Valtek Mark Six Cryogenic Service Control Valves

GENERAL INFORMATION

The following instructions are designed to assist in unpacking, installing and performing maintenance required for the Valtek® Mark Six cryogenic service control valves.

This publication does not contain information on installing, maintaining, troubleshooting, calibrating, and operating Valtek positioners. Refer to the appropriate Valtek Control Products Installation, Operation, Maintenance Instruction when this information is required.

To avoid possible injury to personnel or damage to valve parts, WARNING and CAUTION notes must be strictly adhered to. Modifying this product, substituting nonfactory parts, or inferior parts, or using maintenance procedures other than outlined could drastically affect performance, void product warranties and be hazardous to personnel and equipment.

The Valtek Mark Six is a globe style, single seat, top entry valve with a fabricated cold box extension for use in cryogenic applications down to minus 423°F. Body weight is kept to a minimum to reduce boil-off on valve cool-down. The extension design permits easy access and removal of the valve trim through the cold box. The Mark Six utilizes a spring-energized Teflon seal or a small vent hole through the plug seal to permit only a small amount of liquefied gas into the bonnet areas where it vaporizes and provides a vapor barrier between the liquefied gas and the packing. The pressure resulting from the vaporization of the liquid keeps any more liquid from passing into the bonnet area. The small amount of vaporized liquid is not sufficient to produce high pressures at shut-down.

Unpacking

1. Before installation, check the packing list against the materials received. Lists describing the valve and accessories are included with each valve.
2. When lifting valve from shipping container, position lifting straps to avoid damage to tubing and mounted accessories. Most valves may be lifted by the actuator lifting ring. If one is not provided use lifting straps around yoke legs to lift valve.
3. In the event of shipping damage, contact your shipper immediately.
4. Should any problem arise, contact your Valtek Control Products representative.

Installation

Mark Six valves with vented plugs should always be mounted with the extension and actuator within 15° of vertical. Mark Six valves using spring-energized Teflon plug head seals may be mounted horizontally.

1. Before installation, clean the line of all dirt, scale, welding chips and other foreign material.
2. Check flow direction to be sure the valve is installed correctly. Flow should be over the plug for fail-closed valves, and under the plug for fail-open valves. Flow direction is indicated by an arrow on the bonnet flange.
3. Provide proper overhead clearance above the actuator to allow for actuator removal and trim inspection, should it be necessary. Disassembly clearance depends on the length of the cold box extension and the valve size. To estimate required clearance, add the length of the extension to the appropriate distance recommended for the particular valve size.

Disassembly Clearance (inches)

Valve Size	1/2, 3/4, 1	1 1/2, 2	3	4	6	8	10
Recommended Distance	3	5	6	8	10	13	14

Quick-Check

Prior to startup, stroke the control valve. As the instrument signal pressure is changed, observe the plug position as shown by the stroke indicator plate.

1. Check for full stroke by making appropriate instrument signal change (such as 3-15, 3-9, or 9-15 psi).
2. Check all air connections for leaks.
3. Evenly tighten packing nuts to slightly over finger-tight.

   CAUTION: Do not overtighten packing. This can cause excessive packing wear and high stem friction which may impede stem movement.
4. After valve has been in operation a short time, readjust packing to slightly more than finger-tight.
5. Stroke valve to make sure that the valve fails in the right direction in case of air failure, and that the combined actions of the controller, positioner and valve will provide control of the flow.

STARTUP

WARNING: On valves with spring-energized Teflon seals, it may take hours or even a day for enough liquefied gas to pass into the bonnet area to effectively "balance" the pressure across the plug seal. In the event of air failure in a fail-closed valve during this time, fluid forces may tend to open the valve rather than close it because the effective area of the plug seal is greater than the effective seat area. Once enough vapor is in the bonnet area, the pressures on each side of the plug equalize and normal valve operation results. Valves with spring-energized Teflon seals, are available and do not require time to "balance" the pressure across the plug head.

Troubleshooting

If difficulty is suspected with the control valve, proceed as follows:

1. Make sure valve has sufficient air supply.
2. Check for air leaks anywhere in supply and instrument signal systems and on valve positioner.
3. Make sure packing isn't too tight by loosening gland flange nuts and retightening to just over finger-tight.
4. Push the restriction orifice cleanout plunger on the positioner several times.
5. Check for stem freezing caused by the condensation of atmosphere moisture at the exit of the stem from the packing. If this occurs, a longer extension may be required or the temperature surrounding the packing box should be raised.

