TABLE OF CONTENTS

1.0 PURPOSE AND SCOPE .........................................................................................................................2
2.0 IMPLEMENTATION .................................................................................................................................2
3.0 STANDARD REQUIREMENTS/BASES .................................................................................................2
  3.1 Grandfathered vs. Non-Grandfathered Systems ...........................................................................2
  3.2 Waste Transfer Primary Piping ......................................................................................................3
  3.3 Valves ...............................................................................................................................................10
  3.4 Waste Transfer System Pressure Relieving Devices ..................................................................14
  3.5 Piping Design Analysis ...............................................................................................................15
4.0 DEFINITIONS .......................................................................................................................................15
5.0 SOURCES ............................................................................................................................................16
  5.1 Requirements ...............................................................................................................................16
  5.2 References .......................................................................................................................................16

TABLE OF ATTACHMENTS

ATTACHMENT A - PRE-APPROVED WELD CONFIGURATIONS FOR IN-PROCESS EXAMINATION .................................................................................................................................19
ATTACHMENT B - ENGINEERING AND CONSTRUCTION CONTROLS FOR INSTALLATION OF BURIED PIPE .................................................................................................................................21
1.0 PURPOSE AND SCOPE

This standard applies to waste transfer jumper and valve design and installations in secondary containment structures. This standard implements requirements of HNF-SD-WM-TSR-006, and RPP-13033, “Tank Farms Documented Safety Analysis,” Chapter 3, Section 3.3.2.3.2, “Defense-in-Depth,” Table 3.3.2.3.2-2, Features 12, 25 and 29, Chapter 4, Sections 4.4.1, “Waste Transfer Primary Piping Systems,” 4.4.3, “Isolation Valves for Double Valve Isolation,” and 4.4.7, “Compressed Air System Pressure Relieving Devices.” The technical basis for the requirements in this document, approved deviations, and allowed equivalencies can be found in RPP-RPT-28500, “Technical Basis for TFC-ENG-STD-22, Piping, Jumpers, and Valves.”

Waste transfer primary piping systems for emergency pumping of a double-shell tank (DST) annulus are not required to be safety significant since the piping is used for accident response and not for normal operation, and therefore, is outside of the scope of this standard. However, since emergency pumping is still transferring waste, this standard’s requirements should be used as applicable.

2.0 IMPLEMENTATION

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

Deviations to any requirements of this standard shall be requested from the standard owner. Approved deviations shall be documented in the accompanying standard basis document RPP-RPT-28500.

The use of allowed equivalencies in this standard shall be requested from and approved by the standard owner and the Engineering Discipline Lead - Mechanical if different from the standard owner. Approved allowed equivalencies and the basis for their use shall be documented in the accompanying standard basis document, RPP-RPT-28500.

3.0 STANDARD REQUIREMENTS/BASES

3.1 Grandfathered vs. Non-Grandfathered Systems

Grandfathered waste transfer primary piping systems include SST retrieval systems 241-C-104, 241-C-108, 241-C-109, and 241-C-110 and portions of these retrieval systems reused for subsequent SST retrievals; and DST waste transfer systems installed prior to October 1, 2008. Non-grandfathered waste transfer primary piping systems include SST retrieval systems, except for the grandfathered 241-C-104, 241-C-108, 241-C-109, and 241-C-110 retrieval systems and portions of these retrieval systems reused for subsequent SST retrievals, and DST systems installed on or after October 1, 2008. Grandfathered systems do not have to meet the same requirements as non-grandfathered systems.
3.2 Waste Transfer Primary Piping

3.2.1 General

The general requirements for primary piping shall apply to piping, jumpers, valves, pressure relieving devices, instrumentation, pumps and other miscellaneous equipment outside of the waste tanks that are involved in waste transfer and that may become pressurized during service. (5.1.8)

1. Vendor information and vendor product files shall be evaluated for requirements and recommendations (i.e., handling, storage, installation, preventive maintenance, corrective maintenance, operation, item/component/system design, and testing) to determine which requirements and recommendations are necessary for the item/component/system to perform its intended function and to meet the applicable standards. The requirements and recommendations as determined by the evaluation shall be incorporated into applicable controlling documents and design media. The evaluation shall include justification for not incorporating any vendor requirements or recommendations. (5.1.9)

2. Non-metallic parts shall be replaced when any observable leakage is detected following adjustments (e.g. re-torquing the joint or tightening the packing). Acceptance criteria for leak tests, internal inspections, and other integrity examinations dictate that no detectable leakage is permissible. (5.1.6, 5.1.8)

3. When transfer pumps can deliver pressure greater than the design pressure of the system, a pressure relief valve shall be installed to ensure that the highest pressure developed in the system does not exceed the design pressure of the primary piping system. (5.1.1)

4. In systems connected to compressed air, pressure relief valves are required to prevent over pressurization. Compressed air relieving devices shall have a set pressure that limits compressed air pressure to \( \leq 190 \) psig and be sized for a flow capacity of \( \geq 500 \) cfm. (5.1.5)

