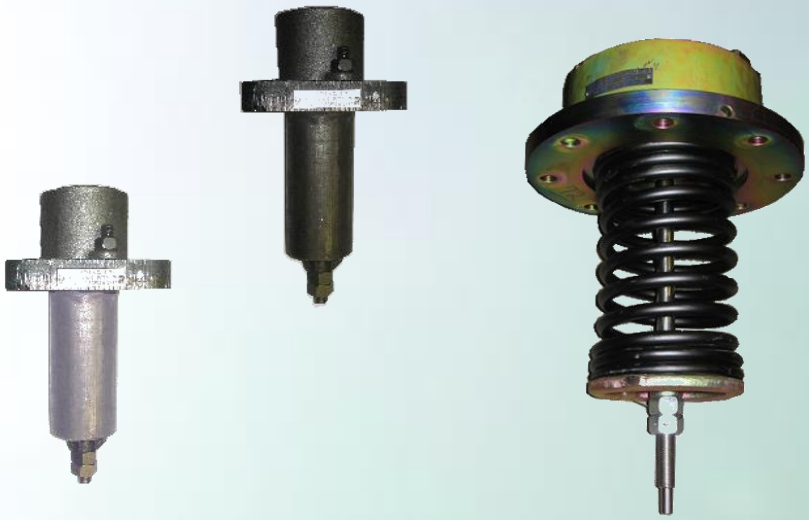
Safety Relief Valve

Product Literature & Maintenance Guidelines

Revision February 7, 2020



1.0 Internal Pressure Relief (Safety) Valves

1.1 Safety Valves are used to protect the tank from over-pressure in such events as an accident involving a fire. McKenzie Valve supplies both low-flow and high-flow capacity designs generally used for non-insulated non-pressure tank cars. Each valve design is available with a 75 psi start-to-discharge pressure.

1.2 The low-flow valve mounts on a standard 3-1/2" nozzle using (4) 3/4"-10 bolts on a 6-1/4" bolt circle as prescribed by AAR Fig E-21. The valves are constructed of either carbon steel or stainless steel with a stainless trim.

1.3 The high-flow valve mounts on a standard 6-1/2" nozzle using (8) 5/8"-11 bolts on a 10-1/4" bolt circle as prescribed by AAR Fig E-11. The valve is constructed of either carbon steel or stainless steel with a stainless steel trim. Carbon steel components are fully plated for maximum corrosion protection.

1.4 The safety valves are available with the standard O-ring material options that are color coded and available at the base price. Alternate O-ring materials are also available as a special order. They will be supplied "**Black**" unless otherwise specified.

Table 1 – Standard Safety Relief Valve offerings

DESCRIPTION	SPRING	AAR APPROVAL NUMBER	CAPACITY @ 85 psig (SCFM)*	(O-RING MATERIAL)**			
				VITON "A"	BUNA "N"	EPDM	NEOPRENE FOOD GRADE
				BROWN	BLACK	PURPLE	WHITE
75 psi CS SRV	A228 MW	PRD-107010	1202	092420-01	092420-03	092420-04	092420-02
75 psi SS SRV	A313 316SS	PRD-107009	1212	092534-01	092534-03	092534-04	092534-05
75 psi CS High Flow SRV	Powder Coated	PRD-120079	21272	085381-03	085381-01	085381-19	085381-02
75 psi High Flow SS SRV	A313 17-7PH	PRD-120079	21272	510794-03	510794-01	510794-19	510794-02

*SCFM = Cubic Feet Per Minute of Air at Standard Conditions
**See the website or Sales Literature for a more complete listing.

1.5 75 psi Low-Flow Safety Relief Valves (92420 and 92534)

