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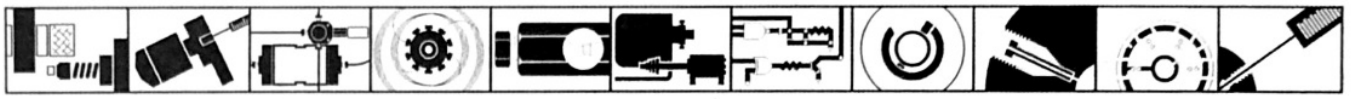

Operation Notes and Cleaning Instructions

W and UW Type Valves

Initial Precautions

After unpacking the valve, do not remove the protective tape from the valve ports until you are ready to install the valve. As supplied, all surfaces are clean and free of contaminants, and must be kept clean to prevent valve damage. Open ports and fittings cause unnecessary risk of particulate matter entering the valve and scratching the sealing surfaces, which is the most frequent cause of premature valve failure.

NOTE:
The most common source of particulate and chemical contamination is tubing which has not been properly cleaned before installation in the valve. To avoid this problem, we suggest purchasing our electrolytically pre-cut and polished tubing, available in standard lengths for any plumbing requirement. If other tubing is to be used, make certain that all tubing ends are free of burrs and cut square with the tube axis, and that all tubing has been chemically and mechanically cleaned.

CAUTION:

Failure to observe proper cleanliness procedures during installation of the valve voids the manufacturer's warranty.

To ensure minimum connection volume, make certain that tubes are seated completely before forming the ferrule on the tube. (For more information on installing fittings, refer to **Technical Note 503**, Fitting Instructions.)

Disassembly

CAUTION:

Do not disassemble the valve unless the system malfunction is definitely isolated to the valve: perform all other system checks first. If disassembly is required, make certain that the following instructions are carefully observed.

Disassembly operations must be performed in a clean, well-lighted area. Flush all hazardous or toxic materials from the valve before starting. *Please read through the entire procedure before beginning.*

As **Figure 1** illustrates, an advantage of this design is that the valve can be disassembled without removing the loops and tubing from the valve or removing the valve from the actuator or mounting bracket.

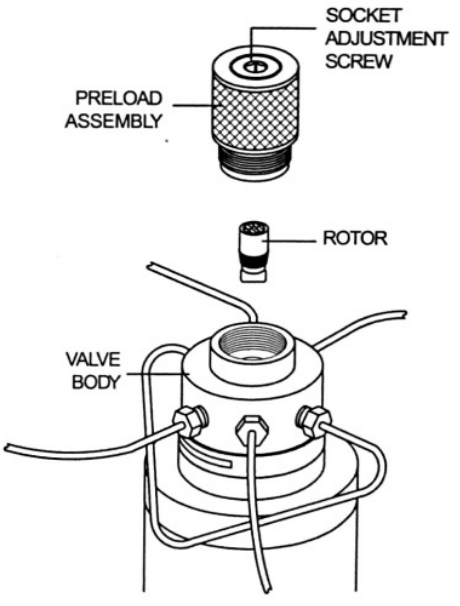

Figure 1: Disassembly

1. When the valve is cool enough to be handled, unscrew the entire knurled preload assembly. (The preload threads may gall if this is attempted while the valve is hot.) Do not tamper with the preset socket adjustment screw.
2. Engage the end of the rotor (**Figure 2**, next page) with a pencil-type magnet, available from Valco or any electronic components supplier. Cycle the valve one time to break the "shear seal" between the rotor and the valve body.

CAUTION:

Any contact between the interior of the valve body and the metal of the rotor or any tool used is likely to cause damage.

3. Carefully withdraw the rotor from the valve body with the magnet. Once the rotor is removed, note the orientation of the rotor tab, which is marked with an ID letter denoting the type of seal material.

Cleaning the Valve Body

1. Wet a cotton swab with a solvent which is compatible with the chromatographic system. Isopropyl alcohol is recommended.
2. Gently swab the polished interior of the valve to remove any loose residue.
3. Blow with clean compressed gas to remove any lint left by the swab.
4. Visually inspect the interior of the valve body. The conical surface should appear highly polished. If any scratches are visible between the ports or anywhere which might suggest a potential leakage path or wear source, the valve should be returned to the factory for regrinding and polishing.

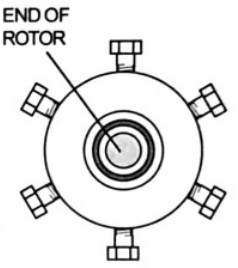

Figure 2: Valve with preload removed

Cleaning the Rotor

1. Carefully grasp the tab end of the rotor, being careful not to mar the metal or touch the polymer. If it is difficult to grip the rotor securely, hemostats or needle-nosed pliers may be helpful. (**Figure 3**) Briefly immerse it in solvent.
2. Gently wipe the polymer with a clean tissue.
3. Blow with clean compressed gas to remove any lint left by the tissue.
4. Visually inspect the rotor. If it shows any scratches and/or a narrowing of the flow passages, replacement is necessary.

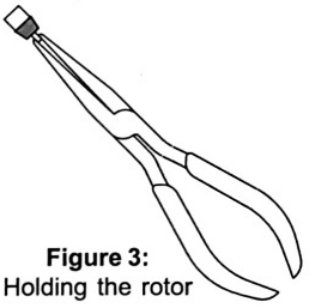

Figure 3: Holding the rotor

Assembly (New or Used Rotor)

1. Place the clean rotor on the pencil magnet and orient it so that the tab will properly engage the slot of the drive mechanism. The list in **Figure 5** shows how to orient the ID letter for different Valco valves. (A C6W is shown in **Figure 4**.)
2. Insert the rotor into the valve body, again being careful that the tab doesn't touch the polished interior of the valve body. Make sure the rotor tab (**Figure 4**) is fully inserted into the slot in the driver. Using a pencil or other small pointed object, hold the rotor in place in the valve body while the magnet is pulled free.
3. Replace the knurled preload assembly, tightening it into the valve body one turn beyond the point where it first touches the rotor. Cycle the valve 10 times to seat the sealing surfaces, leaving the valve fully in its clockwise or counterclockwise position.
4. Tighten the preload until it is fully bottomed-out, and cycle the valve a couple of more times.

