

Project Title: **Facility Package for the OU 7-10 Glovebox Excavator Method Project**
Document Type: **Construction Specification** Project Number 021052
Revision Number: 0

1 SECTION 13914 - MANUAL DELUGE - FIXED NOZZLE SYSTEM

2
3 PART 1 - GENERAL

4
5 Work includes, but is not limited to:

- 6
7 1. Layout, fabricate, install, and test a complete Manual Deluge – Fixed Nozzle System.
8 Include pipe, fittings, industrial monitor nozzles, 2.5-inch hose valves, hangers,
9 supports, earthquake bracing, and all necessary accessories and components to assure
10 a complete and operable system. The hydraulic calculations have been completed on
11 the piping system shown and the design is adequate to supply the needed water flow.
12 If the piping is changed significantly, new hydraulic calculations will be required to
13 be submitted and approved.
14 2. Adjust the flow for each of the industrial monitors to a maximum of 250 gpm. Direct
15 size the spray in the direction as determined by the testing required by this
16 specification.
17 3. This specification connects the piping to an existing pipe that was installed under a
18 previous part of this project and extends the piping into the WES and into the RCS
19 The connection is located approximately 10 feet east of the east wall of the WES.
20

21 RELATED SECTIONS:

22

23 Section 01300	Submittals
24 Section 09900	Painting and Labeling
25 Section 13911	Dry Pipe Systems Specification

26

27 REFERENCES:

28
29 The following documents, including others referenced therein, form part of this Section to the
30 extent designated herein.

31
32 **FACTORY MUTUAL (FM)**

33

34 FM Approval Guide	Fire Protection
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35

36 **NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)**

37

38 NFPA 13	Standard for the Installation of Sprinkler Systems
39 NFPA 14	Standard for the installation of Standpipe Systems

40
41
42

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1 UNDERWRITERS LABORATORY (UL)

2
3 Fire Protection Equipment Directory

4
5 Unless otherwise specified, references in this specification to other specifications, codes,
6 standards, or manuals shall be the latest edition including any amendments and revisions in
7 effect as of the date of this specification.

8
9 SYSTEM DESCRIPTION:

10
11 Reference Drawings: The drawings do not attempt to show complete details of the system
12 installation. The drawings in part are diagrammatic and do not show all offsets, fittings,
13 valves, equipment, etc. It is absolutely essential to study the drawings and confer with the
14 various trades involved to assure that there is no conflict between the system and the work.
15 The hydraulic calculations have been completed on the piping system shown and the design
16 is adequate to supply the needed water flow. If the piping is changed significantly, new
17 hydraulic calculations will be required to be submitted and approved.

18
19 The pitching of pipe, and installation shall be performed per NFPA 13. The layout shall
20 assure that the low points in the system will drain.

21
22 The water supply shall provide a quantity of 250 gpm at 20 psig at each fixed monitor nozzle
23 for the system.

24
25 The piping shall be laid out to meet earthquake criteria using NFPA 13.

26
27 Piping: All above ground piping used in this project for systems shall conform to the Product
28 section of this specification. All piping shall be galvanized and labeled as a minimum.

29
30 Seismic Bracing: Earthquake sway bracing shall be provided based upon NFPA 13 using a
31 "G" factor of 0.5. Calculations, using the zone of influence method, showing the forces on
32 the attachments shall be done to verify that the minimum requirements outlined are not
33 exceeding the allowable strengths of listed equipment or allowable strength of the building
34 structure at the point of attachment. Details of the sway bracing shall be provided on the shop
35 drawings and bracing calculation sheets.

36
37 The Subcontractor shall be responsible for coordinating with the building manufacture to
38 assure the structure is capable of supporting both the static and dynamic loads imposed by the
39 system layout. The forces developed at the point of connection to the structure must be taken
40 into account and approved by the building structural designer.

41
42 Hangers: Layout shall be based upon pressures in excess of 100 psi.

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1 Low Point Drains: Low point drains shall be arranged to allow system drainage. The drains
2 shall discharge to a safe location; drain valves shall consist of 1/4-turn ball valves.

3
4 SUBMITTALS

5
6 A list of submittals for this specification section is found in Section 13911. The submittals
7 are to be made as a single submittal under that specifications section.

8
9 QUALITY CONTROL:

10
11 Sprinkler Subcontractor: The sprinkler contractor for the system shall have a NICET
12 Certified Engineering Technician, (CET), in fire protection system design with a minimum
13 Level III rating. The technician is (1) responsible for overseeing the preparation of the layout
14 drawings and installation; (2) required to certify that the drawings are in accordance with the
15 specification; (3) sign all drawings; and (4) upon completion of the systems installation,
16 verify the installation is in accordance with the working drawings and this specification.

17
18 Manufacturers: Firms regularly engaged in the manufacture of fire protection equipment and
19 piping accessories of types and sizes required, whose products have been in satisfactory use
20 in similar service for not less than 3 yrs.

21
22 Installer: A firm with at least 3 yrs of successful installation experience on projects with fire
23 sprinkler/monitor piping similar to that required for this project. The installing Subcontractor
24 shall be licensed, by the State of Idaho as a Fire Sprinkler Contractor.

25
26 UL Listed or FM Approved: Provide system piping, fittings, and devices with a UL listing
27 and/or FM approval.

28
29 Regulatory Requirements (Codes and Standards): Comply with the provisions of the
30 following codes and standards unless otherwise specified herein.

31
32 DEPARTMENT OF ENERGY

33
34 DOE-ID

Architectural Engineering Standards Section 1385

35
36 FACTORY MUTUAL (FM)

37
38 FM Approval Guide
39 FM Data Sheet 2-8

Fire Protection
Earthquake Protection for Sprinkler Systems

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1 NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

2
3 NFPA 13 Standard for the Installation of Sprinkler Systems
4 NFPA 14 Standard for the Installation of Standpipe Systems
5

6 Unless otherwise specified, references in this specification to other specifications, codes,
7 standards, or manuals shall be the latest edition including any amendments and revisions in
8 effect as of the date of this specification.
9

10 Notification: The Subcontractor shall notify the Contractor in writing two weeks prior to
11 beginning work.
12

13 Workmanship: All work shall be done in a skillful and workmanlike manner. No
14 modifications or rearrangements, not shown on the drawings, shall be made without prior
15 approval from the Contractor.
16

17 DELIVERY, STORAGE AND HANDLING:
18

19 All materials shall be delivered to and stored at the job site in a manner which will prevent
20 foreign material from getting inside the piping, equipment, and valving.
21

22 SEQUENCING /SCHEDULING:
23

24 The static and dynamic loads associated with the fire protection system must be coordinated
25 with the building structural design.
26

27 The aboveground fire water main must be flushed and accepted prior to connection to the
28 sprinkler system riser.
29

30 PART 2--PRODUCTS
31

32 MATERIALS AND EQUIPMENT:
33

34 Industrial Monitor: The Monitor shall be an Elkhart model 299-11H hydrant monitor
35 equipped with a Elkhart Model J "Mystery" Monitor nozzle having a capacity of 350 gpm.
36 The monitor shall have a 2.5 inch swivel base that will be connected to a 2.5 inch hose valve,
37 2.5 inch Elkhart Model U-25, on top of the standpipe.
38

39 Piping: Piping shall be ASTM A 53, type S, grade A, welded or seamless galvanized steel,
40 Schedule 40, conforming to the requirements set forth in NFPA 13.
41

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1 Pipe Fittings: Fitting shall be hot dipped galvanized in accordance with the requirements set
2 forth in NFPA 13. Reduction in pipe size shall be made with one-piece reducing fittings.
3 Bushings will not be acceptable. Plain-end fittings are not acceptable.

4
5 Welded fittings on galvanized piping will not be allowed unless the weld effected zone of the
6 fitting and associated piping is hot dip galvanized.

7
8 Pipe Couplings: Flexible galvanized couplings in pipelines shall be UL listed or FM
9 approved and they shall be in conformance with NFPA 13 using Victaulic, Style 75. Rigid
10 couplings in pipelines shall be Victaulic Style 005, 07, or approved equal. Plain end and
11 welded couplings shall not be allowed.

12
13 Hangers: Hangers shall be of the type and location that is in accordance with NFPA 13 and
14 15.

15
16 Threaded side beam brackets: TOLCO Fig. 58 with bolt and hex nut fastener.

17
18 C-Type beam clamps with retaining strap: TOLCO Fig. 65, 66. Retaining strap TOLCO Fig.
19 69.

20
21 Ring Hanger: TOLCO Fig. 2, 2NFPA, and 200.

22
23 Surge Restrainer: TOLCO Fig. 25.

24
25 Straps: Straps shall be UL Listed and FM approved, ¼" bolt holes, Carbon Steel. Grinnell
26 Short Strap, Fig. 262.

27
28 Earthquake and Sway Bracing: Bracing shall be UL listed or designed by a registered
29 Professional Engineer in the State of Idaho. TOLCO.

30
31 EQUIPMENT AND DEVICE LABELS:

32
33 Labels shall be made upon red engraved laminated phenolic resin nameplates with white
34 lettering. Labels for equipment shall be permanently installed.

35
36 IDENTIFICATION OF PIPING:

37
38 See Section 09900 Painting, for the requirements for labeling all pipe and devices.
39
40
41
42

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1 PART 3--EXECUTION

2
3 FIELD QUALITY CONTROL:

4
5 Installation: Only new and approved nozzles, piping, fittings, hangers, and devices shall be
6 employed in the installation of the system.

7
8 One set of approved layout drawings shall be maintained on the project site during
9 construction. The Subcontractor shall redline all changes daily. The redline drawings shall be
10 incorporated on the "as-built" layout drawings by the Subcontractor.

11
12 QUALITY CONTROL TESTING:

13
14 SUBCONTRACTOR SUPPLIED TESTING:

15
16 Hydrostatic Testing of System Piping: All new fire system piping shall be hydrostatically
17 tested at not less 225-psi pressure for two (2) hours with no visible leakage following an
18 approved procedure. Reference NFPA 13. The Contractor's Representative shall witness
19 testing.

20
21 Deluge Nozzle directional setting: The Subcontractor shall conduct a test to verify that the
22 deluge nozzles will spray in the required direction and at the designated flow rate before they
23 are installed inside of the RCS. The test apparatus shall include a mockup of the nozzle and
24 the pressure-regulating valve. The nozzle shall be located at the same elevation for the test as
25 it will be when installed in the RCS, the nozzle will then flow water and the pattern will be
26 adjusted to cover the required area inside the RCS.

27
28 END OF SECTION 13914

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1 **SECTION 13916 - STATIONARY FIRE PUMP**

2
3 **PART 1 - GENERAL**

4
5 **Section Includes**, but is not limited to:

- 6
7 1. Layout, fabricate, install, and test the fire pump installation including pipe,
8 equipment, 850 gallon water storage tank, 25 gallon fuel day storage tank, 25 gpm @
9 150 psig @ 1760 rpm rotary gear pump, 26 HP diesel engine, hanger supports,
10 earthquake bracing, and all necessary accessories and components to assure a
11 complete and operable system.

12
13 **SUBMITTALS**

14
15 **Submittals include**, but are not limited to:

- 16
17 1. **Working Drawings**: The system working drawings shall be submitted as a complete
18 package for approval. The complete package shall include, make and model of all
19 equipment used. Partial submittals will be considered as incomplete and will not be
20 reviewed. The working drawings must receive an "A" or "B" designation by the
21 Contractor prior to beginning of installation and shall comply with NFPA 13, & 20.
22 2. The Subcontractor shall submit all working drawings for approval prior to
23 construction. All drawings shall be completed on size D (22" X 34") CAD generated
24 drawings. Lettering size shall be a minimum of 1/8 (.125)" inch for all lettering on the
25 main body of the drawing. Border and title block shall follow format in this drawing
26 package. Drawings shall be done using AutoCAD or a similar program that generates
27 dwg files that are compatible with AutoCAD 2000 and use a simplex font. An
28 electronic copy of the As-Built configuration shall be furnished.

29
30 Electronic copies of border and title block format, as well as the construction drawings
31 are available upon request. An A/E Drawing Standard format is available upon request.

32
33 **Catalogue Data**: The catalogue data shall consist of original copies of information regarding
34 each of the devices used in the construction of the Fire Pump System including UL/FM
35 listing or approval data, make and model capacities and ratings, etc.

36
37 **QUALITY CONTROL SUBMITTALS**:

38
39 **Procedures**: The Subcontractor shall submit a hydrostatic and operational test procedure.
40 These procedures must be approved prior to any system be considered operational. Detailed
41 test procedures for the fire pump system, 30 days prior to performing system tests.
42

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1 **Test Reports:** Test reports in booklet form showing all field tests performed to adjust each
2 component and all field tests performed to prove compliance with the specified performance
3 criteria upon completion and testing of the installed system. Each test report shall indicate the
4 final position of controls.

5
6 **Operation and Maintenance Manuals:** Complete copies of the operation manual outlining the
7 step-by-step procedures required for system startup, operation, and shutdown. The manual
8 shall include the manufacturer's name, model number, catalog cuts, diagrams, drawings, parts
9 list, and descriptive data covering the proper operation and testing. The manual shall include
10 simplified diagrams for the system as installed.

11
12 **Certifications:** A Contractor's Material and Test Certification for Above-Ground Piping shall
13 be completed and witnessed, for the hydrostatic test and the system operational test covered
14 by this specification prior to final acceptance of the installation.

15
16 See Section 01300, Submittals and the Vendor Data Schedule for additional submittal
17 requirements.

18
19 **Spare Parts Data:** Spare parts data for each different item of materials and equipment
20 specified, after approval of the detail drawings, and not later than two months prior to the
21 date of beneficial occupancy. The data shall include a complete list of parts and supplies,
22 with current unit prices and source of supply, and a list of the parts recommended by the
23 manufacturer to be replaced after one (1) years of service.

24
25 **Instructions, Framed Instructions:** diagrams, instructions, and other sheets, prior to posting.
26 The framed instructions shall be posted at the fire pump. Framed instructions under glass or
27 in laminated plastic, including wiring and control diagrams showing the complete layout of
28 the entire system, shall be posted where directed. Condensed operating instructions
29 explaining preventative maintenance procedures, methods of checking the system for normal,
30 safe operation, and procedures for safely starting and stopping the system shall be prepared in
31 typed form, framed as specified above for the wiring and control diagrams, and posted beside
32 the diagrams. The framed instructions shall be posted before acceptance testing of the
33 system.

34
35 **REFERENCES:**

36
37 The publications listed below form a part of this specification to the extent referenced. The
38 publications are referred to in the text by basic designation only.

39
40
41
42
43

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1 NATIONAL FIRE PROTECTION ASSOCIATION

- 2
3 NFPA 13 (1999) Installation of Automatic Sprinkler Systems
4 NFPA 750(1999) Installation of water mist Fire Protection Systems
5 NFPA 20(1999) Installation of Stationary Fire Pumps
6

7 DEPARTMENT OF ENERGY

8
9 DOE-ID Architectural Engineering Standards Section 1385
10

11 Unless otherwise specified, references in this specification to other specifications, codes,
12 standards, or manuals shall be the latest edition including any amendments and revisions in
13 effect as of the date of this specification.
14

15 GENERAL REQUIREMENTS:

16
17 The pump manufacturer shall supply the pump furnished for fire protection service with the
18 specified drivers, controls, and pump accessory items. The pump, driver, and controls shall
19 be Underwriters Laboratories (UL) listed for fire protection service. The pumping equipment
20 shall be installed as specified in the National Fire Protection Association (NFPA) 20,
21 Standard for the Installation of Stationary Fire Pumps. The fire pump shall be designed to
22 deliver 25 U.S. gallons per minute (gpm) at a total head of 150 psi. The fire pump shall also
23 be capable of delivering not less than 150% of rated flow at not less than 65% rated head.
24 The shut-off (no flow) head shall not exceed 120% of rated head. Pump shall be furnished
25 with drive, controls, and accessories as detailed in this specification and shown on the
26 drawings.
27

28 Manufacturer's Factory Tests: Each individual pump shall be hydrostatically tested and run
29 tested prior to shipment. The pump shall be hydrostatically tested at a pressure of not less
30 than one and one-half times the no-flow (shut-off) head of the pump's maximum diameter
31 impeller plus the maximum allowable suction head but in no case less than 250 psig.
32

33 Field Acceptance Test: A field acceptance performance test shall be conducted upon
34 completion of pump installation. The test shall be made by flowing water through the
35 installed calibrated flow meter. The test shall be conducted as required in NFPA 20 by the
36 installing Subcontractor in the presence of the Owner. Failure to submit documentation of
37 factory and field tests will be just cause for equipment rejection.
38

39 Standard Products: Material and equipment shall be the standard products of a manufacturer
40 regularly engaged in the manufacture of the products.
41

42 Nameplates: Pumps and motors shall have the manufacturer's name, address, type or style,
43 model or serial number, and catalog number on a plate secured to the item of equipment.

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1 Verification of Dimensions: The Contractor shall become familiar with all details of the
2 work, verify all dimensions in the field, and shall advise the Engineer of any discrepancy
3 before performing the work.

4
5 Welding: Welding shall be in accordance with NFPA 13. Only shop welding with
6 appropriate welding fittings shall be used.

7
8 DELIVERY AND STORAGE:

9
10 All equipment placed in storage shall be stored with protection from the weather, humidity
11 and temperature variations, dirt and dust, or other contaminants.

12
13 PART 2 PRODUCTS

14
15 Rotary Gear Pump: The fire pump shall be a 25 gpm @ 150 psi, construction specifically
16 labeled for fire protection service. The suction water supply for the fire pump shall be from a
17 grade level vertical 48-inch diameter storage tank holding a maximum of 850 gallons. The
18 pump shall have 250 pound rating discharge flanges machined to American National
19 Standards Institute (ANSI) dimensions.

20
21 Approved Manufacturers: Edwards Model EMI 20-420, Rotary Gear Pump.

22
23 Additional Equipment:

- 24
25 1. Pump relief valve-EMI Model 20, 1" set at 170 psi
26 2. Suction and discharge pressure gauges:

27
28 Diesel Engine Controller: The diesel engine controller shall be a Firetrol Model FTA
29 1100ML12N, NEMA 2 enclosure for indoor use, UL/FM listed (mounted and wired).

30
31 Diesel Engine: The pump driver shall be a horizontal shaft, open type, internal combustion
32 engine (EMI Model EMI14041D, rated at 26 HP and 1760 rpm, clockwise rotation viewed
33 from the end opposite the pump. The engine shall be provided by the pump manufacturer
34 with, at a minimum, the following accessories for automatic operation:

- 35
36 1. Radiator and necessary fittings for engine cooling system pre-piped and factory-
37 mounted.
38 2. Flexible exhaust connector
39 3. Residential exhaust silencer (3" Residential)
40 4. Fuel Filters
41 5. Engine jacket water heater, factory installed, 1500W, 120/220 volt.
42 6. One set dual batteries, lead acid type

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- 1 7. Fuel system as required in NFPA 20. A 25-gallon Fuel storage tank sized to provide a
2 minimum supply of one gallon of fuel per engine maximum rated horsepower, plus
3 5% for sump area. The tank shall be furnished with a 150 % rupture basin, 12 gauge
4 steel, 2" emergency vent, 36" wide by 16" deep by 20.5", high floor mounting and
5 with a direct reading level gauge.
- 6 8. The engine shall be run-tested with the pump by the pump manufacturer prior to
7 shipment.

8
9 Water Storage Tank: Shall be an 850-gallon vertical polyethylene tank, 48"X114", equipped
10 with a 18 " diameter manhole. Tank shall be equipped with 1" outlet for pump suction
11 located at the bottom of the tank; 1' inlet at the top of the tank for the pressure relief; an 1 ½"
12 threaded open for the flow meter return, located at the top of the tank; Seismic tie down
13 assemblies for Seismic zone 3 applications; and a 2" 'U' vent in the top of the tank. The tank
14 shall be Model 181 manufactured by Snyder Industries, Lincoln NE 68504 to meet ASTM D-
15 1998-96 Standards.