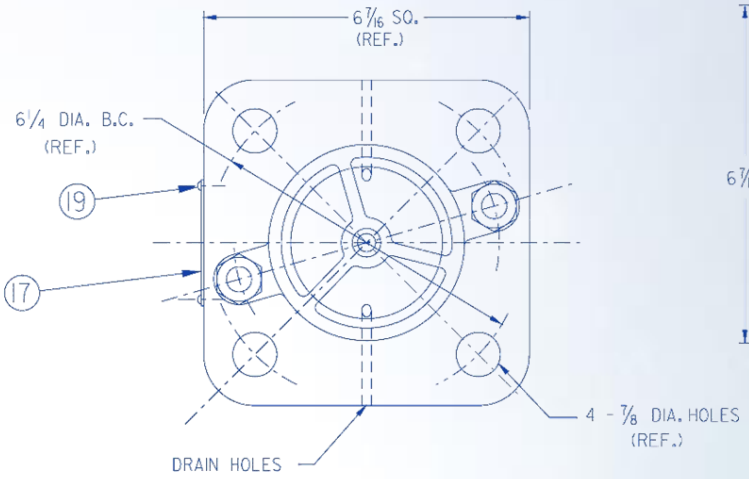


Figure 1: Top View of Low-Flow SRV's

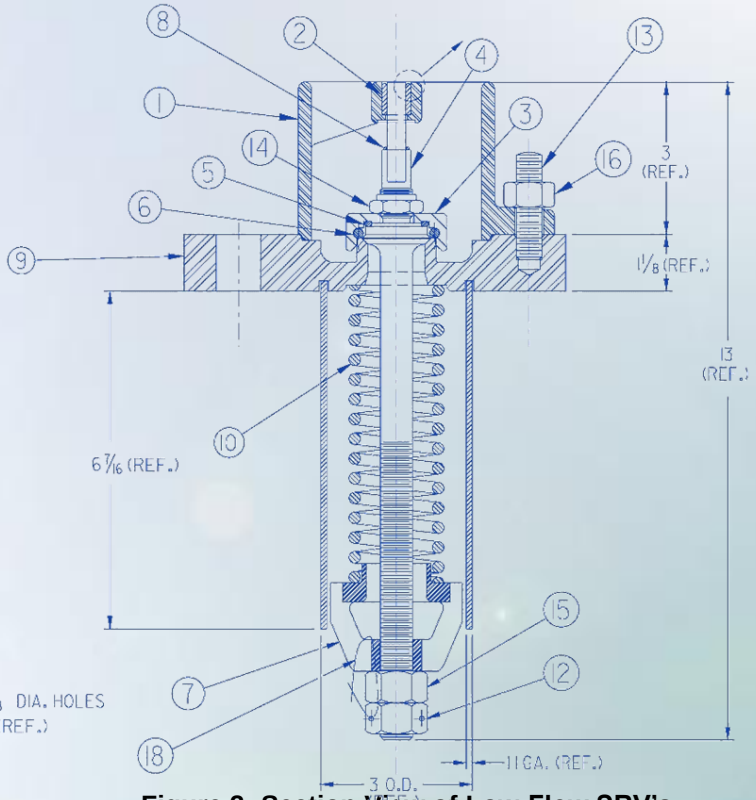


Figure 2: Section View of Low-Flow SRV's

Table 2 – Low-Flow 75 psi Safety Relief Valve Components (92420 & 92534)

SYM	DESCRIPTION	MATERIAL		PART NO		REQ
		SS SRV	CS SRV	SS SRV	CS SRV	
1	GUIDE TOP	CAST SS	CAST CS	26041-01	15909-01	1
2	BUSHING	TEFLON®		15910-01		1
3	CAP	SS	CS	101152-01	101148-01	1
4	STEM	SS		101151-01		1
5	O-RING / O-RING	See Appendix A		See Appendix A		1
6	O-RING / O-RING	See Appendix A		See Appendix A		1
7	FOLLOWER SPRING	CAST SS	CAST CS	26049-01	15966-01	1
8	O-RING	BUNA "N"		208-7331		1
9	SAFETY VALVE FLANGE	SS	CS	503166-03	503166-04	1
10	SPRING	SS	CS MW	26044-01	26386-04	1
12	NUT, HEAVY HEX, 5/8-11 UNC-2B S.F. W/HOLES	A194 GR 6F		24178-03		1
13	STUD 1/2-13 UNC -2A x 2 1/8 LG	A320 316	A193 B7	09604-01	101214-01	2
14	NUT, LOCK 5/8 HEX ESNA	STEEL PLATED		304-8597		1
15	NUT, HEAVY HEX, 5/8-11 UNC-2B S.F.	A194 GR 6F		304-7091		1
16	NUT, HEAVY HEX, 1/2-13 UNC-2B S.F.	A194 GR 6F	A194 GR 2H	304-7055	304-7030	2
17	IDENTIFICATION PLATE	SS		17387-46	17387-45	1
18	SEAL WIRE & DISC	SS & LEAD		305-8425		1
19	SIZE #2 RD HD DRIVE SCREW	SS		304-8745		2