CAUTION:

Make sure that the valve is never left partially actuated. It must always be left in either its fully clockwise or fully counterclockwise position.

5. High temperature valves require conditioning when the rotor is replaced. (*See next section.*)

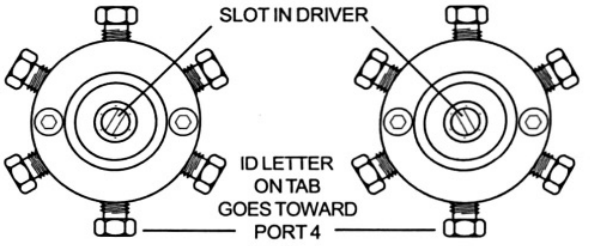

Figure 4: C6W valve with preload and rotor removed, viewed from preload end

Conditioning Procedure for High Temperature Valves

If a WT or UWT series valve is used at less than 300°C, it may become difficult to turn. This can usually be eliminated by repeating a conditioning procedure initially done at the factory. With oxygen-free carrier gas flowing through all the ports, rapidly heat the valve to 325°C. When 325°C is reached, cycle the valve 10 times and let it cool to operating temperature.

Special Instructions for High Pressure W and UW Valves

A simple procedure added to the rotor replacement instructions will often enhance the performance of valves tensioned for use at over 1000 psi. Refer to Step 3 in the section titled Assembly, superceding it with:

3. Replace the knurled preload assembly, tightening it into the valve body by hand just beyond the point where it touches the rotor. Cycle the valve 10 times to seat the sealing surfaces, leaving the valve fully in its clockwise or counterclockwise position.
4. Tighten the preload in quarter-turn increments, cycling the valve 10 times after each step. The preload must end up fully bottomed-out, but attempts at further tightening will not affect the sealing forces.

Number of ports	ID letter toward
3	Port 2
4	Port 3
6	Port 4
8	Port 5
10	Port 6
Internal sample	The side of the valve with the four ports

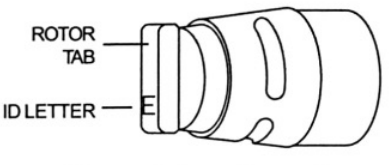

Figure 5: Location and orientation of the ID letter

North America, South America, and Australia/Oceania contact:

Valco Instruments Co. Inc.
P.O. Box 55603
Houston, TX 77255
Sales: (800) 367-8424
Tech: (713) 688-9345
Fax: (713) 688-8106 valco@vici.com

Europe, Asia, and Africa contact:

VICI AG International
Parkstrasse 2
CH-6214 Schenkon
Switzerland
Phone: +41 41 925 6200
Fax: +41 41 925 6201 info@vici.ch

TN-201 Rev 9/10

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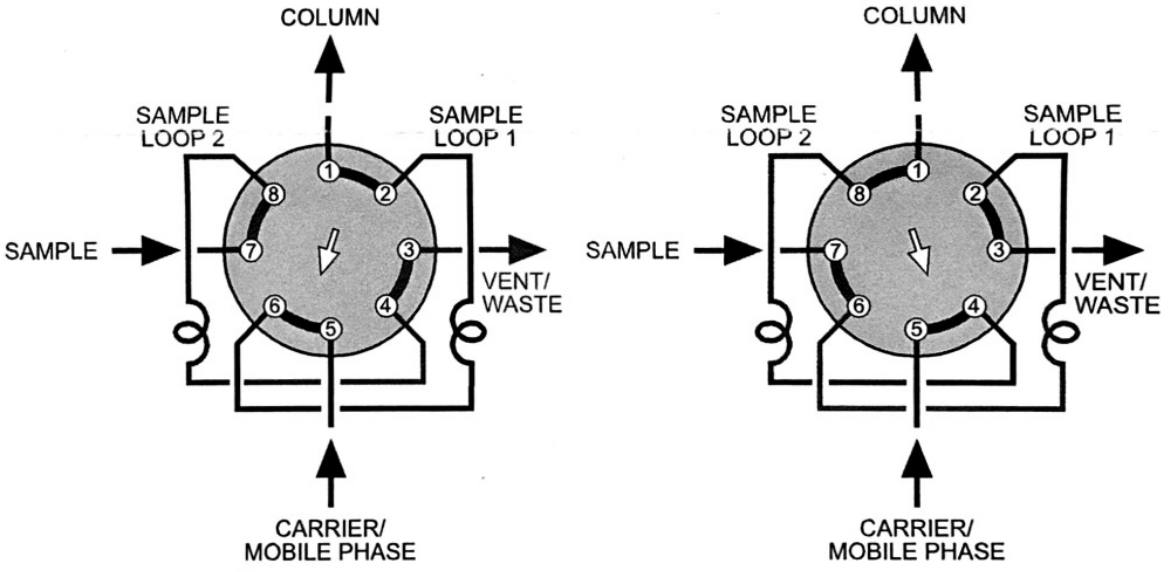
Schematic Flow Diagram – 2 Position Sample Injector

8 Port External Volume Sample Injector
W and UW Type Valves, All Series



Valve viewed from the preload end

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Valco Instruments Co. Inc.
P.O. Box 55603
Houston, TX 77255
Sales: (800) 367-8424
Tech: (713) 688-9345
Fax: (713) 688-8106 valco@vici.com

Europe, Asia, and Africa contact:

VICI AG International
Parkstrasse 2
CH-6214 Schenkon
Switzerland
Phone: +41 41 925 6200
Fax: +41 41 925 6201 info@vici.ch

TN-204 10/00

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Fitting Instructions

Valco fittings are available in various metals (for use with metal tubing) and in PEEK (for use with PEEK tubing.) While metal ferrules can be used with PEEK and other polymeric tubing, polymeric ferrules (including PEEK) should *not* be used with metal tubing. The Valco Zero Dead Volume fitting is comprised of four parts: a female zero volume fitting detail, a male nut, a ferrule, and a length of tubing. (See Figure 1) Since the leak-tightness and integrity of the fitting is dependent upon tubing preparation and proper assembly, this publication addresses those two topics.