16
17 Flow Meter: The fire pump flow meter shall be a Gerand, Model K-25-1 ¼" (616), treaded
18 ends about 3 ¾" long, FM approved with a flow range of 12.5 gpm to 50 gpm.

19
20 MATERIALS:

21
22 Materials and equipment shall conform to the respective publications and other requirements
23 specified herein.

24
25 Bolts and Nuts: Square head Bolts and Heavy Hexagon Nuts. ASME B18.2.1 and ASME
26 B18.2.2 and ASTM A 307, ASTM A 575, or ASTM A 576.

27
28 Chlorine,liquid: AWWA B301.

29
30 Flange Dimensions: ASME B16.1 or AWWA C207

31
32 Gauges: FS GG-G-76, Class 1, Type I, Style X.

33
34 Flange Gaskets: Gaskets shall be non-asbestos compressed material in accordance with
35 ASME B16.21, 1/16-inch thickness, full face or self-centering flat ring type. The gaskets
36 shall contain aramid fibers bonded with styrene butadiene rubber (SBR) or nitrile butadiene
37 rubber (NBR). NBR binder shall be used for hydrocarbon service.

38
39 Hypochlorites. AWWA B300

40
41 Lubricant: Gasket lubricant shall be as recommended by the pipe manufacturer. Thread-
42 cutting oil shall be an all purpose lubricant free from animal or vegetable compounds.

43

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1 **Stainless Steel Pipe:** Stainless steel piping shall be seamless 304L, Schedule 40, conforming
2 to the requirements of ASTM A312.

3
4 **Stainless Steel Pipe Fittings:** Reduction in pipe size shall be made with one-piece reducing
5 fittings. Bushings will not be acceptable. Plain-end fittings are not acceptable. Fittings shall
6 be stainless steel for stainless steel pipe. Segmented, welded elbows shall not be used.
7 Stainless steel fittings shall be 304, ASTM 351 in accordance with the requirements set forth
8 in NFPA 13; Reduction in pipe size shall be made with one-piece reducing fittings. Bushings
9 are not acceptable. Screwed fittings shall utilize TEFLON tape and/or TEFLON paste to
10 prevent galling.

11
12 **Pipe Hangers.** Hangers shall be in accordance with NFPA 750, and in accordance with UL
13 requirements for use in water mist systems C-clamps shall be torqued per manufacturers
14 requirements and have both locknuts and retaining devices furnished by the manufacturer.
15 The C-clamp body shall not be constructed from bent plates.

16
17 **VALVES:**

18
19 **Gate Valves.** Gate or Butterfly valves shall be in accordance with UL-04 listing. Under 2-
20 inch size valves shall be in accordance with MSS SP-80;

21
22 **Check Valves.** Under 3-inch valves shall meet the requirements of MSS SP-80. All valves
23 shall be listed in UL-04 and shall be straightway type, suitable for vertical or horizontal
24 installation with end connections as required to mate with piping in which the valve must be
25 installed.

26
27 **Grooved End Gate and Check Valves.** Grooved end gate and check valves may be used if the
28 manufacturer of the valves certifies that the valves meet the performance requirements of the
29 cited UL-04 standard.

30
31 **ELECTRICAL WORK:**

32
33 Electric equipment and wiring shall be in accordance with Section 16000 Electrical Work,
34 Interior. Conduit, wiring, control, signal devices, and all associated equipment required for
35 the work herein specified, shall be provided under Section 16000 of the specifications.

36
37 **PART 3 EXECUTIONS**

38
39 **INSTALLATION:**

40
41 Unless otherwise indicated or specified, all materials and equipment shall be installed in
42 accordance with the manufacturer's recommendations and in accordance with NFPA 13 and
43 20. Cutting structural members for passage of pipes or for pipe hanger fastenings will not be

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1 permitted. A firm regularly engaged in the installation of fire pump systems shall install the
2 system. The Contractor may reject any proposed installer who cannot show evidence of such
3 qualifications. The Contractor's approval will not relieve the Subcontractor from his
4 responsibilities to perform all work in accordance with specifications and contract terms.

5
6 **Personnel Protection:** Belts, pulleys, chains, gears, couplings, projecting set screws, keys, and
7 other rotating parts shall be so located as to be fully enclosed or guarded to prevent a person
8 coming in contact therewith.

9
10 **PIPE AND FITTINGS:**

11
12 **Pipe:** Pipe used shall not be subject to a working pressure in excess of 25 percent of the
13 hydrostatic pressure test required by ASTM A 312

14
15 **Joints:** Joints shall conform to NFPA 13. Shop welded joints will be permitted. Flanged
16 joints or mechanical grooved couplings shall be provided where indicated or required by
17 NFPA 13. Grooved pipe and fittings shall be prepared in accordance with the manufacturer's
18 latest published specification according to pipe material, wall thickness and size. Mechanical
19 couplings and fittings shall be from the same manufacturer.

20
21 Threaded joints shall be cut with approved thread-cutting oil and shall conform to FED-STD
22 H28/GEN. Joints shall be made tight with Teflon tape. Not more than three threads shall
23 show after the joint is made up.

24
25 Flanged joints shall be faced true, provided with gaskets and made square and tight.

26
27 Gaskets shall be of molded synthetic rubber with central cavity, pressure responsive
28 configuration, and shall conform to ASTM D 2000.

29
30 **Special Couplings:** Special couplings, grooved couplings, and flexible connections approved
31 for use in fire pump and sprinkler systems may be used in place of unions and flanged
32 connections where applicable.

33
34 **Fittings:** Fittings for aboveground piping shall be of a type specifically approved for use in
35 sprinkler systems. Bushings shall be used only where standard fittings of the required size are
36 not available. The use of bushings is further restricted to requirements of NFPA 13.

37
38 **Reducers:** Reductions in pipe sizes shall be made with one piece reducing fittings. Bushings
39 will not be acceptable, except that, when standard fittings of the proper size are not available,
40 single bushings of the face type will be permitted.

41 **Pipe Supports and Hangers:** The recommended methods and requirements for supporting of
42 hanging pipe as set forth in NFPA 13 shall be mandatory.

43

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1 **Escutcheons:** Escutcheons shall be provided at all finished surfaces where exposed piping
2 passes through floors, walls, or ceilings. Escutcheons shall be fastened securely to pipe and
3 shall be chromium-plated iron or chromium plated brass, either one piece or split pattern,
4 held in place by internal spring tension or setscrew.
5

6 **Drains:** The piping system shall be provided with complete drainage facilities as indicated
7 and in accordance with NFPA 13.
8

9 **Protection Against Freezing:** Supply pipes or risers that pass through unheated spaces in or
10 under buildings and are exposed to freezing shall be protected from freezing in accordance
11 with applicable methods in NFPA 13.
12

13 **Protection Of Piping In Seismic Zones:** Protection of piping against earthquake damage shall
14 be provided. Methods of protection shall be in accordance with applicable requirements of
15 NFPA 13.
16

17 **Flushing:** Before acceptance of the piping system, each unit of the completed system shall be
18 flushed as specified. After pressure tests have been made, the unit shall be thoroughly flushed
19 with water until all entrained dirt and mud have been removed
20

21 **Fire Alarm Monitoring:** Equipment necessary to provide a supervisory signal for the fire
22 pump running, pump failure to start and trouble on the pump controller for the fire pump
23 system shall be installed as shown on the drawings.
24

25 **Transmission Of Alarm Signals:** Alarm signal wiring shall be connected to the building fire
26 alarm control panel in accordance with Section 16721.
27

28 **Field Painting And Labeling:** Field painting and labeling are specified in Section 09900
29 PAINTING, GENERAL.
30

31 **Pre-Test Inspection:** After installation of the fire pump system is complete and prior to
32 performing system tests, the system shall be thoroughly inspected by both the Subcontractor
33 and the Contractor or his authorized representative. The Subcontractor shall provide written
34 notice to the Contractor 14 days in advance of the inspection.
35

36 **Tests:** After completion of the pre-test inspection, the Subcontractor shall subject the system,
37 to the tests required by NFPA 20 and as outlined in the approved test procedures, and shall
38 furnish the Contractor with a certificate as required. The Subcontractor shall provide written
39 notice to the Contractor 14 days in advance of tests. All tests shall be performed in the
40 presence of the Contractor or his authorized representative.
41

42 **END OF SECTION 13916**

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1 SUBMITTALS:

2
3 Partial submittals will be considered incomplete and will not be reviewed.

4
5 Submittals include, but are not limited to:

6
7 Pre-weld package

- 8
9 1. Cleaning procedures for stainless steel.
- 10 2. Subcontractor's procedure for the identification and control procedures for tools and
11 equipment.
- 12 3. Welding procedure specifications (WPS) and procedure qualification records (PQR)
13 performed in accordance with AWS D9.1 for off-site welding including a list of
14 procedures selected for use from the INEEL Welding Manual. These procedures shall
15 be referenced on the shop drawings, erection drawings, and contract drawings as
16 applicable.
- 17 4. Welding personnel performance qualification records.
- 18 5. Subcontractor's Nondestructive examination procedures.
- 19 6. Subcontractor's nondestructive examination personnel qualification records.
- 20 7. Procedure for the handling, storage, and control of filler materials and backing
21 material.

22
23 Post-weld packages

- 24
25 1. Weld histories including requirements in Special Conditions such as reports of each
26 inspection, examination and test.
- 27 2. Weld repair reports including weld identification, welder identification numbers, test
28 procedure, reason for rejection, number of repairs required and documentation that the
29 weld is repaired and accepted.
- 30 3. Weld map which shall include the following information: weld procedure
31 specification, unique identification number including welders identification and
32 completion date.
- 33 4. Shop drawings shall show all welds. All necessary information such as location, sizes,
34 weld preparation, etc., shall be shown. The drawings shall differentiate between shop
35 and field welds. The weld procedures, filler material to be used, and NDE
36 requirements shall be indicated.

37
38 Detailed weld repair procedures

- 39
40 1. Detailed weld repair procedures.
- 41
42
43

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1 **QUALITY CONTROL:**

2
3 Only firms regularly engaged in the type of work

4
5 **Codes and Standards Regulatory Requirements (Codes and Standards): Comply with**
6 **provisions of the following codes and standards, unless otherwise specified herein:**

7
8 AWS D9.1

9
10 **WELD PROCEDURE QUALIFICATION:**

11
12 **Off-Site Procedures: The Subcontractor shall establish and qualify Weld Procedure**
13 **Specifications (WPS) for any off-site welding performed during this Subcontract in**
14 **accordance with the requirements of AWS D9.1. Approval will not relieve the Subcontractor**
15 **of the sole responsibility for preparing procedures in accordance with the above referenced**
16 **specification**

17
18 The Subcontractor may use welding procedures from the INEEL Welding Manual
19 listed in PART 3 Execution - Welding Processes paragraph for off-site welding if a
20 letter is submitted as vendor data stating that these procedures are being adopted for
21 use in performance of this subcontract.

22
23 **On-Site Procedures: Any welding which is performed on the INEEL site shall be**
24 **performed in accordance with the qualified Welding Procedure Specifications as**
25 **provided by the Welding Manual and Part 3 EXECUTION of this section.**

26
27 **WELDER QUALIFICATION:**

28
29 **Off-Site: All welding which is performed off of the INEEL site shall be performed by**
30 **welders or operators qualified in accordance with an approved Welding Program and AWS**
31 **D9.1 or AWS B2.1. Welders or welding operators qualified to INEEL Welding Manual**
32 **procedures can be used for off-site welding if the applicable INEEL weld procedures are**
33 **identified and submitted as vendor data. When using INEEL Welding Manual procedures**
34 **for off-site welding, welders shall be qualified at the INEEL Welder Test Facility.**

35
36 **On-Site: All on-site welding performed under this specification shall be performed by**
37 **welders or welding operators qualified at the INEEL Welder Test Facility using the**
38 **applicable procedures specified from the INEEL Welding Manual.**

39
40 **Certification: Upon successful completion of the qualification test, the welder shall be**
41 **provided with a certificate card by the Subcontractor (off-site) or in compliance with the**
42 **INEEL Welding Manual (on-site). The certificate shall state the welding process, codes, and**
43 **procedures under which the welder is qualified, and individual who issued the certificate. The**

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1 welder shall carry the certificate card when performing welding under this contract. The
2 Subcontractor shall have on-file documentation, affidavits, and records of testing and test
3 results that qualified the welder for certification. These records shall be certified by the
4 Subcontractor and shall be made accessible to the Contractor.

5
6 Welder's Identification: The Subcontractor shall assign each welder with an identifying
7 number, letter, or symbol. This symbol shall be used by the welder to identify all welds made
8 by him.

9
10 Renewal of Qualification: Renewal of qualifications for a welder or welding operator
11 working on-site shall be in accordance with the INEEL Welding Manual. Renewal of
12 qualifications of a welder or welding operator working off-site shall be as required in AWS
13 D9.1.

14
15 Nondestructive Examination Procedures: The Subcontractor shall establish detailed
16 inspection procedures and acceptance criteria for each nondestructive examination required in
17 accordance with the requirements specified in Part 3 Execution, and additionally as required
18 to ensure conformance of the work to the contractual requirements.

19
20 Subcontractor's Nondestructive Examination Personnel Qualifications: The Subcontractor's
21 nondestructive examination (including visual examination) personnel shall be qualified for
22 the applicable visual inspections or nondestructive testing method in accordance with the
23 requirements of ASNT SNT-TC-1A for Levels I, II, or III as applicable. Qualification as an
24 AWS Certified Weld Inspector is an acceptable alternative for visual examination. The
25 Subcontractor shall have on-file documentation, affidavits, and records of testing and test
26 results that qualified the nondestructive examination personnel. These records of education,
27 training, and experience to validate qualification shall be submitted as vendor data.

28
29 DELIVERY, STORAGE, AND HANDLING:

30
31 Except as otherwise specified, filler materials and backing materials shall be stored, handled
32 and controlled in accordance with an approved Filler Metal and Backing Material Handling,
33 Storage and Control Procedure. As a minimum the procedure shall include the
34 Manufacturer's Recommendations and the requirements of Volume 2 of the INEEL Welding
35 Manual.

36
37 SAFETY:

38
39 As a minimum, safety precautions during welding shall conform to ANSI Z49.1 as well as
40 any additional requirements specified in the subcontract documents.

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1 PART 2 - PRODUCTS

2
3 GENERAL:

4
5 Welding equipment, electrodes, filler material, and fluxes shall be capable of producing
6 satisfactory welds when used by a qualified welder or welding operator utilizing qualified
7 welding procedures.

8
9 MATERIALS:

10
11 Filler Material: All filler material used in fabrication shall comply with the applicable
12 requirements of AWS D9.1 and have an typical certified material test report (CMTR) issued
13 by the original manufacturer or independent testing laboratory performing material testing for
14 each lot/heat number submitted to the Contractor for approval before use. Filler material for
15 all stainless steel welding shall be ER308L, FOR 3d4 l base metals, and ER304 base metals.

16
17 Straight lengths of bare filler metal shall be marked on each end with heat number and AWS
18 material classification. Spools of filler metal shall be marked on the side of the spool with the
19 heat number and AWS material classification.

20
21 Gases: Shielding and purge gas(es) shall be in accordance with the applicable weld
22 procedure.

23
24 Liquid Penetrant: All liquid penetrant materials shall meet the requirements of ASME
25 Section V, Article 24, SE-165, Method B, Procedure B-3, Visible Solvent-Removable
26 Penetrants. In addition, penetrant materials shall meet the requirements of Section V, Article
27 6, of ASME Code, for sulfur and halogen content regardless of the type of material to be
28 examined.

29
30 PART 3 - EXECUTION

31
32 WELDING OPERATIONS:

33
34 Both off-site and on-site welding shall be accomplished in accordance with AWS D9.1 and
35 the qualified and approved welding procedures using qualified welders and/or welding
36 operators. The use of such procedures will not relieve the Subcontractor of his responsibility
37 for producing weldments conforming to the specified workmanship requirements. Welding
38 shall not be done when the quality of the completed weld could be impaired by the prevailing
39 working or weather conditions. .

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1 WELDING PROCESSES:

2
3 Off-Site: Acceptable welding processes are:

- 4
5 1. Shielded Metal Arc Welding (SMAW)
6 2. Gas Tungsten Arc Welding (GTAW)
7 3. Gas Metal Arc Welding Short Arc (GMAW-S)
8

9 Other welding processes may be used subject to specific approval. The Subcontractor shall
10 submit pertinent data and proposed application of said other welding processes for evaluation
11 by the Contractor prior to performing weld procedure qualification.
12

13 On-Site and Off-site Using INEEL Welding Manual: INEEL Welding Procedures S-2.11, S-
14 3.19, S-6.2, S-6.15, or S-6.19 as applicable.
15

16 Tools and Equipment: Tools and equipment used in the fabrication of stainless steel and
17 nickel-based alloys shall be free from corrosion and shall be maintained free of grease,
18 carbon steel particles or any other foreign matter detrimental to fabrication. Mechanical
19 cleaning tools used for stainless steel shall not cause carbon steel to be embedded into the
20 surface. Wire brush material shall be of a material compatible with the parent material.
21 Grinding wheels shall be resin bonded. Metal removal tools, wire brushes, and grinding
22 wheels shall not have been previously used for other than the parent material. The
23 Subcontractor shall establish and maintain identification and control procedures for
24 equipment and tools including wire brushes and grinding wheels.
25

26 Preparation of Base Metal: Surfaces within 2 in. of any weld location shall be free of any oil,
27 grease, paint, or other material that would prevent proper welding or produce objectionable
28 fumes while welding. If the joints of carbon steel are prepared by arc cutting, the surface
29 shall be ground to bright metal by mechanical means before welding. Plasma arc or laser
30 beam cutting of austenitic stainless steel is permitted provided the cut surface is machined or
31 ground a minimum of 1/16 in. to bright metal.
32

33 Cleaning Stainless Steel: The weld joint and surrounding metal for at least 2 in. back from
34 the joint preparation shall be cleaned before welding. Cleaning shall be accomplished by
35 brushing with a clean stainless steel brush and by scrubbing with a clean lint free cloth
36 moistened with an approved low (less than 35 ppm) chloride or chloride-free solvent. When
37 the weld has cooled, remove all visible weld spatter, flux and scale, however, the base
38 material thickness shall not be compromised. Stainless steels shall not be descaled with
39 nitric-hydrofluoric acid solutions. Final cleaning shall be performed after inspection and
40 when destructive testing is complete.]
41

42 Welding Requirements: Completed welds shall provide a surface that is free from cracks,
43 seams, laps, lamination, and porosity in excess of the specified acceptance requirements. Arc

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1 strikes outside the area of permanent welds shall be avoided on base metal. Arc strikes shall
2 be removed by grinding as described in cleaning paragraph.

3
4 Fillet Welds: Fillet welds shall be made to the size and length as indicated on the drawing or
5 specification. Where length of welds is not specified, the weld shall be continuous for full
6 length of joint. Where spacing of intermittent or staggered weld is shown, the spacing shall
7 be considered maximum only.

8
9 Groove Welds: Groove welds shall be 100% complete penetration welds unless otherwise
10 specified. Groove welds shall be made to the requirements of the drawings and
11 specifications.

12
13 Temporary Welds: Temporary welds shall be subject to the same welding procedure
14 requirements as the final welds. Temporary welds shall be removed unless otherwise
15 permitted by the Contractor. Surface of removed temporary welds shall be made flush with
16 the original surface.

17
18 Backing Strips and Weld Runoff Plates: -The use of backing strips and weld runoff plates is
19 permitted on weldments. The backing strips and weld runoff plates shall be removed after
20 welding, unless otherwise indicated. Surface of removed temporary welds shall be made
21 flush with the original surface.