1.6 75 psi High-Flow Safety Relief Valves

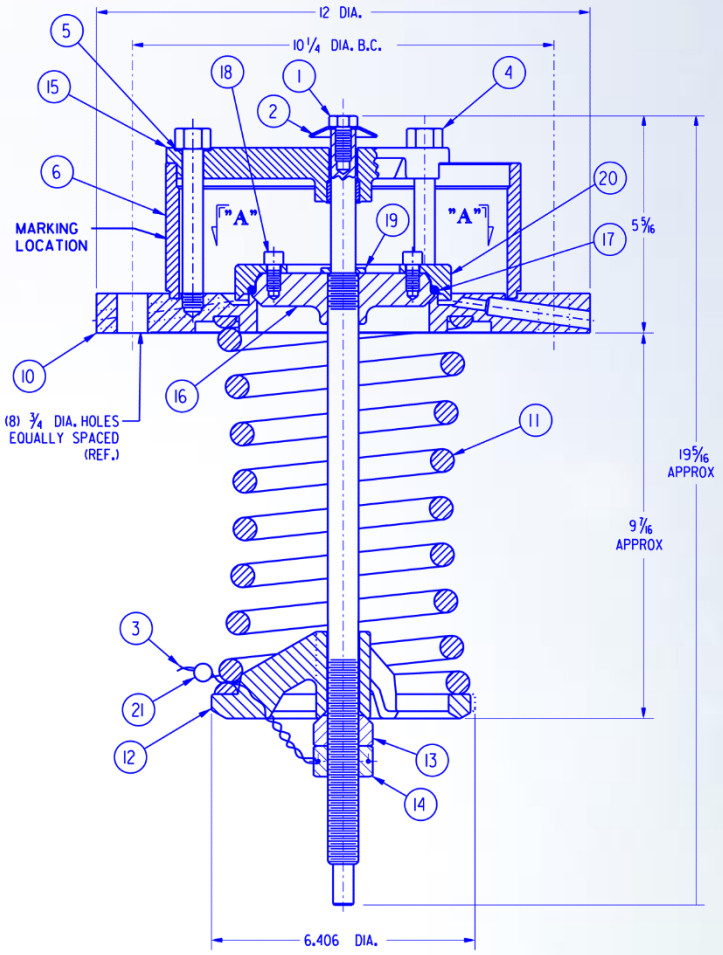


Figure 3: 85381 CS SRV Section View

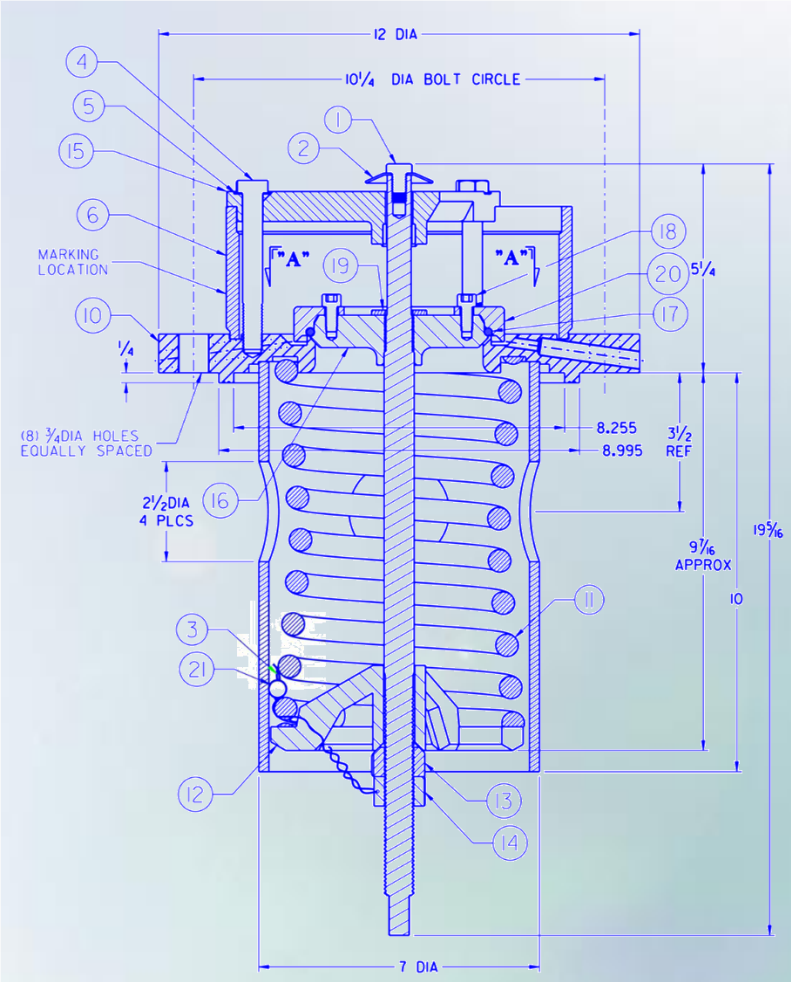


Figure 4: 510794 SS SRV Section View

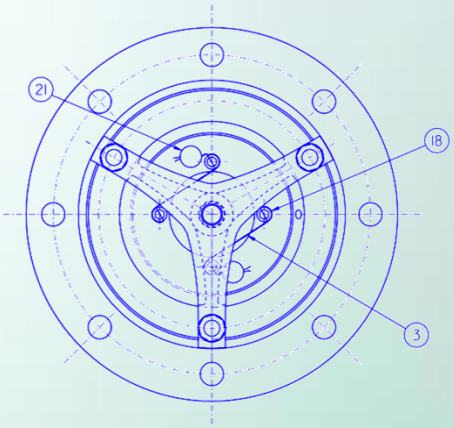


Figure 5: Top View of High-Flow SRV's

Table 3 – High-Flow 75 psi Safety Relief Valve Components (85381 & 510794)						
SYM	**DESCRIPTION**	**MATERIAL**		**PART NO**		**REQ**
		CS SRV	**SS SRV**	**CS SRV**	**SS SRV**	
1	SCREW, CAP, HEX HEAD 3/8-16 UNC-2A	J429 GR5	304 SS	316-3850	304-9085	1
2	COVER, SAFETY VALVE STEM	ALUMINUM		23716-01		1
3	SAFETY WIRE	302 SS		316-3810		2
4	SCREW, CAP, HEX HEAD 1/2-13 UNC-2A	J429 GR5	304 SS	316-3860	304-9230	3
5	WASHER, LOCK 1/2" EXTERNAL TOOTH	CS	304 SS	316-4680	305-9581	3
6	NOZZLE, DISCHARGE	A53	316 SS	23710-01	111319-01	1
10	FLANGE, BODY	A516-70	316 SS	23697-01	510793-01	1
11	SPRING	A401	17-7 PH	105492-01	111356-01	1
12	RETAINER, SPRING	A395	CF8M	23704-01	111321-01	1
13	NUT, HEAVY HEX, 3/4-10 UNC-2B	A194 GR2H	304 SS	MV10019-01	111325-01	1
14	LOCKNUT, HEAVY HEX, 3/4-10 UNC-2B	A194 GR2H	304 SS	23703-01	111326-01	1
15	SUPPORT, S/A BEARING	A395/Teflon	CF8M/Teflon	85385-01	510311-01	1
16	VALVE, POPPET AND STEM S/A	CS/304 SS	316L/304 SS	506713-01	510312-01	1
17	O-RING	See Appendix A		See Appendix A		1
18	SCREW, CAP 5/16-18 UNC-2A	A574 IFI Gr. 1035	F837 Gr. 302 HQ	304-20073	304-20074	4
19	WASHER 11/16	BUNA N		305-8799		1
20	CAP POPPET	AISI C1018	316 SS	23709-01	111323-01	1
21	SEAL	LEAD		316-3900		3

2.0 General Warnings and Disclosures:

2.1. The following guidelines describe McKenzie Valve and Machining Company's standard disassembly and reassembly instructions. These are not meant to conflict, override, supersede or be used in place of a company's safety, production, and engineering standards or government rules and regulations. All DOT, AAR, CTC, national, federal, local, and other regulations that apply must be followed.

2.2. Only trained, qualified personnel should perform any procedures described within this brochure.

2.3. Read and understand the entire procedure before attempting any service or inspection.

2.4. These valves are used in numerous services and complete information about the commodity should be obtained, verified, and reviewed before any inspection or maintenance is performed.

2.5. To avoid exposure to toxic or hazardous conditions and materials, ensure that the direct area and all components are free of hazardous materials before performing any maintenance.

During maintenance, use appropriate personal protection equipment based on the service in which the valve was used. Residual materials may still be in the valve, so appropriate precautions need to be taken.

During installation, take care to ensure the valve is in purchased condition; clean, free of debris, and free of scratches that can lead to leakage. Use appropriate gaskets, fasteners, torque, tools, and methods to install the valve.