VALVE MAINTENANCE

The Valtek Mark Six top entry design allows for easy trim inspection and service without removing the valve body from line or the insulation to get at the bonnet.

Routine maintenance consists of tightening the gland flange nuts to compensate for packing wear. Do not overtighten packing nuts, since this will shorten packing life and may prevent smooth valve performance.

DISASSEMBLY AND REASSEMBLY

WARNING: Depressurize the line to atmospheric pressure and drain all fluids before working on the valve. Failure to do so can cause serious injury.

Disassembling the Actuator

1. Fully retract plug until stroke indicator is pointing to the open position.
2. Remove the bonnet bolts and lift the actuator, bonnet and plug out of the valve.

   CAUTION: The plug head seals may cause the plug to bind in the body, making it difficult to remove the actuator plug assembly. To remove the plug, apply air to the top of the piston, moving the cylinder and bonnet away from the plug head. Place soft (preferable wood) blocking of equal thickness in at least three positions between the body and the bonnet. Apply air underneath the piston to retract the plug.
3. Lift the plug carefully out of the body. Any scraping parts while removing the plug may cause damage. Heavy actuators may require a hoist. If the actuator is not equipped with a lifting ring, use lifting straps around the yoke legs.

Disassembling the Plug from the Actuator

1. Loosen the stem clamp.
2. Loosen the gland flange.
3. Remove the yoke clamp (or yoke bolts if used).
4. Rotate the actuator in a counterclockwise direction to disengage the plug stem from the actuator stem.

   CAUTION: To avoid scoring guides and stem, do not turn plug stem in bonnet. Flats are machined on the plug stem so it can be held with a wrench.
5. Carefully remove plug by pulling it through the bonnet.
6. Push out packing and guides from the bottom of the bonnet, using a dowel.
7. Inspect guides for scratches and scoring. Damaged guides should be replaced and new packing should be used upon reassembly.

Replacing the Soft Seat

1. Disassembling the plug.

   NOTE: *Plug sizes up to 1 1/2 inch use a threaded plug head design that clamps the soft insert and plug insert retainer between the plug head and plug stem. Disassemble the plug by screwing the plug head out*

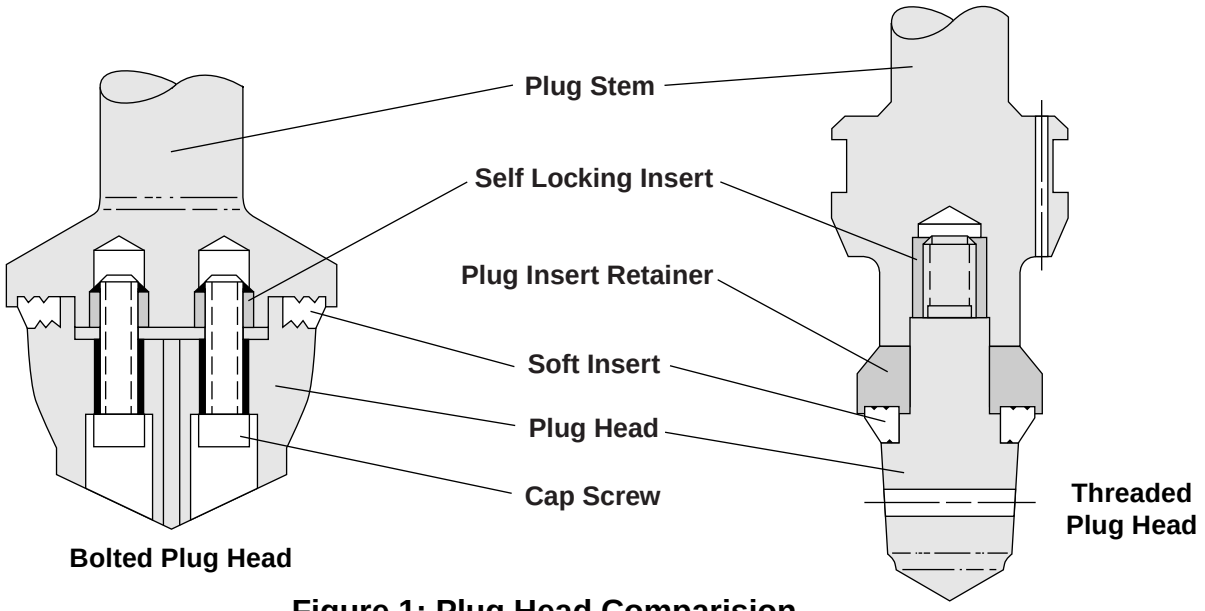

Figure 1: Plug Head Comparision

of the plug stem. A rod may be inserted into the hole drilled through the plug head to facilitate removal.