22
23 Identification of Welds: The welder shall permanently affix his assigned identification mark
24 and applicable weld identification number adjacent to the weld using a vibro-etch tool. The
25 welder shall also record this information on the weld map.

26
27 WELD REPAIRS:

28
29 Defects shall be completely removed by grinding or other approved means to clean, sound
30 metal. Excavated areas shall be PT inspected by the Contractor's Representative to assure
31 defect removal.

32
33 Repairs to correct weld defects shall be made using the same procedure used for the original
34 weld or other previously authorized weld repair procedures.

35
36 Repaired areas shall be re-examined using the same inspection procedures by which the
37 defect was originally detected and the inspection, which was originally specified for the
38 weld.

39
40 No more than two repair attempts will be allowed on any one weld.

41
42 Cutting out, rebeveling and then rewelding is a weld repair.

43

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1 No further attempts to repair shall be carried out without the written authorization of the
2 Contractor.

3
4 Weld repairs subsequent to the first two repair attempts shall be made only after receiving
5 written approval of Subcontractor's repair procedures.

6
7 FIELD QUALITY CONTROL:

8
9 Inspections, examinations, and tests for welds and weldments, shall be performed by
10 qualified inspection, examination, and testing personnel in accordance with the approved
11 procedures. All welds are subject to inspection by the Contractor's Representative who
12 reserves the right to accept, reject or demand removal of welds which are in violation of this
13 specification or the applicable welding procedure specification. The Subcontractor shall
14 provide access for this activity.

15
16 INSPECTIONS:

17
18 Visual Weld Inspection: All welds shall receive a visual (VT) examination. VT inspection
19 shall be performed, evaluated and documented by the Contractor's Representative for on-site
20 and off-site welds. Visual examination procedures shall be in accordance with AWS D9.1.
21 The evaluation of indications and the acceptance criteria shall be in accordance with AWS
22 D9.1.

23
24 Liquid Penetrant Examination: Liquid penetrant (PT) examination shall be performed in
25 accordance with ASME Section V, Article 6 using solvent removable penetrant.
26 All welds shall receive PT of the final pass.

27
28 Liquid penetrant inspection shall be performed, evaluated and documented by the
29 Contractor's Representative for on-site and off-site welds.

30
31 Evaluation of liquid penetrant indications and acceptance criteria shall be in accordance with
32 ASME Section V.

33
34 Contractor Inspection: Surveillance will be performed by the Contractor's Representative to
35 verify compliance of the work to the drawings and specifications. This will include shop and
36 field inspections.

37
38 END OF SECTION 15014

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1 SECTION 15016 - CARBON STEEL DUCTWORK WELDING

2
3 PART 1 - GENERAL

4
5 SUMMARY:

6
7 Section Includes, but is not limited to:

8
9 Ventilation ductwork including structural duct supports.

10
11 REFERENCES:

12
13 The following documents, including others referenced therein, form part of this Section to the
14 extent designated herein. Unless otherwise indicated use the latest edition in effect as of the
15 date of these specifications.

16
17 AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

18
19 ANSI Z49.1 Safety in Welding and Cutting

20
21 AMERICAN SOCIETY FOR NONDESTRUCTIVE TESTING (ASNT)

22
23 ASNT SNT-TC-1A Personnel Qualifications and Certification in
24 Nondestructive Testing

25
26 AMERICAN WELDING SOCIETY (AWS)

27
28 AWS A2.4 Symbols for Welding and Nondestructive Testing
29 AWS A3.0 Welding Terms and Definitions
30 AWS B2.1 Specification for Welding Procedure and Performance
31 Qualification
32 AWS D9.1 Sheet Metal Welding Code
33 AWS QC1 AWS Standard for Qualification and Certification of
34 Welding Inspectors

35
36 IDAHO NATIONAL ENGINEERING and ENVIRONMENTAL LABORATORY (INEEL)

37
38 INEEL Welding Manual.

39
40 DEFINITIONS AND SYMBOLS:

41
42 Definitions for welding terms shall be in accordance with AWS A3.0 and weld symbols shall
43 be in accordance with AWS A2.4, unless otherwise indicated.

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1 SUBMITTALS:

2
3 Submittals include, but are not limited to:

- 4
5 1. Welding procedure specifications (WPS) and procedure qualification records (PQR)
6 performed in accordance with AWS D9.1 for off-site welding including a list of
7 procedures selected for use from the INEEL Welding Manual. These procedures shall
8 be referenced on the shop drawings, erection drawings, and contract drawings as
9 applicable.
10 2. Welding personnel performance qualification records.

11
12 QUALITY CONTROL:

13
14 Codes and Standards Regulatory Requirements (Codes and Standards): Comply with
15 provisions of the following codes and standards, unless otherwise specified herein:

16
17 AWS D9.1

18
19 WELD PROCEDURE QUALIFICATION:

20
21 Off-Site Procedures: The Subcontractor shall establish and qualify Weld Procedure
22 Specifications (WPS) for any off-site welding performed during this Subcontract in
23 accordance with the requirements of AWS D9.1. Approval will not relieve the Subcontractor
24 of the sole responsibility for preparing procedures in accordance with the above referenced
25 specification

26
27 The Subcontractor may use welding procedures from the INEEL Welding Manual
28 listed in PART 3 Execution - Welding Processes paragraph for off-site welding if a
29 letter is submitted as vendor data stating that these procedures are being adopted for
30 use in performance of this subcontract.

31
32 On-Site Procedures: Any welding which is performed on the INEEL site shall be
33 performed in accordance with the qualified Welding Procedure Specifications as
34 provided by the Welding Manual and Part 3 EXECUTION of this section.

35
36 WELDER QUALIFICATION:

37
38 Off-Site: All welding which is performed off of the INEEL site shall be performed by
39 welders or operators qualified in accordance with an approved Welding Program and AWS
40 D9.1 or AWS B2.1. Welders or welding operators qualified to INEEL Welding Manual
41 procedures can be used for off-site welding if the applicable INEEL weld procedures are
42 identified and submitted as vendor data. When using INEEL Welding Manual procedures
43 for off-site welding, welders shall be qualified at the INEEL Welder Test Facility.

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1 **On-Site:** All on-site welding performed under this specification shall be performed by
2 welders or welding operators qualified at the INEEL Welder Test Facility using the
3 applicable procedures specified from the INEEL Welding Manual.
4

5 **Certification:** Upon successful completion of the qualification test, the welder shall be
6 provided with a certificate card by the Subcontractor (off-site) or in compliance with the
7 INEEL Welding Manual (on-site). The certificate shall state the welding process, codes, and
8 procedures under which the welder is qualified, and individual who issued the certificate. The
9 welder shall carry the certificate card when performing welding under this contract. The
10 Subcontractor shall have on-file documentation, affidavits, and records of testing and test
11 results that qualified the welder for certification. These records shall be certified by the
12 Subcontractor and shall be made accessible to the Contractor.
13

14 **Welder's Identification:** The Subcontractor shall assign each welder with an identifying
15 number, letter, or symbol.
16

17 **Renewal of Qualification:** Renewal of qualifications for a welder or welding operator
18 working on-site shall be in accordance with the INEEL Welding Manual. Renewal of
19 qualifications of a welder or welding operator working off-site shall be as required in AWS
20 D9.1.
21

22 **DELIVERY, STORAGE, AND HANDLING:**

23
24 Except as otherwise specified, filler materials and backing materials shall be stored, handled
25 and controlled in accordance with an approved Filler Metal and Backing Material Handling,
26 Storage and Control Procedure. As a minimum the procedure shall include the
27 Manufacturer's Recommendations and the requirements of Volume 2 of the INEEL Welding
28 Manual.
29

30 **SAFETY:**

31
32 As a minimum, safety precautions during welding shall conform to ANSI Z49.1 as well as
33 any additional requirements specified in the subcontract documents.
34

35 **PART 2 - PRODUCTS**

36 37 **GENERAL:**

38
39 Welding equipment, electrodes, filler material, and fluxes shall be capable of producing
40 satisfactory welds when used by a qualified welder or welding operator utilizing qualified
41 welding procedures.
42
43

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1 MATERIALS:

2
3 Filler Material: All filler material used in fabrication shall comply with the applicable
4 requirements of AWS D9.1 and have a typical certified material test report (CMTR) issued
5 by the original manufacturer or independent testing laboratory performing material testing for
6 each lot/heat number submitted to the Contractor before use.

7
8 Straight lengths of bare filler metal shall be marked on each end with AWS material
9 classification. Spools of filler metal shall be marked on the side of the spool with the heat
10 number and AWS material classification.

11
12 Filler material for carbon steel welding shall be ER70S.

13
14 Gases: Shielding and purge gas(es) shall be in accordance with the applicable weld
15 procedure.

16
17 PART 3 - EXECUTION

18
19 WELDING OPERATIONS:

20
21 Both off-site and on-site welding shall be accomplished in accordance with AWS D9.1 and
22 the qualified and approved welding procedures using qualified welders and/or welding
23 operators. The use of such procedures will not relieve the Subcontractor of his responsibility
24 for producing weldments conforming to the specified workmanship requirements. Welding
25 shall not be done when the quality of the completed weld could be impaired by the prevailing
26 working or weather conditions. .

27
28 WELDING PROCESSES:

29
30 Off-Site: Acceptable welding processes are

- 31
32 1. Shielded Metal Arc Welding (SMAW)
33 2. Gas Tungsten Arc Welding (GTAW)

34
35 Other welding processes may be used subject to specific approval. The Subcontractor shall
36 submit pertinent data and proposed application of said other welding processes for evaluation
37 by the Contractor prior to performing weld procedure qualification.

38
39 On-Site and Off-site Using INEEL Welding Manual: INEEL Welding Procedures C2.2,
40 C3.12, C6.18, or C6.20 as applicable.

41
42 Preparation of Base Metal: Surfaces within 2 in. of any weld location shall be free of any oil,
43 grease, paint, or other material that would prevent proper welding or produce objectionable

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1 fumes while welding. If the joints of carbon steel are prepared by arc cutting, the surface
2 shall be ground to bright metal by mechanical means before welding. Plasma arc or laser
3 beam cutting of austenitic stainless steel is permitted provided the cut surface is machined or
4 ground a minimum of 1/16 in. to bright metal.

5
6 Welding Requirements: Completed welds shall provide a surface that is free from cracks,
7 seams, laps, lamination, and porosity in excess of the specified acceptance requirements. Arc
8 strikes outside the area of permanent welds shall be avoided on base metal. Arc strikes shall
9 be removed by grinding as described in cleaning paragraph.

10
11 Fillet Welds: Fillet welds shall be made to the size and length as indicated on the drawing or
12 specification. Where length of welds is not specified, the weld shall be continuous for full
13 length of joint. Where spacing of intermittent or staggered weld is shown, the spacing shall
14 be considered maximum only.

15
16 Groove Welds: Groove welds shall be 100% complete penetration welds unless otherwise
17 specified. Groove welds shall be made to the requirements of the drawings and
18 specifications.

19
20 Temporary Welds: Temporary welds shall be subject to the same welding procedure
21 requirements as the final welds. Temporary welds shall be removed unless otherwise
22 permitted by the Contractor. Surface of removed temporary welds shall be made flush with
23 the original surface.

24
25 Backing Strips and Weld Runoff Plates: -The use of backing strips and weld runoff plates is
26 permitted on weldments. The backing strips and weld runoff plates shall be removed after
27 welding, unless otherwise indicated. Surface of removed temporary welds shall be made
28 flush with the original surface.

29
30 WELD REPAIRS:

31
32 Defects shall be completely removed by grinding or other approved means to clean sound
33 metal. Excavated areas shall be PT inspected by the Contractor's Representative to assure
34 defect removal.

35
36 Repairs to correct weld defects shall be made using the same procedure used for the original
37 weld or other previously authorized weld repair procedures.

38
39 Repaired areas shall be re-examined using the same inspection procedures by which the
40 defect was originally detected and the inspection, which was originally specified for the
41 weld.

42
43 No more than two repair attempts will be allowed on any one weld.

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1 Cutting out, rebeveling and then rewelding is a weld repair.

2
3 No further attempts to repair shall be carried out without the written authorization of the
4 Contractor.

5
6 Weld repairs subsequent to the first two repair attempts shall be made only after receiving
7 written approval of Subcontractor's repair procedures.

8
9 FIELD QUALITY CONTROL:

10
11 All welds are subject to inspection by the Contractor's Representative who reserves the right
12 to accept, reject or demand removal of welds which are in violation of this specification or
13 the applicable welding procedure specification. The Subcontractor shall provide access for
14 this activity.

15
16 INSPECTIONS:

17
18 Visual Weld Inspection: All welds shall receive a visual (VT) examination. VT inspection
19 shall be performed, evaluated and documented by the Contractor's Representative for on-site
20 and off-site welds. Visual examination procedures shall be in accordance with AWS D9.1.
21 The evaluation of indications and the acceptance criteria shall be in accordance with AWS
22 D9.1.

23
24 Contractor Inspection: Surveillance will be performed by the Contractor's Representative to
25 verify compliance of the work to the drawings and specifications.

26
27 END OF SECTION 15016

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1 SECTION 15202 – COMPRESSED AIR PIPING

2
3 PART 1 - GENERAL

4
5 SUMMARY:

6
7 Section Includes, but is not limited to:

- 8
9 1. Furnish (except Government Furnished Equipment - GFE) and install all valves,
10 tubing, pipe, traps, fittings, couplings, hangers, supports, insulation, and
11 appurtenances as required to complete the work as shown on the Subcontract
12 drawings for the following systems:

13
14 PLANT AIR SYSTEM
15 BREATHING AIR SYSTEM

- 16
17 2. Design, fabricate, install, inspect, and test in accordance with the Subcontract
18 specifications and drawings and ASME B31.3 Category D requirements. Comply
19 with ASME B31.3 Chapters I through VII. Special provisions within ASME B31.3
20 for Category D Fluid Service shall be utilized.

21
22 RELATED SECTIONS:

23
24 All welding and weld inspection shall be as specified in Section 15024.

25
26 Upon completion of the piping systems, the Subcontractor shall test as specified in Section
27 15600 to verify that the systems are properly installed.

28
29 REFERENCES:

30
31 The following document including others referenced therein, form part of this Section to the
32 extent designated herein.

33
34 AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

35
36 ASME B31.3 Process Piping
37 ASME Section VIII, Division I Boiler and Pressure Vessel Code

38
39 AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

40
41 ASTM A53 Standard Specification for Pipe, Steel, Black and
42 Hot-Dipped, Zinc-Coated, Welded and Seamless

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1 ASTM A106 Standard Specification for Seamless Carbon Steel
2 Pipe for High-Temperature Service E(1999)
3 ASTM A197 Standard Specification for Cupola Malleable Iron
4 ASTM B280 Standard Specification for Seamless Copper Tube
5 for Air Conditioning and Refrigeration Field
6 Service E
7 ASTM B88 Standard Specification for Seamless Copper Water
8 Tube E
9

10 **MATERIAL DELIVERY, STORAGE, AND HANDLING:**

11
12 The Subcontractor shall ensure that all materials are delivered in a new, undamaged, and
13 protected condition. The finished materials shall be packaged for shipment, pipe ends and
14 tube ends shall be capped with plastic caps to protect the material from dirt and
15 contamination during shipment and subsequent storage.
16

17 All materials shall be inspected by the Subcontractor prior to acceptance. If damage is found
18 or any material identification and/or documentation is missing, the Subcontractor shall
19 promptly report the deficiency to the delivering carrier, the manufacturer, and/or the
20 Contractor's representative as appropriate.
21

22 Materials shall be resealed and repacked after inspection. The Subcontractor shall ensure that
23 materials are stored in a manner to provide protection against damage, atmospheric corrosion
24 and contamination.
25

26 **SUBMITTALS:**

27
28 Submittals include, but are not limited to:

29
30 Manufacturer's Data Reports for each of the breathing air storage tank and the plant air tank.
31

32 Refer to Section 01300, Submittals and the Vendor Data Schedule for additional submittal
33 requirements.
34

35 **QUALITY CONTROL:**

36
37 Design, fabrication, installation, inspection, and testing shall be in accordance with the
38 Subcontract specifications and drawings and ASME B31.3 Category M requirements.
39 Comply with ASME B31.3 Chapters I through VII. Special provisions within ASME B31.3
40 for Category D Fluid Service shall be utilized.
41

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1 Qualifications: Piping and components shall be furnished and installed by a firm regularly
2 engaged in this type of work, and shall maintain shop and facilities for fabrication and
3 maintenance of subject equipment.

4
5 Items of Any One Classification: Items that are used in quantity, such as valves, specialties,
6 accessories, fittings, etc., shall in each case be the product of one manufacturer, and shall be
7 used only for the services recommended by the manufacturer.

8
9 Materials, Products and Equipment: Materials, products and equipment shall be furnished
10 and installed in strict accordance with the Subcontract drawings and these specifications.

11
12 PART 2 - PRODUCTS

13
14 MATERIALS:

15
16 General: All materials, products and equipment shall be as manufactured by the manufacturer
17 specified in this section, or an approved equal. All materials furnished shall be permanently
18 marked or tagged to show ASTM Designation and type of material. Materials shall not be
19 steel stamped for identification.

20
21 Where instruments, valves, equipment or controls are specified, the descriptive narrative shall
22 govern over the catalog part number or model number.

23
24 Unless otherwise specified, all pipes shall be sized according to the drawings. All valves,
25 unless otherwise specified, shall be sized for the line into which they will be installed.

26
27 PLANT AIR SYSTEM

28
29 C-Stl Pipe:

30
31 2" and Smaller Black Carbon Steel, Sch 40, per ASTM A53, Type S-Grade B, or
32 ASTM A106 Grade B.

33
34 C-Stl Fittings:

35
36 2" & Smaller 300# Class, Malleable Iron, SCR D per ASTM A197.

37
38 Copper Tubing:

39
40 1 1/4". Seamless Tubing Hard Drawn per ASTM B280.

41
42 1/8" - 1" Copper, .035" Wall, Hard-drawn or soft-drawn Type K, Straight
43 Length or Coil per ASTM B88.

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1 **Copper Fittings:**

2
3 1 1/4" Wrought Copper Solder Type Pressure Fittings per ASTM B280.

4 1/8" - 1" Brass, Swagelok^R Compression Type fittings.

5 **Soldering Material:** Silver Brazing Wire

6
7 **Ball Valves:** Subcontractor shall provide and install ball valves for on/off service. Where
8 indicated on subcontract drawings, ball valves shall come with lockable handle to
9 accommodate a padlock to prevent accidental handle movement as well as meet the
10 following parameters:

11
12 Design Pressure: 150 psig (400 WOG min)

13 Body Material: Bronze, lead free/Brass

14 Connection Ends: NPT

15 Options: Lockable handle to accommodate a padlock where
16 indicated

17
18 **Check Valves:** Subcontractor shall provide and install check valves to prevent backflow of
19 plant air. Check valve shall meet the following parameters:

20
21 Type: Spring loaded

22 Body Material: Brass

23 End Connections: NPT

24 Seat: TFE

25 Cracking Pressure: Standard

26
27 Check valve shall be Style UN-3 with standard springs as manufactured by Check-All Valve
28 Mfg. or approved equal.