2.6. To avoid physical harm, use appropriate equipment to handle the valves. The design of Safety Relief Valves (SRV) utilizes a compressed spring. <u>These springs store potential energy that could be harmful if uncontrollably released.</u>

When transporting, removing, disassembling, assembling, or installing the valves, do not place any part of your body directly in front of the spring.

Handle the valves with care to avoid damage to the valve and any of its components which might lead to a discharge of this energy. Never try to manually actuate the valve.

3.0 SRV Installation:

3.1. McKenzie Valves are designed using standard mounting dimensions from the Association of American Railroads' (AAR) Manual of Standards and Recommended Practices, Section C-III, Safety and Operations Specifications for Tank Cars.

3.2. All new valves are set and tested at the McKenzie facility to ensure the quality of the valve. If the valve has remained in its original condition and is not more than six months old, the valve will not require new calibration or testing. Prior to installation, the valve should be handled appropriately and inspected to ensure that the gasket sealing surfaces are clean and undamaged. If the valve is more than six months old or damage is found, the valve will require maintenance.

3.3. As each manufacturer may impose different requirements based on service and design, install the valve using the tank car manufacturer's, or other end user's, specified materials and procedures.

3.4. The valve is designed to be installed with the spring inside the tank. Inspect the sealing surfaces and position the appropriate gasket between the valve and its mounting surface. Carefully lower the valve into position taking care to align the gasket, valve, and mounting surface.

3.5. Check to ensure that the fastener threads are clean. As the fasteners are installed, they should be equally tightened in increments to ensure proper alignment and even gasket compression. The recommended increments are: hand tight; then one third of required torque; then two-thirds; then the complete torque. The fasteners should not be tightened in a circular, or rotational, pattern as this may distort the gasket and result in uneven sealing. A criss-cross, or star, pattern as shown in Figure 6 should be used. Once the fasteners are fully tightened, a circular pattern can be used to check the torques.

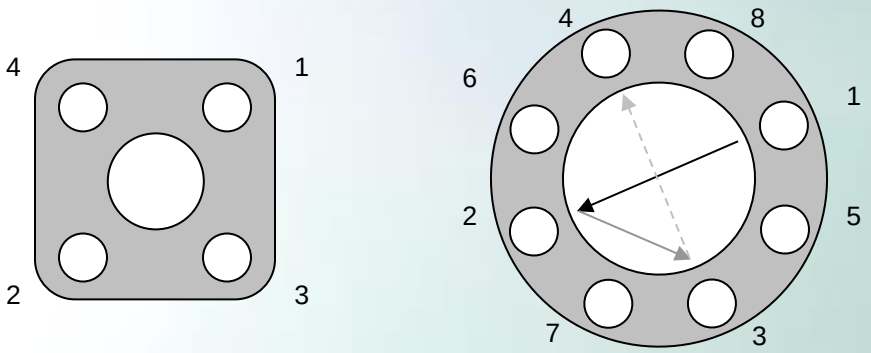


Figure 6: SRV Fastener Torqueing Sequences

3.6. After the valve is installed, check for leakage around the newly installed gasket. If any leaks are detected, the valve should be removed, the valve and mounting surfaces should be inspected, and a new gasket must be installed.