5. Integrity assessments shall be performed and maintained in compliance with the WAC 173-303-640. (5.1.5, 5.1.10)

6. Where required (see TFC-ENG-STD-02), heat tracing shall be of self-limiting design, with maximum temperature not exceeding the maximum temperature permitted for direct contact of an SSC and not create waste or flush water temperatures in excess of the design temperature of other components in the waste transfer system. (5.1.6)

NOTE: Pneumatic testing is only allowed if the HIHTL and waste transfer primary piping systems have never been used and are not connected to HIHTL or waste transfer piping systems that have been used.
7. To prevent exceeding the design pressure of safety-significant waste transfer primary piping systems and safety-significant isolation valves for double valve isolation (and connected safety-significant HIHTL systems), pneumatic testing of waste transfer primary piping systems connections in Tank Farms shall require an ASME code-compliant pressure relieving device with a setpoint that limits the pneumatic pressure in the waste transfer primary piping systems, isolation valves for double valve isolation, and connected HIHTL primary hose assemblies below their design pressures. (5.1.6, 5.1.8)

8. Waste transfer primary piping system connections (e.g., plutonium-uranium extraction [PUREX] head/nozzle connections, Chemjoint connections, process blank/nozzle connections) on the planned waste transfer route shall be leak tested. Connections that are leak tested during fabrication or installation (e.g., system hydrostatic leak test) do not require additional connection leak testing unless the connection is unmade and remade. The planned waste transfer route includes the waste transfer primary piping systems that are pressurized by the WASTE TRANSFER PUMP, or the gravity head from the 242-A Evaporator vessel when the vessel contains waste, up to the first closed isolation valve. The isolation valve is not required to be safety significant with respect to through valve leakage. An exception is that leak testing of waste transfer primary piping system connections on the discharge side of pressure relieving devices is not required.

Leak testing of the waste transfer primary piping connections shall be performed by visual observation. The connection leak testing shall be performed with water at the interfacing water system pressure except when (a) there is no waste transfer system valve downstream of the connection, or (b) closing the valve with water flowing causes a flow transient (water hammer) that could damage safety-significant waste transfer system SSCs. For this leak test, the interfacing water system pressure is maintained at the connection for at least 10 min. If there is no valve downstream of the connection or closing the valve causes an unacceptable water hammer, leak testing is allowed with water flowing through the connection. This leak test requires a minimum water flow of 200 gal through the connection after flow is established in the line. If leak testing with water is not practical (i.e., no available water source), leak testing may be performed at the beginning of the initial waste transfer through the connection. This leak test also requires a minimum waste flow of 200 gal through the connection after flow is established in the line.

Leakage observed at the waste transfer primary piping system connections during the leak test shall be eliminated. Subsequent leak testing of waste transfer primary piping system connections is not required unless the connection is unmade and remade (e.g., the jumper is disconnected and re-installed or repositioned).

Evaluate case (b) above (closing the valve with water flowing) per TFC-ENG-FACSUP-C-27. (5.1.5)

9. Identify engineering limitations and requirements that result from the design and incorporated into applicable controlling documents and design media. These limitations and requirements shall include, as a minimum, installation, testing, and on-site fabrication processes such as cleaning, welding, nondestructive examination, and parameters such as pressure, flow, speed, load limits (static and dynamic), travel limits, physical clearances, control and alarm settings, and environmental and thermal limits. (5.1.9)
10. To prevent exceeding the design temperature rating of safety-significant waste transfer primary piping systems and safety-significant isolation valves for double valve isolation (and connected safety-significant HIHTL systems), routing shall not be in proximity to in-pit heater nozzle discharge as defined on drawing H-14-110255, sheet 1. This requirement is only applicable to in-pit heaters installed in pits as listed on drawing H-14-110255, sheet 1, and when the in-pit heaters are physically installed.  

3.2.2 Grandfathered Piping  
(5.1.5, 5.1.8, 5.1.10)

Grandfathered primary piping systems shall meet the requirements of WAC 173-303-640, “Tank Systems.” Following this regulation, a written assessment reviewed and approved by an Independent Qualified Registered Professional Engineer (IQPRE) attesting to the system’s integrity shall be required. This assessment shall address the design standard(s) to which the system was constructed, dangerous characteristics of the waste that have been and/or will be handled, documented age of the existing system, and the results of a leak test, internal inspection, or other integrity examination certified by an IQRPE that addresses cracks, leaks, corrosion, and erosion. Replacement of pressure boundary SSCs (e.g., gaskets, flowmeters, and bolts) of grandfathered systems or modifications to pressure boundary SSCs (e.g., piping, connectors) of grandfathered systems shall meet the compliance requirements of non-grandfathered systems.

