## 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-AC27-08RV14800

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SAFETY - SIGNIFICANT COMPRESSED AIR SYSTEM PRESSURE RELIEVING DEVICE -  
FUNCTIONS AND REQUIREMENTS EVALUATION DOCUMENT

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The revisions updates the FRED to include a new PRV and manifold to be used during encasement pressure testing. The design temperature has been removed as a critical characteristic. Temperature is not identified as a failure mode and has no effect on the failure modes of the PRV.

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### 13. Related Documents

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Safety - Significant Compressed Air System Pressure Relieving Device - Functions and Requirements Evaluation Document

Prepared by K. Fullerton
Washington River Protection Solutions
Richland, WA 99352
U.S. Department of Energy Contract DE-AC27-08RV14800

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Key Words: Functions, requirements, commercial grade dedication, critical characteristics, CGD, TFC-ENG-DESIGN-C-45, pressure relieving device, PRV, compressed air.

Abstract: This document provides the evaluation and supporting data for safety-significant compressed air system pressure relieving assemblies, for their ability to perform safety functions under those conditions and events for which the safety function is required in accordance with TFC-ENG-DESIGN-C-45, “Control Development Process for Safety Significant Structures, Systems, and Components.”

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J. Flora
K. Fullerton
Washington River Protection Solutions, LLC

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Office of River Protection
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<tr>
<td>ASME®</td>
<td>American Society of Mechanical Engineers</td>
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<td>ASTM®</td>
<td>American Society for Testing and Materials</td>
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<tr>
<td>B&amp;PV</td>
<td>Boiler and Pressure Vessel</td>
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<tr>
<td>C of C</td>
<td>Certificate of Conformance / Certificate of Compliance</td>
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<td>CGD</td>
<td>Commercial Grade Dedication</td>
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<td>DOE</td>
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<tr>
<td>EIN</td>
<td>Equipment Identification Number</td>
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<tr>
<td>FNPT</td>
<td>Female National Pipe Thread</td>
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<tr>
<td>HIHTL</td>
<td>Hose-in-Hose Transfer Line</td>
</tr>
<tr>
<td>HVAC</td>
<td>Heating, Ventilation, and Air Conditioning</td>
</tr>
<tr>
<td>IQRPE</td>
<td>Independent Qualified Registered Professional Engineer</td>
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<tr>
<td>MNPT</td>
<td>Male National Pipe Thread</td>
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<tr>
<td>NCR</td>
<td>Non-Conformance Report</td>
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<td>PrHA</td>
<td>Process Hazard Analysis</td>
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<td>PRV</td>
<td>Pressure Relief Valve</td>
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<tr>
<td>SECD</td>
<td>Safety Equipment Compliance Database</td>
</tr>
<tr>
<td>SSC</td>
<td>System, Structure, and Component</td>
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<td>TOC</td>
<td>Tank Operations Contractor</td>
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<td>TSR</td>
<td>Technical Safety Requirement</td>
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® ASTM is a registered trademark of the American Society of Testing and Materials.  
Sullair® is a registered trademark of Sullair LLC, Michigan City, Indiana.
RPP-RPT-48192, Rev. 2

Units

- **gpm**: gallons per minute
- **in**: inch/inches
- **lb/in² gauge**: pounds per square inch gauge
- **rem**: roentgen equivalent man
- **scfm**: standard cubic feet per minute
1.0 PURPOSE

The purpose of this document is to describe the evaluation of the compressed air pressure relieving device’s ability to perform its safety function(s) under those conditions and events for which the safety function is required. This document identifies the related system, structure, and components (SSCs); critical characteristics; functional and performance requirements; failure modes; boundaries; interfaces; required support systems, and the Key aspects.

2.0 APPROACH

The safety function of the compressed air pressure relieving device was developed based on hazard and accident analysis PrHA-01830. Functional/performance requirements were developed by evaluating the required performance needed to accomplish the safety functions (i.e., prevent or mitigate accidents). Additional applicable functional requirements were developed during engineering evaluations of failure modes when the compressed air pressure relieving device must perform its safety function.

