**DOCUMENT RELEASE AND CHANGE FORM**

Prepared For the U.S. Department of Energy, Assistant Secretary for Environmental Management
By Washington River Protection Solutions, LLC., PO Box 850, Richland, WA 99352
Contractor For U.S. Department of Energy, Office of River Protection, under Contract DE-AC27-08FR14800

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   - ☒ No

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<td>11/27/2017</td>
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8. **Description of Change and Justification**

   - Section 4.2.1, reduced length tolerance of flexible jumpers to 1 inch to ensure sufficient drainage.
   - Section 4.2.3, added requirement to check jig settings after jumper fabrication.
   - Section 4.3.2, added requirements for weld examination lot size and weld selection for volumetric examination.
   - Section 4.7.2, changed acceptance of leakage of PBM valves to ≤ 0.4 mL/min.
   - Section 4.9, updated identification requirements to include equipment identification number (EIN) rather than ‘location number’ in order to reflect current process.

   For the purpose of meeting ignition source control requirements, added Section 4.7.4 to provide methods and requirements for valve resistance testing.

9. **TBDs or Holds**

   - ☒ N/A

10. **Related Structures, Systems, and Components**

   - Related Building/Facilities: ☐ N/A
   - Related Systems: ☒ N/A
   - Related Equipment ID Nos. (EIN): ☒ N/A

11. **Impacted Documents – Engineering**

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12. **Impacted Documents (Outside SPF):**

   N/A

13. **Related Documents**

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<td>DETAILS- 2&quot; CONNECTOR INSTALLATION</td>
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14. **Distribution**

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Jumper Fabrication and Testing Specification for Tank Farms

Prepared by
Glen E. Goessmann
Washington River Protection Solutions, LLC

Date Published
December 2017

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Office of River Protection

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Approved for Public Release;
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1.0 SCOPE

1.1. This specification establishes the requirements for fabrication, assembly, painting, identification, testing, inspection, and delivery of flexible and rigid jumpers for Tank Farms pit use. Additional information concerning jumper design, fabrication and testing will be found in TFC-ENG-STD-22, “Piping, Jumpers, and Valves.”

1.2. This specification does not provide design requirements. Design modifications shall have engineering approval by WRPS Engineering prior to implementation. For jumper design guidance, see Hanford document SD-RE-DGS-002, Jumper Design Standard.

1.3. The drawings and this specification are the primary documents on which shop fabrication of jumpers depends. If this specification conflicts with the drawings, the drawings shall take precedence.

1.4. Jumpers are remotely removable sections of piping that serve to connect permanent pit wall connections to removable components, or are used between adjacent components or between permanent pit wall connections. The attachment points are generally PUREX-type nozzles which mate with the PUREX-type remote connectors on the ends of the jumper (See Figure 1). Connections are sealed by use of a remotely operated impact wrench.

2.0 JUMPER FUNCTION AND TYPES

2.1 Jumper Function

2.1.1. Process jumpers are jumpers that transfer process liquids through pump and valve pits in the routing of waste between underground waste storage tanks or between underground waste storage tanks and processing facilities.

2.1.2. Electrical jumpers are to supply power to pumps and instrumentation in the 242-A Evaporator.

2.2 Jumper Types

2.2.1. Rigid Jumpers are constructed from pipe with remote connectors on each end. Rigid jumpers may contain valves, flowmeters, and other instrumentation and may be braced with structural members called dunnage. Rigid jumpers are designed to fit a specific location/configuration.

2.2.2. Flexible Jumpers are constructed from armor-braided, corrugated metal hose with remote process connectors on each end and should only bend in one plane. Flexible jumpers are
generally two-way jumpers and do not contain valves or instrumentation. The flexible corrugated metal hose section allows for thermal expansion and provides isolation for vibration and/or seismic movement.

2.2.3. Hybrid rigid-flex jumpers are constructed from a combination of pipe and flexible metal braided hose. They may contain valves, flowmeters, and other instrumentation, and may be braced with structural members. Hybrid rigid-flex jumpers provide the best features of both rigid jumpers and flexible jumpers.

3.0 REFERENCES

3.1 The following documents form a part of this Specification to the extent designated, except as modified by the requirements specified herein. If the code of record specifies a different code year or revision, it supersedes the code year or revisions below.


4.0 FABRICATION AND TESTING

4.1 Materials

4.1.1 PUREX-type Remote Connectors: Connector blocks are ASTM A276, Type 304L stainless steel. (ASTM - American Society for Testing and Materials).

4.1.2 Tools marked for stainless steel shall be used on stainless steel only. Tools previously used on carbon steel shall not be used on stainless steel. Areas on the stainless steel pipe that show signs of inadvertent contact with carbon steel (rust marks or streaks) shall be cleaned.

4.1.3 Materials, or WRPS Engineering approved equals, shall be as specified on the jumper drawings. Material certification requirements are imposed on the drawings or in paragraph 5.2 of this specification. The following is a list of materials used in this specification that are not specified on the jumper drawings. Substitutions shall be approved by WRPS Engineering.