3.2.3 Non-Grandfathered Piping

1. Primary piping systems shall be designed, fabricated, tested, inspected, and installed to the requirements of applicable national consensus codes or the strictest applicable state and local codes. Tank Farm primary piping systems are designed, fabricated, tested, inspected, and installed to the requirements of ASME B31.3 for normal fluid service. Volumetric examination (radiographic test [RT] or ultrasonic test [UT]) of welds where specified by ASME B31.3 shall be performed where possible (i.e., in-process examination shall not be specified). In those 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 shall be identified as such on the fabrication drawings. Fabrication drawings shall be approved by WRPS Engineering prior to fabrication. 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 (and appearing in the WRPS Engineering Toolbox webpage SME list). 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. Refer to Section 3.5 for the design of the piping in accordance with applicable requirements of ASME B31.3. (5.1.1, 5.1.6)
2. Leak testing shall meet the requirements of ASME B31.3. Leak testing of connections in piping systems on the discharge side of pressure relieving devices that discharge into vented tanks cannot be performed, and, therefore, leak testing of these connections is not required. (5.1.6)

NOTE: The design temperature of new piping in the AP-01A pit must be ≥ 200 degrees Fahrenheit if an In-pit heater is present to protect the assumptions in RPP-CALC-60536, “In-Pit Heater Bulk Temperature Calculation,” and RPP-CALC-61486, “In-Pit Heater Discharge Temperature and Exclusion Zone.”

3. New piping systems that will normally transport waste shall be designed for a design pressure of ≥ 400 psig and a design temperature of ≥ 200 degrees Fahrenheit for waste transfer systems (e.g., DST farms) that include metallic components and non-metallic components (i.e., Teflon1, Tefzel2, or Kynar3) and a design pressure of ≥400 psig and a design temperature of ≥ 180 degrees Fahrenheit for waste transfer systems (e.g., SST waste retrieval) that include non-metallic components (i.e., ethylene-propylene-diene monomer [EPDM], ultra high molecular weight polyethylene [UHMWPE]). New piping systems installed at DSTs in support of SST waste retrieval that include non-metallic components (i.e., EPDM, UHMWPE) shall be designed for a design pressure ≥ 400 psig and a design temperature of ≥ 180 degrees Fahrenheit. (5.1.6, 5.1.8)

4. Non-metallic discharge hoses shall be constructed of EPDM with reinforcement materials being fully encapsulated. (5.1.8)

5. Metallic piping shall be constructed of stainless or carbon steel. The use of carbon steel should be evaluated by engineering for its suitability for a particular process prior to use. (5.1.8)

6. Non-metallic components including gaskets and seals shall be constructed of ethylene propylene (EP), EPDM, UHMWPE, or Teflon4, Tefzel5, or Kynar6. Alternative materials can be used provided the material is evaluated and determined acceptable for the intended application in a Technical Evaluation which conforms to the requirements of TFC-ENG-STD-34 and is approved by the Engineering Discipline Lead - Mechanical. (5.1.8)

7. New waste transfer piping shall be sloped continuously from high point to low point with a recommended slope of 0.5% (1:200) or greater, as permitted by terrain. This minimizes the impacts of fabrication and installation tolerances and allows for use of standard fabrication/installation controls. All new waste transfer piping shall be installed at greater than or equal to an absolute minimum slope of 0.25% (1:400). Piping installed with minimum slope requires use of enhanced controls and requires approval by the mechanical EDL. In all cases, the design shall account for construction installation tolerances such that the minimum slope is assured. Controls on fabrication and installation shall be imposed to validate that the design requirements were met.

---

1Teflon is a registered trademark of E.I. du Pont de Nemours and Company, Wilmington, Delaware.
2Tefzel is a registered trademark of E. I. du Pont de Nemours and Company, Wilmington, Delaware.
3Kynar is a registered trademark of Arkema, Inc., Philadelphia, Pennsylvania.
4Teflon is a registered trademark of E.I. du Pont de Nemours and Company, Wilmington, Delaware.
5Tefzel is a registered trademark of E. I. du Pont de Nemours and Company, Wilmington, Delaware.
6Kynar is a registered trademark of Arkema, Inc., Philadelphia, Pennsylvania.
Engineering and construction controls shall be documented in a construction specification, in accordance with the requirements for buried waste transfer piping presented in Attachment B of this standard. (The requirements in Attachment B reflect a standard level of controls.) Enhanced controls, if appropriate, shall be developed in coordination with the mechanical EDL and appropriate SMEs. (5.1.2, 5.1.6, 5.1.8, 5.1.10)

### 3.2.4 Jumpers

#### 3.2.4.1 General

1. Jumpers and all components included in the jumper shall be designed, fabricated, tested, inspected, and installed to the requirements of ASME B31.3, for normal fluid service, as applicable. Volumetric examination (RT or UT) of welds where specified by ASME B31.3 shall be performed where possible (i.e., in-process examination shall not be specified). In those 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 shall be identified as such on the fabrication drawings. Fabrication drawings shall be approved by WRPS Engineering prior to fabrication. 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 (and appearing in the WRPS Engineering Toolbox webpage SME list). Individual items described in paragraph 344.7.1 shall be documented (e.g., checklist format) for each in-process examination. Attachment A provides the figures of pre-approved weld configurations where volumetric inspections are not required but shall have in-process examinations 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 shall be identified as such on fabrication drawings. Fabrication drawings shall be approved by WRPS Engineering prior to fabrication. 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. Refer to Section 3.5 for the design of the piping in accordance with applicable requirements of ASME B31.3. (5.1.6)

2. Jumpers containing components that require maintenance shall be designed to be remotely separable from equipment that intrudes into tank waste to allow removal. (5.1.6)

3. Jumper design pressure shall be determined from the maximum static head and either the shutoff head of the pump pressure source or the maximum pressure setting of any pressure relieving device provided, and be at least 400 psig. For the discharge piping of pressure relieving devices, see Section 3.4 for design pressure requirements. (5.1.1, 5.1.8)

4. Jumpers should be designed to allow access for disassembly and/or removal of components (such as valve bodies, valve packing, and flow meters).