4.0 SRV Operation:

4.1. The SRV is not meant to be manually operated. This valve is under spring force and is designed to operate when it is installed into a larger tank or container that experiences a pressure above the valve's rating. Do not attempt to manually actuate the valve, as side loading may occur which in turn may damage the valve.

5.0 Low Flow SRV Disassembly: (Refer to Table 2 and Figures 1 & 2)

5.1. Read and understand the entire procedure before attempting any service or inspection. Follow all safety procedures applicable.

5.2. Before disassembling the valve, measure the assembled height of the spring in the valve. This measurement will be used when assembling the valve.

5.3. Remove the seal disc and seal wire (18). If these are broken, note should be taken that the valve may have been adjusted and spring height may not be accurate.

5.4. Remove the fasteners (16) from the top guide (1) and remove the top guide. Application of a drop of oil to each of the bolts will help when loosening the fasteners.

5.5. Remove the jam nut (12) from the stem of the valve.

5.6. Measure the location of the adjusting nut on the stem. This measurement will be used when inspecting the concentricity of the stem.

5.7. Put the valve upside-down in a spring compression fixture. Apply just enough force to slightly compress the spring. The adjusting nut (15) should move easily. A light amount of oil may be required on the threads. If the valve is stainless steel, anti-seize may be used.

5.8. Carefully remove the adjusting nut (15).

5.9. Slowly and carefully release the force on the spring (10).

5.10. Remove the spring retainer (7) and the spring (10) from the valve.

5.11. Carefully remove the stem assembly (4) from the valve body (9).

5.12. Loosen the lock nut (14) holding the O-ring cap (3) on the stem (4).

5.13. Remove the cap (3).

5.14. Remove all seal materials (5, 6, & 8) from the cap (3) and stem (4). A tool such as an O-ring pick may be needed. Avoid scratching or damaging any sealing surfaces.

5.15. Immediately, discard all seal materials (5, 6, & 8).

6.0 High Flow SRV Disassembly: (Refer to Table 3 and Figures 3, 4, & 5)

6.1. Read and understand the entire procedure before attempting any service or inspection. Follow all safety procedures applicable.

6.2. Before disassembling the valve, measure the assembled height of the spring in the valve. This measurement will be used when assembling the valve.

6.3. Remove the seal disc and seal wire (3, 21). If these are broken, note should be taken that the valve may have been adjusted and spring height may not be accurate.

6.4. Remove the screw (1) and cover (2) from the top of the stem (16)

6.5. Remove the fasteners (4, 5) from the top guide (15) and remove the top guide. Application of a drop of oil to each of the bolts will help when loosening the fasteners.

6.6. Remove the jam nut (14) from the stem of the valve.

6.7. Measure the location of the adjusting nut (13) on the stem (16). This measurement will be used when inspecting the concentricity of the stem.

6.8. Put the valve upside-down in a spring compression fixture. Apply just enough force to slightly compress the spring. The adjusting nut (13) should move easily. A light amount of oil may be required on the threads. If the valve is stainless steel, anti-seize may be used.

6.9. Carefully remove the adjusting nut (13).

6.10. Slowly and carefully release the force on the spring (11).

6.11. Remove the spring retainer (12) and the spring (11) from the valve.

6.12. Carefully remove the stem assembly (16) from the valve body (10).

6.13. If present, remove the seal disc (21) and seal wire (3) from the poppet cap screws (18). Older versions of this design may not utilize this feature. However, if the poppet cap screws have provisions for safety wire and are not properly wired and sealed, note should be taken that the valve may have been altered.

6.14. Remove the cap screws (18) holding the o-ring cap (20) on the stem (16). If the cap screws do not have provisions for safety wiring, discard the cap screws.

6.15. Remove the cap (20).

6.16. Remove all seal materials (17) from the cap (20) and stem (16). A tool such as an o-ring pick may be needed. Avoid scratching or damaging any sealing surfaces.

6.17. Immediately discard all seal materials (17).

7.0 SRV Component Inspection:

7.1. When a SRV is removed from an existing application, it must be cleaned and inspected.

7.2. All gasket materials must be removed and discarded. While removing the gasket, do not use any tools that may cause scratches or grooves. Ensure that all existing gasket material is removed.

7.3. Inspect the sealing surfaces. For a flat face flange, inspect for scratches that can be detected by sliding a fingernail across. For tongue and groove surfaces, examine the sides of the tongue and groove, as well at the top of tongue and bottom of groove. These surfaces should be inspected for scratches as well as roll over material on the edges. If the tongue and groove dimensions have been distorted by shearing or warping, the joint may not properly align. Any pitting or irregularities, which can be seen or felt, may be cause for rejecting the part.

7.4. Replace the Cap, Body, and Stem/Plug as necessary. Do not attempt to remachine any sealing surfaces.

7.5. Clean all threads where oil was applied during disassembly. These may include top guide fasteners, adjusting nut threads on the stem, the lock nut threads on the stem, and cap screws that hold the o-ring cap.