<table>
<thead>
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<th>Description</th>
<th>Source(s)</th>
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<tbody>
<tr>
<td>Molybdenum disulfide (lubricant)</td>
<td>Techni-Chem Corporation</td>
</tr>
<tr>
<td>Blue Goop (lubricant)</td>
<td>Swagelock Company</td>
</tr>
<tr>
<td>Anti-Seize Compound (lubricant) - nuclear grade</td>
<td>Bostik-Findley, Never-Seez</td>
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4.2 Tolerances, Finishes, Positioning, and Bends

4.2.1 Tolerances

4.2.1.1 “Critical Dimensions,” as identified on the drawings or procurement documentation, are those that locate connectors and nozzles to a close tolerance to ensure proper jumper fit. Quality Control shall verify critical dimensions. Unless otherwise specified on the jumper drawing, critical dimensions shall have a tolerance of:

\[ \pm \frac{1}{16} \text{ inch} \]

4.2.1.2 Flexible jumpers shall have an overall length tolerance of \( \pm 1 \) inch, unless otherwise specified on the jumper drawing or procurement documentation.

4.2.1.3 Tolerances for fabrication of individual jumper parts for rigid and hybrid rigid-flex jumpers, (parts dimensioned in the parts list or detailed individually in the drawing), except gussets, shall be as follows:
4.2.1.4 Unless otherwise specified, the tolerances for the cutting of jumper structural shapes (dunnage) and gussets shall be as follows:

- **Linear:** ± ⅛ inch
- **Angles:** ± 2°

4.2.1.5 Unless specified on the drawings, Quality Control verification of dimensions for items listed in paragraphs 4.2.1.3 and 4.2.1.4 are not required.

### 4.2.2 Finishes

4.2.2.1 Remove burrs and break all sharp edges.

### 4.2.3 Positioning

4.2.3.1 Locate jumper components and dunnage envelope within ± ½ inch of the nominal design jumper dimensions unless otherwise specified on jumper drawing.

4.2.3.2 Unless toleranced otherwise, angles that locate parts less than 3 feet apart shall have a tolerance of ± 2°. Angles locating parts 3 feet or more apart shall have a tolerance of ± 1°.

4.2.3.3 Valve Ball Orientation Verification: Prior to installing 3-way valves in the jumper, scribe marks shall be made on the top of the valve stem to indicate the position of the ball ports. Quality Control shall verify that the port orientation of the ball is in accordance with the drawings. Document results.

4.2.3.4 Alignment: Distortion or cold springing of piping/tubing to bring it into alignment for joint assembly is prohibited.

4.2.3.5 PUREX connector gasket retainer, H-2-32421, Details, 2" Connector Installation, utilized in a 2-inch horizontal connector assembly shall be modified in accordance with Appendix A to ensure necessary clearance from the nozzle sealing surface during jumper installation.

4.2.3.6 For rigid and hybrid rigid-flex jumpers where a jig is used, jig inspection shall determine whether the critical dimensions for the jumper have been met per the drawing, and if the jumper, as designed, can be handled properly. The jig setting shall be examined and approved by Quality Control. The methods of inspection are:

a. Before fabrication, verify jig settings to determine if critical jumper dimensions are correct.
b. After fabrication, verify jig settings to determine if critical jumper dimensions are correct.

c. After fabrication, verify the jumper can be removed and reinstalled into the jig without binding.

Use of alternative methods for positioning connectors and nozzles to meet critical dimensions without the use of a jig shall be approved by WRPS Engineering.

4.2.4 Bends

4.2.4.1 Pipe and tubing formed by bending shall meet the quality and minimum wall thickness requirements specified by ASME B31.3, subparagraph 304.2 and paragraph 332.

4.2.4.2 Rigid pipe bends shall have a minimum radius of five times the nominal pipe diameter.

4.3 Welding, Welding Examination, and Weld Identification

4.3.1 Welding

4.3.1.1 Piping/tubing containment welds and attachments thereto shall be welded in accordance with ASME B31.3 for normal service.

4.3.1.2 Steel support dunnage members, lifting bails and their attachment welds shall be welded in accordance with AWS D1.1 or AWS D1.6 for statically loaded structures, as applicable.

4.3.1.3 Welding of dissimilar materials (stainless steel to carbon steel and vice versa) shall be based on the code used to fabricate the major portion of structural sections.

4.3.1.4 Welding shall be performed as noted on the design drawings using qualified procedures and welders.

4.3.1.5 Use of backing rings is not permitted.

4.3.1.6 For weld end valves, the valve’s temperature sensitive components (seats, etc) shall be removed from the valve body prior to welding to the pipe in accordance with the valve manufacturer’s instructions, unless specifically approved by the valve manufacturer. After welding is completed, reassemble valves in accordance with the manufacturer’s instructions.
4.3.2 Welding Examination

4.3.2.1 Piping and tubing containment welds, joints, and attachments thereto shall be examined in accordance with ASME B31.3, paragraph 341.4.1 for normal service. Each jumper shall be considered as a lot for the purposes of examination; weld selection for volumetric examination [radiographic test (RT) or ultrasonic test (UT)] shall be performed by the Buyer. Volumetric examination of welds where specified by ASME B31.3 shall be performed where possible (i.e., in-process examination shall not be specified). The cases where volumetric examination is not possible (e.g., orientation of the weld), the subject welds shall have documented in-process examination in accordance with ASME B31.3, paragraph 344.7 with liquid penetrant or magnetic particle examination specified for the root pass [see paragraph 344.7.1(e)] and will be identified as such on the fabrication drawings. The determination of whether a volumetric inspection is possible shall be made by the WRPS welding SME or WRPS NDE SME as defined by the Engineering Programs manager for each in-process examination, unless already identified on an approved fabrication drawing. Individual items described in paragraph 344.7.1 shall be documented (e.g., checklist format) for each in-process examination. The in-process examinations shall not be used to meet the required representation of the welder’s or the welding operator’s work unless necessary to meet the required representation of work.