Plugs above 2 inch use a bolted design that clamps the soft insert between the plug head and plug stem. Disassemble the plug by removing the cap screws.

2. Clean all parts.
3. Using a new elastomeric insert, reassemble soft seat components as shown.

NOTE: *On small threaded plug heads, make sure the plug head is screwed in tightly to compress the soft insert between the plug insert retainer and the plug head. A self-locking insert prevents the plug head from working loose.*

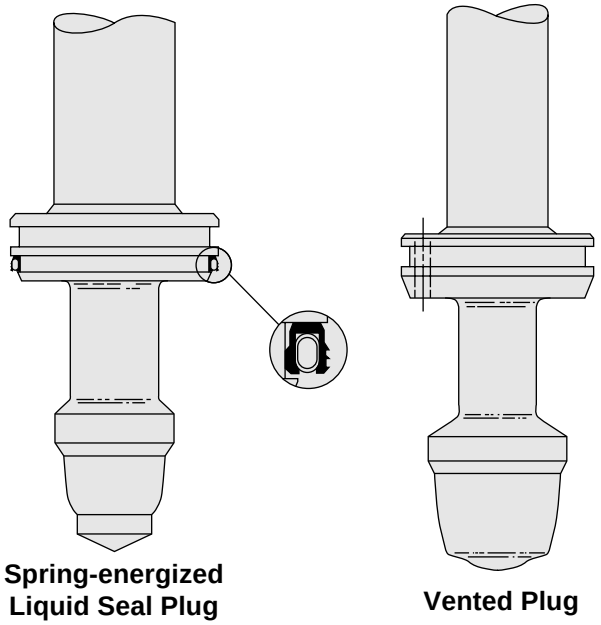

Figure 2: Plug Seal Comparision

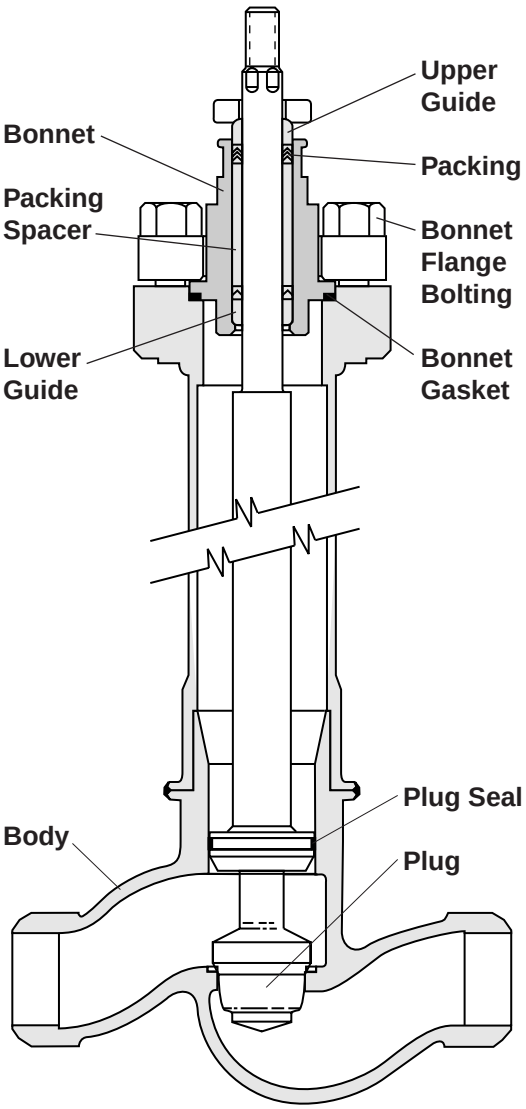

Figure 3: Body Subassembly

Inspecting the Screwed-in Seat Ring

1. Unscrew seat ring using a seat ring assembly tool.

   NOTE: *Flats are machined on the tool so a wrench may be used to turn the seat ring. Assembly tool supports are sometimes needed to keep the assembly tool aligned properly in the seat ring.*

2. If necessary, remachine the seat surface. The seat angle on the seat ring is 33 degrees.

   CAUTION: Insure concentricity of seating surface with the outside diameter of the seat ring.