7.6. Clean and inspect the body of the valve.

7.7. Inspect the “bowl area” for any corrosion and clean with a Scotch-Brite pad (or equivalent) or 400 grit emery cloth as needed. Bead blasting is an acceptable alternative.

7.8. Inspect the sealing area of the flange with a straight edge to verify that the area by the bolt holes is not bent. Inspect the bolt holes for any damage.

7.9. Inspect all threaded holes and chase with a tap as needed.

7.10. Inspect all mating surfaces between valve parts for corrosion, alignment, etc. Clean as needed with a Scotch-Brite pad (or equivalent).

1. Stem and cap (or stem, retainer and plug)
2. Top guide and body
3. Stem, top guide and body
4. Spring and body
5. Spring and retainer (or spring, follower and guide)
6. Seal retainer and body

7.11. Inspect Stem

1. Wire brush the entire length of stem to remove scale, solidified product and any foreign matter.
2. Visually inspect stem for defects and overall condition including threads and poppet for cracks, nicks, and/or pits caused by corrosion, etc., before continuing. Repair work is limited to cleaning and polishing.
3. If the visual inspection is acceptable, perform a water washable liquid penetrant inspection, on the complete stem. Stems with crack like indications shall be replaced.
4. If the threads are slightly galled, run the correct size thread die over the affected area. Stems with severely galled area of thread shall be replaced.

5. Perform stem concentricity inspection.

   Equipment needed:
   1) Dial indicator on a stand
   2) Two v-blocks
   3) End stop

   Procedure:
   1) Place the top guide end of the stem in one v-block.
   2) Place the other v-block at the location where the adjusting nut was measured before disassembly.
   3) Place the dial indicator (as shown) on the outer edge of stem (poppet).
   4) Rotate the stem 360°.
   5) Observe the total dial indicator movement (maximum to minimum measurement), which will be the T.I.R. (total indicator reading).
   6) The maximum T.I.R. shall be:
      0.015 inches for the small capacity designs (092420, etc.)
      0.030 inches for the large capacity designs (085381, etc.)

7.12. Inspect Spring

1. For Non-Coated Springs:
   1. Wire brush the entire length of non-coated springs, as needed, to remove scale, solidified product and any other foreign matter.
   2. Visually inspect the spring for damage or cracks. A crack in the spring is cause for rejection.
   3. If visual inspection is acceptable perform a water-washable or solvent removable liquid penetrant inspection on the complete spring. Springs with crack like indications shall be replaced.
2. For Coated Springs:
   1. Visually inspect the spring for damage or cracks. A crack in the spring is cause for rejection.
   2. Examine coated springs for areas cladding loss.
      a) Springs with areas of flaked cladding, loss greater than one square inch total are to be rejected and replaced.
      b) Minor cladding loss due to rubbing is not cause for rejection.
      c) Inspect the spring for even coil spacing. Reject if coil spacing is uneven.

   Note: A coated spring <u>cannot</u> be inspected by the liquid penetrant method.

3. For all springs not rejected, Perform Compression Inspection:
   1. Measure and record the free height of the spring.
   2. Compress the spring completely, to solid height, and hold for two minutes.
   3. Release the spring and measure the free height and record.
   4. The minimum free height after compressing must not be less than the measurement before compressing. Springs that do not meet this criterion must be rejected and replaced.

7.13. Visually inspect the follower for damage. Move the follower up and down the length of the stem and guide tube (if applicable). Ensure free movement of the follower.

8.0 SRV Low Flow Assembly:

NOTE: Refer to Figures 1 and Figures 2 and Table 2 for components referred to in this Section. Component symbol number are indicated by ( ).

8.1. Make certain that all components have been inspected per Section 7.0 of this document. and ensure they are clean, free of nicks and scratches and are in proper condition for assembly.

8.2. Select the proper o-rings (5 & 6) per the customer specified material using Table A.1. Clean and inspect the o-ring(s) and then apply a very thin film of food grade silicone sealant compound to the o-ring(s).

8.3. Insert the o-ring (5 & 6) into the cap (3).

8.4. Press the cap (3) and o-ring (5 & 6) into position on the stem(4)

8.5. Thread the locknut (14) onto the stem. Torque the locknut (14) to 80 ft-lbs

8.6. Place the stem assembly (3, 4, 5 & 6) into a fixture with the threaded side up. Apply anti-seize compound on the threads of stainless steel stems.

8.7. Set the safety valve flange (9) onto the stem assembly in the fixture. Ensure that the safety valve flange (9) is centered on the stem assembly (3, 4, 5 & 6) and is supported squarely on the o-rings (4 & 5).

8.8. Place the spring (10) and follower spring (7) over the stem (4).

8.9. Compress the spring (10) until the adjusting nut (15) can be started. Tighten the adjusting nut (15) until the measured assembly height (from Disassembly (5.2) is reached. If a compression fixture is available, compress the spring (10) until the measured assembly height is reached and tighten the adjusting nut (15).