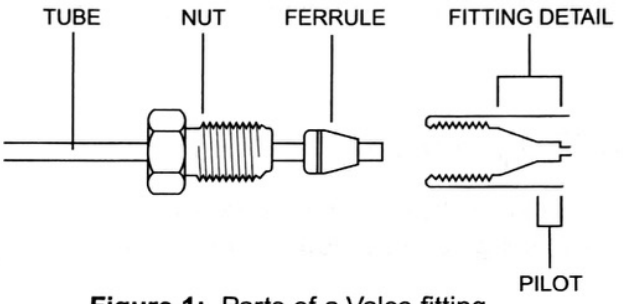

Figure 1: Parts of a Valco fitting

Metal Tubing Preparation

Cutting and Polishing

Since the tubing is an integral part of the fitting, it must be properly prepared if the entire fitting is to function as designed. To insure trouble-free service, Valco suggests purchasing our electrolytically pre-cut and polished tubing, available in stainless steel, electroformed nickel, Nickel 200, Hastalloy C, and other materials.

If other tubing is to be used, make certain that all tubing ends are cut square with the tube axis, and that both the ID and the OD are thoroughly deburred.

Next, inspect the end of the tubing where the ferrule will seat for scratches along its length. (**Figure 2**) Visible scratches along the tubing where the ferrule will seat are not acceptable, but those behind the front edge of the ferrule will not interfere with the integrity of the fitting. Minor scratches can often be eliminated by folding a small piece of fine emery cloth or wet-or-dry sandpaper (200 to 400 grit) around the end of the tubing and rolling the tubing between two fingers. This leaves concentric axial lines in the area where the ferrule seats, which, while not ideal, are less likely to cause a leak than longitudinal scratches.

NOTE: Electropolishing is generally not successful as a repair for bad tubing, as it often simply rounds off the edges of a scratch without removing it.

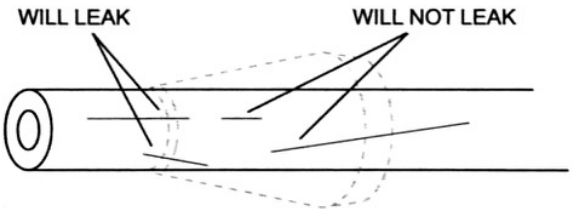

Figure 2: Scratches on tubing

Cleaning

After it has been polished, the tubing must be cleaned to remove residual metal shavings and grit from the sand paper. This is best accomplished by using a syringe or pipette to force a solvent such as methyl or isopropyl alcohol or acetone through the tubing and then drying it with clean, dry compressed air or carrier gas.

CAUTION:

Exercise good laboratory safety practices when using solvents, particularly when subjecting them to pressure.

Polymeric Tubing Preparation

Polymeric tubing should be clean, with ends cut square to the tube axis and free of external and internal burrs. Our Clean Cut tubing cutter, product number JR-797, does a good job.

Fitting Assembly

1. Slide the nut and ferrule onto the tubing in the order shown in **Figure 1**.
2. Insert this assembly into the fitting detail, screwing the nut in two or three turns by hand.
3. Push the tubing all the way forward into the detail so that it seats firmly. This is essential for a proper Zero Dead Volume connection.
4. Manually turn the nut into the detail until it is finger tight.
5. Using the appropriate open end wrench, turn the nut 1/4 turn (90°) past the point where the ferrule first starts to grab the tubing. Fittings larger than 1/8" will require more than 1/4 turn (as much as 180°). The amount of force required can vary considerably due to the friction between the nut and the threads and the composition and wall thickness of the tubing used. Because of these variables a torque specification is unreliable.

North America, South America, and Australia/Oceania contact:
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P.O. Box 55603
Houston, TX 77255
Sales: (800) 367-8424
Tech: (713) 688-9345
Fax: (713) 688-8106 valco@vici.com

Europe, Asia, and Africa contact:
VICI® **VICI AG International**
Parkstrasse 2
CH-6214 Schenkon
Switzerland
Phone: +41 41 925 6200
Fax: +41 41 925 6201 info@vici.ch

TN-503 Rev 11/06

VICI Valco Instruments Co. Inc.

Implementation of the Valco Helical Drive Air Actuator*

Two Position Valves

The recommended implementation approach for all Valco 2 position valves is to pulse a pair of 3-way solenoid valves (MSVA). This applies air to the actuator only during switching, and alleviates problems associated with continous air pressure. The pulsed operation simulates switching by hand while providing the advantages of powered operation.

An air-actuated valve is often controlled by signals supplied by microprocessor-based instruments, data systems, or valve programmers. An interface such as Valco's Digital Valve Interface (DVI) can be used along with low-power negative true logic level signals or with data system contact closures.

PROCEDURE:
(Requires two external events.)

1. Energize solenoid A – valve rotor rotates clockwise. *A 2-second delay is recommended before the next step.*
2. De-energize solenoid – air pressure stops.
3. Energize solenoid B – valve rotor rotates counterclockwise. *A 2-second delay is recommended before the next step.*
4. De-energize solenoid – air pressure stops.

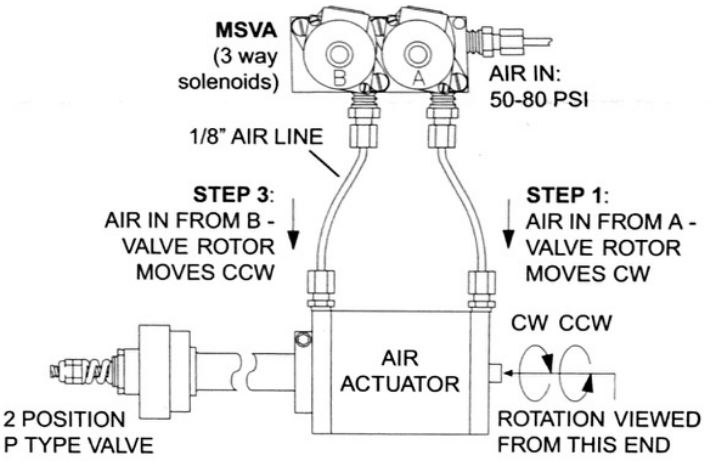

Figure 1

Recommended Actuator Air Pressure

The optimum actuator air pressure depends upon the type of valve in use. Beyond that, variances between like valves and actuators mean that some turn easier than others. General pressure ranges are indicated in the table below, but essentially the optimum pressure for any particular valve/actuator combination is that pressure which yields a reasonable switching time (nominally 0.5 seconds). In practice, it is better to err on the side of too much pressure rather than too little, but as the pressure increases so does the potential for problems associated with the optional 4-way operation described on the next page.

