

# Masoneilan

a Baker Hughes business

# 84003 Series SteamForm™

## Steam Conditioning Control Valve

Instruction Manual (Rev.C)



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## Safety Information

### Important - Please read before installation

These instructions contain **DANGER**, **WARNING**, and **CAUTION** labels, where necessary, to alert you to safety related or other important information. Read the instructions carefully before installing and maintaining your control valve. **DANGER** and **WARNING** hazards are related to personal injury. **CAUTION** hazards involve equipment or property damage. Operation of damaged **equipment can, under certain operational conditions, result in degraded process system performance that can lead to injury or death. Total compliance with all DANGER, WARNING, and CAUTION notices is required for safe operation.**



This is the safety alert symbol. It alerts you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.



Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.



Indicates a potentially hazardous situation which, if not avoided, could result in serious injury.



Indicates a potentially hazardous situation which, if not avoided, could result in minor or moderate injury.



When used without the safety alert symbol, indicates a potentially hazardous situation which, if not avoided, could result in property damage.

**Note: Indicates important facts and conditions.**

## About this Manual

- The information in this manual is subject to change without prior notice.
- The information contained in this manual, in whole or part, shall not be transcribed or copied without Baker Hughes's written permission.
- Please report any errors or questions about the information in this manual to your local supplier.
- These instructions are written specifically for the 84003 Series SteamForm, and do not apply for other valves outside of this product line.

## Useful Life Period

The current estimated useful life period for the 84003 Series SteamForm is 25+ years. To maximize the useful life of the product, it is essential to conduct annual inspections, routine maintenance and ensure proper installation to avoid any unintended stresses on the product. The specific operating conditions will also impact the useful life of the product. Consult the factory for guidance on specific applications if required prior to installation.

## Warranty

Items sold by Baker Hughes are warranted to be free from defects in materials and workmanship for a period of one year from the date of shipment provided said items are used according to Baker Hughes recommended usages. Baker Hughes reserves the right to discontinue manufacture of any product or change product materials, design or specifications without notice.

### **Note: Prior to installation:**

- The valve must be installed, put into service and maintained by qualified and competent professionals who have undergone suitable training.
- All surrounding pipe lines must be thoroughly flushed to ensure all entrained debris has been removed from the system.
- Under certain operating conditions, the use of damaged equipment could cause a degradation of the performance of the system which may lead to personal injury or death.
- Changes to specifications, structure, and components used may not lead to the revision of this manual unless such changes affect the function and performance of the product.

Under certain applications this product:

- Can result in surfaces that present burn (hot) hazards to the end user including potential exposure to the media being processed by/through the product or equipment.
- Can have sharp or protruding edges or surfaces. When working on or with this product additional care may be necessary to avoid contact with these sharp surfaces.
- Can result in surfaces that present slip or loss of footing conditions to the end user. Additional measures should be considered during installation to prevent the collection of fluids/media or the occurrence of slip or trip hazards.
- Can be installed in poorly ventilated or confined areas, or in areas that may contain gases other than oxygen, which can lead to a risk of oxygen depletion and/or personnel asphyxiation. Additional protection shall be used in such installations.
- Can be installed in areas subjecting the end user to cramped or strained working positions. Additional policies and procedures shall be considered to reduce or remove the end user exposure to these conditions.
- Can produce elevated noise levels outside allowable limits for end user exposure. Site monitoring and testing shall be performed to verify any need for engineering or administrative controls to eliminate or reduce hazardous noise levels.
- Can be installed, serviced, or maintained at elevated heights. The end user shall properly use fall protection and appropriate safety equipment and practices to prevent the dropping of tools or equipment when working at heights.
- Can require manual or assisted lifting. It is the end user's responsibility to ensure the lifting means (product lifting points or equipment) are properly installed, torqued, and inspected for use in accordance with local codes and standards.
- Can shift during shipping/transportation. The end user shall take all precautions to determining a load shift and avoid harm.
- Can potentially release process/pressure if defects exist. Additional policies and procedures shall be considered to reduce or remove the end user exposure to these conditions.
- Can contain residual process media or stored energy (eg. trapped pressures, loaded springs, heavy shifting or unstable parts, etc.).
- Horizontal orientation or installations exposure the end user to additional risks for assembly/disassembly. Proper techniques shall be followed to reduce the end users exposure to these hazards.

Personal protective equipment (PPE) and safety equipment shall be used in accordance with local requirements.

**Note: Material safety data sheets (MSDS) shall be available and reviewed in accordance with local requirements. Products shall be installed, serviced, and maintained in accordance with all local and national codes and standards by properly qualified (licensed/certified/trained) personnel.**

Prior to installing, maintaining, servicing, or inspecting the product or equipment, ensure the system or process is in a safe state (e.g., depressurized, adjusted to ambient temperature, properly secured, process properly contained/isolated, etc.)