4.3.2.2 Steel support dunnage structure welds, lifting bails and their attachment welds shall be examined in accordance with AWS D1.1 for carbon steel materials or AWS D1.6 for stainless steel. The final weld pass on the bail assembly attachment welds to dunnage or pipe shall be liquid penetrant examined in accordance with AWS D1.1 or AWS D1.6 as applicable.

4.3.3 Weld Identification

4.3.3.1 Prepare weld identification drawings (weld maps) or mark up existing drawings to show relative positions of pressure retaining welds and attachment welds to pressure retaining components.

4.3.3.2 Assign weld numbers to piping/component weld joints and attachment welds to pressure retaining components. Record weld numbers and welder ID on weld identification drawings (weld maps) as welds are made.

4.3.3.3 Do not reuse weld numbers. If a weld is completely replaced, assign a new number.
4.4 Electrical Requirements

4.4.1 Electrical wiring shall be installed in accordance with the electrical diagram provided on the drawings. Locate and run electrical conduit as close as possible to the dunnage configuration, and in a position protected from damage during handling and installation.

4.4.2 Caution shall be used during the installation of cable or wire to avoid scuffing or cutting of insulation.

4.4.3 Assemble threaded connections on electrical conduit and then seal them against moisture penetration with insulating enamel, “Glyptal 1201” (if required on the drawing) or an equal approved by WRPS Engineering.

4.4.4 Substitution of cable or wire shall have prior approval of WRPS Engineering.

4.5 Threaded and Flanged Joints for Process Jumpers

4.5.1 Threaded joints shall be assembled in accordance with the requirements of ASME B31.3, paragraph 335.

4.5.2 Flanged joints shall be assembled in accordance with the requirements of ASME B31.3, paragraph 335 and PCC-1.

4.5.3 Threaded pipe joints shall be sealed or lubricated with the thread sealants or joint compounds shown in paragraph 4.1.3.

4.5.4 Lubricate PUREX-type remote connector tie rods and operating screw threads. See paragraph 4.1.3 for lubricants.

4.5.5 Connector tie rods shall be safety wired in pairs using the double twist method as described in Appendix B.

4.5.6 Flange bolts and studs shall be torqued in accordance with the design drawing, gasket manufacturer’s recommendations, and ASME PCC-1, Guidelines for Pressure Boundary Bolted Flange Joint Assembly.

4.6 Balance Requirements

4.6.1 Balancing is performed on rigid and hybrid rigid-flex jumpers to locate a point at which to attach a single bail for remote handling of jumpers. Jumpers with more than one lifting bail do not need balancing.

4.6.2 The figure below illustrates the general rule for balancing jumpers having one horizontal and one vertical connector and no dip tubes or entry stubs:
4.6.3 On jumpers with either a horizontal or a vertical leg of 5 ft or more:

Distance “X” or “Y” = 2 inches maximum for longest leg.

4.6.4 On shorter jumpers where neither leg exceeds 5 ft:

Angle “a” or “b” = ± 3° maximum.

If above dimensions for “X” and “Y” or angles “a” and “b” are exceeded, notify WRPS Engineering.

4.6.5 Balance the following jumpers so that all connectors or flanges mate at the same time [“X” and “Y” above = -½ inch to +½ inch]:

Jumpers having two or more horizontal connectors.
Jumpers having two or more vertical connectors.
Jumpers having dip tubes in excess of 12 inches in length.

4.6.6 Balance rigid jumpers that do not fit into any of the definitions above by instructions on the engineering drawing.

4.7 Testing

4.7.1 Hydrostatic Pressure Testing

4.7.1.1 Hydrostatic pressure testing of process jumpers shall be performed using the Supplier’s hydrostatic test procedure, which shall comply with ASME B31.3, Section 345.
4.7.1.2 Test pressures will be identified on the jumper drawings or the procurement documentation.

4.7.1.3 Quality Control shall witness the test to verify that the leak test meets the requirements of this specification. Results of the hydrostatic test shall be documented in a test report.

4.7.1.4 Isolate or remove special equipment or components, such as pressure transducers, that cannot withstand the hydrotest pressure.

4.7.1.5 Measuring instrumentation used in the test (e.g., pressure gauges) shall have current calibration tags. The instrument number and its calibration shall be recorded for each instrument used.

4.7.1.6 Hydrotest two-way valves in jumper assemblies with the valve open. Hydrotest three-way valves in jumper assemblies with all ports exposed to the test pressure simultaneously either by positioning the valve in a mid position or configuring the application of the test pressure through more than one leg.

4.7.1.7 24 hours following hydrostatic pressure testing, re-torque bolted/studded joint connections (e.g., flanges, valves) per design documents’ (and/or manufacturer’s) methods and values. Record final torque values.

Note: This will restore the short-term creep relaxation/embedment losses.

4.7.2 Valve Seat Leak Testing

4.7.2.1 The purpose of this test is to verify that no damage has been sustained by the valve internals during fabrication of the jumper and that valve stops and valve stem positioners are accurately set.

