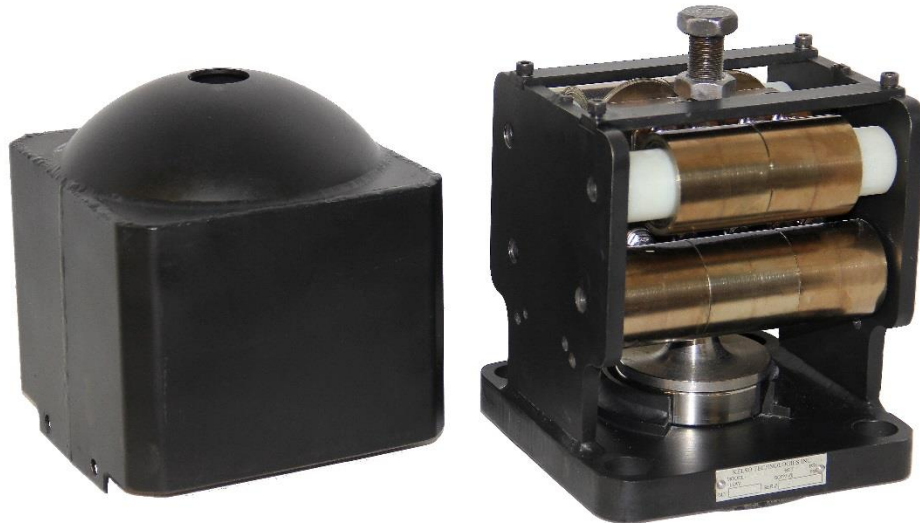




Installation, Operation, Inspection and Maintenance Manual



PRESSURE RELIEF VALVE – HIGH PRESSURE
MODELS: PCH Series

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1.0 Introduction

Kelso external pressure relief valve offers performance and reliability with today's Best Available and Safest Technology. Our experience delivers a technical superior product which includes features such as; constant force spring technology, external valve design that places key components outside of the tank car and away from chemicals that may degrade valve operation over time, increased reliability and performance.

1.1 Precautions

The PCH series PRV's is used as a safety device in the storage and transportation of a wide variety of fluids, many of which are hazardous materials and could cause serious injury or damage. Only personnel which are properly qualified should install, repair or rebuild the PCH series PRV's. Only certified parts from Kelso or one of its authorized representatives should be used in the PCH series PRV's. The PCH series PRV's may be installed on DOT tank cars that carry hazardous chemicals and may travel under pressure.



Read these instructions prior to performing periodic maintenance and/or repairs.

1.2 Regulations

Kelso valves are used in contact with a variety of products, many of which are hazardous materials. The acceptance and transportation of products are regulated by DOT and AAR in the U.S.A. and in Canada by CTC and Transport Canada. Regulations of other governmental bodies must be complied with. All personnel should be familiar with and follow these regulations. Nothing in these instructions is intended to conflict with or supersede these regulations.

Note: Specifications are subject to change without notice.

1.3 Technical Specification

Valve Model	PC330H	PC280.5H
Set Pressure	300 psig	280.5 psig
Flow Rate @ 10% Over Pressure (SCFM)	33.874 SCFM	23.396 SCFM
Orifice Diameter	2.557 in	2.557 in
Flow Area	5.14 in ²	5.14 in ²
Weight	50 lbs.	50 lbs.
Height	10.50 in	10.5 in
Flange Thickness	.88 in	.88 in

