECOVERY SYSTEM SKID	
CLIENT:	AMEC E&E - Richland, Washington		

Drawing or Sketch	Revision	Sheet	Title
DBVS-SK-M109	A	1	Bulk Vitrification DCRS General Arrangement
DBVS-SK-P004	D	1	Bulk Vitrification Waste Dryer P&ID
DBVS-SK-P005	C	1	Bulk Vitrification Waste Dryer Vacuum P&ID
			Total Drawing Pages including cover: 24