29
30 **Rotary Screw Compressors:** The rotary screw air compressor is Government Furnished
31 Equipment (GFE) and is listed in Appendix A, schedule X. Subcontractor shall install one
32 new GFE oil lubricated, air cooled, skid mounted screw compressor to supply 100 psig
33 compressed air service as indicated on the subcontract drawings. The unit will be located
34 outdoors:

35
36 Model: Sullair LS-10 30, 30 HP, 100 psig, 480 VAC,

37 Altitude: 5,000 ft.

38 Ambient Location: outside, no weather cover, packed gravel base

39 Inlet Air Temp: ambient of -20 to 100 F

40 Relative Humidity: 40%

41 Discharge Pressure: 115 psig

42 Barometric Pressure: 12.2 psia

43 Compressor Capacity: 120 ACFM

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1 Compressor Motor Voltage: 480 VAC, 3 Phase, 60 Hz
2 Control Voltage: Internally, supplied by Compressor Manufacturer
3 Motor size: 30 HP, TEFC motor
4 Enclosure: Standard
5 Motor Oil: Sullube (8,000 hour synthetic oil)
6 Modulation: Automatic
7 INEEL Property Number: 321842
8

9 Air Receiver: Subcontractor shall provide and install one ASME Section VIII, Division I air
10 receiver tank with ASME pressure relief valve for storage of compressed air. The tank shall
11 be ASME stamped, registered with the National Board, and bear the National Board number.
12

13 Tank shall meet the following criteria and features:
14

15 Orientation: Vertical
16 Size: 200 gallon
17 Design Pressure: 200 psig
18 Operating Pressure: 110 to 125 psig
19 Design Temperature: -20 to 100 F
20 Design Standard: ASME Section VIII, Division I; tank shall be National
21 board Registered, Manufacturer's Data Report shall
22 accompany the tank.
23 Minimum Ports: 1 1/2" inlet, 1 1/2" outlet, drain connection, inspection
24 ports and pressure relief port
25 Base: A base shall provide attachment points for being
26 secured down.
27

28 Pressure Relief Valve: Subcontractor shall supply and install a pressure relief valve on the air
29 receiver tank to relieve overpressure from the new screw compressor. Valve shall be ASME
30 stamped and rated and meet the following criteria and features:
31

32 Minimum discharge volume: 176 SCFM
33 Design temperature: -20 to 100 F
34 Design pressure: 200 psig
35 Set relief pressure: 150 psig
36 Design Standard: ASME, stamped and rated
37 End Connection: 3/4" NPT
38

39 Pressure relief valve shall be Figure 6010-D-2 as manufactured by Kunkle, or approved
40 equal.
41

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1 Float Operated Liquid Drain Trap: Subcontractor shall provide and install a liquid drain trap
2 to remove the collected moisture from the air storage tank. Trap shall allow for continuous
3 discharge of collected water. Trap shall meet the following parameters:

4
5 Type: Float operated
6 End Connections: 1/2" NPT
7 Body Material: Cast Iron with SST internals
8 Design Pressure: 150 psig min
9

10 Liquid trap shall be model FAI-200 as manufactured by Spirax-Sarco, model T-1 as
11 manufactured by Zeks, or approved equal.
12

13 Compressed Air Filter: Subcontractor shall provide and install a particulate and coalescing
14 filter as shown on the contract drawings and specified herein. The filter shall meet the
15 following parameters:

16
17 Type: Particulate and coalescing filter
18 Air Pipe Size: 1" FNPT
19 Drain Pipe Size: 1/2" FNPT
20 Airflow Capacity: 140 SCFM minimum
21 Pressure Rating: 150 psi
22

23 The compressed air filter shall be a Zeks Accrasieve Accrafilter model 230RT or approved
24 equal. The filter housing shall be equipped with a differential pressure gauge showing filter
25 condition and an automatic mechanical drain trap.
26

27 Oil/Water Separator: Subcontractor shall provide and install an oil/water separator where
28 indicated on subcontract drawings. The oil/water separator shall be a Zeks model 20WOS or
29 approved equal with a minimum capacity of 20 gallons.
30

31 5 Gallon Carboy: Subcontractor shall provide and install one 5 gallon carboy polypropylene
32 portable jug. The jug will be used to collect waste water drained from the oil/water separator.
33 The 5 gallon carboy shall be a McMaster-Carr #9884T14 or approved equal.
34

35 2 Gallon Carboy: Subcontractor shall provide and install one 2 gallon carboy polypropylene
36 portable jug. The jug will be used to collect waste oil drained from the oil/water separator.
37 The 2 gallon carboy shall be a McMaster-Carr #9884T13 or approved equal
38

39 Pressure Gauges: Subcontractor shall provide and install pressure gauges where indicated on
40 subcontract drawings. Pressure gauge shall have a range of 0-150 psig and accuracy of ANSI
41 Grade A 1% or less.
42

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1 Piping Heat Trace: Subcontractor shall provide and install electric heat trace to prevent
2 freezeup of condensate in plant air line. Heat trace shall meet the following parameters:

3
4 Voltage: 120 VAC
5 Design Temperature: -40 to 40 F (80 F differential)
6 Pipe Size: 1 1/4" Plant air line, copper piping
7 Insulation: 1: Fiberglass
8 Service: Ordinary, outside
9

10 Outdoor Piping Insulation: Subcontractor shall provide and install piping insulation with
11 metal jacketing to prevent freezeup of condensate in plant air line. Insulation shall be in
12 accordance with ASTM C553 and meet the following parameters:

13
14 Type: Mineral Fiber with vapor retarder
15 Thickness: 1 inch
16 Service: Outside
17

18 BREATHING AIR SYSTEM:

19
20 C-Stl Pipe:
21 2" and Smaller Black Carbon Steel, Sch 40, per ASTM A53, Type S-Grade B, or
22 ASTM A106 Grade B.
23

24 C-Stl Fittings:
25
26 2" & Smaller 300# Class, Malleable Iron, SCRD per ASTM A197.
27

28 Copper Tubing:
29
30 1 1/4". Seamless Tubing Hard Drawn per ASTM B280.
31
32 1/8" - 1" Copper, .035" Wall, Hard-drawn or soft-drawn Type K, Straight
33 Length or Coil per ASTM B88.

34 Copper Fittings:
35
36 1 1/4" Wrought Copper Solder Type Pressure Fittings per ASTM B280.
37
38 1/8" - 1" Brass, Swagelok^R Compression Type fittings.
39

40 Soldering Material: Silver Brazing Wire
41

42 Air Receiver: Subcontractor shall provide and install one ASME Section VIII, Division I air
43 storage tank with ASME pressure relief valve for storage of compressed air. The tank shall be

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1 ASME stamped, registered with the National Board, and bear the National Board number.
2 Tank shall meet the following criteria and features:

3
4 Orientation: Horizontal
5 Size: 400 gallon
6 Design Pressure: 200 psig
7 Operating Pressure: 110 to 125 psig
8 Design Temperature: -20 to 100 F
9 Design Standard: ASME Section VIII, Division I; tank shall be National
10 Board Registered, Manufacturer's Data Report shall
11 accompany the tank.
12 Minimum Ports: 1 ½" inlet, 1 ½" outlet, drain connection, inspection
13 ports and pressure relief port
14 Base: A base shall provide attachment points for being
15 secured down.
16

17 Receiver tank shall be as supplied by Compair (Rep is Compressor Pump & Service, Inc,
18 801-973-0154) or approved equal.

19
20 Pressure Relief Valve: Subcontractor shall supply and install a pressure relief valve on the
21 air receiver tank to relieve overpressure from the breathing air compressor. Valve shall be
22 ASME stamped and rated and meet the following criteria and features:

23
24 Minimum discharge volume: 100 SCFM
25 Design temperature: -20 to 100 F
26 Design pressure: 200 psig
27 Set relief pressure: 150 psig
28 Design Standard: ASME, stamped and rated
29 End Connection: 3/4" NPT
30

31 Pressure relief valve shall be Figure 6010-D-2 as manufactured by Kunkle (distributor is
32 Paramount, 523-2692)

33
34 Hose Coupling: Subcontractor shall provide and install a hose coupling to allow for tie-in
35 from the breathing air compressor trailer. Hose coupling shall meet the following parameters:

36
37 Size: 1"
38 Material: Malleable iron
39 End Connections: FNPT/Cam-Lok
40

41 Ball Valves: Subcontractor shall provide and install ball valves for on/off service. Where
42 indicated on subcontract drawings, ball valves shall come with lockable handle to
43 accommodate a padlock to prevent accidental handle movement as well as meet the

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1 following parameters:

2

3 Design Pressure: 150 psig (400 WOG min)

4 Body Material: Bronze, lead free/Brass

5 Connection Ends: NPT

6 Options: Lockable handle to accommodate a padlock where
7 indicated

8

9 Check Valves: Subcontractor shall provide and install check valves to prevent backflow of
10 breathing air. Check valve shall meet the following parameters:

11

12 Type: Spring loaded

13 Body Material: Brass

14 End Connections: NPT

15 Seat: TFE

16 Size: 1 1/4"

17 Cracking Pressure: Standard

18

19 Check valve shall be Style UN-3 with standard springs as manufactured by Check-All Valve
20 Mfg. or approved equal.

21

22 Breathing Air Manifold: Subcontractor shall provide and install two "black box" manifolds
23 for providing a tie-in to personnel on breathing air lines. The manifolds shall provide a
24 HEPA filter, organic filter, adjustable pressure regulator, pressure gauge, and 4 outlets for
25 attachments of hoses. Manifold shall be Model 462492 as manufactured by MSA (1-800-
26 MSA-2222) or approved equal.

27

28 PART 3 - EXECUTION

29

30 GENERAL INSTALLATION OF ALL SYSTEMS:

31

32 Shall be in conformity with the applicable requirements of ASME Code B31.3.

33

34 The Subcontractor shall field verify all piping dimensions, prior to fabrication.

35

36 Accessibility: Items such as valves, controls, access doors, specialties, and accessories shall
37 be installed so as to be readily accessible for operation, servicing, maintaining and repairing.

38

39 Pipelines: Pipelines shall be installed per the drawings. The Subcontractor shall coordinate
40 the work of all trades involved on this project to prevent interferences. Piping shall not be
41 routed so as to block equipment access panels or to prevent routine maintenance activities.

42

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1 Piping shall be routed around all electrical components to maintain proper National Electrical
2 Code clearances. The Subcontractor shall notify the Contractor of potential interference
3 issues prior to routing piping. Piping or piping insulation with an exterior surface temperature
4 in excess of 30 C shall not be routed within 6 in. of electrical raceways.
5

6 Pipes shall be full lengths to greatest extent possible. Piping shall be cleaned of dirt, rust,
7 scale, grease and other foreign matter. Piping shall be kept clean as work progresses. Seal in
8 accordance with U.L. requirements wherever piping passes through fire walls.
9

10 Exposed piping shall be run close to other piping, walls and columns. Runs shall be as close
11 together as possible where under ceilings, slabs, and decks. Rack piping on trapeze hangers
12 where possible.
13

14 Indicating instruments shall be installed for easy reading from operating floors or platforms.
15 If 6 ft or more above floors or platforms, set at 45° angle.
16

17 Pipe and Tube Bends: A minimum bend radius of five (5) pipe diameters shall be used unless
18 otherwise specified. All bends shall be free from wrinkles, kinks, and thin or flat spots. "Out
19 of Roundness" shall not exceed 8% for internal pressure and 3% for external pressure
20 between the minimum and maximum cross-sectional dimensions. All bends are to be
21 completed prior to beveling, flanging or cutting to length.
22

23 PIPE JOINTS AND CONNECTIONS:

24
25 Flanged Pipe Joints: Flanged pipe joints shall be in accordance with ASME B31.3. Torque
26 values for flange bolts shall be in accordance with the gasket manufacturers written
27 recommendations for the size and service conditions and ASME Section VIII Division 1
28 App. 2.
29

30 Welded Pipe Joints: Welded joints shall be made in accordance with Welding Section 15024
31 of these specifications.
32

33 Tube Joints: Tube joints shall be in accordance with ASME B31.3 and the fitting
34 manufacturers written instructions.
35

36 PIPE IDENTIFICATION AND VALVE TAGS:

37
38 See Section, Painting 09900 for pipe identification and tagging.
39

40 Color Coding: All pipelines shall be color coded and identified using full English text names
41 according to the following list:
42
43

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1 EQUIPMENT, FIXTURES, ETC.:

2
 3 Equipment shall be set in place, aligned, connected per the applicable drawing, and made
 4 ready for operation. Connections and required safety devices shall be installed. Initial
 5 lubrication shall be provided. Controls shall be set for efficient, stable operation.

6
 7 Fixtures shall be installed and supported per the applicable drawings in a safe, rigid, neat, and
 8 orderly manner. They shall be free from undue stresses and made suitable for normal use.
 9 Wall mounted supports shall be of the type as recommended by the manufacturer of the
 10 fixture used.

11
 12 All of the above shall be protected from damage during and after installation. At completion,
 13 work shall be free from tool marks, discolorations, cracks, scratches, chips and other defects.

14
 15 HANGERS, SUPPORTS AND FASTENERS:

16
 17 Pipe hangers shall be fabricated and installed as shown on the Subcontract drawings. Where
 18 interferences occur with hanger placement, the Subcontractor shall submit an alternative
 19 position to the Contractor for approval.

20
 21 Where hangers are not shown on the Subcontract drawings, the Subcontractor shall install
 22 hangers and supports in accordance with ASME B31.3.

23
 24 Hangers shall be capable of supporting the pipe in all loading conditions. They shall allow
 25 for free expansion and contraction of the piping, and prevent stress resulting from transferred
 26 weight being induced into the pipe or connected equipment. The installation shall support the
 27 piping without sagging and shall be clear of the work of other trades.

28
 29 Supports shall include wall brackets, riser clamps, pipe stands, rollers, insulation protection
 30 saddles, pipe saddles, steel sections, and other suitable devices that may be required for the
 31 proper installation of piping.

32
 33 **Hanger Spacing and Rod Diameter Table**

34

35	Single	Maximum	Minimum
36	Pipe Size	Spacing	Rod diameter
37	(in.)	(ft)	(in.)
38			
39	¼	3	¾
40	½	5	¾
41	¾	6	¾
42	1	7	¾
43	1¼	8	¾
44			
45			
46			

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1 INSTALLATION OF INDIVIDUAL SYSTEMS:

2
3 The installation of each system shall comply with the rules contained in the "GENERAL
4 INSTALLATION OF ALL SYSTEMS" section. All welding and welding inspection shall be
5 in accordance with Welding Section 15024 of this specification.

6
7 FIELD QUALITY CONTROL:

8
9 Subcontractor Supplied Testing: Prepare and submit test procedures and reports as listed in
10 the vendor data schedule.

11
12 Furnish temporary connections to services and instruments for testing. Perform the following
13 tests and inspections in the presence of the Contractor's Representative.

14
15 Tests shall be conducted before making final connections to equipment or before applying
16 insulation.

17
18 Instruments, specialties, and equipment that may be subject to damage shall be isolated
19 during the testing.

20
21 Pneumatic Pressure Testing: Both the Plant Air Piping and Breathing Air Piping shall be
22 pneumatically tested in accordance with ASME B31.3 and these specifications.
23 Pneumatic test pressure for a piping system shall be 110% of its design pressure.

24
25 Test pressure shall be maintained for a minimum of 10 min prior to inspection.

26
27 Pneumatic tests shall be brought up to pressure in gradual steps not to exceed 20 psi using
28 oil-free air or nitrogen. Systems shall be pressurized beyond the set pressure (by 2 psi) and
29 bled back to the set pressure prior to allowing personnel in or around any pressurized system.

30
31 A double block and bleed valve arrangement shall be included in the pressurizing line
32 upstream of its connection to the system being tested. A test pressure gauge shall be
33 downstream of the double block. After each pressure step has been reached, close the block
34 valves and open the bleeder to atmosphere. If after a 5 min period the "step pressure" is held,
35 proceed to the next "step pressure"; if not, examine the system for leakage.

36
37 All instruments which could be damaged during the test shall be disconnected.

38
39 The Subcontractor shall submit a written pneumatic pressure testing procedure to be
40 approved by the Contractor prior to beginning a test. The procedure shall include a test record
41 to be completed after the test.

42
43

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1 TEST RECORDS:

2
3 Accurate test records shall be kept on each system tested. Each test shall be witnessed and
4 approved by the Contractor's Representative. The Contractor's Representative shall be
5 notified forty-eight (48) hrs prior to beginning a test.

6
7 Test Reports shall include for each Test and/or Retest:

- 8
9 1. Identification of system (including all line numbers)
10 2. Testing medium
11 3. Test pressure and pressure steps
12 4. Date and Contractor's approval
13 5. Results
14 6. Contractor's Representative approval space
15 7. Repairs and retests
16 8. Calibration dates of testing and equipment.

17
18 Contractor Inspections: Surveillance will be performed by the Contractor's Representative to
19 verify compliance of the work to the drawings and specifications.

20
21 CLEANING AND PURGING:

22
23 Precautions shall be taken to maintain cleanliness of materials and equipment during
24 delivery, storage and installation. Piping, valves, fittings, and equipment shall be visually free
25 from grease, cutting oils, loose particles, ships, or other foreign matter.

26
27 All piping systems shall be flushed or purged as follows:

- 28
29 1. Breathing Air Lines: Prior to installation of the pipe joints and fittings, the pipe joints
30 and fittings shall be rabbited out with clean, lint-free cotton cloth to remove oils,
31 grease, and dirt. The Contractor shall make two passes minimum with a snug fitting
32 cloth. Each pass shall be applied with a fresh cloth. This process shall continue until
33 the cloth shows no sign of oily residue or dirt. Where it is not possible for the
34 Contractor to clean to the above procedure, the Contractor shall submit a work
35 procedure for approval. After pipe joints and fittings are oil, grease, and dirt free, the
36 lines shall be flushed with water for 10 minutes minimum at a minimum flow rate of
37 10 ft/sec until clear before tying into the equipment. Hoses shall be purged with
38 compressed air for ten minutes until water free.
39 2. Service Air Lines: Lines shall be purged with compressed air at the system pressure to
40 remove dust and debris.

41
42 END OF SECTION 15202

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1 SECTION 15409 - DUST SUPPRESSION SYSTEM (DSS)

2
3 PART 1 - GENERAL

4
5 SUMMARY:

6
7 This section details the requirements for an engineered dust suppression system (DSS). The
8 Subcontractor is responsible for all work described in this specification. The Subcontractor
9 shall furnish and install all equipment, materials and supplies and perform all work and
10 operations necessary to complete the work as shown on the contract drawings and as
11 specified herein. Upon completion of installation, the Subcontractor shall operate and test as
12 specified hereinafter to verify that the systems are properly installed and operates as required.
13

14 Section Includes, but is not limited to:

- 15
16 1. The intent of this design package is to have the Subcontractor responsible for the dust
17 suppression system in its entirety, using the DSS supplier to furnish and install a
18 complete and ready for use DSS assembly (including design, manufacture, and
19 delivery) and install the system with the manufacture's representative on-site
20 assistance.
21 2. Design, fabrication and installation on-site of a DSS, complete with all necessary
22 accessories and components to assure a complete system as shown in drawings.
23 Subcontractor shall be responsible for coordinating all work.
24 3. The specific work to be accomplished under this specification is to design a skid
25 mounted, turnkey dust suppression system to be constructed on site or assembled off-
26 site and moved on-site, ready to place on existing floor of the weather enclosure
27 structure as shown on drawings. Set up shall include anchorage to existing floor,
28 leveling, ready for use. Subcontractor shall install all piping, valves, and nozzles as
29 supplied by the DSS supplier as shown on Subcontract drawings. Final product shall
30 provide a DSS complete with a remotely operated control system and a start/stop push
31 button control system. Dust suppression system shall include a fog system and a spray
32 system.
33

34 Section Does Not Include:

- 35
36 1. Final single-point connection to compressed air will be connected as shown in P-5
37 and power shall be by electrical Subcontractor, see electrical drawings, E-10, E-11.
38

39 RELATED SECTIONS:

40
41 Section 16110 -Electrical Raceways
42
43

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1 **REFERENCES:**

2
3 The following documents, including others referenced therein, form part of this Section to the
4 extent designated herein:

5
6 **AMERICAN SOCIETY OF MECHANICAL ENGINEERS/AMERICAN NATIONAL**
7 **STANDARDS INSTITUTE (ASME/ANSI)**

8
9 **ASME B31.3 Process Piping, Category D.**

10
11 **AMERICAN WELDING SOCIETY (AWS)**

12
13 **AWS D1.1 Structural Steel Welding**

14
15 **FEDERAL COMMUNICATIONS COMMISSION (FCC)**

16
17 **Part 15 Radio Frequency Devices**

18 **Part 18 Industrial Scientific and Medical Equipment**

19
20 **INTERNATIONAL CONFERENCE OF BUILDING OFFICIALS (ICBO)**

21
22 **IBC, 2000 Edition**

23
24 **INTERNATIONAL MECHANICAL CODE (IMC)**

25
26 **NATIONAL ELECTRICAL MANUFACTURES ASSOCIATION (NEMA)**

27
28 **NATIONAL FIRE PROTECTION ASSOCIATION**

29
30 **NFPA 70 National Electrical Code, 2002 Edition**

31
32 **UNDERWRITERS LABORATORIES (UL)**

33
34 **UNIFORM PLUMBING CODE (UPC)**

35
36 **UNITED STATES CODE OF FEDERAL REGULATIONS (CFR)**

37
38 **DEFINITIONS:**

39
40 **SYSTEM DESCRIPTION:**

41
42 **Design Requirements: The Dust suppression system shall comply with the performance**
43 **design requirements and shall be laid out and installed in accordance with the referenced**

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1 codes and standards. The Dust Suppression system shall, as a minimum, be designed and
2 manufactured to comply with the criteria listed below. Refer to reference drawings for
3 location of the Dust Suppression System and associated site utilities.