8.10. Place the valve in the assembly fixture with the spring (10) pointing down.

8.11. Install the o-ring (8) onto the stem.

8.12. Install bushing (2) into the guide top (1).

8.13. Install the two studs (13) into the safety valve flange (9).

8.14. Align the two holes in the guide top (1) with the two studs (13) on the safety valve flange (9) and place the guide top(1) onto the safety valve flange (9). Make certain that the guide top (1) is not binding on the stem (4).

8.15. Install the two nuts (16) onto the studs (13) and tighten to 75 ft-lbs.

8.16. Assembly is complete and the safety valve is ready for testing, Section 10

9.0 SRV High Flow Assembly:

NOTE: Refer to Figures 3, 4 and 5 Table 3 for components referred to in this Section. Component symbol number are indicated by ( ).

9.1. Make certain that all components have been inspected per Section 7.0 of this document. and ensure they are clean, free of nicks and scratches and are in proper condition for assembly.

9.2. The assembly fixture must be checked periodically to ensure that the top and bottom portions are centered. Fixture alignment is critical to ensure even compression of the o-ring (17).

9.3. Place the poppet and stem S/A (16) into the assembly fixture.

9.4. Select the proper o-ring (17) per the customer specified material using Table A.2. Clean and inspect the o-ring and then apply a very thin film of food grade silicone sealant compound to the o-ring.

9.5. Insert the o-ring (17) into the cap poppet (20).

9.6. Align the four holes in the cap poppet (20) with the corresponded threaded holes in the poppet and stem S/A (16). Press the cap poppet (20) and o-ring (17) into position on the poppet and stem S/A (16).

1. Insert a total of 4 socket head cap screws (4) into the holes in the cap poppet (20 and the threaded holes in the poppet and stem S/A (16). Tighten the cap screws (4) to the torque valve per Table 4 using a criss-cross (star) pattern and several passes.

Table 4 – Socket Head Cap Screw Torque Requirements

Part Number	Fastener Material	Torque
304-20073	ASTM A574, IFI Grade 1035 Carbon Steel	250 in-lbs
304-20074	ASTM F837, Grade 302HQ Stainless Steel, Condition CW1	135 in-lbs

9.7. After the cap screws are properly torqued, safety wire (3) is to be installed to prevent the disengagement or movement of the cap screws and provide evidence of unauthorized modifications. The below rules shall be followed:

1. The cap screws (4) are to be wired in pairs (two wires per assembly) using the double-twist method as shown in Figure 7 below.

2. The safety wire (3) is to be wrapped in such a way that the loosening of one cap screw (4) will result in the tightening of another.

3. The wire is to be twisted with 6 to 8 twists per inch.

   Note: Safety wire must never be overstressed; safety wire will break under vibration if twisted too tightly.

4. Safety wire (3) shall be pulled taut when twisted and maintain a light tension when secured.

5. Lead seals (21) are to be applied at the end of the safety wiring (two per assembly).

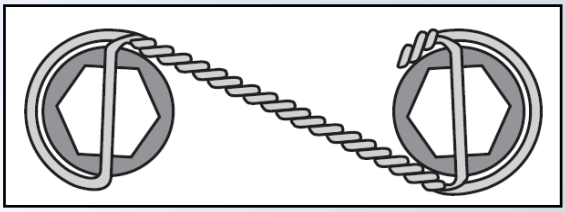


Figure 7: Safety Wiring (Double-Twist, Right-Hand Threads)

9.8. Place the stem assembly (3, 4, 16, 17, 20 & 21) into a fixture with the threaded side up. Apply anti-seize compound on the threads of stainless steel poppet and stem S/A (16).

9.9. Set the flange body (10) onto the stem assembly (3, 4, 16, 17, 20 & 21) in the fixture. Ensure that the flange body (10) is centered on the stem assembly (3, 4, 16, 17, 20 & 21) and is supported squarely on the o-ring (17).

9.10. Place the spring (11) and spring retainer (12) over the poppet and stem S/A (16).

9.11. Compress the spring (11) until the adjusting nut (13) can be started. Tighten the adjusting nut (13) until the measured assembly height (from Disassembly 6.2) is reached. If a compression fixture is available, compress the spring (10)until the measured assembly height is reached and tighten the adjusting nut (13).

9.12. Remove the valve from the assembly fixture and reinstall the valve in the assembly fixture with the spring pointing down.

9.13. Install the discharge nozzle (6) into the groove in the flange body (10) as shown in Figures 3 or 4.

9.14. Install the bearing support S/A (15) over the poppet and stem S/A (16) and into the discharge nozzle (6). Ensure that the bearing support S/A (15) is not binding on the poppet and stem S/A (16). If binding occurs, check the alignment of the stem assembly to the valve body assembly.

9.15. Install a lock washer (5) onto each of the 3 hex head cap screws (4). Install the hex head cap screws (4) and lock washers (5) into each of the three holes in the bearing support

S/A (16) and the threaded holes in the flange body (10). Tighten the hex head cap screws to 25 ft-lbs (300 in-lbs)evenly using several passes.

9.16. Place the cover (2) onto the stem and secure using hex head cap screw (1) by securely threading the hex head cap screw (1) into the poppet and stem S/S (16).