This evaluation was done in accordance with TOC procedure TFC-ENG-DESIGN-C-45, “Control Development Process for Safety-Significant Structures, Systems, and Components.” The following information is provided in this document:

1. Identification of the safety-significant boundaries for the compressed air pressure relieving device.
2. Documentation of support systems required for the compressed air pressure relieving device to perform the intended safety function.
3. An evaluation of interfacing systems whose failure could prevent the compressed air pressure relieving device from performing the intended safety function.
4. Documentation of safety SSC functional and performance requirements necessary for the compressed air pressure relieving device to perform the safety function. The safety SSC functional and performance requirements were identified from design requirements, engineering evaluations and calculations, the interactive hazard/accident analysis safety controls development/evaluation process, and process hazard analysis.
5. Critical characteristics necessary for the compressed air pressure relieving device to perform the safety functions, and identification of how the critical characteristics can be verified to be met. Critical characteristics may be used in the commercial grade dedication (CGD) process to provide reasonable assurance the safety SSC is acceptable and will perform its safety-related function.

Using information from the evaluation described above, critical characteristics for the compressed air pressure relieving device were identified. Subsequent to determining the critical characteristics, key performance requirements were identified. This consisted of identifying any inspections, tests, evaluations or controls needed to verify compliance with critical characteristics.
Compliance with the critical characteristics identified in this Functions and Requirements Evaluation Document shall be verified and documented. Acceptable means of verification can be accomplished by one or more of the following means:

- Procurement from a qualified supplier
- Commercial grade dedication
- Technical evaluation
- Nonconformance report (NCR) disposition (see note below)
- Independent Qualified Registered Professional Engineer (IQRPE) review and approval (Applies only to grandfathered systems upon expiration of the existing approved IQRPE review).
- Testing
- Inspection
- Code compliance
- Certificate of Compliance (C of C) or material certification.

NOTE: The NCR process shall be used to upgrade an existing SSC when the SSC was not procured as safety-significant through a qualified supplier or the CGD process. A Technical Evaluation (refer to TFC-ENG-FACSUP-C-02) shall determine how the FRED critical characteristics were verified and shall be listed in the Safety Equipment Compliance Database (SECD).

Documented evidence of compliance is identified in the SECD (refer to TFC-ENG-FACSUP-C-23 and TFC-ENG-FACSUP-CD-23.3).

3.0 SCOPE

The scope of this evaluation includes the pressure relieving device that protects safety-significant waste transfer systems and components from failure due to overpressure by compressed air systems. The device includes the PRV, the inlet piping system components from the tee connection to the PRV, and the discharge piping. The piping system components between the tee and the PRV and the PRV discharge are included in the safety-significant boundary because their inside diameters are important assumptions in the sizing and set pressure calculations.

4.0 SAFETY FUNCTION

The safety function of the compressed air system pressure relieving device is to limit compressed air system pressure. Limiting compressed air system pressure mitigates the consequences of an air blow accident. Limiting compressed air system pressure also prevents the loss of the safety function of safety-significant SSCs from overpressure.
5.0 SYSTEM DESCRIPTIONS

Pressure relief valve POR315-IA-PRV-101 is included in the portable compressed air system used to blow out residual liquid from HIHTL primary hose assemblies. Pressure relief valve POR315-IA-PRV-101 is installed in the compressed air manifold between the air compressor and the HIHTL systems.

Pressure relief valve POR570-IA-PRV-001 is included in the portable compressed air system used for pneumatic testing of the encasements of waste transfer primary piping systems when the operability of the associated safety significant waste transfer primary piping system is indeterminate. Pressure relieve valve POR570-IA-PRV-001 is installed in the compressed air manifold between the air compressor and the encasements that are being pneumatically tested.

The compressed air manifold is comprised of inlet piping from a tee connection on the air compressor outlet line, either POR315-IA-PRV-101 pressure relief valve or POR570-IA-PRV-001 pressure relief valve, and the pressure relief valve discharge piping. The discharge from the pressure relief valve is to the atmosphere and faces downward. The compressed air manifold is connected to a Sullair 185 portable air compressor. For encasement testing of the SNL-5350 fiberglass-filled composite encasement, a more limited air source may be used instead of the Sullair 185 portable air compressor. The compressed air manifold is controlled under the work control program during use. When not in use the compressed air manifold may be removed from the air compressor and is stored indoors. Section 5.1 provides the overall description of the compressed air pressure relieving device.