4.7.2.2 Seat leakage from each isolation valve shall be verified after jumper fabrication is complete and travel stops and/or closed position indication switches are set. Valves in jumper assemblies shall be tested as per TFC-ENG-STD-22. Test pressure shall be applied on the upstream side of two-way isolation valves, and as identified on the jumper drawing or procurement documents for three-way valves. During each test, verify there is no visible stem leakage. Seat leakage testing requires low pressure and high pressure tests using water. Test duration is for a minimum of five (5) minutes for each test. The low pressure seat leakage test is performed at 50 ±5 psig. The high pressure seat leakage test is performed at 400 +0/-20 psig. The acceptance test for both the low and high seat leakage test is ≤ 4 ml/min except for PBM valves to be used for double valve isolation. PBM valves, to be used for double valve isolation, are tested at the same pressures except the acceptance test leakage is ≤ 0.4 ml/min.
4.7.2.3 Quality Control shall verify that the valve funnel orientation is correct with respect to the top of the valve stem scribe marks (see 4.2.3.3). The valve handle and position indicator disc drawing shall be compared to the funnel slot/insert for the handle and verified to be consistent with the valve stem scribe marks. These verifications shall be designated as a QC Hold Point in the fabrication package. Typically, in Hanford application, three-way ball valves are not positioned to have flow through all the three open ports at the same time.

4.7.2.4 Quality Control shall witness the test to verify that the leak test meets the requirements of this specification. Results of the leak test shall be documented on a test report.

4.7.3 Electrical Testing

4.7.3.1 Instrumentation and power supply cables installed on or in jumpers shall be tested for: (1) resistance, (2) continuity, (3) open circuits, and (4) short circuits after final assembly using a multi-meter or equivalent. High voltage or high current test devices shall not be used.

4.7.3.2 Quality Control shall witness electrical testing. Results shall be documented.

4.7.4 Valve Resistance Testing

4.7.4.1 For the purpose of meeting ignition source control requirements, Quality Control shall verify that electrical continuity exists between the valve stem and the valve body when the valve stop disc is not in contact with the stop pin. If continuity does not exist, a resistance measurement shall be performed of the same configuration to verify that the electrical resistance is less than 1 Mohm. Results of the continuity/resistance test shall be documented on a test report.

4.7.5 Other Testing

Valve Breakaway Torque Test: After final assembly, measure and document the valve’s breakaway torque and verify it is within the valve manufacturer’s specifications.

4.8 Cleaning and Painting

4.8.1 After testing is completed clean the outside of the jumper and manifold to prepare for painting. Remove all carpenter’s chalk, grease, cutting oils, and rust.

4.8.2 Clean, flush, and air-dry internal components of process jumpers and manifolds. Install temporary caps/plugs to maintain cleanliness (foreign material exclusion).

4.8.3 Stainless steel components do not require painting except as needed for identification or for targeting.
4.8.4 Carbon steel dunnage and components shall be painted with either enamel, epoxy paint, or powder coating as per the design drawing and as per the coating schedule shown in Table 1. Final color shall be gray. Apply paint in accordance with manufacturer’s specifications.

**TABLE 1**

<table>
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<tr>
<th>Coat</th>
<th>Enamel</th>
<th>Epoxy</th>
<th>Powder Coating</th>
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<tr>
<td>Prime</td>
<td>1 coat: Industrial Grade Primer</td>
<td>1 coat: Amerlock 400, PSX 700, or approved substitute</td>
<td>1 coat: Thermosetting powder coating based on an epoxy resin (e.g. IFS Coatings - Zinc Rich Primer ELSS 90056 or approved substitute)</td>
</tr>
<tr>
<td>Finish</td>
<td>2 coats: Amercoat 220, PPG Pitt-Tech, or approved substitute</td>
<td>1 coat: Amerlock 400, PSX 700, or approved substitute</td>
<td>1 coat: Thermosetting polyester powder coating (e.g. IFS Coatings - RAL 7037 Dusty Grey PLSF 70184 or approved substitute)</td>
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4.8.5 Do not paint carbon steel components of PUREX-type connector assemblies, except for those items identified in paragraph 4.8.7, which are painted yellow for targeting. This painting is to assist the crane operator during jumper installation.

4.8.6 It is not mandatory to coat inaccessible areas. Some surfaces/areas of structural shapes may fall into this category. All surfaces shall be drainable when the jumper is installed.

4.8.7 Special Marking for Targeting

4.8.7.1 Paint the jumper parts listed below, in the areas specified, with enamel or epoxy paint as listed in paragraph 4.1.3. Final color shall be yellow. Apply paint in accordance with manufacturer’s specifications.

- Bails: Top 8 inches
- Kickplates: Top face (not nozzle)
- Funnel Guides: Inside Surface

4.9 **Identification**

4.9.1 Stencil identification information on rigid and hybrid rigid-flex jumpers with the same type of paint applied to the jumper. Letters and numbers shall be ¾ to 1-¾ inches high, block type, black on yellow background. Identification information should be readable from above if possible.
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Information shall be as specified by the jumper drawing and shall include drawing number, drawing revision number, weight, and (if specified) the jumper equipment identification number (EIN), which reflects the use location and connections of the assembly.