3. Install seat ring using a seat ring assembly tool.

Reassembly of Mark Six

1. Install a new bonnet gasket.
2. Carefully lower plug as far as it will go into the body.
3. Slide the bonnet actuator assembly over plug stem.
4. Insert guides and packing into the bonnet.
5. Place the gland flange onto the plug stem.
6. Screw the actuator stem onto the plug stem by rotating the actuator in a clockwise direction.

   CAUTION: Do not allow plug to rotate. Leave two or three threads exposed for air-to-close valves. For air-to-open valves, screw the plug stem as far as it will go into the actuator stem.

7. Assemble yoke clamp or tighten the yoke bolts.
8. Cycle the valve to retract the plug.
9. The plug head seals, when used, make it necessary to drive the plug into the body using the actuator. Partially bolt down the bonnet flange and supply air to upper actuator port to extend the plug. Repeat operation, if necessary, to bring bonnet fully down into the body.
10. Tighten two opposing bonnet bolts one-sixth turn. Tighten all bonnet bolts one-sixth turn at a time, alternating between opposing bolts. Firmly tighten all nuts evenly and completely, using full wrench force to compress the gasket and seat the bonnet metal-to-metal in the body. Proper tightness requires considerable force; however, the bottoming of the parts metal-to-metal can easily be felt through the wrench.

    CAUTION: Insufficient tightening will result in improper gasket compression.

11. Adjust stem engagement for air-to-open valves only, using the following procedure.

    NOTE: *Proper stem engagement is essential on air-to-open valves to provide stiff, stable operation as the valve throttles near the seat.*

    Cycle the valve to closed position. Observe plug position as shown by the stroke indicator plate. This position is the bottom of the actuator piston stroke. Cycle the valve to open position. Screw the plug out of the actuator one-half turn. Cycle the valve to closed position. Observe the plug position as indicated by the stroke plate. Repeat this procedure, comparing plug position each time until the indicated plug position is about 1/8 inch above the initial or bottom position. This procedure must be followed to assure stiff stable operation as well as tight shutoff. Tighten all nuts evenly and completely, using full wrench force to compress the gasket and seat the bonnet metal-to-metal in the body. Proper tightness requires considerable force; however, the bottoming of the parts metal-to-metal can easily be felt through the wrench.
12. Tighten the stem clamp.
13. Tighten packing nuts to slightly over finger-tight.
14. Adjust stroke indicator position to indicate closed position when valve is closed.

Removing Actuator, Including Yoke (Without Disassembling the Valve Body Subassembly)

1. Fully retract the plug until the stroke indicator is pointing to the open position.
2. Loosen the stem clamp.
3. Loosen the gland flange.
4. Remove the yoke clamp (or yoke bolts if used).
5. Turn actuator completely off the plug and bonnet.

   CAUTION: Do not allow the plug stem to rotate. Flats are machined on the stem so it may require a hoist. If a lifting ring is not provided, use lifting straps around the yoke legs.

Reassembling Actuator, Including Yoke

1. Lift the plug off the seat and turn the actuator onto the plug. On air-to-open valves screw the actuator stem onto the plug stem as far as it will go. On air-to-close valves, leave two or three threads exposed.

   CAUTION: Do not allow the plug to turn on the seat at any time. Do not turn the plug in the bonnet. Flats are machined on the plug stem so it can be held with a wrench.

2. Assemble yoke clamp or tighten yoke bolts.
3. Adjust the stem engagement for air-to-open valves only, according to the procedure outlined in the “Reassembly of Mark Six” instructions, step 11.
4. Cycle the valve to closed position.
5. Slide the stem clamp on the actuator stem so pointer indicated “closed” on the stroke plate.
6. Tighten the stem clamp.
7. Tighten the gland flange nuts evenly to slightly over finger-tight.