5. Jumpers shall be designed in a manner that does not preclude them from a hydrostatic leak test as required by ASME B31.3. (5.1.1)
6. Jumpers shall use PUREX connectors and nozzles for connections on jumpers required to be remotely separable by Section 3.2.4.1, item 3 except as required by Section 3.2.4.4, item 10. When the requirement to be remotely separable is not needed, other connectors and/or nozzles shall meet the other requirements of this standard, such as ASME B31.3. (5.1.6)

7. Jumpers shall be fabricated in accordance with RPP-14541, and an approved project fabrication specification or an approved fabrication drawing. (5.1.6)

8. Jumper assemblies shall be analyzed for freeze protection requirements (see TFC-ENG-STD-02). Jumper design temperature shall be suitable for process and environmental conditions. (5.1.1)

9. Jumper assemblies shall be designed to permit installation using slings or have one or more permanently installed lifting points that are accessible. (5.1.6)

10. Lifting points shall be in accordance with drawing H-2-90161 or be designed in accordance with the requirements of RPP-8360. Lifting bails in accordance with drawings H-2-90160, H-2-90162, H-2-90163 may be used where analyzed to be acceptable in accordance with the requirements of RPP-8360. This requirement applies to jumper lifting points and not to lifting bails included on PUREX connectors. (5.1.1, 5.1.6)

3.2.4.2 Rigid Piping, Rigid Tubing, and Rigid Jumpers

1. Jumpers shall be sloped continuously from high point to low point with a minimum slope of 0.25 % (1:400) wherever connecting nozzle locations and interfaces permit. See also, Section 3.2.3, Step 7. (5.1.6)

2. The guidance provided in SD-RE-DGS-002 shall be considered in the design of rigid piping, rigid tubing, and flexible metal jumpers. (5.1.6)

3.2.4.3 Flexible Metal Hose Jumpers

1. Flexible metal hose jumpers shall be the minimum length necessary to accommodate alignment and movement without coiling and with minimized droop. Flexible metal hose jumpers should be supported, where necessary, to permit drainage. (5.1.6)

2. Changes in direction shall comply with the manufacturer’s minimum bend radius and twist requirements. These requirements shall be included on installation drawings, Engineering Change Notices (ECNs), or other design documents. (5.1.6)

3. Flexible metal hose jumpers shall be identified on drawing H-14-107346 or other released design document (e.g., ECN). The drawing/document shall include the pit number, nozzle connection locations, ECN for the jumper, jumper identification number, jumper test pressure, and description of connector interfaces. (5.1.6)
3.2.4.4 Flexible Non-Metallic Hose Jumpers


2. Hose assemblies shall be designed to the requirements of RMA IP-2. (5.1.6)

3. The effective service life of EPDM non-metallic flexible jumpers and hoses is a function of several factors. Among these are the hose material’s resistance to the chemical effects of process fluids, ambient environmental conditions, exposure to ionizing radiation, and the manufacturer’s stated shelf life. Prudent engineering dictates that equipment used to transfer waste have a life expectancy greater than the forecasted operational time period, including some margin to allow for delays in future schedules should they occur. Hose-in-Hose Transfer Line assemblies have an established maximum useable life based on shelf life plus service life as established in RPP-6711, “Evaluation of Hose in Hose Transfer Line Service Life,” which is also applicable to EPDM non-metallic flexible jumpers and hoses. (5.1.6, 5.1.8)

4. Non-metallic hose reinforcement materials shall be fully encapsulated. (5.1.6, 5.1.8)

5. Internal surfaces of the hose and fittings shall be compatible with the process fluid chemical and physical properties. (5.1.8)

6. Where ignition source control requirements apply, hose material shall meet the requirements of TFC-ENG-STD-45. (5.1.4)

7. Minimum burst pressure specified for hose assemblies shall not be less than 4 times the design (maximum working) pressure of the hose assembly. (5.1.6, 5.1.8)

8. Hose design pressure for vacuum conditions shall be for the maximum vacuum condition of the process, but not less than 6 inches water gauge vacuum. (5.1.6)

9. Hose assemblies shall be capable of withstanding pressure and temperature cycling between ambient and design conditions without failure. (5.1.8)

   NOTE: Crimped-on, or Internally Expanded Full Flow couplings as defined in RMA IP-2, Chapter 5, may be used to join hose to fittings if qualified to RPP-14859.