The preferred arrangement of the identification information is shown below:

<table>
<thead>
<tr>
<th>Jumper EIN</th>
<th>Drawing No.</th>
<th>Rev.</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>xxxxx-WT-x-[xxx]</td>
<td>H-14-xxxxx</td>
<td>x</td>
<td>xxxx lbs</td>
</tr>
</tbody>
</table>

An alternate arrangement may have the location number above the drawing number:

<table>
<thead>
<tr>
<th>Jumper EIN</th>
<th>Drawing No. and Revision</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>xxxxx-WT-x-[xxx]</td>
<td>H-14-xxxxx, Rev x</td>
<td>xxxx lbs</td>
</tr>
</tbody>
</table>

NOTE: The jumper EIN is taken from the drawing and indicates the jumper use location and connecting nozzles.

4.9.2 For individual component part marking and identification, as applicable, refer to Appendix C.

5.0 QUALITY ASSURANCE PROVISIONS

5.1 Quality Assurance Program

The Vendor’s Quality Assurance Program must be evaluated and approved in accordance with NQA-1 and will be specified in procurement documents.

5.2 Certified Material Test Reports

5.2.1 Certified Material Test Reports (CMTRs), certified by the responsible manufacturer of materials used in fabrication of pressure containing pipe, fittings, and flanges, shall be furnished. Reports shall present results of chemical analysis and physical tests specified in ASME, ASTM Codes or Standards, as applicable, and Standard Specifications for production lots and heats of materials. For weld filler metal, submit legible CMTRs certified by responsible manufacturer with results of chemical analysis and physical tests required for Schedule 1 level of testing in accordance with AWS 5.01.

5.2.2 Material traceability shall be maintained through fabrication for material requiring CMTRs.
5.3 Qualifications

5.3.1 Qualification of Welding Personnel: Personnel for welding pressure-retaining components shall have been qualified in accordance with ASME B31.3, paragraph 328.2 prior to the start of welding. Personnel for welding jumper lifting bails and their attachment welds and jumper support dunnage members shall have been qualified in accordance with either AWS D1.1, AWS D1.6, or ASME Section IX, as applicable, prior to the start of welding. Maintain a copy of welder performance qualification test results and renewal of qualification documentation at jobsite.

5.3.2 Qualification/Demonstration of Welding Procedures: Welding Procedure Specifications (WPSs) for welding pressure-retaining components along with attachments thereto, shall have been qualified in accordance with ASME B31.3, paragraph 328.2 prior to start of welding. WPSs for welding jumper lifting bails and their attachment welds and jumper support dunnage members shall have been qualified in accordance with either ASME Section IX, AWS D1.1, or AWS D1.6 as applicable before welding. In lieu of qualification of WPSs, Standard Welding Procedure Specifications (SWPS) developed and controlled by the American Welding Society (AWS) and accepted in Article V of ASME Section IX may be utilized within the specific limitations of 328.2.2. The AWS is considered a responsible and recognized organization and prior Inspector (ASME B31.3, Section 340) approval is not required. If utilized, SWPSs shall be demonstrated and documented in accordance with ASME B31.3 and ASME IX (QW-100.1, Article V and Appendix E). Document demonstration tests using Form QW-485 or equivalent form. SWPSs shall be demonstrated prior to the start of welding. Documentation tests are considered synonymous with qualification of a WPS in accordance with ASME Section IX, QW-100.3 and the current edition and mandatory addenda of ASME Section IX shall be used. Maintain copy of WPSs, procedure qualification records (PQRs), SWPSs, and Supporting Demonstration Records as applicable at the jobsite.

5.3.3 Qualification of Welding Examination Personnel: Supplier shall maintain copies of examination personnel certifications and written examination performance procedures at jobsite.

5.3.3.1 Personnel performing visual weld examinations shall be Certified Welding Inspectors (CWI) who have received certification in accordance with AWS QC1. Certified Associate Welding Inspectors (CAWI), certified in accordance with above standard, may perform examinations when under immediate direction of CWIs.

5.3.3.2 Personnel performing other nondestructive examinations (NDE) shall be certified in accordance with an approved procedure, which shall meet requirements of ASNT- SNT-TC-1A. Use Level II or III personnel to interpret test results.

5.3.4 Qualification of Welding Examination Procedures: Examination procedures shall be in accordance with ASME B31.3. Maintain copies of procedures at the jobsite.
6.0 RECORDS / SUBMITTALS

6.1 Submittals shall be identified by the Purchase Order number and/or Work Package number, this Specification number, Item number, and Supplier name and contact data.

6.2 With WRPS Engineering approval, items marked with an asterisk (*) need not be resubmitted to WRPS Engineering if the Supplier has recently fabricated equipment to this specification and the asterisked items have not changed.