Figure 1.3.1

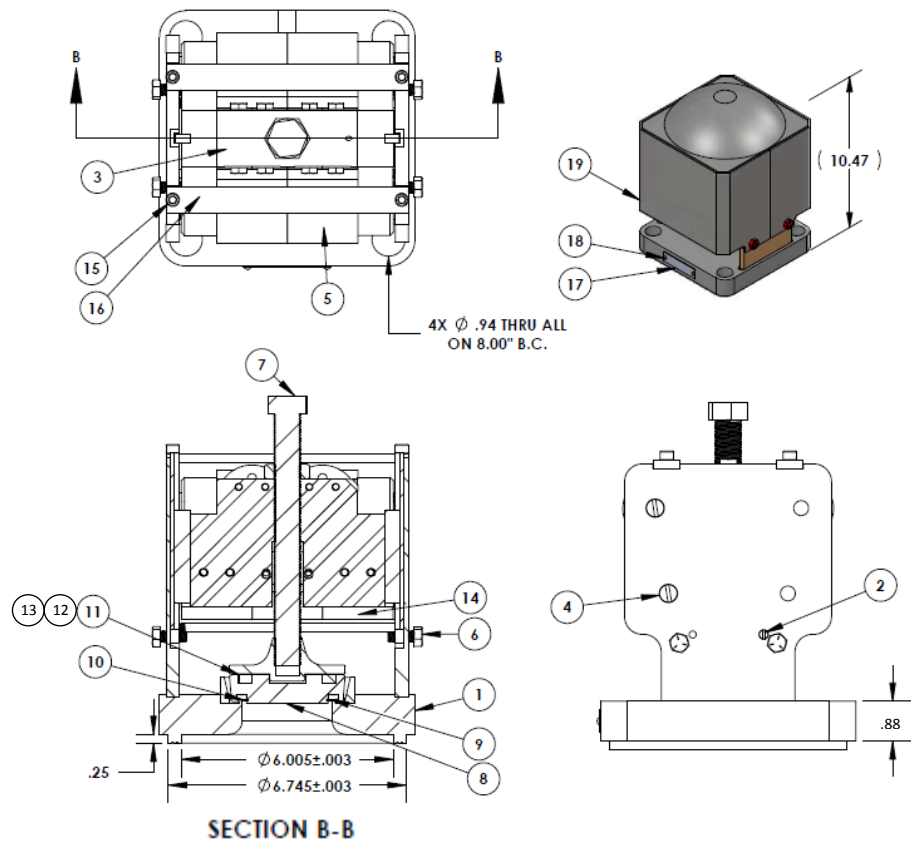


Figure1.3.2

Item	QTY	Description
1	1	Body Assembly
2	2	Lift Stop
3	1	Spring Block Assembly
4	4	Drum Bolt
5	2	Spring/Drum Assembly
6	4	5/16-18 X 3/4 Hex Bolt
7	1	Adjustment Screw Assembly
8	1	Sealing Disc
9	1	Seal
10	1	Spirolox® Ring
11	1	Needle Bearing Assembly
12	1	Thrust Washer Top
13	1	Thrust Washer Bottom
14	1	Spring/Drum Assembly
15	4	1/4-20 X 3/4 SHCS
16	2	Flat Bar
17	1	Nameplate
18	2	Nameplate Rivet
19	1	Cover Assembly

Figure 1.3.3

1.4 Required Tools

Open/Boxed End Wrench - 1/2", 1-1/16", 1-1/8"
Sockets – 1/2", 1-1/16", 1-1/8"
Ratchet
Slotted Screw Driver
Allen Wrench – 3/16"
Hammer

Pliers/Vise Grips
Lint-Free Cloth
Emery Paper (400 grit)
Adjustable Wrench
Loctite 242®
Loctite Moly-50® or C5-A® Copper Based Anti-Seize

2.0 Valve Installation



Only companies and their personnel which are certified by the Association of American Railroads shall perform maintenance and periodic testing of Kelso valves.

2.1 Preliminary Considerations



New valves are tested, adjusted and sealed at Kelso. If a new valve has been left in its original packaging, is undamaged and is not more than six months old, it may be installed on a tank car without retesting or recalibration. Prior to installation, ensure that the valve remains clean and that the gasket sealing surfaces are not damaged in any way, shape or form.

2.2 Procedure

1. Prior to removing any valve or fitting from a tank, ensure that the internal pressure is atmospheric and that personnel exposure to hazardous chemicals are eliminated.
2. When the securement bolts have been removed from the mounting flange, remove the valve and discard the old flange gasket.
3. With a tongue and groove mating surface, ensure that while removing the old gasket no damage is done to the bottom of the groove. Any burrs, radial gouges and debris should be removed.
4. A new valve should be kept in its original shipping container to prevent harmful damage to the valve or its components.
5. The nameplate will verify the test date of the valve. If the last known test date is within six months, the valve can be installed without retesting or requalifying.
6. Place a new gasket on the tank mounting flange. Gasket material should be compatible with the chemical being shipped. Inspect the valve mating flange for defects as described in Paragraph 2.2.3 above. Install the valve on the mounting flange and secure using bolts tightening to at 1/3 increments in an alternating star pattern to a prescribed torque between 200 to 250 foot pounds. Our suggested

value is only to be used in the event your company does not have a procedure for this.



The preferred method for applying valve is to do so with the cover not applied. There is potential during installation that the tool may make contact with the valve's constant force springs. Once torqueing is complete, inspect springs per Section 4.1.6. of this manual.