10. End fittings shall be swaged. (5.1.6)

11. Hose assemblies shall be designed to prevent kinking or abrasion due to hose growth. (5.1.6)

12. Changes in direction shall comply with the manufacturer’s minimum bend radius and twist requirements. Hose growth shall be evaluated to ensure that the growth can be accommodated by the hose support system without damage to the hose or other equipment in the structure. Manufacturer’s recommended installation requirements shall be detailed on design drawings, ECNs, or other design documents. (5.1.6)
13. Hose shall be protected by inclusion of guards to prevent abrasion of the hose, where necessary. (5.1.6)

14. Flexible non-metallic hose jumpers should be supported, where necessary, to permit drainage.

15. Jumper assembly and installation design shall incorporate a means to remove any residual waste or accumulated liquids from the assembly. (5.1.10)

16. Methods of installation, operation, and retrieval (including relocation of jumper assemblies and methods for removing accumulated liquids) shall be evaluated to determine mechanical loads which may act on the hose/fitting joints. A means of ensuring the jumper leak-tight integrity shall be provided when subjected to these mechanical loads. (5.1.10)

17. The exterior surfaces of non-metallic hose jumper assemblies that are reused shall be visually examined for abrasion or other damage prior to reuse. If insulated, the insulation shall be visually examined for abrasion or other damage prior to reuse. (5.1.6)

18. Service life and shelf life of hose material used in flexible non-metallic jumpers shall be evaluated and identified. The date of manufacture, date of first exposure to process conditions, and date of expiration of service life shall be recorded on the assembly drawing that depicts the specified assembly’s configuration or other released design document (e.g., tracking drawing). (5.1.8)

19. Flexible non-metallic hose jumpers shall be identified on drawing H-14-107346 or other released design document (e.g., ECN). The drawing/document shall include the pit number, nozzle connection locations, ECN for the jumper, jumper identification number, jumper test pressure, reference assembly drawing, and description of connector interfaces. (5.1.6)

3.3 Valves

3.3.1 General

1. Waste transfer valves shall meet the requirements of ASME B31.3. (5.1.1, 5.1.3, 5.1.6)

2. Waste transfer valves shall be either full-ported ball valves, v-ported ball valves, or check valves. In this application, ball valves shall be designed and installed in the stem up position and shall incorporate a resilient seat material. (5.1.6)

3. Ball valve designs shall be designed for a minimum of 5 degrees of over- or under-travel to ensure port closure when the valve is positioned in the “closed” or “blocked” position. (5.1.6)

4. Two-way valves shall be designed to close in the clockwise direction. (5.1.6)
5. Valves that are required to be manipulated during a transfer cycle shall be power operated. For SST retrieval operations, valves that are required to be manipulated during a transfer cycle (e.g., valves located within the valve boxes which are used to direct flow to the sluicers and V-Port ball valves used occasionally to trim slurry pump flow) may be manually operated where specifically evaluated for personnel exposure (ALARA) and approved by the Engineering Discipline Lead - Mechanical. (5.1.6)

6. The valve positioning method shall be designed to provide valve position within the over- or under-travel limits of the valve. (5.1.7)

7. Waste transfer valves shall be located within a jumper assembly. (5.1.6, 5.1.7, 5.1.8)

8. Valves that are positioned using valve stops shall have valve stop pins located at the following positions (5.1.7):
   - Two-way T-handle operated valve stops at 0 and 90 degrees
   - Two-way motor and manual gear operated valve stops at -3 and 93 degrees
   - Three-way T-Port 180 degree T-handle operated valve stops at 0 and 180 degrees
   - Three-way T-Port 180 degree motor and manual gear operated valve stops at -3 and 183 degrees
   - Three-way T-Port 90 degree T-handle operated valve stops at 0 and 90 degrees
   - Three-way T-Port 90 degree motor and manual gear operated valve stops at -3 and 93 degrees.

3.3.2 Valve Manual Operator Design

1. Manually operated valves to be installed in pits shall be fitted with valve funnels for installation of valve handles. (5.1.6)

2. Valve handles for manually operated valve designs shall be in accordance with approved drawings. (5.1.6)

3.3.3 Valve Testing

NOTE: Tests specified in steps 1, 2, and 3 shall be performed and documented by the manufacturer prior to shipment.

1. Valve body shell tests shall be performed for all transfer valves in accordance with ASME B16.34. (5.1.1)

2. Manufacturer’s seat closure tests shall be performed for all transfer valves in accordance with ASME B16.34 for test pressure (gas not less than 80 psi) and test time utilizing the test methods in API 598. (5.1.1)
3. Seat leakage from each flow port to the isolated port(s) shall be within the limits specified in API 598 if a seat closure test is performed. (5.1.1)

4. Valve travel limit stop settings shall be verified prior to installation of the valve. (5.1.6)

### 3.3.4 Waste Transfer Isolation Valves for Double Valve Isolation

1. Two valves in series shall be provided in locations defined in HNF-SD-WM-TSR-006, Section 5.8.6, to physically disconnect piping and components from the planned waste transfer route. (5.1.4)

2. Valves shall have valve seats at each position shown in RPP-RPT-41859. (5.1.7)

3. Waste transfer valves installed in jumpers after September 30, 2009 shall have low pressure and high pressure seat leakage testing using water conducted after installation of the valve in the piping manifold or jumper. Test duration is for a minimum of five 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 pressure leakage test is ≤ 4 ml/min. All valves shall be evaluated for through valve leakage for low pressure and high pressure. (5.1.5, 5.1.7)

Leak rates at pressures other than design pressures are evaluated by adjusting the leak rate using the following equation (Ref. NUREG-1482, Revision 1, Section 4.4.4):

\[
\frac{L(\text{maximum})}{L(\text{test})} = \sqrt{\frac{dP(\text{maximum})}{dP(\text{test})}}
\]

Where:

- \(L\) – Leak Rate
- \(dP\) – Differential Pressure.