9.17. Assembly is complete and the safety valve is ready for testing, Section 10.

10.0 SRV Testing:

10.1. Install the pressure relief valve in the test well or equivalent fixture.

10.2. Cycle the valve by increasing the test well pressure until there is an audible release of air through the valve, and then reduce the pressure until the air flow stops. Cycling the valve helps provide consistency in test results between valves that have sat for varying lengths of time.

10.3. Start-to-Discharge Pressure

1. The AAR definition of start to discharge pressure (STD) is "the pressure, measured at the valve inlet, at which there is a measurable lift of the closure device on a safety relief valve, or at which discharge becomes continuous as determined by seeing, feeling or hearing."
2. Slowly increase the pressure in the test well.
3. Measure and record the start to discharge pressure as defined above. The acceptable start to discharge pressure is defined in BOE-6000. “The tolerance for a reclosing pressure relief valve is ±3 psi for valves with a start-to-discharge pressure of 100 psi or less and ±3% for valves with a start-to-discharge pressure greater than 100 psi.” If the start to discharge pressure is outside the acceptable range the valve setting should be readjusted by tightening or loosening the spring retaining nut as needed.

10.4. Vapor-Tight Pressure

1. The AAR definition of vapor tight pressure (VTP) is "the pressure, measured at the valve inlet after closing, at which no further fluid flow s detected at the downstream side of the seat of a safety relief valve."
2. An effective indication of vapor tight pressure is when there are no more bubbles or at least a 10 second delay between bubbles.
3. Slowly decrease the pressure in the test well.
4. Measure and record the vapor tight pressure as defined above. The acceptable vapor tight pressure is defined in BOE-6000. “The vapor tight pressure of a reclosing pressure relief valve must be at least 80 percent of the start-to-discharge pressure.” If the vapor tight pressure is below the minimum VTP the valve shall be rejected. The valve should be disassembled, and all sealing surfaces closely checked before rebuilding.

10.5. Record the valve serial number, start to discharge pressure, and vapor tight pressure using the AAR certificate of test form, which must be signed and dated.

10.6. Remove the putty, etc. from the drain holes and drain off any water. Remove the valve from the pressure test well.

10.7. Install the locking nut (or top nut) by using 2 wrenches to tighten it to 45±15 ft-lbs. against the adjusting nut (or adjusting screw), without changing the adjusting nut position.

Install the safety wire(s) and lead seal(s) as required. Typical seal locations are: holes in the adjusting nuts, top guide fasteners, set screw, etc.

Appendix A : O-Rings for Repairs

Table A.1: O-rings For Low Flow 75 psi SRV/PRV (92420, 92534, etc.)

MATERIAL	SYM #5	SYM #6	Related Valve Assemblies
			92420-, 92534-, 508941-, 508942-, 508943-, & 508554
CS 4560	208-0776	208-0777	25
EPDM WHITE FOOD GRADE	108-20156	108-20157	24
SIMRIZ 7295	108-20135	108-20136	23
CS 5350	208-16041	208-16042	22
PAI 9703	208-16039	208-16040	21
CS EP787	208-16037	208-16038	20
CS 4273	208-16031	208-16032	19
VITON F	208-16028	208-16029	18
BUTYL RUBBER	208-9672	208-9673	17
BUNA-N WHITE FOOD GRADE	208-16055	208-16056	16
15 NOT USED			
VITON B - CERTIFIED	208-16051	208-16050	14
KALREZ 6375	208-7301	208-7302	13
CHEMRAZ 505	308-9857	308-7318	12
VITON B	208-19992	208-19993	11
VITON EXTREME ETP	208-16008	208-16012	10
VITON GF-S	208-16007	208-16011	09
CS 5355	208-16006	208-16010	08
CS 4273B	208-16005	208-16009	07
VITON GFLT	208-19989	208-19990	06
NEOPRENE	308-7333	308-7334	05
EPDM	208-7323	208-7328	04
BUNA-N	208-7324	208-7329	03
NEOPRENE FOOD GRADE	208-7322	208-7327	02
VITON A	208-7321	208-7326	01

Table A.2: O-rings For High Flow SRV/PRV (85381, 510794, etc.)		
MATERIAL	SYM #17	Related Valve Assemblies
		85381-, 510282-, 510794-, 510866-, 510867- & 511055-
CAROLINA SEAL BN661	208-29199	28
SIMRIZ 7295	208-20038	27
COMPOUND 9703	208-7982	26
EPDM WHITE FOOD GRADE	208-16063	25
CS 5350	208-16036	24
CS EP787	208-16035	23
KALREZ 6375	208- 7294	22
CS 4273	208-16034	21
BUNA-N WHITE FOOD GRADE	208-7980	20
EPDM	208- 7471	19
VITON EXTREME ETP	208-16004	18
VITON GF-S	208-16003	17
CS 5355	208-16002	16
CS 4273B	208-16001	15
VITON GFLT	208-19991	14
CHEMRAZ 505	108- 9799	13
VITON B	308- 6019	12
VITON A - CERTIFIED	208-19959	11
KALREZ 4079	308- 9782	10
VITON B - CERTIFIED	708-9956	09
05, 06, 07 & 08 NOT USED		
BUTYL RUBBER	308- 7413	04
VITON A	308- 7412	03
NEOPRENE FOOD GRADE	308- 7472	02
BUNA-N	208- 7469	01