Prior to commissioning or returning the equipment to service, local codes and standards may require that testing (e.g., overpressure, leakage, mechanical or electrical operation, etc.) be conducted to verify the installation. Additional protection shall be taken into consideration to protect the end user from exposure to the hazards associated to the failure modes of the testing, potential hazards should leaks be found, etc.

## **WARNING**

**Installation of this device in proximity of people, or property that may be adversely affected should the device fail, leak, generate excessive noise, or other such hazard, should be minimized and/or precautions taken to reduce the associated hazards. Loitering or gathering around this type of equipment should be avoided.**

## **Recommendations prior to Installation of Valve into Pipeline**

The valve should be properly prepared and configured as per the recommendations below prior to installation to ensure the best performance.

## **CAUTION**

- **The functional trim should not be installed in the valve when connecting the valve into the pipeline.**
- **The functional desuperheater nozzles should not be installed when connecting the valve into the pipeline or during flushing.**

## **Working Space Requirements**

## **DANGER**

**At a minimum, an envelope 3 feet (1m) from any working surface on the valve or desuperheater body should be maintained to facilitate easy access. The valve assembly drawing depicts the necessary space requirements to accommodate an actuator and its installation or removal.**

## **Appropriate Lift Points**

The SteamForm valve assembly (including desuperheater) may be lifted by the bosses provided on the valve body. Take note of the C.O.G. for the assembly or component to be lifted, the outlet of a valve assembly should be secured against 'kicking out' during an initial lift. Straps may be used around the valve inlet, as well as the desuperheater pipe in the horizontal orientation. Care must be taken to avoid damage to any installed fixtures and accessories throughout the lifting process.

## **CAUTION**

**Do not lift any portion of the valve assembly by the water ring or related piping connections. Do not lift any portion of the valve assembly by the actuator or any accessories.**

The center of gravity (C.O.G.) for each component and assembly is included on their respective drawings for reference. Appropriate lifting locations are included if necessary.

# Definitions

**Body (Inlet):** Refers specifically to the core valve body and inlet component. For hydrostatic testing, this will include the bonnet as a complementary pressure containing component.

**Center of Gravity (CG):** The average location of the weight of an object.

**Desuperheater (DSH or Outlet):** Refers only to the pipe attached to the valve body outlet including integrated nozzle subassemblies, housings, and flanges. In the context of hydrostatic testing, this WILL NOT include the water ring.

**Desuperheater Subassembly (S/A):** Refers to the Desuperheater as described above and the attached Water Ring.

**Functional Trim Subassembly (S/A):** Includes the Cage, Seat Ring (or seat ring diffuser), and Plug Subassembly designed to provide flow control in service.

**Job Rated Valves:** A “job rated” valve is an Intermediate Class as defined by ASME B16.34 and is determined from extrapolation between ASME Pressure Classes. The interpolation is computed from the standard referenced.

**Hydro Assembly Drawing:** A valve assembly drawing indicating the components fitted to the valve body, desuperheater, and/or water ring during a hydrostatic test. This drawing also includes the number of hydro tests with their respective pressures and durations.

**Hydro Packing Components:** Includes the Hydro Packing Flange, Hydro Packing Plug, and designated hydro packing rings as defined in the valve assembly drawing.

**Hydro Trim Components:** Consists of the Hydro Cage, Hydro Seat Ring, and other Flushing/Hydro Kit components as defined in the Hydro Assembly Drawing.

**Hydrostatic Test Scenario:** The hydrostatic test configuration and assembly procedure defined by the Hydro Assembly Drawing.

**Lifting Hardware:** Hooks, shackles, or other devices selected for the purpose of lifting the valve assembly or individual components and tools. These devices provide connection to a crane or hoist.

**Plug Assembly Drawing:** A drawing showing the finished plug assembly including the dimensions necessary to drill and pin the plug stem joint.

**Plug S/A:** Sub assembly including the plug and stem. In the case of a pilot-balanced valve, this includes the pilot plug, spring(s), and retainer.

**Pressure Region:** One of up to three separate regions of the SteamForm Valve Assembly that must be hydrostatically tested to a particular pressure and hold time per the Hydro Assembly Drawing.

**Rating:** The rating of a valve is an ASME, IEC or JPI classification that indicates the allowable temperature and pressure for the valve.

**Trim Installation Device (TID):** The SteamForm Valve Trim Installation Device (TID) is a configurable tool intended to lift and assemble trim assemblies in the horizontal orientation. The tool attaches to trim components by means of size-specific adaptors, and may be used to install or remove a seat ring or seat ring diffuser, as well as a cage with plug S/A installed.