Valve type	Suggested air pressure
P	50-60 psi
UW	40-50 psi**
W	30-40 psi

**High pressure (2000-5000 psi UW valves may require 60-80 psi)

Alternate Implementation for 2 Position W and UW Type Valves

The use of two 3-way solenoid valves is the recommended implementation approach for all Valco two position valves. However, it is possible to use a single 41E1 4-way solenoid for W and UW type valves, as shown in **Figure 2**.

CAUTION:

When using the 41E1 4-way solenoid actuation, actuating pressure in excess of 60 psig may cause valve leakage.

PROCEDURE:
(Requires one external event.)

1. Energize solenoid – air in through Normally Closed port. Valve rotor rotates clockwise.
2. De-energize solenoid – air in through Normally Open port. Valve rotor rotates counterclockwise.

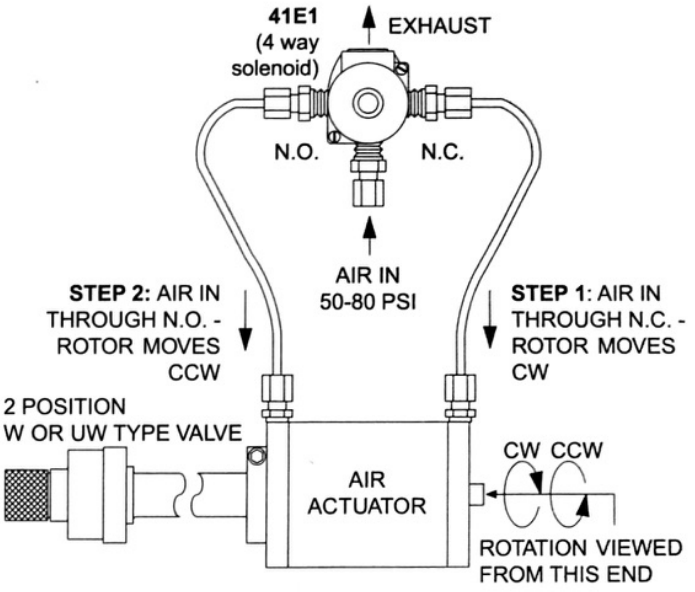

Figure 2

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Houston, TX 77255
Sales: (800) 367-8424
Tech: (713) 688-9345
Fax: (713) 688-8106 valco@vici.com

Europe, Asia, and Africa contact:

VICI AG International
Parkstrasse 2
CH-6214 Schenkon
Switzerland
Phone: +41 41 925 6200
Fax: +41 41 925 6201 info@vici.ch

TN-405 Rev 12/11

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Two Position Air Actuator O-Ring Replacement

You will need:

1. 7/64" and 9/64" hex driver
2. 3/8" open end wrench
3. 3/16" screwdriver
4. An awl or small jeweler's screwdriver
5. Silicone lubricant (such as Dow Corning DC-111)
6. Lint-free tissues and a clean shop rag

You will also need one of the following:

Description	*Product No.*
Standard O-ring kit	OR
High temperature O-ring kit	ORT

Disassembly

1. Apply air pressure to the actuator inlet nearest the valve. Then use the open end wrench to remove the air supply lines from the actuator.

2. Remove the valve and valve-mounting hardware from the actuator.

Closemount valve (Figure 1)
Use the 7/64" hex driver to loosen the HWSC-SC6-10B/socket-head screw in the stainless CR4/clamp ring. Pull off the valve and its attached black-anodized CR41/closemount standoff. With a 9/64" hex driver, remove the two HWSC-SC8-6TDH/ modified socket-head screws which hold the clamp ring to the actuator.

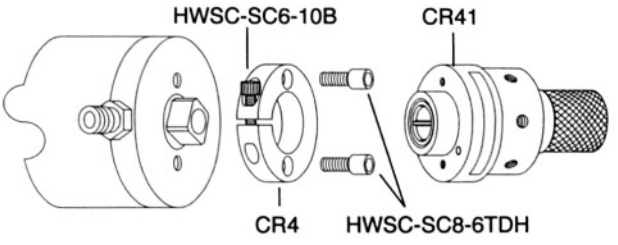


Figure 1: Closemount valve removal

Valve on a standoff (Figure 2)
Use the 9/64" hex driver to loosen the HWSC-SC8-10B/socket-head screw in the black anodized CR3/clamp ring on the actuator. Pull off the standoff with the valve attached. The same hex driver will remove the two HWSC-SC8-6/ socket-head screws which hold the clamp ring to the actuator.

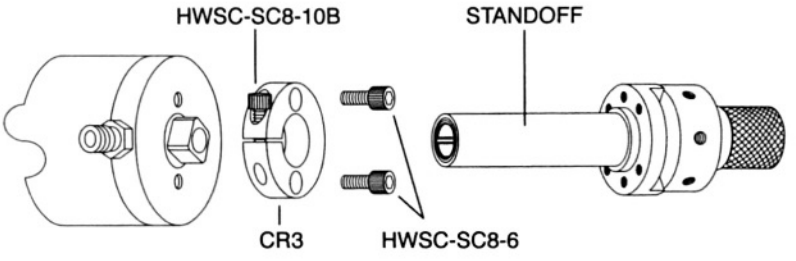


Figure 2: Removal of a valve on a standoff

3. Use the 9/64" hex driver to remove the three end cap screws with PEEK washers. (**Figure 3**) Some models have slotted head screws instead of hex head.

4. Place the actuator on a hard work surface with the end cap screw holes up. Push down on the cylinder, and the female end cap will pop up.

5. While holding the cylinder and the rest of the assembly together, pull the female end cap all the way off. If the bearing and thrust race washers fall out, just set them aside.