7. Once the valve has been secured to the car, a suitable leak test should be performed to ensure that the flange mating surfaces are pressure tight.
8. Once the leak test has been performed, place valve cover over valve. Take cover bolts and lock washers and install through cover and into spring bracket engaging only a few threads. Wrench tighten in a crisscross pattern. Do not overtighten.

2.3 Leak Inspection

All newly installed valves must be tested under pressure to confirm that no leaks are present.



WARNING: Loose nuts, improper flange seating, damaged and incorrect size gaskets can result in leaks at the valve joints.

2.4 Valve Operation



Operation of all valves must conform to all applicable TC, AAR, DOT and other governmental bodies.



Kelso valves are spring loaded by a constant force set of springs and there are no provisions for a manual activation. Valves are activated when a positive pressure occurs in the rail tank.

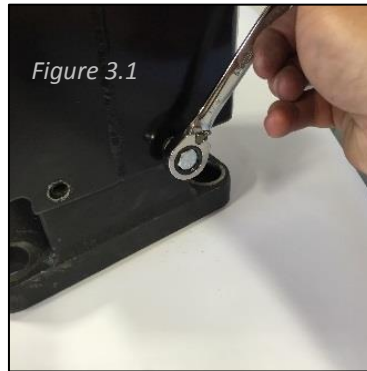
3.0 Disassembly



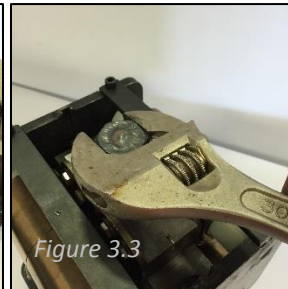
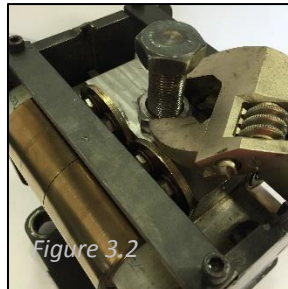
Prior to any servicing of Kelso Valves, ensure all participating personnel have adequate personal protective equipment.

3.1 Procedure

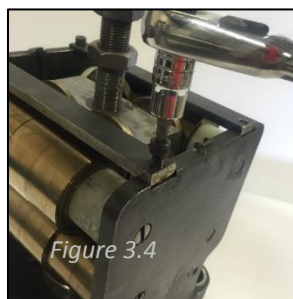
1. Start by removing the cover. Loosen the four Cover bolts, two from each side of the valve using $\frac{1}{2}$ " wrench/socket. Then lift the cover from the valve. (Figure 3.1)



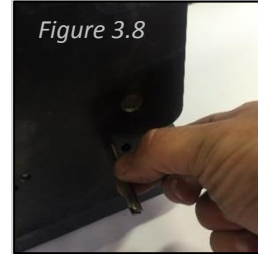
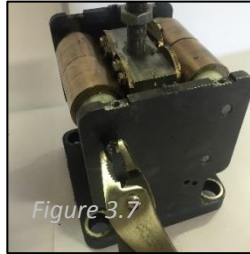
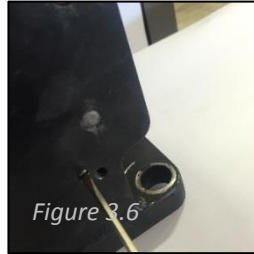
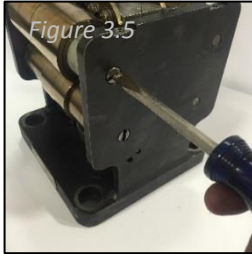
2. Back off the jam nut several turns with an Adjustable Wrench. Then loosen the adjustment screw using a 1" socket/wrench to relieve the spring tension on the sealing disc. (Figure 3.2 & 3.3)



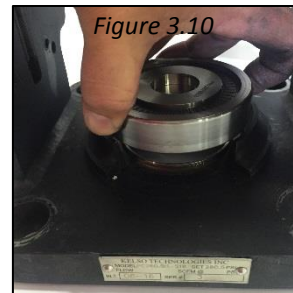
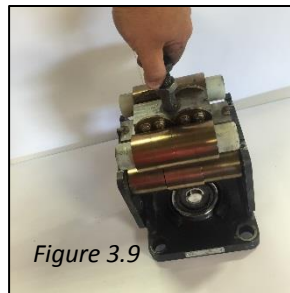
3. Once spring tension is relieved, remove the Spring Bracket Braces. Using a $\frac{3}{16}$ " Allen Wrench, remove the four Brace Screws and detach the brace bracket from the valve body. (Figure 3.4)