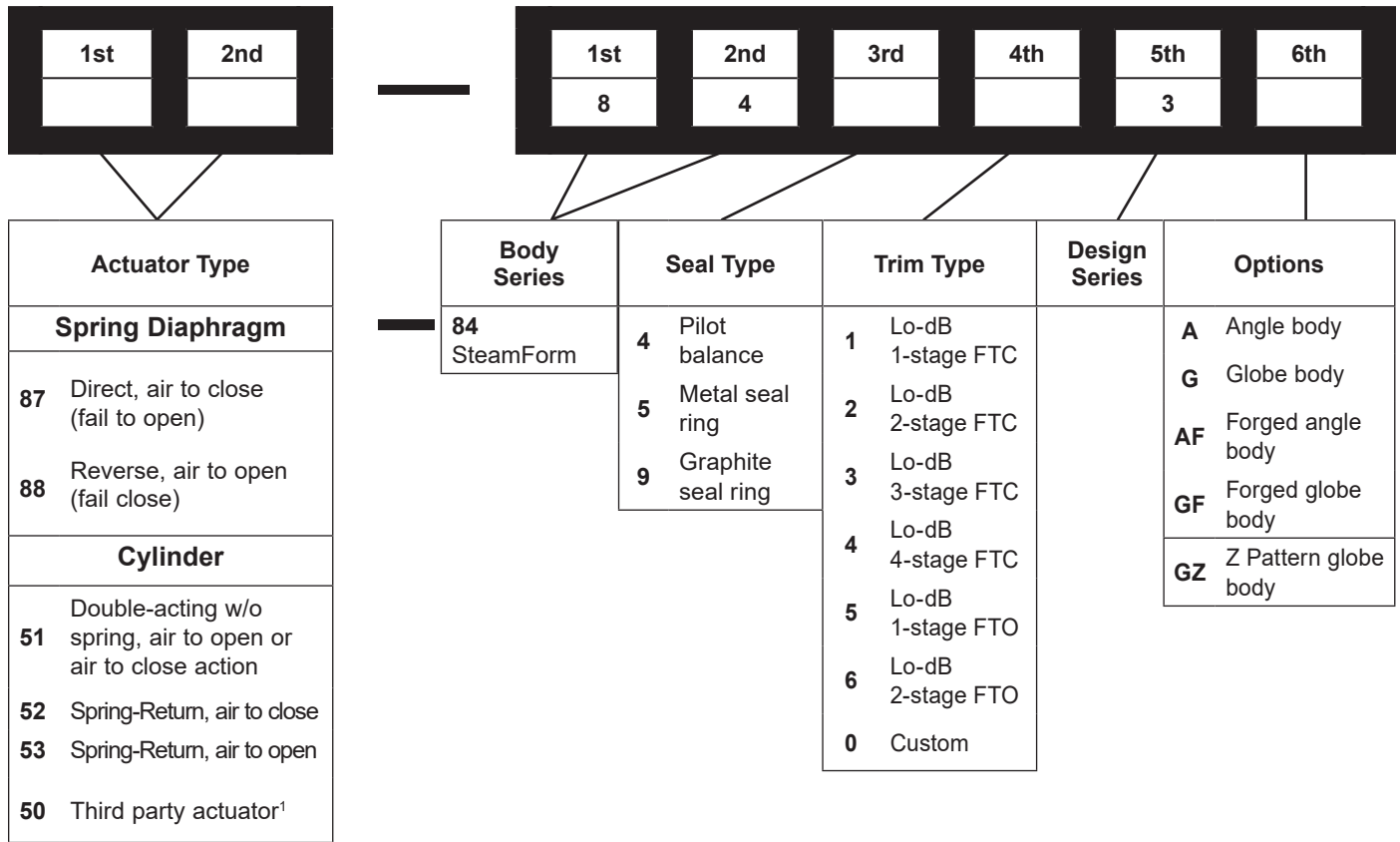
**Trim Installation Device Adapters (TID Adapters):** A component or assembly designed to mechanically connect the TID and a valve trim assembly.

**Valve Assembly Drawing:** An assembly drawing indicating the all of the necessary components included in the final configuration of the SteamForm Valve Assembly as it will be utilized by the customer in service. This drawing will include the Functional Trim.

**Valve Assembly (or SteamForm Valve Assembly):** Includes the valve body and attached desuperheater subassembly with all inclusive internal components.



# 84003 Series SteamForm Numbering System



1. Must be evaluated and approved by Baker Hughes.

**NOTE:**

*Multiple stage valves can be equipped with either welded or drop in type diffusers for stages 2-4. The welded diffusers are less costly because the overall body size can sometimes be reduced, but must be cleaned or flushed through the bonnet using special trim. Valves using Drop-In diffusers can be cleaned or flushed through the valve using special trim designed for the purpose. See Figure 3 and "Flushing Operations" on page 9.*

# Introduction

## Scope

The following instructions are designed to guide the user through the installation and maintenance of the **Masoneilan™** 84003 Series SteamForm steam conditioning valve.