4
5 **PERFORMANCE REQUIREMENTS:**

6
7 **FOG:**

8
9 **Droplet size for Fog System:** The equipment shall be designed on the principle of wetting
10 airborne dust with atomized water (no chemicals or wetting agents) with a minimum of 85%
11 of the droplets below 10 microns in diameter. Operating pressures to achieve these droplet
12 specifications shall not exceed the following: For water, 15 psi, for air 70 psi.

13
14 Documentation of test results confirming these performance standards must be submitted.

15
16 **Glovebox And Overburden Dump Area Coverage:** Fog shall suppress dust from falling debris
17 from the bucket and upward momentum of dust due to displacement of air.

18
19 **Pit Area Coverage:** Fog shall suppress dust from the digging operation.

20
21 **SPRAY:**

22
23 **Droplet size for Spray System:** The equipment shall be designed on the principle of wetting
24 the material in the pit with approximately 85% of droplets 100-200 microns in diameter.

25
26 **Pit Area Coverage:** Spray shall moisturize all surfaces of the pit.

27
28 **STRUCTURAL:**

29
30 **Size Requirement:** Maximum exterior dimension of skid shall be 6'-0" x 5'-0" with a
31 maximum height of 9'-0", as shown on drawings. See drawings for RCS penetration
32 size allowances and pit fog/spray assembly size allowances.

33
34 **Structural Design Loads:** Structural considerations for all equipment, piping, tubing, &
35 conduit installation shall include the following:

- 36
37
- 38 1. Dead and Live Loads: per IBC, 2000
 - 39 2. Seismic: Seismic loads shall be determined and applied in accordance with the IBC
40 with parameters as follows: S_v period acceleration = 0.357g, 1-sec acceleration, $S_1 =$
41 0.131g, Site Class C, Seismic Importance Factor = 1.0 for structures and components,
42 and Seismic Use Group I.
 - 43 3. Maximum floor loading of skid assembly, with tank full of water: 200 psf

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1 MECHANICAL:

2
3 The following are the Mechanical requirements for the design, fabrication and construction of
4 the DSS. The DSS supplier shall provide all mechanical systems for the DSS which shall
5 include a turnkey skid mounted system, controls, and all piping and components to ensure a
6 complete system, ready for use.

7
8 The Dust Suppression System shall be designed to operate under the following conditions
9 inside the Weather Enclosure Structure:

10
11 Indoor temperature: 50°F

12
13 Air Supply: Available plant air supply is 80 cfm at 100 psi. The DSS shall come pre-piped
14 with a single point connection and regulators as required.

15
16 SKID MOUNTED SYSTEM:

- 17
18 1. Water Tank: Tank shall be an insulated 500 gallon tank. Tank shall have capability
19 for complete drainage, low level cutoff and alarm, water level indicator, 2" fill port
20 with filter, immersion heater sized for -14°F, pump supply, and pump return. System
21 shall include the following as a minimum:
- 22 2. Filters for compressed air
 - 23 3. 5 micron filters for water, shall be 2 filters in parallel for isolation.
 - 24 4. Solenoid valves for on-off control as required by sequence of operation.
 - 25 5. Air and Water Pressure Regulators and Liquid filled Gauges
 - 26 6. Air and water supply lines
 - 27 7. Water Supply Pump: Shall have a high pressure relief valve and recirculate to tank in
28 the case of over pressurization. Pump shall have isolation valves.
 - 29 8. System shall have a manual three way valve downstream from the pump to drain the
30 tank for decommissioning purposes.
 - 31 9. Complete control system
- 32

33 CONTROLS:

34
35 The DSS supplier shall design a system to control the performance of the dust suppression
36 system equipment and shall perform operations in accordance with the sequence of
37 operations as shown on the drawings. Controls shall be by a Programmable Relay Logic
38 Controller for complete flexibility in choosing type of timed output, initiation trigger and
39 length of timed output for each of the control circuits. An adjustable set point thermostat
40 shall be used for initiation of tank immersion heater and purge system, for freeze protection.
41 The tank immersion heater and the purge system shall be on stand by power. Provide an
42 automatic water purge system to purge all water downstream of the systems internal water
43 filter outlet and an adjustable timer to regulate purge times of the water purge system upon

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1 dust suppression system shutdown, or if temperature drops for freeze protection. Purge
2 system shall have a manual switch as well. Indicate and adjust the air and water pressure to
3 the nozzles at each treatment point. All controls for the dust suppression system shall be
4 mounted in NEMA 4 enclosures. Gauges, valves, regulators, and distribution manifolds shall
5 be mounted within these enclosures. The following items shall be mounted on the front face
6 of the electrical control enclosures:

- 7
- 8 1. Main on/off switch to energize or de-energize the DSS and indicator light
 - 9 2. Control switches (power on/off/auto) for each control circuit.
 - 10 3. Status lights for power (on/off) for each circuit.
 - 11 4. Status lights for low (air and water) pressure.
 - 12 5. Status of heating circuit where required.
 - 13 6. Control Switches for purge system (hand/off/auto)

14

15 Dump Site Controls: On-off push button control modules for each glovebox location shall be
16 installed per manufacture's instruction in location shown on drawings.

17

18 Wireless Controls for Pit: Two (2) handheld remotes shall be provided for control of the fog
19 and spray in the pit. Remote shall have 7 buttons; Spray 1, Spray 2, Spray 3, Fog 1, Fog 2,
20 Fog 3, OFF. Wireless controls must be in accordance with the following:

21

22 FCC (47 CFR) Parts 15 and 18

23

24 ISM bands are as follows:

25

ISM Frequency	Tolerance	Band
915 MHz	+/-13.0 MHz	902 – 928 MHz
2.450 GHz	+/-50.0 MHz	2.400 – 2.500 GHz
5.800 GHz	+/-75.0 MHz	5.725 – 5.875 GHz
24.125 GHz	+/-125.0 MHz	24.000 – 24.250 GHz
245.00 GHz	+/-1.0 GHz	244.00 – 246.00 GHz

26

27 ELECTRICAL:

28

29 Electrical conduit, junction boxes, disconnects, cabinets, and equipment shall be designed for
30 the applicable codes and standards. All electrical installation and equipment shall be per
31 Division 16- Electrical of this specification. The electrical systems required for the DSS shall
32 be in accordance with the following provisions:

33

34 Incoming Service: A 120 Volt, 1 Phase, 60 Hz electrical service is available in the vicinity of
35 the DSS skid location. The total demand for the DSS shall not exceed two 20 amp circuits.

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1 The system shall be supplied with 2 junction boxes (one for stand by power, one for regular
2 power service) for a single point connection of each incoming service. The junction boxes
3 shall be located on the skid assembly.

4
5 Wiring: Common neutrals i.e. Edison type circuits or multi-branch circuits shall not be
6 allowed. Where a neutral conductor is required, a dedicated neutral conductor shall be
7 provided for each phase conductor.

8
9 Code Compliance: The complete installation shall be in accordance with applicable sections
10 of the National Electrical Code (NEC). Provide required clearances per the NEC.

11
12 Control Wiring: All control voltage shall be 24 volt. All control wiring shall be installed
13 according to Electrical raceways spec section 16110.

14
15 **SUBMITTALS:**

16
17 Submittals include, but are not limited to:

18
19 The Subcontractor shall submit all data required by this specification to the Contractor for
20 review and approval.

21
22 Vendor data includes but is not limited to the following:

23
24 Detailed Design: The Dust Suppression System detailed design and final layout shall be
25 submitted as a complete bound package for review and approval by the Contractor prior to
26 fabrication release of DSS components. A complete package shall include all working plans,
27 shall indicate critical dimensions, weights, required clearance, supports, connections or
28 attachments to existing structures & systems components and location/size of each field
29 connection, including electrical, compressed air and other vendor data required by this
30 specification section. Drawings shall be stamped by a Professional Engineer registered to
31 practice Mechanical Engineering in the State of Idaho. The Subcontractor shall insure that the
32 design packages are submitted to the Contractor complete and ready for review.

33
34 The DSS Supplier shall provide all vendor data required for a design review by the
35 contractor. The Contractor shall return to the DSS supplier review comments of the design for
36 incorporation. Once contractors comments are incorporated, the contractor will review the
37 final design for acceptance prior to fabrication.

38
39 Product Data: The DSS supplier shall submit a data package including the manufacturer's
40 technical data for procured components installed as part of the DSS skid assembly, including
41 the tank, pump, solenoid valves, piping, nozzles, and other components. The product data
42 sheets shall identify dimensions, weight, capacities, ratings and other interface information.

43

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1 **Control System Drawings:** The DSS supplier shall submit complete construction drawings
2 for the DSS control system for approval. The drawings shall include layout drawings of the
3 proposed control system; and wiring and pneumatic line schematics and drawings for the
4 thermostats, controllers, switches, instruments, panels, and equipment. The drawings shall
5 accurately show the connections of signals, air supply, water supply, and power for each
6 component, and the interconnections between the components.

7
8 **Start Up Procedure:** DSS supplier shall submit start-up procedure for system.

9
10 **Calculations:** The DSS supplier shall submit design calculations for the Seismic bracing
11 required per specification sections 13911 and 13914. Drawings and Design Calculations shall
12 be stamped by a Professional Engineer registered to practice Structural Engineering in the
13 State of Idaho.

14
15 **Special Packaging, Shipping, & Rigging Procedure:**

16
17 The Subcontractor shall submit field storage, transportation, & handling of DSS skid and
18 assembly.

19
20 **Quality Control Submittals:**

- 21
22 1. Water Piping In Service Testing Procedure
23 2. Water Piping In Service Testing Report
24 3. Compressed Air Piping In Service Testing Procedure
25 4. Compressed Air Piping In Service Testing Report
26 5. Fog Nozzle Droplet Size Performance Data
27 6. System Operational Test Procedure
28 7. System Operational Test Report

29
30 **Operation and Maintenance Manuals:** The supplier shall submit a data package including the
31 Operating and Maintenance Manuals for the DSS. The supplier shall include a recommended
32 maintenance schedule for items requiring periodic maintenance.

33
34 Refer to Section 01300, Submittals and the Vendor Data Schedule for additional submittal
35 requirements for operation and maintenance manuals.

36
37 **QUALITY CONTROL:**

38
39 The DSS shall be fabricated in accordance with national consensus codes & standards using
40 commercial assembly techniques, material, and procedures typically used in the construction
41 and assembly of similar systems.

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1 Qualifications: The Dust Suppression System shall be furnished and constructed by a firm
2 that is qualified and regularly engaged in the design and fabrication of similar turnkey
3 systems. Provide proof of experience, minimum five years, as a manufacturer with a
4 successful record of in-service performance in the fabrication and setup of these systems and
5 with the quality indicated. The Subcontractor shall maintain a shop and facilities for
6 fabrication of such systems.

7
8 Manufacturers: Firms regularly engaged in the manufacture of similar systems for not less
9 than 5 years.

10 11 DELIVERY, STORAGE AND HANDLING:

12
13 All materials shall be delivered to and stored at the job site in a manner that will prevent
14 damage and foreign material from getting inside the piping and associated valving.

15
16 Packaging, Shipping and Handling: Prior to shipping, the Subcontractor shall protect
17 openings in housings with plywood. Temporarily seal all open conduit connections, open
18 wiring, conductors and piping.

19
20 Where DSS skid assembly is pre-manufactured off site, Subcontractor shall submit drawings
21 and other documents, as required, and clearly identify rigging loads, and general setup
22 instructions for the DSS. The Subcontractor shall make arrangements and obtain permits for
23 transporting the DSS from the Subcontractor's fabrication facility to the INEEL Site
24 approximately 60 miles west of Idaho Falls, ID. The Subcontractor shall be responsible for
25 protecting and transporting the DSS to the Contractor's facility at the INEEL.

26
27 Marking and Handling: With the equipment shipping documents, the Subcontractor shall
28 provide complete identification and location of temporary material contained within the
29 equipment for shipment, handling or storage, which must be removed prior to
30 commissioning, including components shipped inside larger sections, and provide
31 instructions for removal, as required. The Subcontractor shall provide written
32 recommendations for field storage, transportation and handling of the Dust Suppression
33 System Skid Assembly and its components and auxiliary equipment.

34 35 PART 2 - PRODUCTS

36 37 MATERIALS AND EQUIPMENT:

38
39 All materials furnished shall be permanently marked or tagged to show ASTM Designation
40 and type of material. Materials shall not be steel stamped for identification. The finished
41 materials shall be packaged for shipment, pipe ends shall be capped with plastic caps to
42 protect the material from dirt and contamination during shipment and subsequent storage.

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1 PIPING:
2

3 Flexible: The piping supplying compressed air and water downstream from the skid assembly
4 shall be of non-corrosive materials, flexible in nature and housed within an armored sheath or
5 conduit. All internal components shall be of non-corrosive materials.
6

7 Stainless Tubing: Tubing shall be stainless steel MIL-T-8504 composition 304, .035" wall,
8 seamless, ASTM A269TP304.
9

10 VALVES:
11

12 Check Valves: Valves shall be in line adjustable check valve, brass with stainless steel
13 spring, adjustable cracking pressure, bubble tight seal, Buna "N" O-ring, 300 psi pressure
14 rating, Swagelok end connections, valves for use with water and air lines, shall be
15 manufactured by Nupro or approved equal.
16

17 Isolation Valves: Manual ball valves shall be brass, with SS ball and stem, TFE seat,
18 swagelok ends, 3000 psig @ 70F, Shall operate from -20F to 350F, and shall be
19 manufactured by Hoke or approved equal.
20

21 Solenoid Valves: Valves shall be two-way, normally closed, for water and air service.
22 Minimum operating pressure shall be 0 psi and max 150 psi, max temperature shall be 188F,
23 brass body, stainless spring, 24 volt, UL listed, NPT or Swagelok fittings. Valves shall be
24 ASCO series 8210 or approved equal.
25

26 NOZZLES:
27

28 Fog Nozzles: Nozzles shall be stainless steel, have no moving parts, have a turn down ratio
29 of 290:1, be horizontally and vertically adjustable to 45 degrees, and have a positive external
30 locking mechanism. Each nozzle or group of nozzles shall have an armored nozzle
31 protection shield which is also adjustable with a positive external locking mechanism, shall
32 have integral air and water tubing fittings, shall be easily maintainable, i.e. quick disconnect
33 fittings, or screwed fittings, shall have an integral connector for flexible tubing conduit to
34 provide strain relief for air and water tubing.
35

36 Spray Nozzles: Nozzles shall be stainless steel or brass, have no moving parts, be
37 horizontally and vertically adjustable to 45 degrees, and have a positive external locking
38 mechanism. Each nozzle or group of nozzles shall have an armored nozzle protection shield
39 which is also adjustable with a positive external locking mechanism, shall have integral air
40 and water tubing fittings, shall be easily maintainable, i.e. quick disconnect fittings, or
41 screwed fittings, shall have an integral connector for flexible tubing conduit to provide strain
42 relief for air and water tubing.
43

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1 FITTINGS:

2
3 Bulkhead Fittings: All Bulkhead fittings shall be **safety significant**. Bulkhead fittings shall
4 create a bubble tight seal capable of withstanding 1.2 inches of water minimum during the
5 RCS pressure testing, shall have service rating of -20F to 350F, fitting shall be torqued
6 according to manufacture and UL842. Unit shall be 316 stainless steel in accordance with
7 ASTM A-182 and A-479. O-ring shall be of Buna material. Bulkhead union (BU) shall be
8 by Parker Model WB2A5 or approved equal.

9
10 Swagelok Fittings: Shall be stainless steel, swagelok compression fittings, ATM A276
11 TP316.

12
13 Skid Assembly: All surfaces shall be galvanized or painted. Painted surfaces shall include
14 one coat of primer and a minimum of one coat of finish paint. Color shall be manufacturer's
15 standard. Skid shall be a fully welded, rigid structural steel base in accordance with AWS.

16
17 Fire Rating: Materials shall have a minimum flame-spread rating <24 and fuel
18 contribution/smoke.

19
20 Sealant: Seal all penetrations with elastomeric joint sealant, along exterior finish of RCS or
21 WES to insure proper enclosure.

22
23 Anchorage: Anchor skid to existing 3/16" carbon plate floor with TEK self-tapping hexhead
24 screws, size as required.

25
26 PART 3 - EXECUTION

27
28 INSTALLATION OF ALL SYSTEMS:

29
30 Shall be in conformity with the applicable requirements of the applicable latest edition of
31 referenced codes and standards. Water and air piping shall be accordance with ANSI B31.3
32 Category D, Uniform Plumbing Code (UPC) and International Mechanical Code (IMC).

33
34 ACCESSIBILITY:

35
36 Items such as valves, controls, specialties, and accessories shall be installed so as to be
37 readily accessible for operation, servicing, maintaining and repairing.

38
39 PIPE LINES:

40
41 Install pipe to uniform pitches between points for which elevations are established. Use
42 level or other approved method to accomplish this.

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1 Anchorage against slippage shall be provided by means of tie rods and pipe clamps, or
2 other approved means. Joints shall be made accessible for inspection and repair prior to
3 testing.

4
5 Pipelines shall be installed in neat and orderly manner. Installation shall avoid interference
6 with work of the other trades.

7
8 Unions shall be used to install valves and equipment so as to facilitate dismantling as may
9 be required.

10 Pipes shall be full lengths to greatest extent possible. Piping shall be cleaned of dirt, rust,
11 scale, grease and other foreign matter. Piping shall be kept clean as work progresses.

12
13 Exposed piping shall be run close to other piping, walls and columns.

14
15 Install pipe insulation on all water systems.

16
17 PIPE JOINTS:

18
19 Plastic Pipe Joints: Plastic pipe joints shall be made in strict accordance with written
20 instructions of plastic pipe and fitting manufacturer. The recommended materials and
21 installation equipment shall be used to make the joints. Any leaks, revealed by the pressure
22 testing procedure, shall be repaired at no additional cost to the Operating Contractor.

23
24 EQUIPMENT, FIXTURES, ETC.:

25
26 Equipment shall be set in place, aligned, connected, and made ready for operation.
27 Connections and required safety devices shall be installed. Initial lubrication shall be
28 provided. Controls shall be set for efficient, stable operation.

29
30 Nozzle mounts shall be installed and supported in a safe, rigid, neat, and orderly manner.
31 They shall be free from undue stresses and made suitable for normal use.