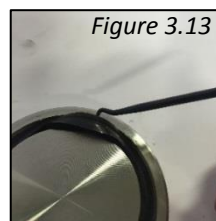
4. Next remove the four drum bolts and the two lift stops using a slotted screw driver. Once the drum bolts and lift stops are loose, remove the drum bolts and stops from the valve body, pliers may be needed to pull the bolts free of the assembly. (Figure 3.5 – 3.8)



5. With the drum bolts, lift stops and spring brace brackets removed, lift the spring block, then the sealing disc from the valve assembly. (Figure 3.9 & 3.10)



6. Turn the sealing disc over and remove the Spirolox® ring. Lift the end of the ring with a pick or screw driver and uncoil the ring from the groove. Remove elastomeric seal carefully with a non-abrasive tool, use caution not to damage seal mating surfaces. (Figure 3.11-3.14)



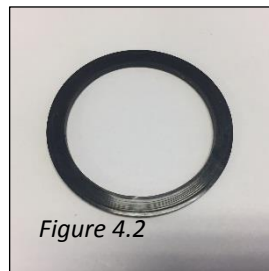
Note: A seal removal kit containing all associated utensils can be obtained from Carolina Seal.

4.0 Inspection

The valve and most components can be visually inspected without removal from the tank car. However, a proper inspection should be made whenever the valve is rebuilt or when suspect operation warrants.

4.1 Components

1. **Elastomeric Seal** - The seal must be replaced when the valve is rebuilt. Upon inspection the seal should be secured and concentric in the sealing disc groove (Figure 4.1 & 4.2). For seals with an etch, install with the etch facing up, toward (against) the sealing disc. The etch identifies the seal pedigree compound and should be validated with the car owner specifications. If the seal is installed with the etch down (away from) the sealing disc, it will not impact form, fit or function but it may impact the integrity of the etch. Impact of the etch is not cause for condemnation. The seal should be free from tears, folds, abrasions, cracking and a buildup of debris. Replace when any of these defective conditions occur.



The seal has been manufactured with a proprietary composition and should only be replaced with Kelso supplied material.



It is recommended that any replacement parts be purchased through Kelso Technologies for form, fit and function.

2. **Adjustment Screw** - Inspect threads for galling, excessive wear and/or other damage and replace if necessary. If needed run a 3/4-16 UNF-2A die along threads to correct. If cracks/fractures are present replace adjustment screw. (Figure 4.3)
3. **Sealing Disc** - Inspect disc seating surface for scratches, dents, excessive wear, damage, etc. Replace if such conditions exist. Visually inspect the thrust washers and needle bearing for any damage. (Figure 4.4)
 - 3.2 **Thrust washer** - should be flat within 0.25" and not bent or folded. (Figure 4.5)
 - 3.3 **Needle bearing** - should not be compressed and be able to rotate freely. (Figure 4.5)

3.4 **Spirolox®** - retaining ring can be reused. If deformed or damaged, replace. (Figure 4.6)



If any component of the bearing assembly is damaged, assembly should be replaced.

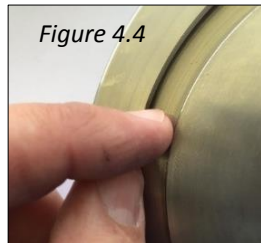


Figure 4.4

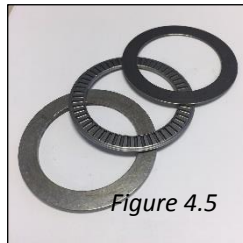


Figure 4.5

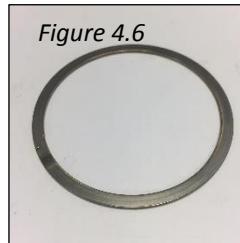


Figure 4.6

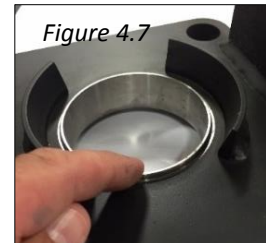


Figure 4.7

4. **Valve Seat Area** - Inspect the seating area for scratches, gouges, dents, excessive wear, damage, etc. Replace if such conditions exist. It might be beneficial to use a fine grade Emory Paper to remove any residue or stubborn commodity. The seat is the most crucial piece for proper valve operation and any discontinuity can cause the valve to leak. (Figure 4.7)