The SteamForm product is part of Baker Hughes Masoneilan's Engineered Product portfolio, and is custom designed to fit our customers' most difficult applications. For this reason, sections of this instruction manual may be replaced with specific drawings and descriptions that apply only to the valves that are specified for use on a given project. For further detailed information on your specific 84003 Series SteamForm valve design, please contact the Baker Hughes Masoneilan factory.



**Figure 1 - 84003 Series SteamForm steam conditioning valve**

## Serial Plate

The serial plate is usually fixed to the side of the actuator yoke. It indicates information about the valve including size and type, pressure class rating, body/bonnet material, and serial number.

### **! WARNING**

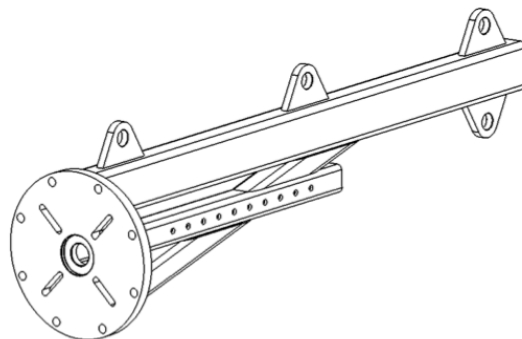
**Careful attention must be paid towards the serial plate prior to pressurizing of the SteamForm valve. Inlet, outlet, and water connections may be independently designed for the conditions at their point of operation, thus ANSI pressure class ratings may differ at each connection.**

## After Sales Service

Baker Hughes offers Masoneilan After Sales Service comprised of highly qualified technicians to support the installation, operation, maintenance and repair of its equipment. For support contact the local Baker Hughes Masoneilan representative or Baker Hughes Masoneilan factory located closest to you.

## Trim Installation Device (TID)

A fixture to facilitate the safe and successful installation or removal of trim from a valve body in the horizontal orientation must be utilized. A local representative should be contacted for information regarding the tool as trim-size specific adaptors are required to mount the lifting tool.



**Figure 2 - Trim installation device**

## Spare Parts

Only Masoneilan replacement parts should be used when carrying out maintenance operations. Obtain replacement parts through local Baker Hughes Masoneilan representatives or Masoneilan Parts Department.

When ordering spare parts, the MODEL AND SERIAL NUMBERS indicated on the manufacturer's serial plate **MUST BE GIVEN**. The serial plate is on the side of the actuator yoke.

## Actuator and Accessories

Actuators and other valve accessories have their own instruction manuals that provide information and details on the assembly and installation. Refer to the appropriate instruction manual for each unique accessory.

## Unpacking

Care must be exercised when unpacking the valve to prevent damage to the accessories and component parts. Contact the local Baker Hughes Masoneilan Sales Office or Service Center with any issues or problems. Be sure to note the valve model number and serial number in all correspondence.

## Installation

**Note: It is highly recommended to review the SteamForm Installation Guide (31014) for a thorough explanation of the proper SteamForm system layout. These design guidelines are intended for performance optimization of the steam conditioning system.**

The recommendations provided on the installation guide include, but are not limited to:

- Upstream straight pipe length
- Downstream straight pipe length
- Temperature sensor quantity and location
- Pressure sensor location
- Pipe size and selection
- Downstream piping material transition
- Spray water system and strainer recommendations
- Piping drain locations

For optimum valve performance, it is critical to implement as recommended on the SteamForm Installation Guideline.

## Piping Cleanliness

Before installing the valve in the line, clean piping and valve of all foreign material such as welding chips, scale, oil, grease or dirt. Gasket mating surfaces must be thoroughly cleaned to ensure leak-free joints. Sacrificial start-up fixtures can be purchased from Baker Hughes Masoneilan to protect the operational trim during the installation and line flushing phases.

### CAUTION

If major system or piping modifications (or repairs) are performed, thorough flushing and blow down of the system will be required prior to reinstalling the trim. Sacrificial flushing trim should be installed in this valve to protect the integrity of the flow passages. Failure to follow this warning will violate the valve warranty agreement and could result in control instability, excessive noise levels, and valve leakage.

## Isolation Bypass Valve

To allow for in-line inspection, maintenance and removal of the valve without service interruption, provide a manually operated shutoff valve on each side of the control valve and a manually operated throttling valve in the bypass line. The location of the downstream isolation valves requires special consideration in the case of the 84003 Series SteamForm as a result of the spray water injection system on the outlet of the SteamForm valve. If the downstream isolation valve is close coupled to the SteamForm, the system will struggle to properly control downstream temperature as the water injection becomes interrupted by the location of the isolation valve. Please contact the factory for specific recommendations on a suitable downstream location of the isolation valve.

## Heat Insulation

In case of a heat-insulated installation, do not insulate the valve bonnet and take protective measures relative to personal safety.

## Hydrostatic Testing and Line Cleaning

During this operation, the control valve must not be used as an isolating valve. This means that the valve must always be opened before carrying out pressure tests in the process line, leaning of pipes, etc. Otherwise equipment damage or failure of the seal rings could result. Trim flushing and hydrostatic test kits used during the flushing process can be purchased from the Baker Hughes Masoneilan factory.