4. Each isolation valve port having the potential to be pressurized in service shall be tested. (5.1.6)

NOTE: Manufacturer’s seat leakage tests do not ensure that a valve will satisfy post-fabrication seat leakage test acceptance criteria.

5. Manufacturer’s valve testing shall meet the requirements of Section 3.3.3. (5.1.6)

6. Valves used for isolation shall have a positive position stop, switch, or other means to ensure accurate positioning for the flow path being isolated. For valves that rely on a position switch for indication of position, loss of power to the switch or any interposing relays shall not result in indication that the valve is in the blocked position. (5.1.6)

7. Power actuators for waste transfer isolation valves shall either fail-as-is or fail to the valve blocked position for isolation. For air operated valves, the valve shall fail to the blocked position under a loss of air or loss of electrical power condition. (5.1.7)

8. Automated valve control systems (e.g., programmable logic controllers) shall not be used to position waste transfer isolation valves used for double valve isolation. (5.1.5, 5.1.6)
9. For isolation valves that are positioned using the valve indicating disk and reference pointer, the reference pointer shall align with the indicator disk when the valve is in the closed or block-flow position. (5.1.6, 5.1.7)

10. Isolation valves shall be designed using a minimum design pressure of 400 psig and design temperature $\geq 180$ degrees Fahrenheit for waste transfer systems (e.g., SST waste retrieval) that include non-metallic components (i.e., EPDM, UHMWPE) and $\geq 200$ degrees Fahrenheit for waste transfer systems (e.g., DST farms) that include metallic components and non-metallic components (i.e., Teflon, Tefzel, or Kynar). (5.1.5, 5.1.6, 5.1.7)

11. Valve bodies shall be constructed of carbon or stainless steel. The ball shall be constructed of solid 316 stainless steel or nickel coated 316 stainless steel, and the valve seats shall be constructed of one or more of the following materials that conform to the requirements of TFC-ENG-STD-34 (5.1.5, 5.1.6, 5.1.7):

- Teflon with 50% Stainless steel
- Tefzel
- Tefzel with ethylene-propylene-rubber (EPR) back O-ring
- Kynar
- Kynar with an EPR back O-ring
- UHMWPE.

3.3.5 Ignition Source Control for Waste Transfer System Valves
(5.1.4, 5.1.6)

With respect to Ignition Source Control requirements for new piping designs, specification of ball valves shall be code compliant, documented, and verified as described in TFC-ENG-STD-45.

The following requirements represent industry best practice to ensure compliance to national codes and standards, in order of preference:

1. Bonding and grounding per NFPA 77 of the valve stem to body achieved by specification of valves with specific internal anti-static features, identified by the manufacturer, that provide conductivity between valve stem and body (e.g., FlowTek Triad series).

2. ATEX certification of the valve. Non-Electrical equipment shall comply with ATEX Group IIC, Category 1G, T2 through T6 or has no temperature marking.

3. Bonding and grounding per NFPA 77 of the valve stem to body achieved by use of an external bonding jumper installed from stem/ball to body/piping as documented in design fabrication/installation details for the valve or jumper.

4. Resistance testing. Evidence of less than 1 Mohm resistance between valve stem and body determined through documented testing. The resistance testing shall form the basis for an equivalent safety technical evaluation document via a dedicated technical evaluation compliant to TFC-ENG-STD-45, Section 3.4.
3.4 Waste Transfer System Pressure Relieving Devices

1. When waste transfer system pressure relieving devices are necessary to protect SSCs from over pressurization, they shall meet the requirements identified in ASME B31.3 and ASME Boiler and Pressure Vessel Code Section VIII Division 1 as specified in ASME B31.3. Special attention should be given to the footnotes provided in the codes. (5.1.1, 5.1.6)

2. When utilizing a rupture disk device in combination with a pressure relief valve, the design shall evaluate failure modes (e.g., leakage developed in the rupture disk due to corrosion or other cause) that can result in pressure building up in the space between the rupture disk and pressure relief valve. The space between a rupture disk device and a pressure relief valve shall be provided with a pressure gage, a try cock, free vent, or suitable telltale indicator, refer to UG-127 in ASME BPVC Section VIII Division 1. This arrangement permits detection of disk rupture or leakage. The maximum backpressure that can be developed in the space between the rupture disk device and the pressure relief valve prior to burst/leak shall be accounted for in the selection of the burst pressure. (5.1.1, 5.1.6)