5.1 OVERALL DESCRIPTION

The compressed air pressure relieving device is comprised of the tee connection, the PRV and the discharge piping off of the PRV. The following are the specifications for the PRV:

- Equipment Identification Number (EIN): POR315-IA-PRV-101, POR570-IA-PRV-001
- Dresser Consolidated Part Number: 1-19096LCF-2-CC-MS-34-MT-FT-GS
- Inlet/Outlet Ports: 1" MNPT x 1" FNPT
- American Society of Mechanical Engineers (ASME) Section VIII, “UV” Stamped Pressure Relief Valve.
- Set Pressure 150 lb/in\(^2\) gauge
- Must pass minimum flow rate of 273 standard cubic feet per minute (scfm)

5.2 BOUNDARIES

The compressed air system pressure relieving device is bounded by the tee connection, pressure relief valve, and the discharge piping. Figure 1 shows the boundary of the pressure relieving device for the compressed air system. The pressure relief device SSCs includes the following components listed on drawing H-14-109449 and H-14-110805.

- SSCs on drawing H-14-109449, Waste Retrieval System Pneumatic Manifold Assembly, and H-14-110805, Piping Pneumatic Manifold Assembly
Item 5, 1” Elbow, 90°, 3000#, FNPT
Item 6, 1” Close Nipple, Schedule 40
Item 7, 1” Tee, 3000#, FNPT
Item 10, Pressure Relief Valve, Dresser Consolidated
Item 12, 1” Pipe, Schedule 40
Figure 1. Pressure Relieving Device System Boundary
Figure 2. PRV Valve Cross-Section

DIMENSIONS & WEIGHT
A: 82.6 mm - 3-1/4 in
B: 47.6 mm - 1-7/8 in
C: 263.5 mm - 10-3/8 in
D: 49.2 mm - 1-15/16 in
Weight: 2.2 kg - 4-3/4 lb

BILL OF MATERIALS

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<td>8. SPINDLE MS 19000L&amp;M</td>
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<td>16. PLAIN CAP</td>
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Valve picture is for reference only and is not to scale.
5.3 INTERFACES
The compressed air system pressure relieving device interfaces are the waste retrieval system (lowest design pressure 275 lb/in\(^2\) gauge) and water systems (design pressure 150 lb/in\(^2\) gauge).

6.0 SYSTEM EVALUATION

6.1 FUNCTIONAL/PERFORMANCE REQUIREMENTS
The functional and performance requirements for the compressed air system pressure relieving device are to limit compressed air system pressure to \(\leq 500\) lb/in\(^2\) gauge. This ensures that onsite worker consequences due to an air blow accident are below 100 rem and PAC-3. (See RPP-13033, Section 3.3.2.4.5 for the basis for this functional requirement).

To provide a margin of safety, the performance requirement for compressed air system pressure relieving devices is to limit compressed air pressure to \(\leq 190\) lb/in\(^2\) gauge. This performance requirement ensures that onsite worker consequences of an air blow accident are below 5 rem and PAC-2. (See RPP-13033, Section 3.3.2.4.5 for the basis for this performance requirement).

The performance requirement to limit compressed air pressure to \(\leq 190\) lb/in\(^2\) gauge also prevents the loss of the safety function of safety-significant waste transfer primary piping systems whose design pressure is 275 lb/in\(^2\) gauge or 400 lb/in\(^2\) gauge, HIHTL primary hose assemblies whose design pressure is 375 lb/in\(^2\) gauge or 425 lb/in\(^2\) gauge, and isolation valves for double valve isolation whose design pressure is 400 lb/in\(^2\) gauge from overpressure.

The primary functional/performance requirement is that the POR315-IA-PRV-101 and POR570-IA-PRV-001 compressed air system pressure relieving device is sized and has a set pressure that limits compressed air pressure to \(\leq 190\) lb/in\(^2\) gauge. To meet this requirement, the pressure relieving device is sized (i.e., flow capacity) and the set pressure established in accordance with ASME B31.3, Section 322.6.3, which references Section VIII, Division 1 of the ASME Boiler and Pressure Vessel Code. In accordance with ASME B31.3 and Section VIII, Division 1 of the ASME Boiler and Pressure Vessel Code [UG-125(c)], pressure relieving devices shall prevent the pressure from rising more than 10% or 3 lb/in\(^2\), whichever is greater, above the design pressure except as permitted elsewhere in the code. Therefore, a set pressure of \(\leq 172\) lb/in\(^2\) gauge is required to limit the compressed air pressure to \(\leq 190\) lb/in\(^2\) gauge (172 lb/in\(^2\) gauge + 10% of 172 \(\leq 190\) lb/in\(^2\) gauge).