## Flow Direction

The valve must be installed so that the process fluid will flow through the valve in the direction indicated by the flow arrow located on the body.

## Welded Connections

### CAUTION

Carefully review the information in this section prior to welding any valves inline. Refer any additional questions to the local Baker Hughes Masoneilan Sales Office or Service Center.

## Pre-Weld Preparation

Carefully follow the installation steps defined in the sections noted below prior to performing weld procedures.

## Welding Process

Perform welding process in accordance with the standard requirements for the materials and weld construction of the specific valve. Apply post weld heat treatment if required.

### CAUTION

Internal valve components should be removed prior to performing any post weld heat treatment in order to prevent damaging any soft goods (such as PTFE seals). If unable to remove the elastomeric components, then other methods must be employed to prevent the local temperature around the seals from exceeding the maximum material limits (typically 450°F / 232°C for Teflon based materials).

## Post Weld Cleaning and Assembly

Inspect the body, bonnet, and trim components for cleanliness and surface condition. Remove any foreign materials, such as weld chips, slag or scale. Make sure there are no nicks, scratches, burrs or sharp corners on sealing and sliding surfaces. Clean all gasket interface surfaces and reassemble using new gaskets to ensure sealing integrity.

## Actuator Assembly

Assemble the pneumatic actuator onto the control valve using the appropriate instructions for the specific actuator model and type. Connect air pressure lines to the actuator ports to meet intended operating mode (i.e., air-to-extend, air-to-retract, or double-acting). Actuator supports are not to be welded to the actuator

# Commissioning Process

The SteamForm installation process flow is dependent both on the valve configuration itself and customer requirements. The process below provides an overview of the installation and commissioning process. Each step is outlined in greater detail in the following sections.

1. Valve preparation
2. Install valve in pipeline (this step is the responsibility of the customer, and must be performed with the internal trim components removed and stored in a safe location.)
3. Flushing operations
4. Hydrostatic testing operations
5. Final assembly

Common trim configurations associated with flushing and hydrostatic testing in the field are depicted below:

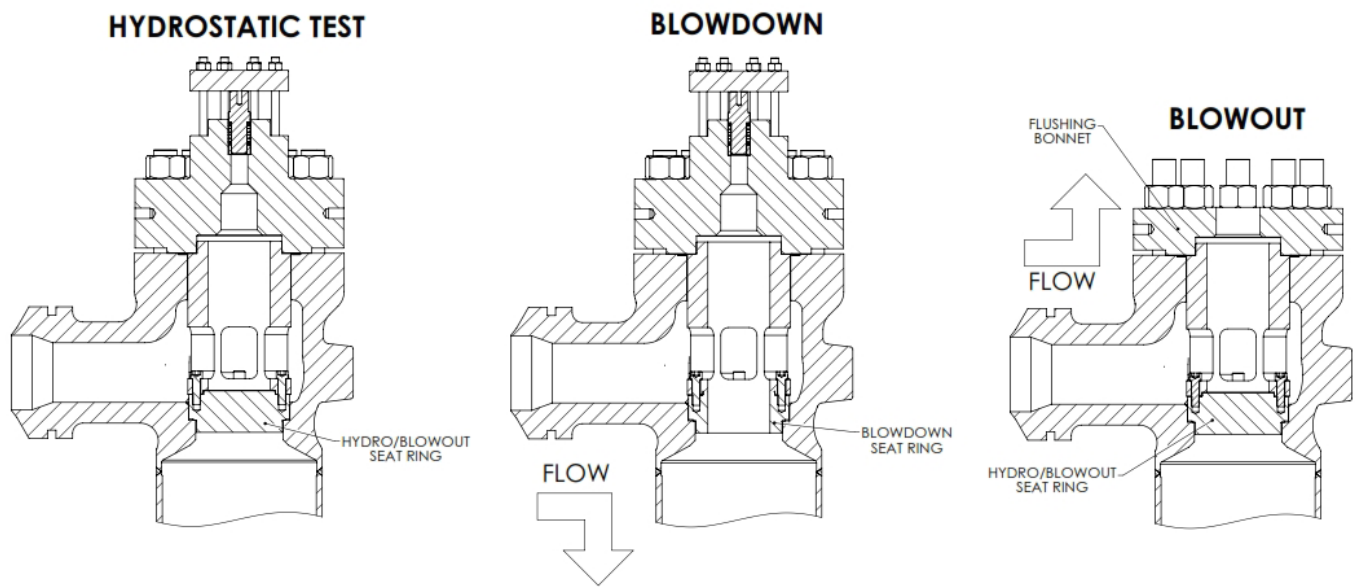


Figure 3 - Example flushing and hydrostatic testing fixtures

## Valve Preparation

### ⚠ CAUTION

Prior to performing any maintenance on the valve, isolate the valve and vent the process pressure.