### DOCUMENT SUBMITTALS

<table>
<thead>
<tr>
<th>Item</th>
<th>Title</th>
<th>Purpose</th>
<th>When required</th>
</tr>
</thead>
<tbody>
<tr>
<td>1*</td>
<td>[deleted]</td>
<td>[deleted]</td>
<td>[deleted]</td>
</tr>
<tr>
<td>2</td>
<td>Schedule</td>
<td>Pre-purchase Evaluation</td>
<td>With bid</td>
</tr>
<tr>
<td>3*</td>
<td>Welder Performance Qualifications</td>
<td>Approval</td>
<td>Prior to fabrication</td>
</tr>
<tr>
<td>4*</td>
<td>WPSs, PQRs, SWPSs, and SWPS Demonstration Records</td>
<td>Approval</td>
<td>Prior to fabrication</td>
</tr>
<tr>
<td>5*</td>
<td>CWI and CAWI Certifications</td>
<td>Approval</td>
<td>Prior to fabrication</td>
</tr>
<tr>
<td>6*</td>
<td>NDE Personnel Certification Records</td>
<td>Approval</td>
<td>Prior to fabrication</td>
</tr>
<tr>
<td>7</td>
<td>Fabrication, Inspection and Test Plan (ie. Shop Traveler)</td>
<td>Approval</td>
<td>Prior to fabrication</td>
</tr>
<tr>
<td>8*</td>
<td>Test Procedures</td>
<td>Approval</td>
<td>Prior to testing</td>
</tr>
<tr>
<td></td>
<td>- Hydrostatic testing</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Valve leak testing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Test Records</td>
<td>Approval</td>
<td>Prior to shipping</td>
</tr>
<tr>
<td></td>
<td>- Balancing (if required)</td>
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<td>- Hydrostatic testing</td>
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<td></td>
</tr>
<tr>
<td></td>
<td>- Valve seat leak testing</td>
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<td></td>
</tr>
<tr>
<td></td>
<td>- Electrical testing</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Valve resistance/continuity testing</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Other tests as required by drawings or procurement documentation</td>
<td></td>
<td></td>
</tr>
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<td>10</td>
<td>Inspection and Examination Records</td>
<td>Approval</td>
<td>Prior to shipping</td>
</tr>
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<td></td>
<td>- Component Identification</td>
<td></td>
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</tr>
<tr>
<td></td>
<td>- Welding</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Critical Dimensions</td>
<td></td>
<td></td>
</tr>
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<td></td>
<td>- Jig Dimensions (if used)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Random Dimensional</td>
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<td></td>
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<tr>
<td></td>
<td>- Valve ball orientation</td>
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## DOCUMENT SUBMITTALS

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<thead>
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<th>Item</th>
<th>Title</th>
<th>Purpose</th>
<th>When required</th>
</tr>
</thead>
<tbody>
<tr>
<td>11</td>
<td>Certified Material Test Reports (CMTRs)</td>
<td>Review/Information</td>
<td>Prior to shipping</td>
</tr>
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<td>12</td>
<td>Completed Fabrication, Inspection and Test Plan (i.e. Shop Traveler)</td>
<td>Review /Information</td>
<td>Prior to shipping</td>
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<td></td>
<td>*See Section 6.2</td>
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</table>

### 7.0 PREPARATION FOR DELIVERY AND STORAGE

7.1 Jumpers and pipe manifolds shall be protected or packaged for storage or transfer.

7.2 All adhesive-backed tapes are prohibited from contact with connector or nozzle mating parts.
Figure 1 - PUREX Type Remote Process Connector and Nozzle

<table>
<thead>
<tr>
<th>SIZE</th>
<th>TYPE</th>
<th>CONNECTOR BLOCK END</th>
<th>LENGTH (INCHES)</th>
<th>WEIGHT (LBS)</th>
<th>DRAWING NO.</th>
<th>WEIGHT (LBS)</th>
<th>DRAWING NO.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1 x 1</td>
<td>Connection Assembly</td>
<td>1 23/32</td>
<td>15.5</td>
<td>H-2-32410-1</td>
<td>15.5</td>
<td>H-2-32410-2</td>
</tr>
<tr>
<td>2</td>
<td>BLANK</td>
<td></td>
<td>1 23/32</td>
<td>18</td>
<td>H-2-32410-3</td>
<td>18</td>
<td>H-2-32410-4</td>
</tr>
<tr>
<td>3</td>
<td>2 x 2</td>
<td></td>
<td>2 7/16</td>
<td>20</td>
<td>H-2-32420-1</td>
<td>20</td>
<td>H-2-32420-2</td>
</tr>
<tr>
<td>4</td>
<td>2 x 1 1/2 DIP TUBE</td>
<td></td>
<td>2 7/16</td>
<td>20</td>
<td>H-2-32420-5</td>
<td>20</td>
<td>H-2-32420-5</td>
</tr>
<tr>
<td>5</td>
<td>BLANK</td>
<td></td>
<td>2 7/8</td>
<td>32</td>
<td>H-2-32420-3</td>
<td>32</td>
<td>H-2-32420-4</td>
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<td>6</td>
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<td></td>
<td>3 9/16</td>
<td>76</td>
<td>H-2-32430-1</td>
<td>76</td>
<td>H-2-32430-2</td>
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<td>7</td>
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<td></td>
<td>3 9/16</td>
<td>80</td>
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<td>80</td>
<td>H-2-32430-5</td>
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<tr>
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<td></td>
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<td>76</td>
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<td>76</td>
<td>H-2-32430-4</td>
</tr>
<tr>
<td>9</td>
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<td></td>
<td>3 9/16</td>
<td>76</td>
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<td>76</td>
<td>H-2-32430-4</td>
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<td>83</td>
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<tr>
<td>11</td>
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<td>120</td>
<td>H-2-32440-2</td>
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<td>12</td>
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<td>126</td>
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<td>13</td>
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<td>14</td>
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<td>4 5/32</td>
<td>150</td>
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<td>150</td>
<td>H-2-32440-7</td>
</tr>
</tbody>
</table>