The set pressure and capacity requirements are met by specifying a set pressure of 150 lb/in\(^2\) gauge and selecting a pressure relief valve with a capacity to handle 278 scfm of air. A set pressure of 150 lb/in\(^2\) gauge was chosen so that the PRV will also protect general service equipment, such as water skids. The ASME Section VIII rated capacity of this valve at 150 lb/in\(^2\) gauge is 278 scfm which is meets the design capacity of \(\geq 273\) scfm as calculated in RPP-CALC-48263.
6.1.1 Vendor Recommended Installation Practices

The following are recommended installation practices that the pressure relief valve manufacturer suggests for a 19000 series valve to function properly.

- Mount PRV in a vertical position (± 1 degree).
  - This PRV is installed in the compressed air manifold that is connected to the portable air compressor, so a tolerance of ± 1 degree is unrealistic. An e-mail from Dresser acknowledged that this tolerance is their only guarantee to prevent seat leakage, that the valve reseats properly and no moving parts are misaligned (Appendix B). This does not affect the safety function as this tolerance has no affect on initial popping of the valve. If the valve does not reseat properly, it will be easily noticed as air will be able to leak through the valve still. The valve needs to be mounted in a near vertical position.

- The pressure drop from the vessel (compressed air line) to the PRV shall not exceed 3% of the PRV set pressure.
  - This is incorporated in the PRV sizing calculation. Per RPP-CALC-48263, “This assumption includes the facts that losses between the airline and the safety relief valve are negligible.”

- The PRV inlet pipe must be ≥ the inlet connection to the PRV
  - This is incorporated as part of the design (see H-14-109449 or H-14-110805).

- The PRV discharge pipe size must be ≥ the nominal size of the PRV outlet flange
  - This is incorporated as part of the design (see H-14-109449 or H-14-110805).

- The PRV discharge piping must be designed to limit the total backpressure to ≤ 10% of the PRV set pressure or 400 lb/in\(^2\) gauge, whichever is smaller.
  - This is incorporated in the PRV sizing calculation. Per RPP-CALC-48263, “The discharge of the safety relief valve is sized to make the effects of back pressure negligible...”

6.2 FAILURE MODE EVALUATIONS

6.2.1 Loading Conditions

The following are the loading conditions that were evaluated:

**Dead Load:** Dead loads consist of the weight of the pressure relieving device and connected piping and fittings. Piping is schedule 40 and is more than adequate to support its self-weight.

**Snow Loads:** Snow loads on the pressure relieving device are negligible compared to the dead loads and easily accommodated by the design.

**Wind Loads:** The pressure relieving device is not designed to function during or after high winds.
Ash Fall Loading: Ash fall loads on the pressure relieving device are negligible compared to the dead loads and easily accommodated by the design.

Earth and Groundwater Pressure: This loading condition is not applicable as the portable compressed air system is located above grade.

Vehicle Traffic: This loading condition is not applicable as the portable compressed air system is located above grade.

Vehicle Collision: The pressure relieving device is not designed to function during or after a vehicle collision.

Blast Effects: The pressure relieving device is not designed to function during or after blast effects/missiles from propane/LPG tank explosions

Earthquake Loads: The pressure relieving device is not credited to perform its safety function during or after a seismic event (RPP-13033, Section 3.3.2.4.7.3, “Natural Events”).

Thermal Forces: The system contains no rigid jumpers or otherwise anchored pipe. The piping from the tee up is not restrained so thermal forces are negligible and easily accommodated by the design.

Creep and Shrinkage Loads: Creep and shrinkage loads are not an applicable failure mode for this pressure relieving device.

Hose Whip: If hoses become disconnected the pressure relieving device is not required to perform its safety function.

Load Drops: The pressure relieving device is not designed to perform its function during or following loading due to load drops.

Undermining from Failed Water Hoses: Undermining from broken water hoses is not an applicable failure mode for this pressure relieving device.

Water Hammer: Water hammer is not an applicable failure mode for this pressure relieving device.

6.2.2 Process Conditions

The only process condition the pressure relieving device is evaluated for is compressed air.

Process Pressure/Vacuum: Over pressure failure of the inlet or discharge piping will not fail the safety function. The PRV is self protecting.

Process Temperature (Low): According to manufacturers literature (Dresser Consolidated, General Information: Safety Relief Valve) design temperatures ranging from -25°F to 300°F (high conservative value bounding the compressed air temperature) are well within the temperatures this PRV can handle.
**Process Temperature (High):** According to manufacturers literature (Dresser Consolidated, General Information: Safety Relief Valve) design temperatures ranging from -25°F to 300°F (high conservative value bounding the compressed air temperature) are well within the temperatures this PRV can handle.