## Valve Actuation

Access to the internal components of the valve should be accomplished with the actuator removed. Refer to the appropriate actuator instruction manuals for detailed instructions.

### ⚠ WARNING

Actuator may be pre-loaded with tension from air pressure or springs. Prior to disconnecting instrumentation read all instructions for the specific actuator.

## Disconnect Instrumentation

Disconnect all mechanical connections between the positioner and the other instruments. Disassemble the valve stem and actuator stem coupling as described in the following sections.

## Air-to-Retract Actuators

Apply sufficient air pressure to the actuator to retract the stem completely. Disconnect the plug stem from the actuator stem depending on the connection type as described below.

## Threaded Connection

Unscrew the plug stem from the actuator stem, making sure the plug never contacts the seating area (liner or seat ring) at any time during disassembly.

# CAUTION

Contact between the plug and seating area during this disassembly process may cause damage to the seating surfaces. It may be necessary to disassemble the actuator yoke from the valve bonnet and lift the actuator off the valve to avoid plug to seating surface contact.

## Split Clamp Connection

Remove the screws and disassemble the stem connector from the valve and actuator stem.

## Air-to-Extend Actuators

For this actuator configuration, the valve plug is already in the fully retracted position without any air pressure applied. Disconnect the plug stem and actuator stem as described in the threaded connection and stem connector sections above depending on the connection type.

## Actuator Removal

Disconnect all electrical and air connections to and from the actuator. Disassemble yoke nut or yoke attachment screws, and lift the actuator off of the valve being careful not to damage the bonnet threads.

### For horizontal installations:

- a. Support the actuator with an appropriate crane, hoist or lifting device. Be sure that any instrumentation is properly protected and sufficiently free of any incidental harm resulting from a lift.
- b. Remove any existing static actuator supports.
- c. Remove stem clamp.
- d. Remove the nuts or spud nut connecting the actuator yoke to the bonnet.
- e. Carefully guide the actuator and yoke sub-assembly away from the valve, ensuring no contact between the sub-assembly and the stem, or any exposed stud threads.
- f. Store the sub-assembly in a safe location.

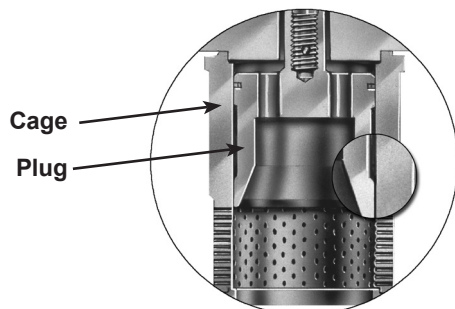


Figure 4 - Straight plug design

## Valve Disassembly

The following procedure assumes that the valve has been shipped with the functional trim installed, which must be removed to install the necessary trim for commissioning operations.

## Opening Pressurized Chamber

The valve must always be reassembled with a new packing set and gaskets. Replace the conical spring if slightly damaged or worn. Before disassembly, make sure that the appropriate parts are available.

1. Remove the packing flange nuts then remove the packing flange and the packing follower.
2. Check the exposed part of the valve plug stem to confirm it is clean enough for ease of removal of the bonnet.
3. Remove the body nuts.
4. Lift the bonnet and remove from the valve body. During this operation, the valve plug stem must be pushed downward to ensure the valve plug remains inside the valve body.
5. Remove the body gasket from the groove on top of the valve body.
6. Remove the conical spring from the groove on top of the valve cage. Some designs for low temperature service may not include a conical spring.

# CAUTION

Do not remove the body studs from the body. If studs sustain damage during testing, commissioning or maintenance, contact factory.

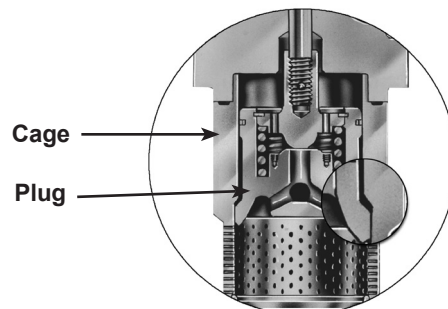


Figure 5 – Bell shaped plug, pilot design only



## Vertical Orientation - Removal of Installed Trim

1. Remove the valve plug assembly from the valve cage by pulling the valve plug stem upward. In the case of the bell-shaped plug design (see Figure 5); pulling the plug stem will remove both the plug and cage together. For straight plug designs (see Figure 4), after removal of the plug lift the the cage to remove from the valve body.
2. The next step is to remove the valve seat ring or seat ring diffuser by lifting the part out of the body.
3. Remove the seat ring gasket from the valve body.
4. Remove the packing set and the guide bushing from the bonnet.