32
33 All of the above shall be protected from damage during and after installation. At
34 completion, work shall be free from tool marks, discolorations, cracks, scratches, chips and
35 other defects.

36
37 VALVE TAGS:

38
39 After installation, all valves shall be identified by tagging with their valve number
40 designation as shown on the drawings. The tag shall be fabricated from 24 gage, 3/4 in. wide,
41 3 in. long, AISI Type 303 or 304 stainless steel metal strip with 3/16 in. high letters stamped
42 in the metal surface. The tags shall be tied to the valve with AISI Type 304 annealed stainless
43 steel bead chain with stainless steel catches. All tags must be free from sharp edges.

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1 Tagging shall be done at 20-ft intervals and at least once in each area. Any pipes entering or
 2 leaving an area shall be labeled at the sleeve connections on both sides of the penetrations.
 3

4 PIPE IDENTIFICATION:

5
6
7
8
9
10
11
12
13
14
15
16

PIPE CONTENT IDENTIFICATION LIST

<u>PIPE CONTENT AND LABEL TEXT</u>	<u>COLOR*</u>
AIR, PLANT	Blue/White
WATER, INDUSTRIAL	Green/White

* Background Color / Letter Color

Size of Labels

<u>Outside Diameter of Pipe of Covering (in.)</u>	<u>Width of Color Band A (in.)</u>	<u>Size of Legend Letters B (in.)</u>
¼ to ½	8	½
¾ to 1 ¼	8	½

(All dimensions are given in inches.)

17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34

Small Piping: Where pipe diameters are too small to accept labels, apply background colors and labels (or stenciling) to rigid phenolic "sign boards," sized to accommodate Brady labels, and hung with stainless steel bead chain from the piping.

Apply flow arrows to all sizes.

HANGERS, SUPPORTS AND FASTENERS:

Shall be of the type best suited for the service involved and installation method recommended.

Hangers shall be capable of supporting the pipe or tubing in all conditions of operation. They shall allow for free expansion and contraction of the piping, and prevent stress resulting from transferred weight being induced into the pipe or connected equipment. The installation shall support the piping or tubing without sagging and shall be clear of the work of other trades.

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1 Supports shall include wall brackets, riser clamps, pipe stands, pipe saddles, steel sections,
 2 and other suitable devices which may be required for the proper installation of piping and
 3 tubing.

4 In general, the following table shall apply for hanger spacing of steel or copper pipe and
 5 tubing, and shall not apply where any valves, flanges, fittings, etc., create concentrated
 6 loads between supports. Where concentrated loads exist, additional supports at that
 7 location shall be provided:

9	Single	Maximum	Minimum
10	Pipe Size	Spacing	Rod Diameter
11	<u>(inch)</u>	<u>(feet)</u>	<u>(inch)</u>
12			
13	1/4	4	3/8
14	3/8	4	3/8
15	1/2	5	3/8
16	3/4	6	3/8
17	1	6	3/8
18	1 1/4	6	3/8
19	1 1/2	6	3/8
20	2	8	3/8

21
 22 Hangers and hanger spacing for plastic piping shall be in accordance with the plastic
 23 piping manufacturer's written instructions.

24
 25 CLEANING:

26
 27 PIPING SYSTEMS SHALL BE FLUSHED OR PURGED AS FOLLOWS:

- 28
 29 1. Water systems shall be flushed with water at system pressure for 5 minutes.
 30 2. Air system shall be purged with compressed air at system pressure for 1 minutes.

31
 32 Flushing shall be witnessed by the Contractor's Representative. The test water shall not be
 33 disposed of on the Pit 9 Surface. The test water may be disposed of in the Main Channel
 34 Flow System (MCFS) in accordance with the Subcontractors approved disposal plan. Scour
 35 and erosion of soils shall be prevented. Sedimentation will not be allowed in the MCFS. The
 36 disposal of the test water shall be coordinated with RWMC operations. System shall be left in
 37 a drained condition.

38
 39 QUALITY CONTROL TESTING:

40
 41 Subcontractor Supplied Testing: Prepare and submit test procedures and reports as listed in
 42 the vendor data schedule.

43

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1 Furnish temporary connections to services and the instruments for testing. Perform the
2 following tests and inspections in the presence of the Contractor's Representative.

3
4 Instruments, specialties, and equipment that may be subject to damage shall be isolated
5 during the testing.

6
7 Water Piping: The piping shall receive an in-service pressure tested at system pressure in
8 accordance with ANSI B31.3, category D with no visible leakage.

9
10 Air Piping: The piping shall receive an in-service pressure tested at system pressure in
11 accordance with ANSI B31.3, category D with no visible leakage.

12
13 System Of Operation Test: Test shall verify correct sequence of operation.

14
15 FIELD QUALITY CONTROL:

16
17 Surveillance will be performed by the Contractor's Representative to verify compliance of
18 the work to the drawings and specifications.

19
20 One set of approved installation shop drawings shall be maintained on the project site during
21 construction. The Subcontractor shall redline all changes daily. The redline drawings shall be
22 incorporated on the "as-built" design drawings by the Subcontractor.

23
24 Contractor Inspection and Testing: Surveillance will be performed by the Contractor's
25 Representative to verify compliance of the work to the drawings and specifications.

26
27 END OF SECTION 15409

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1 **SECTION 15800 - HEATING AND VENTILATION SYSTEM**

2
3 **PART 1 - GENERAL**

4
5 **SUMMARY:**

6
7 The Subcontractor shall furnish and install all equipment, material, and supplies and perform
8 all work and operations necessary for installation of the Heating and Ventilation System
9 including air distribution systems and related equipment as shown on the subcontract
10 drawings and as specified herein.

11
12 The heating and ventilation system consists of the following subsystems:

13
14 **WEATHER ENCLOSURE STRUCTURE (WES)**

15
16 WES Inlet Air System
17 WES Heating Systems

18
19 Personnel Monitoring Room
20 Inlet Air System

21
22 Personnel Access Room
23 Inlet Air System

24
25 Transfer Vestibule
26 Supply Air System
27 Exhaust Air System

28
29 **RETRIEVAL CONFINEMENT STRUCTURE (RCS)**

30
31 RCS Inlet Air System from Personnel Access Room
32 RCS Inlet Air System from WES
33 RCS Inlet Air System from PGS Drumout Station Tent
34 RCS Exhaust Air System

35
36 Exhaust System

37
38 Carbon Steel Exhaust Ductwork
39 Main Exhaust Fan
40 Back-Up Exhaust Fan

41
42 Pressure and Flow Measuring Systems

43

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1 Section Includes, but is not limited to:

- 2
- 3 1. Purchase and installation of WES Inlet Air System including inlet air ductwork and
 - 4 supports, inlet air filters, and inlet air counterbalanced backdraft damper.
 - 5 2. Purchase and installation of WES Heating System including radiant heaters and unit
 - 6 heaters.
 - 7 3. Purchase and installation of Personnel Monitoring Room Inlet Air System including
 - 8 transfer grille.
 - 9 4. Purchase and installation of Personnel Access Room Inlet Air System including inlet
 - 10 air counterbalanced backdraft damper.
 - 11 5. Purchase and installation of Transfer Vestibule Supply and Exhaust Air Systems
 - 12 including ductwork and supports, supply fan, and exhaust air counterbalanced
 - 13 backdraft damper.
 - 14 6. Purchase and installation of RCS Exhaust Air System including carbon steel
 - 15 ductwork, supports.
 - 16 7. Purchase and installation of Main Exhaust Fan and Back-up Exhaust Fan.
 - 17 8. Purchase and installation of Pressure and Flow Measuring systems including pressure
 - 18 sensors and transmitters, and flow measurement sensors and transmitters.
 - 19 9. Coordinate the installation of the heating and ventilation system with the work of
 - 20 other trades.

21

22 RELATED SECTIONS:

23

24 Testing of the Heating and Ventilation systems shall be in accordance with the Testing

25 Adjusting, and Balancing section of this specification.

26

27 Purchase, fabrication, and installation of stainless steel ductwork, filter housings, and other

28 safety significant equipment shall be in accordance with the Safety Significant Heating and

29 Ventilation Systems section of this specification.

30

31 REFERENCES:

32

33 The following documents, including others referenced therein, form part of this section to the

34 extent designated herein.

35

36 **AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)**

37

38	ASTM A36	Standard Specification for Structural Steel
39	ASTM A569	Standard Specification for Steel, Sheet and Strip,
40		Carbon, Hot Rolled, Structural Quality
41	ASTM A635	Standard Specification for Steel, Sheet and Strip,
42		Heavy-Thickness Coils, Carbon, Hot-Rolled

43

Project Title: Facility Package for the OU 7-10 Glovebox Excavator Method Project

Document Type: Technical Specifications

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Revision Number: 0

- 1 **ASTM C518** **Standard Test Method for Steady-State Heat Flux**
- 2 **Measurements and thermal Transmission Properties by**
- 3 **Means of the Heat Flow Meter Apparatus**
- 4 **ASTM C534** **Standard Specification for Preformed Flexible**
- 5 **Elastomeric Cellular Thermal Insulation in Sheet and**
- 6 **Tubular Form**
- 7 **ASTM D1056** **Standard Specification for Flexible Cellular Materials -**
- 8 **Sponge or Expanded Rubber**
- 9 **ASTM E96** **Standard Test Methods for Water Vapor Transmission**
- 10 **of Materials**

11

INTERNATIONAL MECHANICAL CODE (IMC)

12

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

13

14

- 16 **NFPA 70** **National Electric Code**
- 17 **NFPA 90A** **Standard for the Installation of Air Conditioning and**
- 18 **Ventilating Systems**
- 19 **NFPA 90B** **Standard for the Installation of Warm Air Heating and**
- 20 **Air Conditioning Systems**

21

SHEET METAL AND AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION, INC. (SMACNA)

22

23

24

- 25 **SMACNA** **HVAC Duct Construction Standards**
- 26 **SMACNA** **HVAC Systems - Duct Design**
- 27 **SMACNA** **Round Industrial Duct Construction Standards**

28

UNDERWRITERS LABORATORIES (UL)

29

30

SYSTEM DESCRIPTION:

31

32

The systems included herein are as follows:

33

34

WES Inlet Air System is a static system allowing air to enter the WES. The system consists of an inlet air penthouse furnished and installed by the WES manufacturer. Air is drawn through the inlet air penthouse into the inlet air duct. WES static pressure is maintained negative with respect to the outside atmosphere by using the inlet air counterbalanced backdraft damper. The air is then filtered and released into the WES.

35

36

37

38

39

40

WES Heating Systems consist of unit heaters located around the perimeter of the WES, and radiant heaters located over work areas or other strategic locations. Control of the heaters is by integral thermostats. The unit heater fans are to operate continuously.

41

42

43

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1 Personnel Monitoring Room Inlet Air System is a static system consisting of an inlet air
2 transfer grille in the wall of the personnel monitoring room.

3 Personnel Access Room Inlet Air System is a static system consisting of a counterbalanced
4 backdraft damper located in the wall between the personnel access room and the personnel
5 monitoring room. This damper maintains the personnel access room at a constant negative
6 pressure with respect to the personnel monitoring room.

7
8 The Transfer Vestibule Supply Air System is a fan-powered system, consisting of supply air
9 ductwork, a supply air fan with integral filter, and a manual balancing damper. This system
10 supplies fresh air to the transfer vestibule.

11
12 The Transfer Vestibule Exhaust Air System is a static system consisting of a counterbalanced
13 backdraft damper located in the wall between the transfer vestibule and the WES. This
14 damper maintains the transfer vestibule at a constant positive pressure with respect to the
15 WES.

16
17 The RCS Exhaust Air System consists of carbon steel ductwork downstream of the main
18 exhaust filter bank including isolation dampers and duct supports. The system ductwork
19 extends from the main exhaust filter bank to the exhaust fans, and from the exhaust fans to
20 the exhaust stack.

21
22 The Main Exhaust Fan provides exhaust ventilation for the facility. This fan is operated with
23 a variable frequency controller, which modulates the fan speed to maintain a constant
24 vacuum pressure within the RCS.

25
26 The Back-up Exhaust Fan provides exhaust ventilation for the facility in the event of a loss of
27 normal electrical power or main exhaust fan malfunction. This fan operates at the design
28 speed to exhaust approximately ½ of the normal airflow, with no speed control or
29 adjustments. Operation of this fan is by manual start/stop switch, and will require manual
30 opening and closing of fan isolation dampers.

31
32 The Pressure and Flow Measuring Systems provide local and remote readout for pressures
33 and flows at various locations throughout the facility.

34
35 **SUBMITTALS:**

36
37 **Submittals include,** but are not limited to:

38
39 **Product Data:** Submit product data for those products called out in this specification and the
40 Vendor Data Schedule to include manufacturer's technical data for each model indicated,
41 including rated capacities of selected model clearly indicated; dimensions; required
42 clearances; shipping, installed, and operating weights; furnished specialties; accessories; and
43 installation and startup instructions. Also include maintenance data.

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1 Wiring Diagrams: Submit detailed wiring diagrams for those products called out in this
2 specification and in the Vendor Data Schedule for power, signal, and control systems of
3 components supplied by the Subcontractor, and differentiate between manufacturer-installed
4 and field-installed wiring.
5

6 Construction Component Testing: The Subcontractor shall submit a procedure to test the
7 HVAC system components operation and verify proper operation of each system component.
8 After testing, the Subcontractor shall submit a test report detailing the results of the testing.
9 This testing shall be completed and approved prior to starting of the Test, Adjust and Balance
10 work.
11

12 See Section 01300, Submittals and Vendor Data Schedule for additional submittal
13 requirements
14

15 QUALITY CONTROL:
16

17 Installer: Firms with successful installation experience on projects with heating and
18 ventilation systems similar to those required for this project.
19

20 Comply with ASHRAE (American Society of Heating, Refrigeration and Air-Conditioning
21 Engineers) rating and installation recommendations, except as otherwise indicated.
22

23 Comply with NFPA 90A
24

25 Comply with NFPA 90B
26

27 Listing and Labeling: Provide electrically operated components specified in this Section that
28 are listed and labeled.
29

30 The terms "listed" and "labeled": as defined in the national electrical code, article 100.
31

32 Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory"
33 as defined in OSHA Regulation 1910.7.
34

35 Comply with NFPA 70 National Electrical Code.
36

37 Manufacturers: Firms regularly engaged in manufacture of heating and ventilation systems of
38 types and sizes required and whose products have been in satisfactory use in similar service.
39 Equipment shall be as specified or approved equal.
40
41

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1 DELIVERY, STORAGE, AND HANDLING:
2

3 Deliver: Deliver heating and ventilation systems and other equipment furnished in this
4 section in factory wrapped containers. Coordinate delivery of units in sufficient time to allow
5 movement into/onto structure.
6

7 Store: Store heating and ventilation systems and other equipment furnished in this section in
8 clean dry space; protect from dirt, fumes, water, and construction traffic.
9

10 Handle: Handle equipment furnished in this section carefully to avoid damage to components
11 and finish. Protect finish during installation. Do not install damaged equipment; replace
12 damaged parts or equipment and remove them from project site. Handle units to comply with
13 manufacturer's written rigging and installation instructions for unloading and moving to final
14 location.
15

16 SITE CONDITIONS:
17

18 All equipment shall be capable of operating to the limits specified herein at the construction
19 site at an elevation of 5000 ft. msl.
20

21 PART 2 - PRODUCTS
22

23 All materials, products, and equipment shall be purchased or manufactured as specified in
24 this section. Ductwork products shall be in accordance with SMACNA Round Duct
25 Construction Standards and the International Mechanical Code.
26

27 Ductwork size, location, and permissible fitting configurations are shown on the subcontract
28 drawings. All fittings installed in the ductwork system shall have loss coefficients less than or
29 equal to those shown in the SMACNA "HVAC Systems Duct Design" Loss Coefficient
30 Tables.
31

32 MANUFACTURERS:
33

34 Firms regularly engaged in manufacture of heating and ventilation systems of types and sizes
35 required and whose products have been in satisfactory use in similar service. Equipment shall
36 be as specified on Subcontract drawings.
37

38 EXTRA MATERIALS:
39

40 Furnish extra materials described below that match products installed, are packaged with
41 protective covering for storage, and are identified with labels describing contents.
42 Recommended shelf life shall be included for all extra materials.
43

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1 **Fan Belts:** One set for each belt-drive fan system installed.

2

3 **Filters:** One set of all filters which are supplied under this subcontract (not GFE).

4

5 **DUCTWORK:**

6

7 All duct material shall be in accordance with this specification and the SMACNA Round
8 Duct Construction Standards, for the pressure classification shown on the subcontract
9 drawings. Duct pressure classifications shall be as defined in the SMACNA "HVAC Duct
10 Construction Standards." Unless otherwise shown on the subcontract drawings, material
11 gage, duct reinforcing, and connections shall be in accordance with the SMACNA Round
12 Duct Construction Standards for the given pressure classification. The abrasive particulate
13 classification for the duct system is Class 1. Specific weight of particulate to be conveyed in
14 the duct system is 0 lb/cubic ft.

15

16 **CS Duct Materials:** Duct material for CS designated systems shall be hot-rolled steel sheet in
17 accordance with ASTM A569 Commercial Quality, or hot rolled steel plate in accordance
18 with ASTM A635. Carbon steel structural shapes shall be hot rolled in accordance with
19 ASTM A36. Carbon steel ductwork shall be painted in accordance with Section 09900 of this
20 specification.

21

22 **DUCTWORK HANGERS AND SUPPORTS:**

23

24 Ductwork supports for CS designated ductwork shall be in accordance with SMACNA
25 Round Industrial Duct Construction Standards.

26

27 **Flex Connections:** Where shown on the subcontract drawings to prevent vibration
28 transmission and absorb expansion, flexible connections shall be installed. Flex connection
29 shall be rated for the pressure classification of the duct system. Flexible element shall be ½
30 in. neoprene/polyester material rated for up to 250°F. Connection shall be capable of
31 allowing 1 in. axial compression, ½ in. axial extension, and ¾ in. lateral offset.

32

33 **DUCTWORK INSULATION:**

34

35 Insulation shall be installed where shown on the subcontract drawings. No asbestos will be
36 allowed. All insulation shall meet NFPA Standards for low fire hazard classification of:
37 Flame Spread: 25 maximum, Fuel Contributed: 50 maximum, and Smoke Developed: 50
38 maximum.

39

40 **Elastomeric Duct Insulation:** Elastomeric duct insulation shall be in accordance with ASTM
41 C534, and of the thicknesses shown on the subcontract drawings. Operating temperature
42 limits shall be minus 40°F to plus 220°F. Thermal conductivity shall be no greater than 0.27

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1 (Btu in.)/(hr sq. ft deg F) at 75°F mean temperature, in accordance with ASTM C518.
2 Moisture absorption shall be no more than 6% by weight in accordance with ASTM D1056.
3 Insulation shall be resistant to Ozone. Insulation shall have a water vapor permeability of
4 0.17 perms in accordance with ASTM E96. Insulation shall be Armstrong Armaflex II or
5 approved equal. For outdoor applications, insulation shall be covered with a weather resistant
6 protective finish of the same manufacturer as the insulation. Finish shall be Armstrong WB
7 Armaflex Finish for Armaflex II insulation.

8

9 **EQUIPMENT:**

10

11 **WES Inlet Air Filters:** WES inlet air filters shall be UL Class 2 Listed, 25-30% average
12 efficiency with an average arrestance of 90-93% based on ASHRAE Test Standard 52.1-92,
13 Flanders Airpure Pleat Panel Filters, Model FRP30 Series 200, 24" x 24" x 2". Submit
14 product data.

15

16 **Counterbalanced Backdraft Dampers:** Counterbalanced backdraft dampers shall be an
17 industrial pressure relief damper, counterbalanced to maintain 0.1 inches water gage pressure
18 differential across the damper for the velocity range from approximately 40 fpm to
19 approximately 800 fpm. Damper shall be Greenheck Model HPR-120 Industrial Pressure
20 Relief Damper. Submit product and maintenance data.