**Process Chemistry (Chemical Attack by Waste, Headspace Vapors, Etc.):** Process conditions only consist of air; therefore process chemistry is not an applicable condition to the pressure relieving function.

**Fluid Expansion Effects (e.g., Thermal):** Process conditions consist only of air. Pressures could be generated by temperature changes in trapped air. Over pressure failure of the inlet or discharge piping will not fail the safety function. The PRV is self protecting.

**Erosion:** Process conditions only consist of air; therefore erosion is not an applicable condition to the pressure relieving function.

**Corrosion:** The compressed air may contain water vapor of condensation. This PRV is installed in a vertical position; therefore any condensate would not accumulate in the PRV. Any corrosion to the PRV will cause it to leak air or release earlier, therefore self protecting.

**Radiation Fields:** Process conditions only consist of air and the pressure relieving device is located above grade. Therefore radiation fields are not an applicable condition to the pressure relieving function.

**Plugging/Fouling:** Process conditions only consist of air; therefore plugging/fouling is not an applicable condition to the pressure relieving function.

**Plugged Filters (High Delta Pressure):** There are no filters associated with this device; therefore plugged filters are not an applicable condition to the pressure relieving function.

**Flammable Gas Deflagration/Detonations within Process Equipment:** Process conditions only consist of air; therefore flammable gas deflagration/detonations are not applicable conditions to the pressure relieving function.

### 6.2.3 Environmental Conditions

The following are the Environmental Conditions that were evaluated:

**Temperature – Low:** TFC-ENG-STD-02, “Environmental/Seasonal Requirements for TOC Systems, Structures and Components,” requires in Section 3.1.1, “Temperature,” that Tank Farm SSCs be designed to withstand outside ambient temperatures down to -25°F. According to manufacturers literature (Dresser Consolidated, General Information: Safety Relief Valve) design temperatures ranging from -25°F to 300°F (high conservative value bounding the compressed air temperature) are well within the temperatures this PRV can handle. Low environmental temperatures fall within this range.
Temperature – High: TFC-ENG-STD-02, “Environmental/Seasonal Requirements for TOC Systems, Structures and Components,” requires in Section 3.1.1, “Temperature,” that Tank Farm SSCs be designed to withstand outside ambient temperatures up to 115°F. According to manufacturers literature (Dresser Consolidated, General Information: Safety Relief Valve) design temperatures ranging from -25°F to 300°F (high conservative value bounding the compressed air temperature) are well within the temperatures this PRV can handle. High environmental temperatures fall within this range.

Thunderstorms, Dust, and Ice Glaze: Since the pressure relieving device has discharge piping facing downward, it is not directly subject to failure due to thunderstorms, dust, or ice glaze.

Solar Radiation (e.g., Direct Affects/Damage due to Exposure to UV): The pressure relieving device exterior is metallic and is not subject to failure due to exposure to solar radiation.

Atmospheric Pressure: No failure modes have been identified related to atmospheric pressure.

Ash (Exposure to Ash Particles): Since the pressure relieving device has discharge piping facing downward, it is not directly subject to ash particles.

Exposure to Water (e.g., Humidity/Condensation, Precipitation, Flooding by Service Water): Since the pressure relieving device has discharge piping facing downward, it would not be affected by humidity/condensation, precipitation.

Exposure to Leaked Fluids Other Than Water (e.g., Compressor Oil): The PRV consists of all metallic components that are not affected by other potential fluids, including compressor oil.

Exposure to/Submergence in Leaked Waste: Exposure to leaked waste is not an applicable condition to the pressure relieving function.

Fires (Range Fires, Vehicle Fires, Refueling Activity Fires, Other Fires): The pressure relieving device is not designed to function during or after exposure to fires (i.e., range fires, vehicle fires, etc.).

High Radiation Fields: High radiation field are not an applicable condition to the pressure relieving function.

Flammable Gas Deflagrations in Enclosures: The pressure relief device is located above grade outside of any waste enclosures (e.g., waste transfer associated structures). Therefore, flammable gas deflagrations in enclosures are not an applicable condition to the pressure relieving function.

Mechanical Abrasions: There was no mechanism identified that would result in mechanical abrasion.
6.2.4 Other Failure Modes

**Vibrations:** Vibrations would cause the PRV to relieve and not affect the safety function of the pressure relieving device.