## Horizontal Orientation - Removal of Installed Trim

Figures 6a and 6b show shows the trim installation device mounted to the main trim assembly. Adaptor pieces may vary in appearance for various trim sizes, but the function remains the same.

1. If a seat ring diffuser is employed, remove the flanges covers from the jack points if available. Otherwise proceed to step 9.
2. Thread the diffuser support rods into the jacket points until contact is made. Apply 1 full turn after contact to support the diffuser (see figure 7).
3. Position and install the appropriate TID adapter to the trim using a crane or hoist and the provided hardware.
4. Perform a check to ensure that the TID adapter and all connecting hardware are correctly installed.
5. Using a crane or hoist and the provided lifting hardware, position and connect the TID, including the appropriate counterweight, to the adapter. Ensure that the TID apparatus is supported at all times by the crane or hoist. The trim may not be used to support the weight of the TID.
6. Secure the valve stem to the TID and adapter assembly to prevent movement of the valve plug subassembly during trim removal.

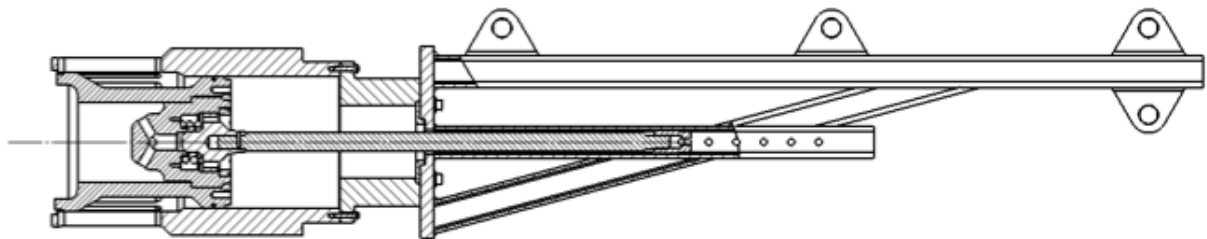


Figure 6a - Trim mounted to TID

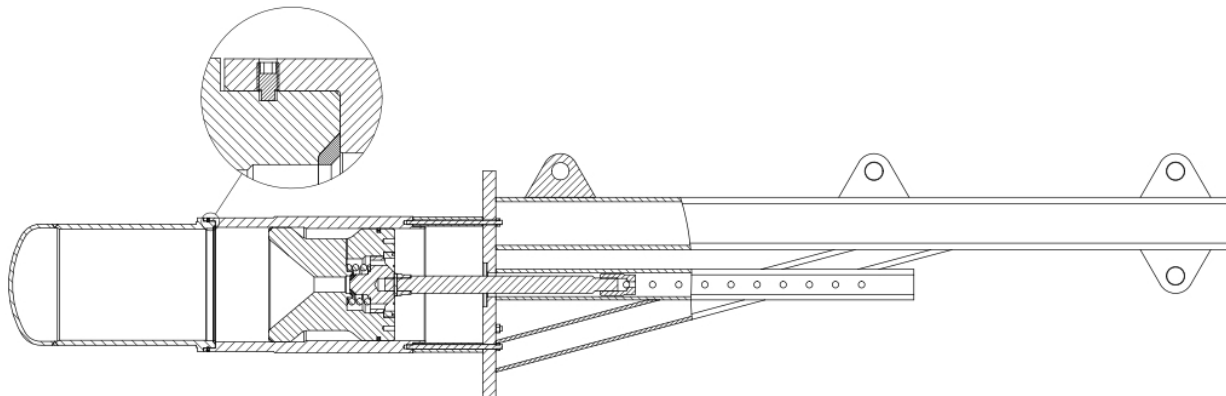


Figure 6b - Trim mounted to TID-Cartridge design

7. Once the TID is attached securely to the trim adaptor, adjust the height and angle of the TID such that the trim lifts slightly off of the body bore surface, indicating that the trim is supported and balanced.
8. Perform a check to ensure that the TID, TID adapter, all connecting hardware, and all lifting hardware are correctly installed.
9. Attach a come-along or other device to the TID to provide a horizontal force to remove the trim from the valve. Horizontal movement may require periodic adjustments to maintain proper alignment during disassembly.
10. Carefully apply force as it may be necessary to overcome stiction. It's extremely important to slowly remove the trim from the valve as it is possible for the seat ring to fall free from the cage and fall loose in the body.
11. Carefully slide the trim assembly out of the valve body taking special care to observe the vertical movement of the trim as it exits the valve body. It may be necessary to adjust the height and angle of the TID in order to ensure the trim does not contact the body or body studs during disassembly.
12. As the trim fully exits the body, be mindful of potential lateral movement due to lack of alignment or environmental factors. Carefully guide the trim to the desired storage location.
13. Store the trim horizontally on a wooden or protective surface, and secure it against movement to prevent damage.
14. Disconnect the TID from the adapter.