3. Pressure relieving devices shall be installed so as to minimize the buildup of salts or other residue from the waste that may impair operation. (5.1.6)

4. Pressures due to elevation differences between the pressure relieving device and the protected SSCs shall be factored into the set pressure or marked burst pressure of the pressure relieving device. (5.1.1)

5. The pressure relieving device shall protect the SSCs over all conditions that the pressure relieving device is required to be operable (e.g., temperature, specific gravity, viscosity). (5.1.1)

6. Non-metallic materials shall conform to the requirements of TFC-ENG-STD-34. (5.1.6)

7. The design pressure of the discharge piping of the pressure relieving devices shall be at least the highest pressure that could develop in that piping. (5.1.1)

8. The design of the discharge piping shall provide assurance that the discharge piping is self-draining to prevent solids buildup (See sections 3.2.4.2, 3.2.4.3, and 3.2.4.4). (5.1.1)

9. A bellows for spring-operated pressure relief valves is required per manufacturer’s recommendations for slurry transfers or if discharge back pressure exceeds manufacturer’s recommendations. When a bellows is specified, the bonnet vent plug shall be removed to allow air to enter or exit the bonnet. The plastic shipping plug in the vent opening shall be removed prior to installation unless the manufacturer assures that the shipping plug will not affect operation of the relief valve. (5.1.6)
3.5 Piping Design Analysis

3.5.1 Background

The “Pressure Safety” requirements of 10 CFR 851 dictate that pressurized systems be designed in accordance with the ASME B31 series Codes. The Office of River Protection (ORP) is the Owner as referenced in the B31 series Codes for the Tank Farms, 242-A Evaporator, 222-S Laboratory, and the Effluent Treatment Facility (ETF). DOE O 420.1C and the Tank Farm Documented Safety Analysis (DSA) also require that safety significant systems be designed in accordance with ASME B31.3. In addition, the Washington State Administrative Code for Dangerous Waste (WAC 173-303-640) requires the waste storage tank piping systems be certified by an Independent Qualified Registered Professional Engineer (IQRPE) prior to use: ASME B31.3 is listed as a guidance standard for design and installation of the piping system. Based on these requirements, the primary reference Code for the design, fabrication, examination/inspection, installation, and testing of Tank Farm waste transfer piping systems will be ASME B31.3.

3.5.2 Design Process

(5.1.1, 5.1.4, 5.1.5, 5.1.6)

Users must be familiar with, and have a working knowledge of, ASME B31.3 requirements. However, the Designer shall be qualified per ASME B31.3 paragraph 301.1. The Code is not a design handbook and generally a simplified approach is used with basic principles and formulas. A more rigorous analysis may be applied; however the approach shall be documented.

TFC-ENG-DESIGN-C-60 provides a method and explains requirements for performing analyses of pressures and stresses in waste transfer systems, sub-systems, or components in accordance with piping codes and governing engineering procedures. Analyses shall be prepared in accordance with TFC-ENG-DESIGN-C-60.

3.5.2.1 Corrosion Allowance

(5.1.6)

For both austenitic stainless steel piping and carbon steel piping, the corrosion-erosion allowance used for pressure design of piping components and determining longitudinal stresses in piping systems shall be 0.2 mils per year for the expected service life of the system.

4.0 DEFINITIONS

Jumper. A removable/reconfigurable assembly of piping, tubing, hose, and components providing primary containment while installed within a secondary containment structure.

Primary Piping. Piping, jumpers, valves, pressure relieving devices, instrumentation, pumps and other miscellaneous equipment outside of the waste tanks that is involved in waste transfer and that may become pressurized during service.
5.0 SOURCES

5.1 Requirements

1. 10 CFR 851, “Worker Safety and Health Program,” 851.27(b) (7)-(8).


3. DOE O 252.1A, “Technical Standards Program.”


5. RPP-13033, “Tank Farms Documented Safety Analysis.”


9. TFC-PLN-02, “Quality Assurance Program Description.”


5.2 References


10. Hanford Drawings.
   e. H-2-90172, all sheets, “Standard Valve Funnel Extension Assembly.”
   f. H-14-100543, all sheets, “Valve Handle Assembly, 2 and 3-Way Valves.”
   g. H-14-100971, all sheets, “Funnel Assembly 2 and 3-Way Valves.”
   h. H-14-100972, all, “Valve Handle Assembly, 2 and 3-Way Valves.”
   i. H-14-107346, all sheets, “DST Waste Transfer Piping Diagram.”
   j. H-14-110255, Sheet 1, “In Pit Heating Mechanical Fabrication.”


17. RPP-CALC-60536, 2016, “In-Pit Heater Bulk Temperature Calculation,” Rev. 1, Washington River Protection Solutions LLC, Richland, WA.