21

22 **WES Radiant Heaters:** WES radiant heaters shall be fixed overhead radiant heaters, 13.5 kW
23 capacity, UL listed, CSA Certified, 480 volt 3 phase, Chromalox ChromaStar – Infra-Red
24 Comfort Heaters, complete with hangar kits, and power disconnect kits. Submit product data
25 and wiring diagrams.

26

27 **WES Unit Heaters:** WES unit heaters shall be high capacity horizontal blower unit heaters,
28 15 kW capacity, wall mounted, continuous duty fan motors, 480 volt 3 phase, integral
29 transformer for fan motor if needed, integral thermostats, Chromalox Model UP-15. Submit
30 product data and wiring diagrams.

31

32 **Personnel Monitoring Room Transfer Grille:** Transfer grille shall be Metal Aire Series DG
33 SF Door/Transfer Grille.

34

35 **Transfer Vestibule Supply Fan:** Transfer vestibule supply fan shall be a belt drive,
36 centrifugal, inline fan, supplying 768 cfm of outside air at 0.6 inches water gage static
37 pressure, Greenheck Model BSQ-100-4 with NEMA 1 toggle on/off switch, motor cover, UL
38 listed, filter box with 1" filter racks and aluminum washable filters, wiring pigtail, inline
39 outlet guard, bearings with grease fittings, extended lubrication lines, and motor with thermal
40 overloads. Submit product data and wiring diagrams.

41

42 **Main Exhaust Fan:** The main exhaust fan shall be a centrifugal, single width, airfoil design,
43 Class III, arrangement 1, CW rotation, TAU discharge position, steel construction, 20 hp

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1 motor, VFD compatible 460 volt 60 hz 3 phase TEFC motor, capable of delivering 6,361 cfm
2 at 12" water gage static pressure. Accessories and options shall include shaft guard, belt
3 guard, UL listing, free standing isolator structural base factory mounted, motor slide base,
4 punched inlet and outlet flanges, and extended lube lines. Fan shall be Greenheck Model 20-
5 AFSW-41. Submit product data and wiring diagrams.

6
7 **Back-Up Exhaust Fan:** The back-up exhaust fan shall be a centrifugal, single width, airfoil
8 design, Class III, arrangement 9, motor location L, CW rotation, UB discharge position, steel
9 construction, 5 hp motor, 460 volt 60 hz 3 phase TEFC motor, capable of delivering 3,600
10 cfm at 4" water gage static pressure. Accessories and options shall include shaft guard, belt
11 guard, UL listing, free standing isolator structural base factory mounted, motor slide base,
12 punched inlet and outlet flanges, and extended lube lines. Fan shall be Greenheck Model 20-
13 AFSW-41. Submit product data and wiring diagrams.

14
15 **Excavator Exhaust Fan:** Excavator exhaust fan shall be backward inclined, non-overloading
16 type, with single thickness blades and statically and dynamically balanced wheel. All
17 surfaces of the fan and fan wheel shall be painted with Heresite air-dry phenolic synthetic
18 resinous coating. Fan motor shall be industrial grade, ½ hp, 120 VAC. Fan shall be Car-Mon
19 Products Series CMD-7 with appropriate hose connections for high temperature flex tube
20 specified herein.

21
22 **Fan Isolation Dampers:** Fan isolation dampers shall be heavy duty round industrial control
23 dampers, flanged frame, butterfly type, painted steel frame, EPDM blade seal, external
24 bronze axle bearings, O-ring axle shaft seal, manual quadrant actuator, Greenheck Model
25 HCDR-351. Submit product data.

26
27 **Pressure Indicators:** Pressure indicators shall indicate differential pressure, ranges from 0 to
28 10 inches water gage. Accessories and options shall include adjustable signal flag and 3-way
29 vent valve on both ports.

30
31 **Instrument Tubing:** Instrument tubing shall be stainless steel, MIL-T-8504 composition 304,
32 or ASTM A269 TP304, 0.035" wall, seamless. Fittings, shall be stainless steel, ASTM A276
33 TP316.

34
35 **Pressure Indicating Transmitter:** Pressure indicating transmitter shall be capable of
36 converting differential pressure signals into a 4-20 mA DC output linear to the sensed
37 pressure. Transmitter shall also contain an integral LCD for differential pressure display.
38 Transmitter shall be Air Monitor Corporation Veltron DPT 2500I.

39
40 **Flow Element:** Flow element shall be capable of continuously measuring the duct airflow
41 capacity utilizing an airflow traverse station. Flow element shall be Air Monitor Corporation
42 VOLU-Probe/VS. Submit product data.

43

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1 **Flow Indicating Transmitter:** Flow transmitter shall be capable of converting the total and
2 static pressure signals from the flow element described above into a 4-20 mA DC output
3 linear to airflow volume. Transmitter shall also contain an integral DCD for flow display.
4 Transmitter shall be Air Monitor Corporation Veltron DPT 2500I.

5
6 **High Temperature Flex Tube:** High temperature flex tube shall be designed for use on
7 overhead diesel exhaust stacks. The assembly shall include an EPDM exhaust adapter, lifting
8 ring, spring balancer, high temperature tubing, and a ductwork flange set appropriate for
9 connections to excavator exhaust fan specified herein. Assembly shall be Car-Mon Products
10 Series DEP Diesel Exhaust Package with Series TS Tubing Sling.

11
12 **PART 3 - EXECUTION**

13
14 **FABRICATION AND INSTALLATION OF DUCTWORK:**

15
16 Assemble and install ductwork in accordance with recognized industry practices, which will
17 achieve air tight and noiseless systems capable of performing each indicated service. Install
18 each run with a minimum of joints. Align ductwork accurately at connections. Coordinate
19 duct installation with installation of equipment, controls, and other associated work of the
20 ductwork system. Installation shall be in accordance with SMACNA Round Duct
21 Construction Standards and the International Mechanical Code.

22
23 All ductwork welding shall be in accordance with the welding section of this specification.
24 Ductwork shall be arranged and spaced to clear structural framing and the work of other
25 trades. Piping or other interferences shall not pass through ducts.

26
27 Access panels shall be installed where shown on the subcontract drawings. Access panels
28 shall be in accordance with SMACNA "HVAC Duct Construction Standards."
29 Ductwork connections shall be in accordance with SMACNA Round Industrial Duct
30 Construction Standard. Ductwork connections for CS and SST designated duct systems shall
31 be butt-welded except at equipment connections or where flanges are shown on the
32 subcontract drawings or where ductwork connects to equipment. All equipment connections
33 shall be flanged. Gasket material for flanged connections shall be 1/8 in. neoprene.

34
35 **Duct Gage, Supporting, and Reinforcing:** Unless otherwise shown on the subcontract
36 drawings, duct gage, hangar spacing, and reinforcing shall be as follows: CS-designated
37 ductwork shall be in accordance with SMACNA Round Industrial Duct Construction
38 Standards. The abrasive particulate classification for welded duct systems is Class 1. Specific
39 weight of particulate to be conveyed in welded duct systems is 0 lb/cubic ft. Duct Supports
40 shall be installed in accordance with the requirements of the SMACNA Round Industrial
41 Duct Construction Standards for the duct material gage, reinforcing, pressure classification,
42 and duct classification. Duct supports shall be attached to the facility floor structure and the
43 exhaust fan and stack structure only. The Subcontractor shall submit as-built drawings of the

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1 ductwork system showing duct gage, reinforcing type, and support location including type
2 and upper and lower connection type for all ductwork installed by this project.

3
4 Equipment Installation: Equipment installation shall be in accordance with SMACNA
5 "HVAC Duct Construction Standards" and the manufacturer's recommendations.

6
7 CLEANING AND PROTECTION:

8
9 Clean Ductwork Internally: Clean ductwork internally, unit by unit as it is installed. Clean
10 external surfaces of foreign substances, which might cause corrosive deterioration of the
11 metal. Where air distribution accessories and ductwork are to be painted, clean surfaces of
12 foreign substances, which might interfere with painting or cause paint deterioration.

13
14 Temporary Closure: At ends of ducts, which are not connected to equipment or air
15 distribution devices at the time of ductwork installation, provide temporary closure of
16 polyethylene film or other covering which will prevent the entrance of dust and debris until
17 the time connections are to be completed.

18
19 INSTALLATION/APPLICATION/ERECTION:

20
21 Setting: All equipment shall be installed in conformance with the manufacturer's
22 recommendations and set in proper alignment. Each item shall be leveled and adjusted for
23 proper height by means of leveling bolts, plates, and/or shims. Equipment supports shall be
24 independent of associated piping, component brackets, and supports or other similar
25 attachments.

26
27 Protective Coatings: After completion of the installations and before testing or initial
28 operation of the equipment all special protective temporary coatings, covers, etc., which were
29 applied for protection during shipment and storage, and which did not require removal for
30 assembly and/or installation shall be removed.

31
32 Alignment: All new rotating equipment shall be aligned and balanced in accordance with the
33 recommendations of the manufacturer of the equipment. The alignment of all mechanical
34 drives shall be checked and demonstrated to be within the manufacturer's recommended
35 tolerances. The Subcontractor shall arrange with the manufacturer for correcting defective
36 alignments, if any, and shall follow recommendations of manufacturer for correction.

37
38 FIELD QUALITY CONTROL:

39
40 Contractor Supplied Testing: the Contractor will perform no testing.

41
42 Subcontractor Supplied Testing: The Subcontractor shall perform construction component
43 testing to verify proper operation of all systems and components installed under this section.

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1 A written test procedure shall be submitted prior to testing. Test reports detailing all testing
2 shall be submitted after testing.

3

4 The Subcontractor shall also engage an agent or firm that is qualified to perform Testing,
5 Adjusting, and Balancing (TAB) on the completed HVAC system. See Testing, Adjusting
6 and Balancing Section of this specification.

7

8 Welded joints and seams shall be tested in accordance with the requirements of the welding
9 section of this specification.

10

11 Contractor Surveillance: Surveillance will be performed by the Contractor to verify
12 compliance of the work to the Subcontract drawings and specifications.

13

14 END SECTION 15800

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1 SECTION 15801 - SAFETY SIGNIFICANT VENTILATION SYSTEMS

2
3 PART 1 - GENERAL

4
5 SUMMARY:

6
7 The Subcontractor shall furnish and install all equipment, material, and supplies and perform
8 all work and operations necessary for installation of the Safety Significant Ventilation
9 Systems including air distribution systems and related equipment as shown on the
10 subcontract drawings and as specified herein.

11
12 The safety significant ventilation systems consists of the following subsystems:

13
14 **PACKAGING GLOVEBOX STRUCTURE (PGS)**

15
16 **Inlet Air System**

17
18 **RETRIEVAL CONFINEMENT STRUCTURE (RCS)**

19
20 **RCS Inlet Air System from Personnel Access Room**
21 **RCS Inlet Air System from WES**
22 **RCS Inlet Air System from PGS Drumout Station Tent**
23 **RCS Exhaust Air System**
24 **Pressure and Flow Measuring Systems**

25
26 Section Includes, but is not limited to:

- 27
- 28 1. Purchase and installation of PGS Inlet Air System including ductwork and supports.
29 Installation of inlet air filter housings (GFE), isolation dampers (GFE), and HEPA
30 filters (GFE).
 - 31 2. Purchase and installation of RCS Inlet Air System from Personnel Access Room
32 including ductwork and supports. Installation of inlet air filter housings (GFE),
33 isolation dampers (GFE), and HEPA filters (GFE).
 - 34 3. Purchase and installation of RCS Inlet Air System from WES including ductwork and
35 supports. Installation of inlet air filter housings (GFE), isolation dampers (GFE), and
36 HEPA filters (GFE).
 - 37 4. Purchase and installation of RCS Inlet Air System from PGS Drumout Station Tent
38 including ductwork and supports. Installation of inlet air filter housings (GFE),
39 isolation dampers (GFE), and HEPA filters (GFE).
 - 40 5. Purchase and installation of RCS Exhaust Air System including stainless steel fire
41 screen, stainless steel ductwork, supports, pressure relief damper and associated
42 actuator. Installation of exhaust filter housing (GFE), isolation dampers (GFE),
43 moisture separator elements (GFE), pre-filters (GFE), and HEPA filters (GFE).

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1 6. Coordinate the installation of the heating and ventilation system with the work of
2 other trades.

3
4 RELATED SECTIONS:

5
6 Testing of the Heating and Ventilation systems shall be in accordance with the Testing
7 Adjusting, and Balancing section of this specification.

8
9 Purchase, fabrication, and installation of carbon steel ductwork and associated equipment
10 shall be in accordance with the Heating and Ventilation System sections of this specification.

11
12 REFERENCES:

13
14 The following documents, including others referenced therein, form part of this section to the
15 extent designated herein.

16
17 **AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)**

18
19 ASTM A36 Standard Specification for Structural Steel
20 ASTM A240 Standard Specification for Heat-Resisting Chromium
21 and Chromium-Nickel Stainless Steel Plate, Sheet, and
22 Strip for Pressure Vessels

23
24 **INTERNATIONAL MECHANICAL CODE (IMC)**

25
26 **NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)**

27
28 NFPA 70 National Electric Code
29 NFPA 90A Standard for the Installation of Air Conditioning and
30 Ventilating Systems

31
32 **SHEET METAL AND AIR CONDITIONING CONTRACTORS' NATIONAL
33 ASSOCIATION, INC. (SMACNA)**

34
35 SMACNA HVAC Duct Construction Standards
36 SMACNA HVAC Systems - Duct Design
37 SMACNA Round Industrial Duct Construction Standards

38
39 **UNDERWRITERS LABORATORIES (UL)**

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1 **SYSTEM DESCRIPTION:**
2

3 The systems included herein are as follows:
4

- 5 1. The PGS Inlet Air System is a static system, static meaning no fan is included in this
6 system, consisting of an inlet air HEPA filter, a balancing/isolation damper, and
7 ductwork connecting to each PGS. This system provides a confinement boundary by
8 filtering all inlet air to each PGS.
- 9 2. The RCS Inlet Air System from the Personnel Access Room is a static system
10 consisting of an inlet air HEPA filter, a balancing/isolation damper, and ductwork
11 connecting to the RCS. This system provides a confinement boundary by filtering all
12 inlet air from the personnel access room to the RCS.
- 13 3. The RCS Inlet Air System from the WES is a static system consisting of an inlet air
14 HEPA filter bank, balancing/isolation dampers, and ductwork connecting to the RCS.
15 This system provides a confinement boundary by filtering all inlet air from the WES
16 to the RCS.
- 17 4. The RCS Inlet Air System from the PGS Drumout Station Tent is a static system
18 consisting of an inlet air HEPA filter, balancing/isolation dampers, and ductwork
19 from the PGS Drumout Station Tent to the filter, and from the filter to the RCS. This
20 system provides a confinement boundary by filtering all air transferred from the tent
21 to the RCS.
- 22 5. The RCS Exhaust Air System consists of stainless steel fire screen, stainless steel
23 ductwork, balancing/isolation dampers, and the main exhaust filter bank. The system
24 ductwork extends from the RCS wall to the main exhaust filter bank including outlet
25 transitions and isolation dampers. This system provides a confinement boundary by
26 filtering all exhaust air from the RCS prior to exhausting through the exhaust stack.
27

28 **SUBMITTALS:**
29

30 **Submittals include,** but are not limited to:
31

32 **Product Data:** Submit product data for those products called out in this specification and the
33 Vendor Data Schedule to include manufacturer's technical data for each model indicated,
34 including rated capacities of selected model clearly indicated; dimensions; required
35 clearances; shipping, installed, and operating weights; furnished specialties; accessories; and
36 installation and startup instructions. Also include maintenance data.
37

38 **Wiring Diagrams:** Submit detailed wiring diagrams for those products called out in this
39 specification and in the Vendor Data Schedule for power, signal, and control systems of
40 components supplied by the Subcontractor, and differentiate between manufacturer-installed
41 and field-installed wiring.
42

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1 Construction Component Testing: The Subcontractor shall submit a procedure to test the
2 HVAC system components operation and verify proper operation of each system component.
3 After testing, the Subcontractor shall submit a test report detailing the results of the testing.
4 This testing shall be completed and approved prior to starting of the Test, Adjust and Balance
5 work.

6
7 See Section 01300, Submittals and Vendor Data Schedule for additional submittal
8 requirements

9
10 QUALITY CONTROL:

11
12 Installer: Firms with successful installation experience on projects with heating and
13 ventilation systems similar to those required for this project.

14
15 Comply with ASHRAE (American Society of Heating, Refrigeration and Air-Conditioning
16 Engineers) rating and installation recommendations, except as otherwise indicated.

17
18 Comply with NFPA 90A

19
20 Listing and Labeling: Provide electrically operated components specified in this Section that
21 are listed and labeled.

22
23 The terms "listed" and "labeled": as defined in the national electrical code, article 100.

24
25 Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory"
26 as defined in OSHA Regulation 1910.7.

27
28 Comply with NFPA 70 National Electrical Code.

29
30 Manufacturers: Firms regularly engaged in manufacture of heating and ventilation systems of
31 types and sizes required and whose products have been in satisfactory use in similar service.
32 Equipment shall be as specified or approved equal.

33
34 DELIVERY, STORAGE, AND HANDLING:

35
36 Deliver: Deliver heating and ventilation systems and other equipment furnished in this
37 section in factory wrapped containers. Coordinate delivery of units in sufficient time to allow
38 movement into/onto structure.

39
40 Store: Store heating and ventilation systems and other equipment furnished in this section in
41 clean dry space; protect from dirt, fumes, water, and construction traffic.

42

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1 **Handle:** Handle equipment furnished in this section carefully to avoid damage to components
2 and finish. Protect finish during installation. Do not install damaged equipment; replace
3 damaged parts or equipment and remove them from project site. Handle units to comply with
4 manufacturer's written rigging and installation instructions for unloading and moving to final
5 location.

6
7 **SITE CONDITIONS:**

8
9 All equipment shall be capable of operating to the limits specified herein at the construction
10 site at an elevation of 5000 ft. msl.

11
12 **PART 2 - PRODUCTS**

13
14 All materials, products, and equipment shall be purchased or manufactured as specified in
15 this section. Ductwork products shall be in accordance with SMACNA Round Duct
16 Construction Standards and the International Mechanical Code.

17
18 Ductwork size, location, and permissible fitting configurations are shown on the subcontract
19 drawings.

20
21 **MANUFACTURERS:**

22
23 Firms regularly engaged in manufacture of heating and ventilation systems of types and sizes
24 required and whose products have been in satisfactory use in similar service. Equipment shall
25 be as specified herein and as shown on Subcontract drawings.

26
27 **FIRE SCREEN:**

28
29 Fire screen shall be stainless steel, with mesh of 8 to 16 openings per inch.

30
31 **DUCTWORK:**

32
33 All duct material shall be in accordance with this specification and the SMACNA Round
34 Duct Construction Standards, for the pressure classification shown on the subcontract
35 drawings. Duct pressure classifications shall be as defined in the SMACNA "HVAC Duct
36 Construction Standards." Unless otherwise shown on the subcontract drawings, material
37 gage, duct reinforcing, and connections shall be in accordance with the SMACNA Round
38 Duct Construction Standards for the given pressure classification. The abrasive particulate
39 classification for the duct system is Class 1. Specific weight of particulate to be conveyed in
40 the duct system is 0 lb/cubic ft.

41
42 **SST Duct Materials:** Duct material for SST designated systems shall be 304L stainless steel
43 in accordance with ASTM A240.

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1 DUCTWORK HANGERS AND SUPPORTS:

2
3 Ductwork supports for this system are shown on the subcontract drawings.