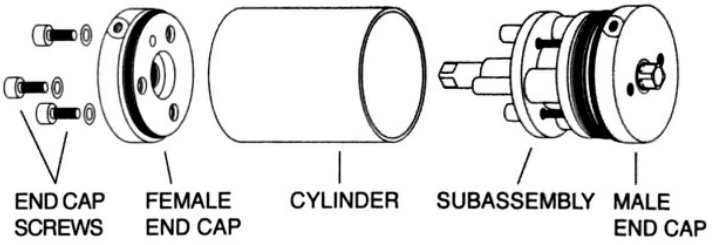


Figure 3: Steps 3 – 6

6. Repeat the procedure with the actuator inverted, so that the cylinder slides loose from the male end cap. Remove the cylinder.

7. Pull the subassembly off the male end cap as indicated in **Figure 4**. (NOTE: Recently purchased actuators may have a sub-assembly made primarily of molded plastic, differing in appearance from the one shown in **Figures 3**, **4**, and **5**. The procedures are the same for either type.)

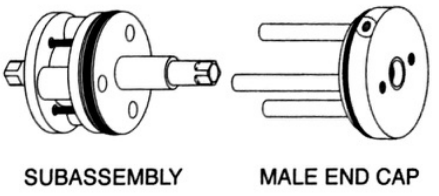


Figure 4:
Removing the subassembly from the male end cap

8. Loosen but do not remove the three slotted head screws which hold the subassembly together.

9. Take care to hold the rest of the subassembly together, and slide the O-ring plate off the drive shaft. (**Figure 5**) (If the sub-assembly comes apart despite your caution, reassembly instructions are provided at the end of this procedure.)

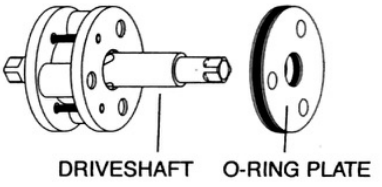


Figure 5:
Sliding the O-ring plate off of the shaft

O-ring Replacement

The O-rings to be replaced are in the two end caps and the O-ring plate. The internal end cap O-rings are easier to get to if the washers and bearing are removed.

1. Use the small screwdriver or awl to remove the old O-rings, being careful not to scratch the metal.

2. Use a lint-free tissue to clean the O-ring grooves as completely as possible.

3. As each new O-ring is installed, coat it with a thin layer of silicone lubricant. We recommend Dow Corning DC-111.

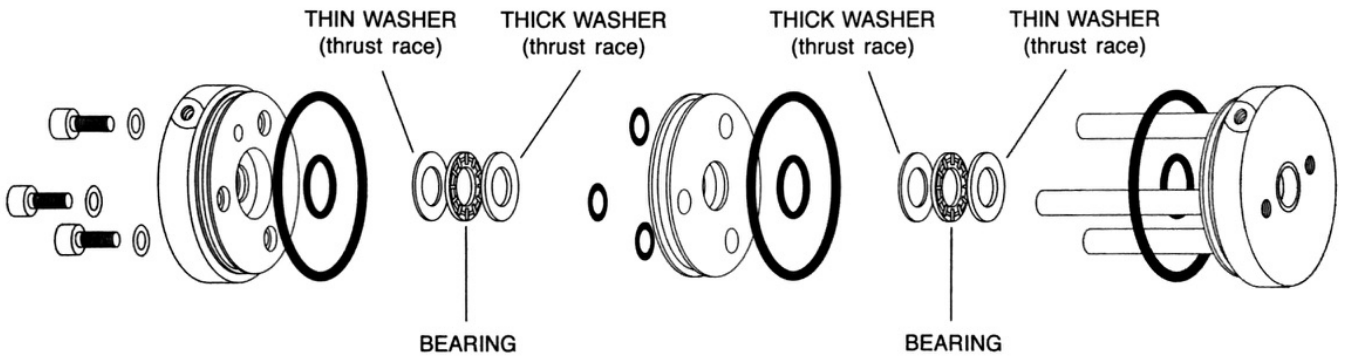


Figure 6: O-ring locations

Assembly

Where it's possible to do so, apply a slight rotating action to the parts as they go over or through the O-rings to help prevent any nicking or tearing of the new parts.

1. While being careful that the subassembly doesn't come apart, gently push the O-ring plate onto the drive shaft. Make sure that the threaded holes in the plate are facing the subassembly.
2. Screw the slotted-head screws into the O-ring plate, and push the drive shaft into the O-ring plate as far as it will go. (**Figure 7**)
3. Place the thrust race washers and bearing in the male end cap. (The thin washer goes in first, as in **Figure 6**.) One of the flats on the drive shaft will line up with a line drawn between two of the holes in the O-ring plate, as shown in **Figure 8**. Slide the subassembly onto the pins of the male end cap with this flat lined up with the air inlet on the end cap.

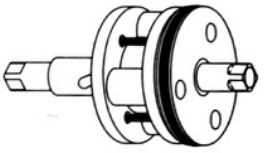


Figure 7:
Subassembly

4. Install the cylinder, sliding it over the subassembly and pressing the male end cap into it.
5. Place the thrust race washers and bearing in the female end cap. (The thin washer goes in first, as in **Figure 6**.) Press the end cap into the cylinder, making sure that the air inlet hole is in the same orientation as the one in the male end cap.
6. Install the three end cap screws with the new PEEK washers provided.
7. Replace the valve mounting hardware and air supply lines.
8. Apply air pressure to the actuator inlet nearest the valve so that the actuator will be in the same position as it was when the valve was removed.

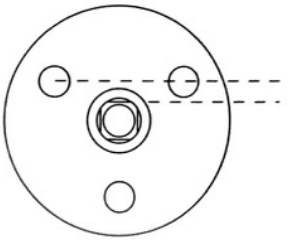


Figure 8:
O-ring plate orientation

9. Slide the valve with its standoff or CR41/closemount standoff into the clamp ring, making sure that the square hole in the valve coupling or in the end of the standoff driveshaft is fully engaged by the square of the actuator drive shaft. Tighten the clamp ring screw.