Repair work on valves involving machining, grinding or other alterations/modifications can be performed only by the valve manufacturer, by the car owner or user with the valve manufacturer's permission. The flat gasket face on the valve body mounting surface or the gasket tongue may be machined to remove nicks and burrs. (AAR M1002 Appendix A. Paragraph 3.11)

5. **Spring Drum** - Provides a frictionless surface for the spring to bear upon, should be examined for signs of distress. The drum edges should not be flared or show signs of cracking. The bore through the drums should be round and wear of 1/32" or more will require replacement of the drum (see diagram below). The drums are manufactured from nylon and exposure to excessive heat may cause damage. If the drum needs to be replaced and drum is stuck in the spring coil, use the new drum to push the old drum through the coil. This way no damage occurs to the spring coil. (Figure 4.8 & 4.9)



Figure 4.8

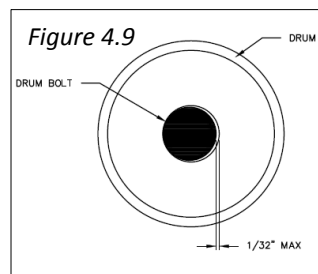


Figure 4.9

6. **Springs** - To perform an adequate examination, it is not necessary to remove the springs from the spring block. The springs should be cleaned of all foreign matter before inspection. Springs, are made

from stainless steel and should show no signs of pitting or corrosion. The exposed surface of the spring should be examined for cracking or any defect which could be a stress concentrator; a nick, gouge or an irregular bend. If one spring is defective, then the complete spool should be replaced. When replacing spring coils the number of laminations may vary, replace in kind. Springs may relax from around the spring drum over time, providing an appearance of gapping between the spring drum and spring. Gapping may be rectified during rebuild and adjustment. If rebuild and adjustment does not correct the gapping but the valve passes testing, then the springs are not considered condemnable. (Figure 4.10 & 4.11)



DO NOT use steel abrasives or steel wire brushes to clean spring, the stainless steel may become contaminated and corrode unnecessarily.

4.2 Cleaning

All components, except the spring and drums, of the Kelso valve may be cleaned using:

1. Wire brushes and/or clean towel/cloth.
2. Low pressure water, glass bead, sand or soda blasting provided the blast media is not angular in form or leaves iron content on stainless parts.
3. A chemical/surfactant application, in conjunction with manufactures prescribed instructions, to achieve a desired result. It is suggested the chemical/surfactant be of neutral pH to ensure the integrity of the metal composition.
4. Regardless of cleaning method, it is suggested that the parts be double rinsed and dried (with sanitary towel) prior to reinstallation and immediately after any chemical/surfactant application.



Disposal should be managed in accordance with all applicable state and federal regulations.

5.0 Assembly

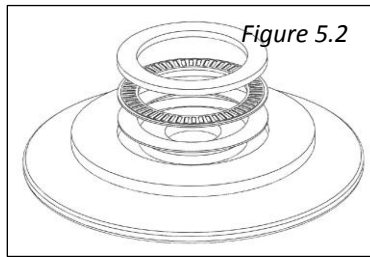
Prior to assembly, inspect the valve seat on the valve body, ensure that the area contacting the seal is smooth and free of irregularities. Inspect the spring block assembly ensuring the spring bolts are tight and the spring drums are in place.

5.1 Procedure



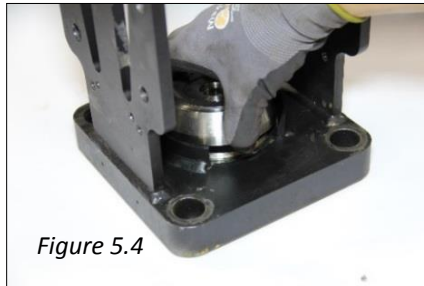
As of (2/24/2016) Kelso utilizes a compound authentication procedure where by all seals are etched with the pedigree compound and tracing number. If the seal does not have an etch, refer to the car owner for the proper pedigree compound.