**Chattering:** The PRV is properly sized for normal and worst-case conditions; therefore chattering is highly unlikely. If chattering were to occur, it would easily be noticed and the PRV would be replaced.

**Portable:** It is acknowledged that the Sullair 185 air compressor and compressed air manifold are portable and may be moved, modified or damaged. Because of this, the safety-significant components need to be under configuration control so that they cannot be used in a condition that compromises its safety function. This compressed air manifold that contains the safety-significant PRV and piping will be managed under the work control program during use and in a storage facility when not in use. This ensures that the safety-significant components are not used in a manner in which they were not evaluated for.

6.2.5 Aging

The PRV set pressure may decrease with time due to general aging (e.g., exposure to enclosure environments, change in spring tension). ASME B&PV Section VII, C4.220, “Inspection and Maintenance,” recommends testing intervals of up to 24 months for PRVs associated with power boilers. Based on this ASME-established interval, it is recommended that a PRV be tested to verify that the set pressure is within acceptable tolerances no more than 24 months from the date of installation and every 24 months thereafter or be replaced. The PRV is considered as installed the first time it is physically attached to an air compressor. Possible failures due to general aging are addressed by establishing acceptable testing intervals.

6.3 SUPPORTING SYSTEMS

An evaluation of supporting SSC’s for the compressed air pressure relieving device was performed in accordance with TFC-ENG-DESIGN-C-45, Attachment A, Section 3.0. The purpose of this evaluation was to determine if the pressure relieving device relied on any support SSC’s to perform their intended safety function.

**Electrical Power:** The pressure relieving device does not need electrical power to perform its safety function.

**Compressed Air:** The pressure relieving device does not need other sources of compressed air to perform its safety function.

**Pressure Relief:** This section is part of the TFC-ENG-DESIGN-C-45 format, and does not apply to this evaluation. It is included here for completeness.

**Temperature Control (HVAC):** No HVAC systems are required for the pressure relief device to perform its safety function.
Freeze Protection: Ambient temperatures outside the pit can be as low as –25 °F as specified in TFC-ENG-STD-02, “Environmental/Seasonal Requirements for TOC Systems, Structures and Components,” design parameters. According to manufacturers literature (Dresser Consolidated, General Information: Safety Relief Valve) design temperatures ranging from -25°F to 300°F (high conservative value bounding the compressed air temperature) are well within the temperatures this PRV can handle. No freeze protection is required for the pressure relief device to perform its safety function.

Cooling: No cooling systems are required for the pressure relief device to perform its safety function.

Lubrication: The compressed air pressure relieving device has passive components that have no need for lubrication.

Filtration: There is no filtration required for the compressed air pressure relieving device.

Water: Use of water as a support system is not required for the compressed air pressure relieving device to perform its required safety function.

Other: No other supporting systems have been identified.

7.0 CONTROLS

7.1 SHELF LIFE AND SERVICE LIFE

This PRV contains all metallic components; therefore no shelf life needs to be established. For service life, the PRV is to be tested to verify that the set pressure is within acceptable tolerances no more than 24 months from the date of installation and every 24 months thereafter or be replaced. The PRV is considered as installed the first time it is physically attached to an air compressor. See section 6.2.5 Aging for further evaluation.

7.2 OTHER CONTROLS

No other controls have been identified.
8.0 CRITICAL CHARACTERISTICS

The critical characteristics for the compressed air pressure relieving device’s safety are:

- Pressure relief valve (PRV);
  - Set pressure must be $\leq 172$ lb/in$^2$ gauge
  - Flow capacity must be $\geq 273$ scfm
- Pressure relieving device inlet and discharge piping dimensions (i.e., components listed in Section 5.2, “Boundaries,” meet configuration assumptions used in the relief valve sizing calculations (e.g., pipe length and inner diameter, inner diameter and type of elbows)).