Valve Alignment

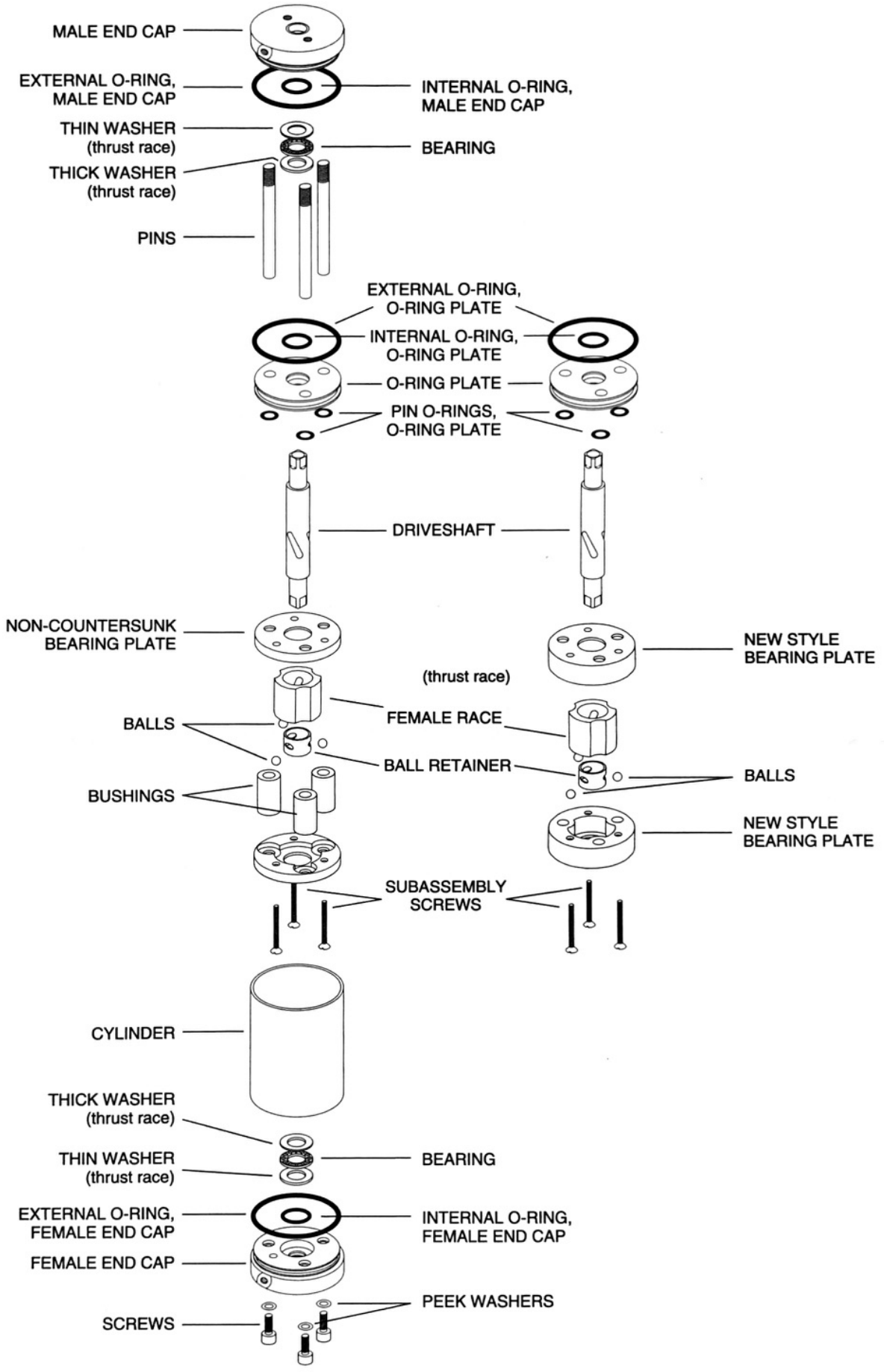
Valves which have been installed using two 3-way solenoids or a Valco Digital Valve Interface will not maintain actuation force after they have been actuated. For accurate valve alignment, a temporary method of supplying continuous air pressure to the selected actuator inlet must be contrived.

1. Switch the actuator from one position to the other several times to make sure that the play in the coupling mechanism has been absorbed.
2. Visually inspect the valve body cutout to determine if the rotor pin is against the stop. If it is, proceed to Step 3. If it is not, proceed to Step 4.
3. Switch the actuator to its other position and repeat the visual inspection. If the rotor pin is touching the stop in this position also, the valve and actuator are properly aligned. If the pin does not touch the stop, proceed with Step 4.
4. Switch the actuator to the other position.
5. Slowly loosen the clamp ring screw until the valve body moves, indicating that the actuator has travelled to the end of its stroke. Immediately re-tighten the clamp ring screw.
6. Repeat the visual inspection. If the steps have been executed correctly, the rotor pin should contact the stops in both positions. If it does not, repeat the entire procedure.

Rebuilding the Subassembly

Hopefully this section will be unnecessary, but just in case the subassembly fell apart somewhere along the line, here's how to get it back together. See **Figure 9** for parts identification.

1. Put a liberal coating of DC-111 on the slots in the driveshaft.
2. Place the ball retainer over the shaft so that the holes in the retainer line up with the slots in the shaft.
3. Put the balls in the holes of the retainer so that they rest in the slots. They should be held in place by the thick lubricant.
4. Notice that the slots in the female race extend all the way to one end but not the other. Observe also that one end of the driveshaft has a 1/4" hole. Put that end of the driveshaft into the end of the female race which has the slot openings, sliding the balls into the slots.
5. Place the male end cap on a flat work surface. Set the O-ring plate on the end cap with the pins lined up to go through the three small O-rings. Don't press it on yet: that will only dislodge the O-rings.
6. The two bearing plates are identical except that one of them has three countersunk holes to accept the heads of the subassembly screws. Locate the one which is not countersunk and line it up on top of the O-ring plate. (In the rare cases where both bearing plates are countersunk, they are interchangeable.) Press down to force the pins through the O-rings and bearing plate, continuing until the two parts are riding about half-way down the pins.
7. Slide the three bushings over the pins.
8. Install the driveshaft/ball assembly with the 1/4" hole end down. The female race will rest *between* the bushings.
9. Place the remaining bearing plate in position with the countersunk holes up, and screw the entire assembly together. Tighten the screws in rotation to insure optimum alignment.
10. Now pull the subassembly off of the male end cap so that its orientation can be checked, and proceed with Step 2 of the Assembly.