**GENERAL NOTES:**

(UNLESS OTHERWISE SPECIFIED)

- MAXIMUM TORQUE TO APPLY FOR CLAMPING FORCE IS 500 FT-LBS.
Appendix A –

2-Inch Horizontal Gasket Retainer Modification
A1.0 SCOPE

This appendix provides requirements for gasket retainer modification for use in 2-inch horizontal PUREX connector head assemblies. Dimensions and tolerances assigned in PUREX horizontal skirt, H-2-68214 Rev. 6, 7, and 8 create an assembly configuration where the gasket retainer protrudes from the outer face of the skirt (See Figure 2). The method of installation for jumpers with horizontal connector heads provides the potential for the edge of the gasket retainer to damage the sealing surface of the nozzle. Reduction to the thickness of the gasket retainer is required to mitigate this concern.

A2.0 APPLICATION OF 2-INCH HORIZONTAL GASKET RETAINER MODIFICATION

A2.1 The requirements and modification instructions is only applicable to gasket retainers which protrude out of the 2-inch PUREX horizontal skirt (as seen in Figure 2). Protruding gasket retainers in vertical PUREX connectors do not pose a risk to the nozzle sealing surface due to the method of installation.

A3.0 MODIFICATION REQUIREMENTS

A3.1 Determining the need for modification shall be completed by fully engaging the gasket retainer into the associated 2-inch horizontal skirt with the applicable gasket installed.

A3.2 Modification to the gasket retainer is required if the outer face of the gasket retainer protrudes past the outer face of the horizontal skirt.

A3.3 Gasket retainer surface to be machined shall be that which protrudes out of the horizontal skirt after installation (See Figure 2). Note: Machining the outer surface of the gasket retainer will not modify the critical dimensions of the PUREX connector head assembly.

A3.4 Remove gasket from gasket retainer prior to modification to prevent damage to the gasket.


A3.6 2-inch horizontal PUREX connector heads which utilize modified gasket retainer H-2-32421-18, H-2-32421-19, H-2-32421-20, or H-2-32421-21, shall be individually identified on the jumper fabrication drawings. This shall provide documentation to support gasket retainer item selection for potential gasket replacement activities.
Figure 2: Configuration of Gasket Retainer Requiring Modification

- Gasket Retainer Surface to be Machined
- Horizontal Skirt
- Outer Face
Appendix B –

Basic Safety Wiring Double Twist Method
B1.0 SCOPE

This appendix provides requirements for safety wiring of threaded fasteners via the double twist method. This process of safety wiring is intended to be applied to the connector assembly for which loosening of threaded fittings is a hazard.

Safety wiring is the application of wire to fastener patterns to prevent relative movement of equipment which is subjected to loosening due to vibration, pulsation, tension, torque, etc.

B2.0 MATERIALS

The safety wire shall be per ASTM A-580, any 300 series stainless steel, condition ‘A’ wire. The wire shall be a minimum of .032 inch and a maximum of .048 inch diameter.

New safety wire shall be used upon each application (salvaging of once used safety wire is prohibited). If the wire has three or more twists undone, replace the wire completely.

B3.0 APPLICATION OF DOUBLE-TWIST SAFETY WIRING

B3.1 Parts shall be ‘A’ wired in such a manner that the safety wire shall be put in tension when the fastener tends to loosen. Care shall be exercised when installing safety wire to insure that it is tight but not overstretched.

Twisted Parts of the wire shall have a minimum of five twists per inch.

B3.2 When multiple fasteners are spaced from 4 to 6 inches apart, three fasteners shall be the maximum number in a series that can be safety wired together, with a single length of wire. For typical PUREX connector applications, 3 separate lengths of safety wire are used.

B3.3 The strands, while taut, shall be twisted until the twisted portion is just short of the nearest safety wire hole in the next fastener. The twisted portion of the safety wire shall be within ¼ inch of the hole in the next fastener. Caution shall be exercised during the twisting operation to keep the wire taut but not overstretched, or allowing it to become nicked, kinked, or otherwise mutilated. Abrasions normally caused by commercially available wire twisting pliers shall be acceptable.

B3.4 After wiring the last fastener, the wire shall be twisted to form a pigtail of three to five twists. Wire in excess of these twists shall be cut off. The pigtail shall be bent in towards the part to prevent it from becoming a snag.
B4.0 QUALITY ASSURANCE PROVISIONS

B4.1 Material and safety wiring installation shall be checked for compliance with this appendix.

B4.2 Kinks, nicks, or stress that reduces the wire diameter by more 20% shall be cause for rejection.

Figure 3 – Multiple Fastener Application Double Twist Method-Single Hole

Note: The figure shown above is for right handed thread application. Wiring for left handed threads will be opposite.
Appendix C –

Part Marking and Identification Methods
C1.0  SCOPE

This appendix provides requirements for permanent identification methods applicable to manufactured or procured parts, sub-assemblies, and assemblies.

C2.0  GENERAL REQUIREMENTS

C2.1  Cleanliness – Surfaces to be marked shall be cleaned of oil, grease, dirt, cutting oils, corrosion, or any other material that would adversely affect the application or adhesion of the marking.

C2.2  Legibility – All markings shall be clearly legible. Color markings, including black and white, shall contrast with the color or the surface to which it is applied. Freehand lettering for the purpose of temporary marking shall be in printed form.