1. Prior to assembly, inspect the valve flange seat ensuring the area contacting the seal is smooth and free of irregularities such as, nicks, gouges, depressions from porosity. If needed, lightly clean the valve seating area with Emery Cloth then wipe the surface clean.
2. Inspect the sealing disc, the area contacting the seal should be smooth and free of irregularities such as nicks, gouges, depressions from porosity.
3. Insert seal into sealing disc. Install seal into sealing disc and ensure the seal is completely seated. Then install the Spirolox® retaining ring. The ring must sit flat against the seal and be fully engaged in its retaining groove. (Figure 5.1)

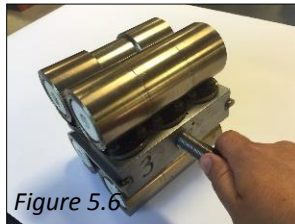
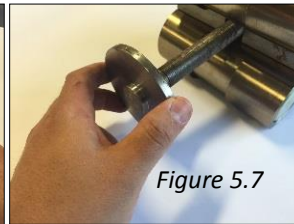


4. Next insert the bearing assembly onto the sealing disc. Place the thinner thrust washer on first, then insert the needle bearing. Pack the bearing assembly with Loctite Moly-50 Thread Lubricant or Loctite C5-A Copper Based Anti-seize. Then insert the thicker thrust washer. (Figure 5.2)

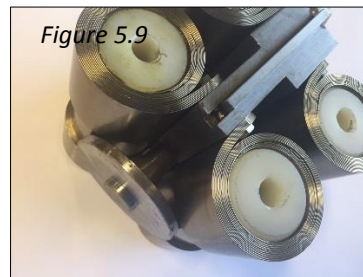
5. Clean flange and install sealing disc assembly. The sealing disc should rest concentrically on the valve seat, equally between the disc guides. (Figure 5.4)

*Figure 5.4*

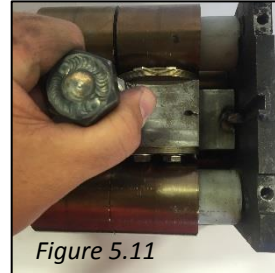
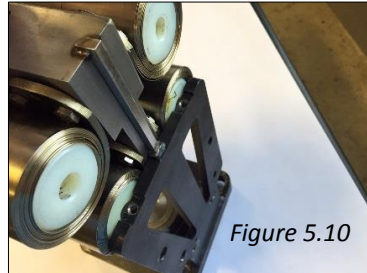
6. Thread the adjustment screw fully into the spring block assembly. (Figure 5.6 – 5.7)

*Figure 5.6**Figure 5.7*

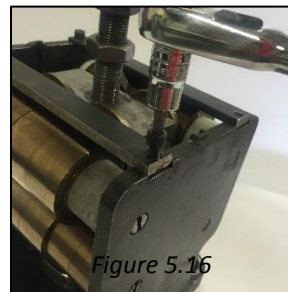
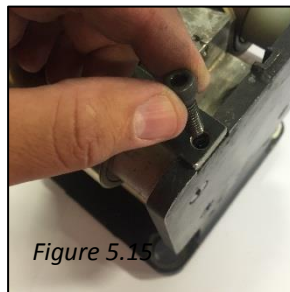
7. Lightly coat the threads of the adjustment screw with Loctite Moly-50 Thread Lubricant or Loctite C5-A Copper Based Anti-seize, below the spring block assembly. Run the adjustment screw into the spring block assembly until the top of the adjustment screw flange and the spring block assembly meet. (Figure 5.8 & 5.9)

*Figure 5.8**Figure 5.9*

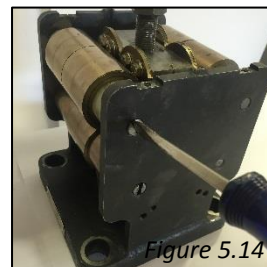
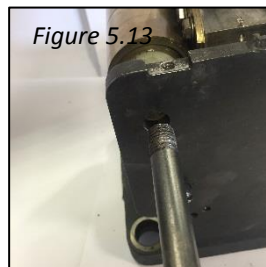
8. Place the assembled spring block/adjustment screw assembly into the valve assembly. The tabs of the spring block will fit into a channel on each side of the valve assembly, lower the spring block/adjustment screw assembly, ensuring the assembly seats properly on the sealing disc. (Figure 5.10 & 5.11)



9. Apply Loctite 242 to the four spring bracket brace bolts. Place the two spring bracket braces across the valve body and insert bolts through the brace and into the spring brackets of the valve body. Torque to 8 ft.-lbs. (Figure 5.15 & 5.16)



10. Apply thread locker to the threaded ends of the drum bolts. Then insert the four drum bolts through the spring brackets and drums, ensuring all bolts are inserted in the correct orientation. Wrench tighten the drum bolts with a slotted screw driver until they are equally spaced between the spring brackets. (Figure 5.12 - 5.14)



11. Use a socket/wrench to cycle spring block assembly up/down to exercise springs by turning the adjustment screw until the block rises, meets the top of the spring bracket and down until little/no spring resistance is present.
12. Now rotate adjustment screw clockwise by hand until resistance is felt. At this point springs are just beginning to deflect. Measure down from the top of the spring bracket to the top of the spring block.