North America, South America, and Australia/Oceania contact:

Valco Instruments Co. Inc.
P.O. Box 55603
Houston, TX 77255
Sales: (800) 367-8424
Tech: (713) 688-9345
Fax: (713) 688-8106 valco@vici.com

Europe, Asia, and Africa contact:

VICI AG International
Parkstrasse 2
CH-6214 Schenkon
Switzerland
Phone: +41 41 925 6200
Fax: +41 41 925 6201 info@vici.ch

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Valco Instruments Co. Inc.

Standoff Assembly for Air or Electric Actuators

2 Position Valves

Standoff assemblies allow a valve to be mounted in a heated zone while leaving the actuator isolated outside the zone. Valco valves ordered on a standoff with an air or electric actuator are shipped from the factory fully assembled. Follow these instructions to mount the valve in an oven.

Installation

1. Remove the valve/standoff assembly from the actuator by loosening the HWSC-SC8-8B screw in the CR3 clamp ring. (**Figure 2** or **3**).
2. Remove the CR2 clamp ring from the standoff and mount it on the oven wall or mounting bracket. (The standoff requires an 11/16" clearance hole, and the two mounting holes in the clamp ring are on a 1" center.) Once the clamp ring is mounted, slide the standoff through it.
3. Firmly press the end of the standoff into the CR3 clamp ring mounted on the actuator, making sure that the square driver of the actuator engages the squared hole of the standoff drive shaft. Position the assembly so that the valve cutout is visible.
4. Tighten the HWSC-SC8-8B screw in the CR3 clamp ring.
5. Align the valve and actuator according to the steps in **Alignment Procedure**.

CAUTION:

If the valve and actuator are not properly aligned before use, the internal slots and ports in the valve body will not align properly Sample flow will be restricted, and other problems may result.

6. Position the standoff in the CR2 clamp ring and tighten the HWSC-SC6-8 B screw to secure the standoff in place.

Visually Checking the Alignment

The valve and actuator arrive from the factory accurately aligned and ready to use. However, any time the clamp ring on the actuator is loosened to readjust or remove the valve from the actuator, the alignment must be checked.

It is important to note that the actuator drives only the rotor within the valve body (via the driveshaft): the valve body and standoff remain stationary with respect to the actuator. To check the alignment, cycle the actuator from one position to the other and observe the location of the rotor pin. (**Figure 1**) The rotor pin should come to rest against both sides of the cutout in the valve body. If it does not, realignment is necessary.

If the pin does not contact the stop in either position, the actuator does not stroke far enough. This should never be the case with newly purchased valve and actuator combinations, but it could come up if you are using these instructions to retrofit an actuator to a valve. **Technical Note 408** and the two position electric actuator manual contain instructions for adjusting the stroke of an electric actuator. For an air actuator, consult the factory.

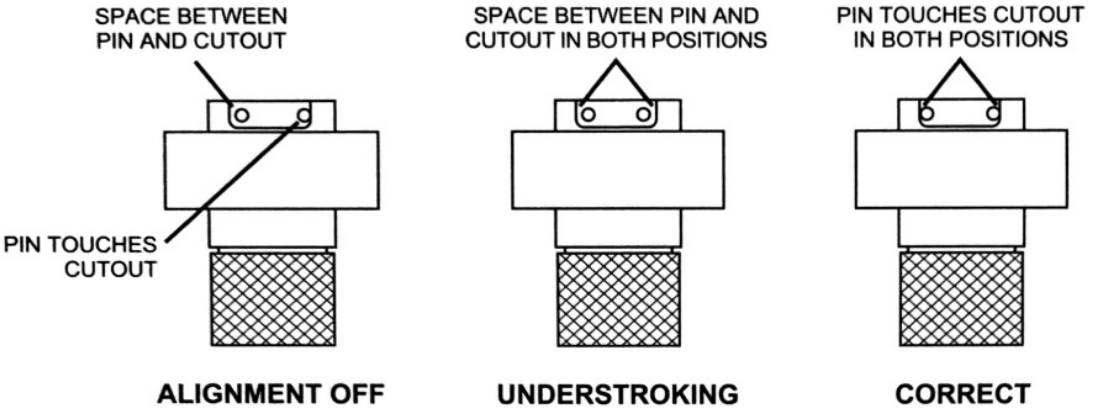

Figure 1: Visually checking the alignment (rotor pin shown in both positions)

Alignment Procedure

In air actuated valves, air must be maintained on the actuator throughout this procedure. Actuators which have been installed with a Valco Digital Valve Interface or with two 3-way solenoid valves will not allow this. The DVI or solenoids must be bypassed so that gas is supplied directly to the actuator.

1. After determining that alignment is necessary, actuate the valve so that the rotor pin is against one stop.
2. Loosen the clamp ring screw slightly. This will allow the actuator to complete its travel if it was being stopped by the end of the valve rotor travel. The valve will rotate slightly.
3. Tighten the clamp ring screw and cycle the actuator to the other position. The pin should come to rest against the stop. If it does not, repeat the procedure. If after several attempts the pin still does not contact the stop in both positions, consult the factory.