4
5 Flex Connections: Where shown on the subcontract drawings to prevent vibration
6 transmission and absorb expansion, flexible connections shall be installed. Flex connection
7 shall be rated for the pressure classification of the duct system. Flexible element shall be 1/8
8 in. neoprene/polyester material rated for up to 250°F. Connection shall be capable of
9 allowing 1 in. axial compression, 1/2 in. axial extension, and 3/4 in. lateral offset.

10
11 EQUIPMENT:

12
13 Pressure Relief Damper: The RCS pressure relief damper shall be heavy duty round
14 industrial control damper, flanged frame, butterfly type, painted steel frame, EPDM blade
15 seal, external bronze axle bearings, O-ring axle shaft seal, 120 volt electric actuator,
16 Greenheck Model HCDR-351. Damper actuator shall hold damper in a normally closed
17 position, with a fail open upon loss of electrical power. Damper shall open within two
18 seconds of loss of power utilizing a spring return with motor disengaged. Closing of damper
19 shall be by actuator motor. Actuator shall be Surepower 49 Type SR. Submit O&M manuals,
20 spare parts list, product data and wiring diagrams.

21
22 GOVERNMENT FURNISHED EQUIPMENT (GFE):

23
24 G-Series HEPA Filter Housings: G-Series HEPA Filter Housings are GFE.

25
26 BF Series Filter Housings: BF Series filter housings are GFE.

27
28 HEPA Filters: All HEPA filters are GFE.

29
30 Main Filter Bank Moisture Separator: The moisture separator element is GFE.

31
32 Main Filter Bank Pre-Filters: The main filter bank pre-filters are GFE.

33
34 Main Filter Bank Heater Section: The main filter bank heater section is GFE.

35
36 Main Filter Bank DOP Test Sections: The main filter bank DOP test sections are GFE.

37
38 Low Leakage Isolation Dampers: Low leakage isolation dampers are GFE.

39
40 Bubble Tight Isolation Dampers: Bubble tight isolation dampers are GFE.

41
42

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1 PART 3 - EXECUTION

2
3 FABRICATION AND INSTALLATION OF DUCTWORK:

4
5 Assemble and install ductwork in accordance with recognized industry practices, which will
6 achieve air tight and noiseless systems capable of performing each indicated service. Install
7 each run with a minimum of joints. Align ductwork accurately at connections. Coordinate
8 duct installation with installation of equipment, controls, and other associated work of the
9 ductwork system. Installation shall be in accordance with SMACNA Round Duct
10 Construction Standards and the International Mechanical Code.

11
12 All ductwork welding shall be in accordance with the welding section of this specification.

13
14 Ductwork shall be arranged and spaced to clear structural framing and the work of other
15 trades. Piping or other interferences shall not pass through ducts.

16
17 Access panels shall be installed where shown on the subcontract drawings. Access panels
18 shall be in accordance with SMACNA "HVAC Duct Construction Standards."

19
20 Ductwork connections shall be in accordance with SMACNA Round Industrial Duct
21 Construction Standard. Ductwork connections for CS and SST designated duct systems shall
22 be butt-welded or groove-welded except at equipment connections or where flanges are
23 shown on the subcontract drawings or where ductwork connects to equipment. All equipment
24 connections shall be flanged. Gasket material for flanged connections shall be 1/8 in.
25 neoprene.

26
27 Duct Gage, Supporting, and Reinforcing: Duct gage, supporting, and reinforcing shall be as
28 shown on the subcontract drawings.

29
30 Equipment Installation: Equipment installation shall be in accordance with SMACNA
31 "HVAC Duct Construction Standards" and the manufacturer's recommendations.

32
33 CLEANING AND PROTECTION:

34
35 Clean Ductwork Internally: Clean ductwork internally, unit by unit as it is installed. Clean
36 external surfaces of foreign substances, which might cause corrosive deterioration of the
37 metal. Where air distribution accessories and ductwork are to be painted, clean surfaces of
38 foreign substances, which might interfere with painting or cause paint deterioration.

39
40 Temporary Closure: At ends of ducts, which are not connected to equipment or air
41 distribution devices at the time of ductwork installation, provide temporary closure of
42 polyethylene film or other covering which will prevent the entrance of dust and debris until
43 the time connections are to be completed.

44

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1 INSTALLATION/APPLICATION/ERECTION:
2

3 Setting: All equipment shall be installed in conformance with the manufacturer's
4 recommendations and set in proper alignment. Each item shall be leveled and adjusted for
5 proper height by means of leveling bolts, plates, and/or shims. Equipment supports shall be
6 independent of associated piping, component brackets, and supports or other similar
7 attachments.
8

9 Protective Coatings: After completion of the installations and before testing or initial
10 operation of the equipment all special protective temporary coatings, covers, etc., which were
11 applied for protection during shipment and storage, and which did not require removal for
12 assembly and/or installation shall be removed.
13

14 Alignment: All new rotating equipment shall be aligned and balanced in accordance with the
15 recommendations of the manufacturer of the equipment. The alignment of all mechanical
16 drives shall be checked and demonstrated to be within the manufacturer's recommended
17 tolerances. The Subcontractor shall arrange with the manufacturer for correcting defective
18 alignments, if any, and shall follow recommendations of manufacturer for correction.
19

20 FIELD QUALITY CONTROL:
21

22 Contractor Supplied Testing: the Contractor will perform no testing.
23

24 Subcontractor Supplied Testing: The Subcontractor shall perform construction component
25 testing to verify proper operation of all systems and components installed under this section.
26 A written test procedure shall be submitted prior to testing. Test reports detailing all testing
27 shall be submitted after testing.
28

29 The Subcontractor shall also engage an agent or firm that is qualified to perform Testing,
30 Adjusting, and Balancing (TAB) on the completed HVAC system. See Testing, Adjusting
31 and Balancing Section of this specification.
32

33 Joints and seam shall be tested in accordance with the requirements of the welding section of
34 this specification.
35

36 Subcontractor Inspection: The work shall be inspected and tested by the Subcontractor to
37 verify compliance with the Subcontract drawings and specifications.
38

39 Contractor Surveillance: Surveillance will be performed by the Contractor to verify
40 compliance of the work to the Subcontract drawings and specifications.
41

42 END SECTION 15801

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1 SECTION 15980 - TESTING, ADJUSTING, AND BALANCING - (TAB)

2
3 PART 1 - GENERAL

4
5 SUMMARY:

6
7 The Subcontractor shall furnish and install all equipment, materials, supplies and perform all
8 work and operations necessary to test the installation of the Heating and Cooling System,
9 Ventilation Fans, Blowers, and the Air distribution system as specified herein.

10
11 Section Includes, but is not limited to:

12
13 Testing, adjusting, and balancing of the ventilation systems to produce design objectives,
14 including the following:

- 15
16 1. Balance and adjusting complete ventilation systems to provide indicated flow
17 quantities and indicated pressures.
18 2. Measuring electrical performance of heating and ventilation equipment.
19 3. Setting quantitative performance of ventilation equipment.
20 4. Verifying that automatic control devices are functioning properly.
21 5. Measuring sound and vibration.
22 6. Reporting results of the TAB procedures and TAB activities.

23
24 RELATED SECTIONS:

25
26 Section 15800 Heating and Ventilation Systems.
27 Section 15801 Safety Significant Ventilation Systems.

28
29 Special testing and adjusting requirements unique to particular systems and equipment are
30 included in the Sections that specify those systems and equipment.

31
32 REFERENCES:

33
34 The following documents, including other referenced therein, form part of this Section to the
35 extent designated herein.

36
37 AMERICAN SOCIETY OF HEATING, REFRIGERATING AND
38 AIR-CONDITIONING ENGINEERS, INC. (ASHRAE)

39
40 ASHRAE 1995 HVAC Applications Chapter 34 Testing, Adjusting, and
41 Balancing
42
43

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1 ASSOCIATED AIR BALANCE COUNCIL (AABC)

2
3 AABC National Standards (Latest Edition)
4 AABC Test and Balance Procedures (Latest Edition)

5
6 NATIONAL ENVIRONMENTAL BALANCING BUREAU (NEBB)

7
8 NEBB Procedural Standards for Testing, Adjusting, Balancing
9 of Environmental Systems (Latest Edition)
10 NEBB Procedural Standards for the Measurement and
11 Assessment of Sound and Vibration (Latest Edition)

12
13 SHEET METAL AND AIR CONDITIONING CONTRACTORS
14 NATIOAL ASSOCIATION, INC. (SMACNA)

15
16 HVAC Systems Testing, Adjusting and Balancing (Latest Edition)

17
18 SYSTEM DESCRIPTION:

19
20 The systems included herein are as follows:

- 21
- 22 1. WES Inlet Air System is a static system, static meaning no fan is included in this
23 system, allowing air to enter the WES. The system consists of an inlet air penthouse
24 furnished and installed by the WES manufacturer. Air is drawn through the inlet air
25 penthouse into the inlet air duct. WES static pressure is maintained negative with
26 respect to the outside atmosphere by using the inlet air counterbalanced backdraft
27 damper. The air is then filtered and released into the WES.
 - 28 2. WES Heating Systems consist of unit heaters located around the perimeter of the
29 WES, and radiant heaters located over work areas or other strategic locations. Control
30 of the heaters is by integral thermostats. The unit heater fans are to operate
31 continuously.
 - 32 3. Personnel Monitoring Room Inlet Air System is a static system consisting of an inlet
33 air transfer grille in the wall of the personnel monitoring room.
 - 34 4. Personnel Access Room Inlet Air System is a static system consisting of a
35 counterbalanced backdraft damper located in the wall between the personnel access
36 room and the personnel monitoring room. This damper maintains the personnel
37 access room at a constant negative pressure with respect to the personnel monitoring
38 room.
 - 39 5. The Transfer Vestibule Supply Air System is a fan-powered system, consisting of
40 supply air ductwork, a supply air fan with integral filter, and a manual balancing
41 damper. This system supplies fresh air to the transfer vestibule.
 - 42 6. The Transfer Vestibule Exhaust Air System is a static system consisting of a
43 counterbalanced backdraft damper located in the wall between the transfer vestibule

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- 1 and the WES. This damper maintains the transfer vestibule at a constant positive
2 pressure with respect to the WES.
- 3 7. The PGS Inlet Air System is a static system consisting of an inlet air HEPA filter, a
4 balancing/isolation damper, and ductwork connecting to each PGS. This system
5 provides a confinement boundary by filtering all inlet air to each PGS.
- 6 8. The RCS Inlet Air System from the Personnel Access Room is a static system
7 consisting of an inlet air HEPA filter, a balancing/isolation damper, and ductwork
8 connecting to the RCS. This system provides a confinement boundary by filtering all
9 inlet air from the personnel access room to the RCS.
- 10 9. The RCS Inlet Air System from the WES is a static system consisting of an inlet air
11 HEPA filter bank, balancing/isolation dampers, and ductwork connecting to the RCS.
12 This system provides a confinement boundary by filtering all inlet air from the WES
13 to the RCS.
- 14 10. The RCS Inlet Air System from the PGS Drumout Station Tent is a static system
15 consisting of an inlet air HEPA filter, balancing/isolation dampers, and ductwork
16 from the PGS Drumout Station Tent to the filter, and from the filter to the RCS. This
17 system provides a confinement boundary by filtering all air transferred from the tent
18 to the RCS.
- 19 11. The RCS Exhaust Air System consists of ductwork, balancing/isolation dampers, and
20 the main exhaust filter bank. The system ductwork extends from the RCS wall to the
21 main exhaust filter bank, from the main exhaust filter bank to the exhaust fans, and
22 from the exhaust fans to the exhaust stack. This system provides a confinement
23 boundary by filtering all exhaust air from the RCS prior to exhausting through the
24 exhaust stack.
- 25 12. The Main Exhaust Fan provides exhaust ventilation for the facility. This fan is
26 operated with a variable frequency controller, which modulates the fan speed to
27 maintain a constant vacuum pressure within the RCS.
- 28 13. The Back-up Exhaust Fan provides exhaust ventilation for the facility in the event of
29 a loss of normal electrical power or main exhaust fan malfunction. This fan operates
30 at the design speed to exhaust approximately ½ of the normal airflow, with no speed
31 control or adjustments. Operation of this fan is by manual start/stop switch, and will
32 require manual opening and closing of fan isolation dampers.
- 33 14. The Pressure and Flow Measuring Systems provide local and remote readout for
34 pressures and flows at various locations throughout the facility.

35
36 **SUBMITTALS:**

37
38 Submittals include, but are not limited to the following:

39
40 **Personnel Qualifications:** Prior to testing submit evidence that the testing, adjusting, and
41 balancing Agent and this Project's testing, adjusting, and balancing team members meet the
42 qualifications specified in the "Quality Control" Article below.

43

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1 Test Procedures: Prior to testing submit the testing, adjusting, and balancing strategies and
2 step-by-step procedures for approval. Include a complete set of report forms intended for use
3 on this Project.

4
5 Certified Testing, Adjusting, and Balancing Reports: Submit reports prepared, as specified in
6 this Section, on approved forms certified by the testing, adjusting, and balancing Engineer.

7
8 Instrument Calibration Reports: Submit calibration information on each instrument that will
9 be used on the project. Calibration standards shall be traceable to NIST. For instrument
10 calibration, include the following:

11
12 Report Data: Include the following:

- 13
14 1. Instrument type and make.
15 2. Serial number.
16 3. Application.
17 4. Dates of use.
18 5. Dates of calibration.
19 6. Agency performing calibration.

20 See Section 01300, Submittals and the Vendor Data Schedule for additional submittal
21 requirements.

22
23 QUALITY CONTROL:

24
25 Heating and Ventilation System Testing: The heating and ventilation systems shall be made
26 operational and tested by a firm with testing, adjusting, and balancing certification by either
27 AABC or NEBB. The firm shall have experience with testing and balancing requirements
28 similar to those required for this project, and who is not the installer of the systems to be
29 tested and is otherwise independent of the project. The test, adjust, and balance firm shall
30 employ a Professional Engineer (PE) with current licensure in the State of Idaho for
31 supervision of the Test, Adjust, and Balancing. The systems shall operate as delineated in the
32 Sequence of Operation and be balanced to airflows listed and shown on the sub-contract
33 drawings and in these specifications.

34
35 Certification of Testing, Adjusting, and Balancing Reports: Certify the testing, adjusting, and
36 balancing field data reports. This certification includes the following:

- 37
38 1. Review field data reports to validate accuracy of data and to prepare certified testing,
39 adjusting, and balancing reports.
40 2. Certify that the testing, adjusting, and balancing team complied with the approved
41 testing, adjusting, and balancing plan and the procedures specified and referenced in
42 this Specification.

43 The Testing, Adjusting, and Balancing Reports shall be in one of the following forms:

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43

1. Testing, Adjusting, and Balancing Reports: Use standard forms from AABC's "Test and Balance Procedures", latest edition.
2. Testing, Adjusting, and Balancing Reports: Use standard forms from NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems", latest edition.
4. Testing, Adjusting, and Balancing Reports: Use standard forms from SMACNA's "HVAC Systems--Testing, Adjusting, and Balancing", latest edition.

Instrumentation Type, Quantity, and Accuracy: As described in AABC latest National Standards; NEBB's latest "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems," Section II, "Required Instrumentation for NEBB Certification"; or calibrate instruments at least every 6 months or more frequently if required by the instrument manufacturer.

SITE CONDITIONS:

Testing, adjusting, and balancing shall not proceed until items to be tested are completed and operable to the sequence of operation as delineated on the subcontract drawings. The TAB Subcontractor shall ensure that there is no latent residual work still to be completed.

WARRANTY:

Guarantee: Provide a National Project Performance Guarantee on AABC'S "National Standards" forms or a Special Guarantee on NEBB forms stating that AABC/NEBB will assist in completing the requirements of the Subcontract Documents if the testing, adjusting, and balancing Firm fails to comply with the Subcontract Documents. Guarantee includes the following provisions:

1. The certified Firm has tested and balanced systems according to the Subcontract Documents.
2. Systems are balanced to optimum performance capabilities within design and installation limits.

PART 2 – PRODUCTS:

N/A

PART 3 - EXECUTION:

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1 EXAMINATION:

2
3 Examine Subcontract Documents to become familiar with project requirements and to
4 discover conditions in systems' designs that may preclude proper testing, adjusting, and
5 balancing of systems and equipment.

6 Examine approved submittal data of heating and ventilation systems and equipment.
7

8 Examine system and equipment installations to verify that they are complete and that testing,
9 cleaning, adjusting, and commissioning specified in individual Specification Sections have
10 been performed.

11
12 Examine heating and ventilation systems and equipment installations to verify that indicated
13 balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices,
14 balancing valves and fittings, and manual volume dampers, are properly installed, and their
15 locations are accessible and appropriate for effective balancing and for efficient system and
16 equipment operation.

17
18 Examine manual damper open/closed labeled positions are correct and marked or labeled if
19 not readily observable.
20

21 Examine systems for functional deficiencies that cannot be corrected by adjusting and
22 balancing.
23

24 Examine air-handling equipment to ensure clean filters have been installed, bearings are
25 greased, belts are aligned and tight, and equipment with functioning controls is ready for
26 operation.
27

28 Examine equipment for installation and for properly operating safety interlocks and controls.
29

30 Report deficiencies discovered before and during performance of testing, adjusting, and
31 balancing procedures to the Contractor.
32

33 TEST PREPARATION:

34
35 Prepare the testing, adjusting, and balancing plan that includes strategies and step-by-step
36 procedures.
37

38 Submit test procedures and instrumentation calibration reports prior to testing.
39

40
41 Complete system readiness checks and prepare system readiness reports. Verify the
42 following:
43

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- 1 1. Permanent electrical power wiring is complete.
- 2 2. Automatic temperature-control systems are operational.
- 3 3. Equipment and duct access doors are securely closed.
- 4 4. Isolating and balancing dampers are open and controls are operational.
- 5 5. Fan shivs are appropriate size and fan overspeed protection is appropriate.

6
7 Doors are closed so design conditions for system operations can be met.

8
9 FIELD QUALITY CONTROL:

10
11 Site Tests: The Subcontractor or his agents shall perform the following tests:

12
13 Perform testing and balancing procedures on each system according to the procedures
14 contained in AABC National Standards and Test and Balance Procedures, procedures
15 contained in NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of
16 Environmental Systems", or procedures contained in SMACNA's "HVAC Systems--Testing,
17 Adjusting, and Balancing" and this Section.

18
19 Set heating and ventilation system airflow rates within the following tolerances:

- 20
- 21 1. Supply and Exhaust Fans: 0 percent to plus 5 percent.
- 22 2. WES Inlet Air System: No tolerance.
- 23 3. PGS Inlet Air System: 0 percent to plus 5 percent.
- 24 4. PGS Drumout Station Tent Inlet Air System: 0 percent to plus 5 percent.
- 25 5. RCS Inlet from PGS Drumout Station Tent: 0 percent to plus 5 percent.
- 26 6. RCS Inlet from WES: 0 percent to plus 5 percent.
- 27 7. RCS Inlet from Personnel Access Room: 0 percent to plus 5 percent.

28
29 Do not cut holes in stainless steel ductwork, gloveboxes, RCS, or other structures within the
30 facility. Utilize existing probe holes and openings as appropriate. Holes may be cut in carbon
31 steel ductwork as needed for testing probes. After testing and balancing, close probe holes
32 and patch with standard plastic plugs.

33
34 Mark equipment settings with paint or other suitable, permanent identification material,
35 including damper-control positions, valve indicators, and similar controls and devices, to
36 show final settings.

37
38 Submit test reports after test completion.

39
40 Contractor Surveillance: Surveillance shall be performed by the Contractor to verify
41 compliance of the work to the subcontract drawings and specifications.

42

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1 Subcontractor Inspection: The work shall be inspected and tested by the Subcontractor to
2 verify compliance with the subcontract drawings and specifications.

3

4 END OF SECTION 15980