Critical characteristics of each component are listed in Table A-1 of Appendix A.
9.0 REFERENCES


APPENDIX A

COMPRESSED AIR PRESSURE RELIEVING DEVICE’S CRITICAL CHARACTERISTICS
### Table A.1. Compressed Air Pressure Relieving Device Critical Characteristics. (1 Sheet)

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
<th>Safety Function from RPP-13033</th>
<th>Critical Characteristics</th>
<th>Acceptance Criteria</th>
</tr>
</thead>
</table>
| 1   | EIN: None Assigned  
Nomenclature: 1” Elbow, 90°, 3000#, FNPT  
Material: ASTM® A105 Stainless Steel | The safety function of the compressed air system pressure relieving device is to limit compressed air system pressure. Limiting compressed air system pressure mitigates the consequences of an air blow accident. | Dimensions | Elbow shall meet dimensional requirements as specified on H-14-109449 or H-14-110805. |
| 2   | EIN: None Assigned  
Nomenclature: 1” Close Nipple, Schedule 40  
Material: ASTM® A106 Grade B Stainless Steel | The safety function of the compressed air system pressure relieving device is to limit compressed air system pressure. Limiting compressed air system pressure mitigates the consequences of an air blow accident. | Dimensions | Nipple shall meet dimensional requirements as specified on H-14-109449 or H-14-110805. |
| 3   | EIN: None Assigned  
Nomenclature: 1” Tee, 3000#, FNPT  
Material: ASTM® A105 Stainless Steel | The safety function of the compressed air system pressure relieving device is to limit compressed air system pressure. Limiting compressed air system pressure mitigates the consequences of an air blow accident. | Dimensions | Tee shall meet dimensional requirements as specified on H-14-109449 or H-14-110805. |
| 4   | EIN: POR315-IA-PRV-101, POR570-IA-PRV-001  
Nomenclature: Pressure Relief Valve, Dresser Consolidated  
Material: Various. See Figure 2 | The safety function of the compressed air system pressure relieving device is to limit compressed air system pressure. Limiting compressed air system pressure mitigates the consequences of an air blow accident. | Set Pressure | The PRV set pressure shall be ≤172 lb/in² gauge. |
|     |                          |                               | Flow Capacity | The PRV shall have a flow capacity of ≥ 273 scfm. |
| 5   | EIN: None Assigned  
Nomenclature: 1” Pipe, Schedule 40 Threaded One End, Length as Required  
Material: ASTM® A106 Grade B Stainless Steel | The safety function of the compressed air system pressure relieving device is to limit compressed air system pressure. Limiting compressed air system pressure mitigates the consequences of an air blow accident. | Dimensions | Pipe shall meet dimensional requirements as specified on H-14-109449 or H-14-110805. |

**Acronyms:**
- ASTM = American Society for Testing and Materials  
- °F = degrees Fahrenheit  
- FNPT = female national pipe thread  
- PRV = pressure relief valve  
- lb/in² gauge = pounds per square inch gauge  
- scfm = standard cubic feet per minute

**Trademarks:**
- ASTM® is a registered trademark of the American Society for Testing and Materials.

**References:**
APPENDIX B

E-MAIL WITH DRESSER ON VERTICAL POSITIONING TOLERANCE
From: Byers, Matthew E [mailto:matt.byers@dresser.com]
Sent: Wednesday, June 22, 2011 2:35 PM
To: Fink, Peter K
Cc: Brian Bull; Smith, Ryan D
Subject: Re: Question on Vertical Tolerance of Dresser Valves

Peter,

Your statements are correct.

Matt Byers
Manager, Application Engineering
Dresser Consolidated
GE Energy

On Jun 22, 2011, at 4:02 PM, "Fink, Peter K" <Peter_K_Fink@RL.gov> wrote:

After reading these e-mails, I conclude the following:

1) The vertical tolerance may only inhibit reseating or seat leakage due to internals possibly shifting.
2) These issues do not affect the valve from initially popping open at or possibly below the set pressure.

I want to confirm that these assumptions are correct before we go ahead with our safety analysis.

Thank You,

Peter Fink
Retrieval & Closure Engineer
509-373-4470
Peter_K_Fink@rl.gov
Contractor to the United States Department of Energy

From: Brian Bull [mailto:b_bull@bay-valve.com]
Sent: Wednesday, June 22, 2011 11:24 AM
To: Fink, Peter K
Subject: FW: Question on Vertical Tolerance of Dresser Valves

BRIAN BULL
PRESSURE RELIEF VALVE SALES
BAY-VALVE SERVICE, INC.
4385 S. 133rd St - Seattle, WA 98168
Tel: (206) 267-3927 Fax: (206) 286-6541
b_bull@bay-valve.com
SHIP: ARO
From: Byers, Matthew E [mailto:matt.byers@dresser.com]
Sent: Wednesday, June 22, 2011 11:17 AM
To: Brian Bull
Cc: Rathbun, Mike
Subject: RE: Question on Vertical Tolerance of Dresser Valves

Brian,

The main issue would be seat leakage and reseating due to all internals being shifted one way or the other.