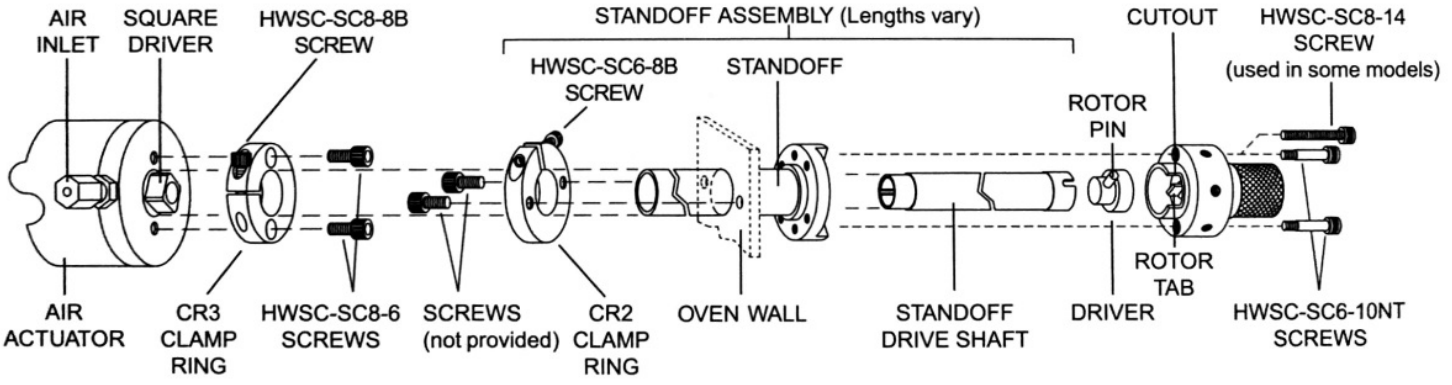

Figure 2: W Type valve with standoff assembly and air actuator

Disassembly

The valve can be removed from the standoff assembly without affecting alignment by removing the screws shown at the extreme right of **Figures 2** and **3**. The alignment is not changed so long as the HWSC-SC8-8B screw in the CR3 clamp ring is not loosened. However, any time the clamp ring screw is loosened, the alignment must be checked.

NOTE:

The old P type 10 port valves have only one HWSC-SC6-10NT screw. W valves with more than 10 ports and UW valves with more than 8 ports have *no* mounting holes; they are held in place by a clamp ring on the end of the standoff and are removed by loosening the clamp ring screw. *Valves with no mounting holes cannot be removed from the standoff without affecting the alignment.*

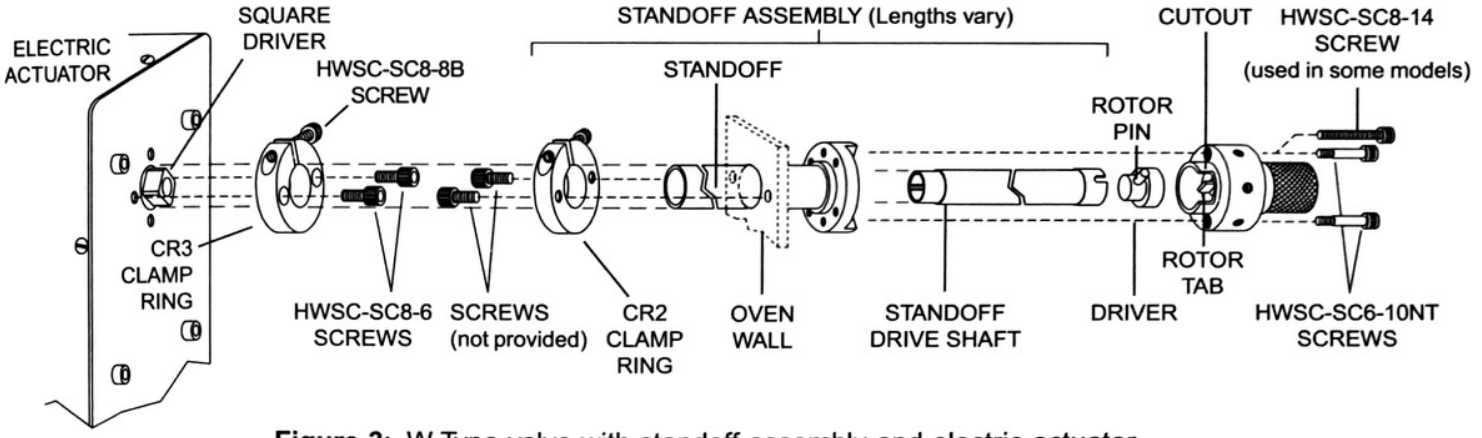

Figure 3: W Type valve with standoff assembly and electric actuator

Assembly

The instructions under Installation cover typical use of the standoff assembly. If further disassembly is necessary, follow these instructions for reassembly:

1. If an actuator has been specified for use with a standoff, it will come from the factory with the CR3 clamp ring already mounted. The clamp ring should not be removed from the actuator: however, *if* for some reason it has been, reattach it with the screws called out in **Figures 2** and **3**.

   CAUTION:

   The clamp ring is fixed to air actuators with a 3/8" screw, while electric actuators use a 1/2" screw. Do not use a screw longer than 1/2" in electric actuators, as it will interfere with internal moving parts and damage the actuator.

2. For an air actuator, apply air pressure to the air inlet closest to the valve. For an electric actuator, switch to the LOAD position.

3. Turn the valve to the counterclockwise position, shown by the position of the rotor tab in **Figures 2** and **3**. The valve and actuator are now both in the LOAD position.

   CAUTION:

   The valve and actuator must be in corresponding rotational positions before assembly. If they are not, the valve or electric actuator may be damaged when operated.

4. Slide the standoff drive shaft into the standoff. Position the valve on the standoff, making sure the slot of the drive shaft is fitted over the rotor pin. Attach the valve to the standoff with the HWSC-SC6-10NT screws, choosing the orientation that leaves the rotor pin and valve cutout visible. (P Type 10 port valves have only one HWSC-SC6-10NT screw. As described earlier, some valves have no mounting holes and are held onto the standoff with a clamp ring.)

5. Follow Steps 2-6 under Installation.

Additional Information on High Temperature Valves

High temperature valves that have not been used for long periods have a tendency to stick and resist turning. If this occurs, the valve must be reconditioned. If a high temperature valve is forced to turn when stuck, or if squeaking occurs during turning, the rotor material may gall onto the valve body. This usually means that a leak path is created, necessitating repair. To recondition the valve, heat it to 340°C without switching, then switch it from position to position a few times before letting it cool to operating temperature.

North America, South America, and Australia/Oceania contact:

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Houston, TX 77255
Sales: (800) 367-8424
Tech: (713) 688-9345
Fax: (713) 688-8106 valco@vici.com

Europe, Asia, and Africa contact:

VICI AG International
Parkstrasse 2
CH-6214 Schenkon
Switzerland
Phone: +41 41 925 6200
Fax: +41 41 925 6201 info@vici.ch

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