18. RPP-CALC-61486, “In-Pit Heater Discharge Temperature and Exclusion Zone.”


22. TFC-ENG-DESIGN-C-15, “Commercial Grade Dedication.”

23. TFC-ENG-DESIGN-C-60, “Preparation of Piping Analyses for Waste Transfer Systems.”


27. TFC-ENG-STD-02, “Environmental/Seasonal Requirements for TOC Systems, Structures, and Components.”


## ATTACHMENT A - PRE-APPROVED WELD CONFIGURATIONS FOR IN-PROCESS EXAMINATION

<table>
<thead>
<tr>
<th>Description</th>
<th>Figure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pipe to PUREX connector block (e.g., 2-inch connector, 3-inch connector)</td>
<td><img src="image1.png" alt="Diagram" /></td>
</tr>
<tr>
<td></td>
<td><img src="image2.png" alt="Diagram" /></td>
</tr>
</tbody>
</table>
ATTACHMENT A - PRE-APPROVED WELD CONFIGURATIONS FOR IN-PROCESS EXAMINATION (cont.)

Pipe to PUREX connector block (e.g., connector with a dip tube)

O-Let

WELD PER MANUFACTURER’S INSTRUCTIONS, TYP 2X

2X Ø.375 THRU PIPE WALL
ATTACHMENT B - ENGINEERING AND CONSTRUCTION CONTROLS FOR INSTALLATION OF BURIED PIPE

The contractor shall develop construction controls to ensure that the specified slope is met. Design media including construction specification shall address all of the following:

1. Project/Site Conditions – site specific soils data – geotech testing
   a. Design agent shall consider type of pipe, as well as the site geotechnical conditions, before developing the specification for the trenching, backfill, and bedding.

2. Trench Excavation
   a. Trenches must be sufficient width in the pipe zone to permit proper installation and bedding of pipe, and to provide required compaction of backfill.
   b. Placement of bedding material shall precede the install of pipe. This shall include necessary leveling of trench bottom foundation material as well as placement and compaction of required bedding material to uniform grade so the entire length of the pipe will be uniformly supported.
   c. As a construction industry best practice, trenches / excavations are typically maintained free of ponding water, during construction. The design agent shall develop requirements to prevent/eliminate detrimental effects of ponding water in the excavation during construction.

3. Prep of foundation for Pipe Laying
   a. Objective of trench & bedding/foundation design is long-term stability so that there is no shifting in grade resulting in traps / relative low points in the pipeline slope.
   b. Design agent shall specify bedding/foundation material, depth/thickness, and compaction requirements such that the pipeline slope will remain stable over time. The bedding/foundation shall be capable of resisting upheaval and settlement.
   c. Materials to be considered include, but are not limited to; granular bedding material, controlled density fill, and/or in-situ soils.
   d. Whenever the bottom of the trench is unstable and does not afford a stable foundation, remove such part, for the full width of the trench, and replace with select fill material. Except for crushed/granular bedding, stones shall not come in contact with the pipe or be within six inches of the pipe.
   e. Requirements if/when rock is encountered: The foundation shall be backfilled to the bottom of the pipe zone, with gravel or other suitable material, and compacted to form a uniformly dense, unyielding foundation.

4. Bedding – Laying Down Piping
Piping, Jumpers, and Valves Manual Engineering
Page 22 of 22
Issue Date September 14, 2017

ATTACHMENT B - ENGINEERING AND CONSTRUCTION CONTROLS FOR INSTALLATION OF BURIED PIPE (cont.)

a. Spec shall include detail for the depth of lift and level of compaction of the bedding around the pipe with attention to the pipe haunches. Material shall be carefully worked under the pipe haunches, such that there are no voids. Pipe zone bedding material shall provide uniform support along the entire length of the pipe. All adjustments to line and grade shall be made by scraping or filling with bedding material under the body of the pipe and not by blocking or wedging. Bedding disturbed by pipe movement shall be reconsolidated prior to backfill.

b. Start placement only when weather conditions are favorable. Do not place fill on frozen ground, or when it is raining. Do not lay pipe in standing water, or when the trench or weather conditions are unsuitable for the work.

5. Surveying (See also, TFC-ENG-STD-39, Civil Survey for Tank Farm Facilities.)

a. Perform all survey work required for construction, including the establishment of base lines and any detailed surveys and/or bench marks adjacent to the work.

b. Provide a level of survey detail as required to account for fabrication tolerances associated with the double containment piping, if applicable.

c. Survey line and grade, for the trench/foundation, at control point intervals of no greater than 50 feet.

d. After an accurate grade line has been established, the pipe shall be laid in conformity with the established line, in a properly de-watered trench.

e. A second survey of final pipe installation shall be conducted at all field joint locations and at the top-center of encasement fittings. Survey the piping system for elevation and location. Elevation and location shall be in accordance with the drawings. Piping (including all carrier and encasement pipes) shall slope as shown on the drawings with no traps.

f. Submit survey results for approval prior to backfilling. Include a “hold point”, which will be signature released by the Buyer’s Construction Field Representative.

6. Backfilling

a. After laying pipeline, ensure that lines have been pressure tested and inspected before backfilling and filling. During compaction, exercise care to avoid pipe misalignment and to provide uniform bearing along pipe barrel.

b. Design agent shall specify any Select-Earth-Backfill areas and suitable materials.

c. Design agent shall specify remaining Common-Backfill areas and suitable materials.