Regards,

Matt E. Byers
Manager, Applications Engineering
GE Energy/Dresser Consolidated
P.O. Box 1430 Alexandria, LA 71309-1430, USA
8011 Shreveport Hwy., Pineville, LA 71360
Office: +1 318 640 6401   Fax: +1 318 640 6175
Mobile: +1 318 715 0768
E-mail: matt.byers@ge.com
www.dresser.com
<image001.jpg>
GE imagination at work

From: Brian Bull [mailto:b_bull@bay-valve.com]
Sent: Wednesday, June 22, 2011 1:14 PM
To: Byers, Matthew E
Cc: Rathbun, Mike
Subject: RE: Question on Vertical Tolerance of Dresser Valves

Thank you, Matthew.

What is the reasoning behind the need to be upright?
I can see the valve opening prior to its set pressure or maybe a problem with reseating...

BRIAN BULL
PRESSURE RELIEF VALVE SALES
BAY-VALVE SERVICE, INC.
4385 S. 133rd St - Seattle, WA 98168
From: Byers, Matthew E [mailto:matt.byers@dresser.com]
Sent: Wednesday, June 22, 2011 11:08 AM
To: Rathbun, Mike
Cc: Brian Bull
Subject: RE: Question on Vertical Tolerance of Dresser Valves

Mike,

I would say a +/-1.5 degrees wouldn’t inhibit performance. So another ½ degree either way from the recommended 1 degree.

Regards,

Matt E. Byers
Manager, Applications Engineering
GE Energy/Dresser Consolidated
P.O. Box 1430 Alexandria, LA 71309-1430, USA
8011 Shreveport Hwy., Pineville, LA 71360
Office: +1 318 640 6401   Fax: +1 318 640 6175
Mobile: +1 318 715 0768
E-mail: matt.byers@ge.com
www.dresser.com
<image001.jpg>
GE imagination at work

From: Rathbun, Mike
Sent: Tuesday, June 21, 2011 4:28 PM
To: Byers, Matthew E
Cc: Brian Bull
Subject: FW: Question on Vertical Tolerance of Dresser Valves
Importance: High

Matt,

Is there something in writing this 1 degree issue? Seems they are putting together a mobile unit and this issue keeps coming up.

Thanks,
Hey Mike,

Got a question from a WRPS engineer about the necessity that the valve remains upright. Is there somewhere I could look or someone I could talk to for a specific answer/OK for their use?

Thanks,

Brian Bull

PRESSURE RELIEF VALVE SALES
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Tel: (206) 267-3927 Fax: (206) 286-6541
b_bull@bay-valve.com
SHIP: ARO
FOB: FACTORY
FRT: PREPAID & ADD (OR COLLECT ON YOUR ACCOUNT)
TERMS: N30 (SUBJECT TO CREDIT APPROVAL)
PRICES ARE GOOD FOR 30 DAYS

Brian,

I am following up on this e-mail I sent a few days ago. If you could respond ASAP it would be greatly appreciated. The way our design stands right now, this PRV will be on a mobile unit and may or may not be able to meet this 1 degree vertical position, although it will be required to be in a “near” vertical position. I am trying to justify that the 1 degree is not critical to it
relieving pressure, only that it relates to reseating. If this is not the case, let me know because we will need to change our design.

**Please respond as soon as you can.** My deadline is coming up and I don’t want to hold this up longer than it has been already.

Thank You,

Peter Fink
Retrieval & Closure Engineer
509-373-4470
Peter_K_Fink@rl.gov
Contractor to the United States Department of Energy

Brian,

I called and asked you these questions about two months ago. Since all I got was a verbal confirmation, I wanted to send them to you again making sure I understood correctly the first time.

The Installation, Operation and Maintenance Manual for 19000 Series Consolidated Relief Valves states, “Installing a safety relief valve in any position other than vertical (±1 degree) will adversely affect its operation as a result of the induced misalignment of moving parts.” (Page 13)

What is the reasoning for the one degree vertical tolerance for positioning the relief valve? Is this only a reseating issue? Also is there a maximum angle that this valve can be positioned at before its operability to open is compromised?

Thank You,

Peter Fink
Retrieval & Closure Engineer
509-373-4470
Peter_K_Fink@rl.gov
Contractor to the United States Department of Energy