C3.0  PERMANENT IDENTIFICATION METHODS

<table>
<thead>
<tr>
<th>Type</th>
<th>Identification Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type 1</td>
<td>Vibratory marking</td>
</tr>
<tr>
<td>Type 2</td>
<td>Die stamping</td>
</tr>
<tr>
<td>Type 3*</td>
<td>Raised marking forged or cast into surface</td>
</tr>
<tr>
<td>Type 4*</td>
<td>Recessed marking forged or cast into the surface</td>
</tr>
<tr>
<td>Type 5</td>
<td>Electrochemical etch</td>
</tr>
<tr>
<td>Type 6</td>
<td>Nameplate</td>
</tr>
<tr>
<td>Type 7</td>
<td>Self-adhesive label</td>
</tr>
<tr>
<td>Type 8</td>
<td>Painting</td>
</tr>
<tr>
<td>Type 9 (or Type G)</td>
<td>Packaging</td>
</tr>
<tr>
<td>Type 10 (or Type F)</td>
<td>Tagging</td>
</tr>
<tr>
<td></td>
<td>*Not commonly used onsite</td>
</tr>
</tbody>
</table>

C3.1  Type 1 – Vibratory Marking – Vibratory tools shall be fitted with a carbide marking point, or equivalent, and shall be adjusted to produce a shallow rounded impression 0.003 to 0.011 inch in depth. The marking tool tip minimum radius shall be 0.005 inch. The
size (height) of characters produced by vibratory marking shall be selected within the range of $\frac{1}{16}$ to $\frac{1}{2}$ inch.

C3.2 Type 2 – Die Stamping – Die stamps shall be low-stress type stamps. The minimum tip radius of the dies shall be as specified for the following character sizes:

<table>
<thead>
<tr>
<th>Character Size</th>
<th>Minimum Tip Radius</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Inch)</td>
<td>(Inch)</td>
</tr>
<tr>
<td>1/16</td>
<td>0.005</td>
</tr>
<tr>
<td>3/32</td>
<td>0.006</td>
</tr>
<tr>
<td>1/8</td>
<td>0.007</td>
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<tr>
<td>3/16</td>
<td>0.008</td>
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<td>1/4</td>
<td>0.010</td>
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<td>3/8</td>
<td>0.012</td>
</tr>
<tr>
<td>1/2</td>
<td>0.014</td>
</tr>
</tbody>
</table>

C3.2.1 Impression depth shall not exceed 0.10 inch

C3.2.2 Die stamp marking shall be applied to a flange, an integrally cast or forged boss or pad, the base or support of the item, or other visible low stress location.

C3.2.3 The material thickness of an item to be marked shall not be reduced by die stamping to less than the minimum specified on the component drawing or specification (if available).

C3.3 Type 3 and 4 – Integral Markings – Raised or recessed identification markings that are cast into the surface of the item are acceptable. Recessed markings shall not reduce the material thickness of an item to less than the minimum specified on the component drawing or specification. The size of forged or cast characters called out on the drawing/specification shall only be limited by the space available, but in no case be less than 0.09 inch in height.

C3.4 Type 5 – Electrochemical Etching – The electrolyte and neutralizer used for electrochemical etching shall be compatible with the material to be marked. The depth of etching shall be no greater than 0.5% of the material thickness or 0.003 inch, whichever is less. The size of characters produced by electrochemical etching shall be selected within the range of $\frac{1}{16}$ to $\frac{1}{2}$ inch; however, the recommended minimum size is 0.1 inch to accommodate typing applications.

C3.5 Type 6 – Nameplates – The physical requirements, (e.g., material, nameplate dimensions, character size, and arrangement) for metal and plastic nameplates shall be either detailed on the applicable drawing or specification or defined by reference to an applicable nameplate standard, specification, or drawing. The attachment method of the nameplate shall be specified as well.

C3.6 Type 7 – Self-Adhesive Labels – Self adhesive labels may be used for identification providing they meet the requirements of section C4.0. When used to mark components in systems such as piping or electrical systems or used as a regulatory marking, self-
adhesive labels shall conform to applicable government, society, or industry standards or codes.

C3.7 **Type 8 – Painting** – Paints suitable for the purpose and/or as specified shall be used to apply stenciled markings to items. Stenciled markings may be applied using a template or silkscreen the size of the stenciled characters specified on the drawings/specification shall be selected within the range of ⅓ to 3 inches. The color and type of paint to be used shall also be specified on the drawing/specification. Crafted (freehand sign painted) application of marking in lieu of stenciling, is acceptable with due consideration being given to the higher cost involved.

C3.8 **Type 9 (or Type G) – Packaging** – Identical items too small to be identified individually may be packaged in a box or bag marked with the item identification.

C3.9 **Type 10 (or Type F) – Tagging** – Items not suited for other methods of identification may be tagged. Tags and attaching material shall be compatible with the item material to the extent specified in section C4.0. For Type F only, the tag shall be removable.

C4.0 **MATERIAL COMPATIBILITY**

Materials used for marking or for removal of markings shall be physically and chemically compatible with the material to which the markings will be applied or removed.

C5.0 **QUALITY ASSURANCE PROVISIONS**

Visual Inspection – Item surfaces and markings shall be visually inspected to determine conformance with the applicable requirements specified in section C3.0 as detailed in the applicable Quality Assurance Inspection Plan.