13. Pressure testing must be completed before moving forward. Adjustments cannot be made once cover is installed.



With the springs set, the valve should be held before testing. This will allow the settling of the springs, disc and seal and should provide consistent opening and closing pressures. Valves should be kept in a warm environment. PCH series high pressure valves should dwell for 12 hours.

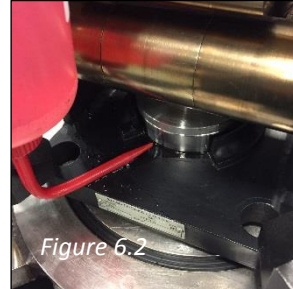
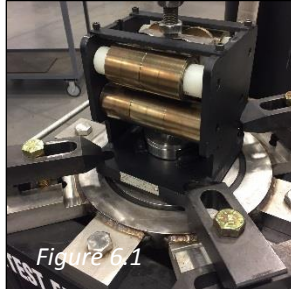
6.0 Pressure Testing and Adjustment



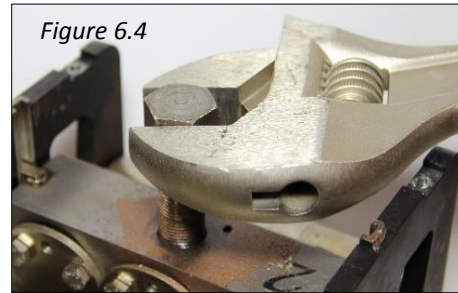
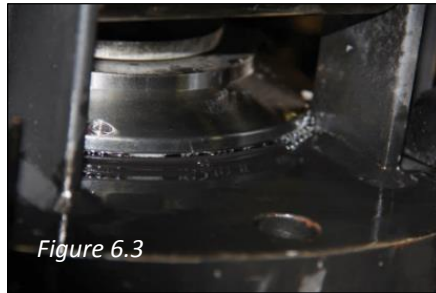
Refer to AAR publication “Regulations for Tank Cars”. Appendix A applies specifically to valves. This section prescribes the start-to-discharge pressure (STD), the vapor-tight pressure (VTP), their tolerances and integrity positive pressure test.

6.1 Procedure

1. Bolt the valve onto a suitable test stand. Raise the pressure in the test stand and leak test the mating surface of the mounting flanges as well as any test stand fittings to ensure the device is not losing air at any point. Repair leaks and retest. Release the air from the test stand. (Figure 6.1)



2. Perform Bubble Leak Test per approved test leak procedure. Adjust valve as suggested below to achieve the desired STD and VTP settings.
3. Raise the pressure in the test stand until the first visual evidence of leakage is observed and note this pressure as the “Start to Discharge” (STD). (Figure 6.2)

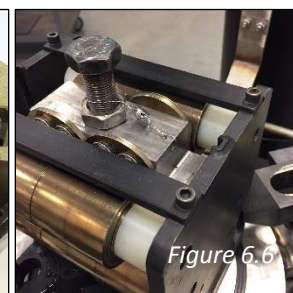
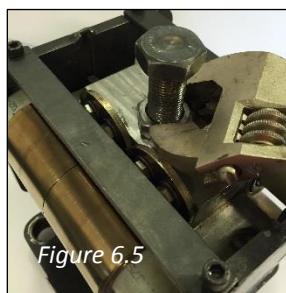


- a. **Adjustment:** If the pressure indicated is below the acceptable AAR tolerance for the valve setting, rotate the adjustment screw clockwise, leak test again. (Figure 6.3) Repeat until the desired set pressure for the valve being worked on is established. See Table 6.10 for pressure setting. Record data.
- b. **Adjustment:** If the pressure indicated is above the acceptable AAR tolerance for the valve setting, rotate the adjustment screw counter-clockwise, leak test again. (Figure 6.3) Repeat until the desired set pressure for the valve being worked on is established. See Table 6.10 for pressure setting. Record data.

Valve Type	STD	VTP
PC300H	309-291 psig	240 psig
PC280.5H	272-288 psig	224 psig

Table 6.10

4. After establishing the STD, allow valve to reseal with no leakage observed. This is considered “Vapor Tight Pressure” (VTP). VTP is confirmed by spraying a continuous film of test solution at the intersection of the sealing disc and the valve flange. If VTP is above 80% of the nominal set pressure, continue; otherwise investigate seal conditions and mating surfaces, etc. to resolve the problem. Record data.
5. After achieving STD and VTP, perform the STD and VTP tests again ensuring test results are consistent. Record final data.
6. Rotate jam nut clockwise until it binds with the spring block, locking the adjustment screw in place. (Figure 6.5) Torque to 25 ft-lb
7. Install lead and wire seal through jam nut and spring block to prevent accidental valve adjustment. (Figure 6.6)



6.2 Valve Completion

1. After testing rinse or blow off valve to remove test solution and/or any foreign material from the valve assembly. Allow to drain and dry.
2. Apply thread lock to the lift stops. Now install the lift stops through one spring bracket and into the other spring bracket on the opposite side. Wrench tighten with a slotted screw driver until they are equally spaced between the spring brackets. (Figure 6.7)

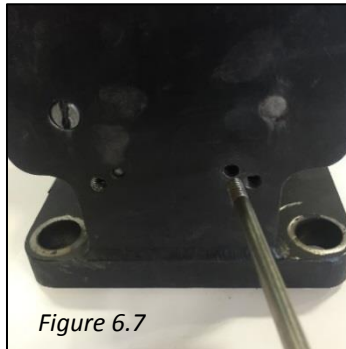


Figure 6.7

3. Place cover over valve. (Figure 6.8) Place split lock washers and cover bolts in a 5" x 5" poly bag. Cover to be applied after valve is installed and leak tested on car. Refer to Section 2.2.8. for valve cover application.

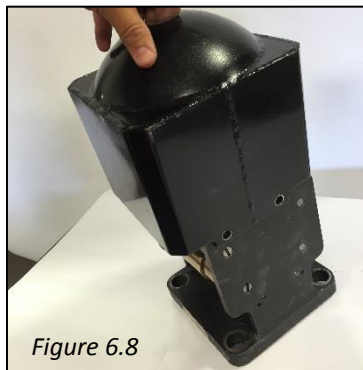


Figure 6.8

7.0 Maintenance

Under normal operating conditions, PCH series PRV's should not require maintenance until a periodic retest is required by code or there are signs of leakage through the valve (not leakage between the tank and valve mounting flanges). DOT and AAR have set forth a retest interval between tests. The PCH series PRV has been designed to minimize the valves exposure to any chemicals being shipped by mounting all components to the exterior of the tank. This advantage allows for immediate visual inspection of most components.



These instructions only describe maintenance to a valve which has been removed from the tank car and located in a suitable environment for retest. Kelso recommends all maintenance only be performed on valves which have been removed from the tank.



Note: AAR requires that new seals be installed when a valve is rebuilt. (AAR M1002 Appendix D-3.4)

7.1 Testing valves in storage

Valves that are factory set, sealed, have been left in their original shipping containers, are undamaged and are no more than six (6) months old: may be installed without being retested.

7.2 Valve Repair



Repair work on valves involving machining, grinding or other alterations/modifications can be performed only by the valve manufacturer, by the car owner or user with the valve manufacturer's permission. The gasket tongue of the valve body mounting flange may be machined to remove nicks and burrs. (AAR M1002 Appendix A. Paragraph 3.11)

Tolerances on gasket tongue must not be exceeded.

8.0 Special Guidelines



Determining Applicable Pressure Values:

Refer to AAR publication "Regulations for Tank Cars". Appendix A applies specifically to valves. This section prescribes the start-to-discharge pressure (STD), the vapor-tight pressure (VTP) and their tolerances and the positive pressure integrity test.



Test Stand and Pressure Gauge Requirements:

It is recommended that the test stand mounting must be equivalent to the AAR M1002 figures in Appendix E for the valve being tested. The pressure gauge must meet the requirements of AAR M1002 Appendix D 4.5 "Test Gauge Standards" and must be date-tagged accordingly.

9.0 Warranty Information

See the Warranty Terms and Conditions.

10.0 Revision Log

Revision Level	Revision Date	Summary of Change(s)
2	9/7/2018	Editorial Updates to Sections 2.2, 5.0, and 6.2.3.
1	3/23/2017	General Update
0	9/13/2016	Original Document