15. Ensure that the adapter is properly supported by a crane or hoist and remove all connecting hardware from the trim assembly to free the adapter.
3. Position the TID and adapter assembly for insertion into the valve body using a crane or hoist and the provided lifting hardware.
4. Carefully insert the assembly into the valve body so that the adapter mates with the seat ring diffuser.
5. Connect the adapter to the seat ring diffuser using long threaded rod.
6. Once the rod has been threaded fully into the seat ring, drive a nut down to come into contact with the adaptor flange.
7. The threaded rod and nut may be tightened by double-nutting the top of the rod and turning, providing preload on the joint at the seat ring.
8. If necessary, reposition the lifting hardware to accommodate the new CG of the combined TID and seat ring assembly.
9. Perform a check to ensure that the TID, adapter, and seat ring diffuser are all properly connected with all prescribed hardware.
10. Attach a come-along or other device to the TID to provide a horizontal force to remove the trim from the valve.
11. Carefully slide the trim assembly out of the valve body taking special care to observe and support the vertical movement of the trim as it exits the valve body.
12. Add any additional supports or make any required adjustments to ensure that the whole assembly will be balanced and can be safely removed beyond the valve body studs.
13. Carefully continue to remove the assembly while clearing the valve body studs.
14. Ensuring that the seat ring diffuser will be properly supported, remove the seat ring diffuser from TID at the adapter.
15. It may be necessary to remove the adapter from the seat ring diffuser. Ensure that the adapter is properly supported by a crane or hoist and remove all connecting hardware from the seat ring diffuser to free the adapter.
16. If the seat ring gasket is stuck to the body bridge or seat ring, it must be carefully removed so as not to scratch or damage the seating surface. Specific care must also be taken to prevent the gasket from falling into the body gallery or pipeline.
17. Remove the support rods from the jack points to avoid contact during reassembly.
18. Store the trim horizontally on a wooden or protective surface, and secure it against movement to prevent damage.

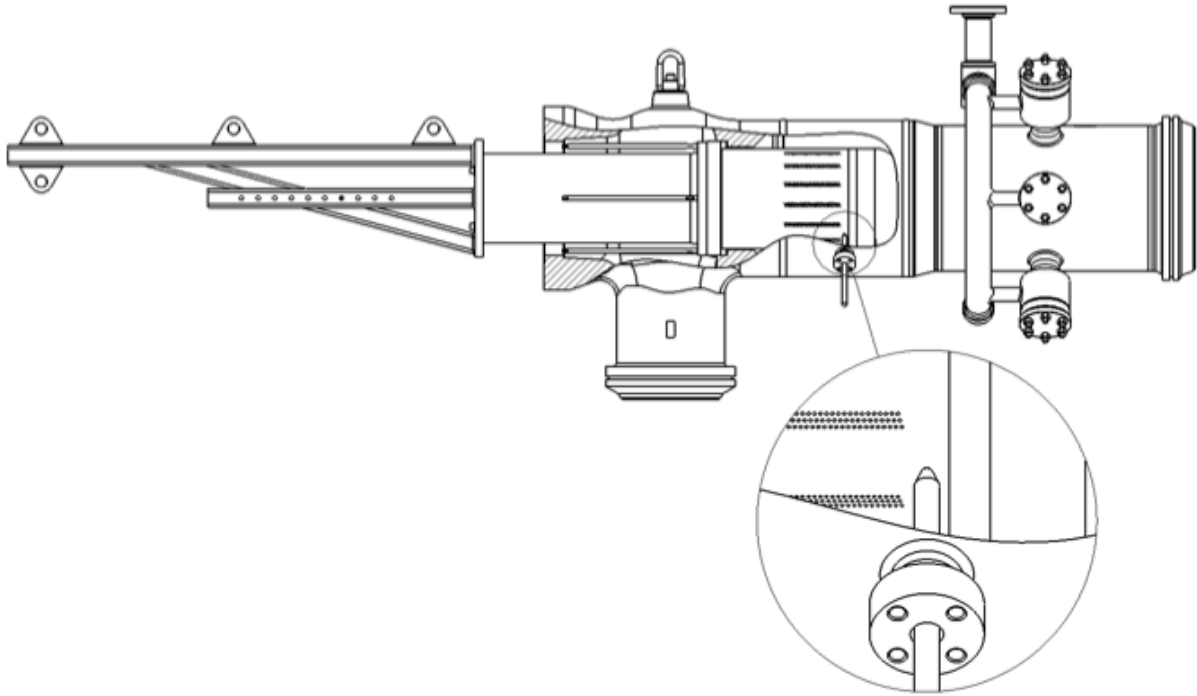
## Seat Ring Removal

It may be possible to remove the seat ring from the body cavity by hand. If a seat ring removal adaptor has not been provided, the following steps may be employed:

- a. Long sections of threaded rod may be screwed into the corresponding holes on the top surface of the seat ring.
- b. One rod or other device should be inserted into the valve and through the seat ring. This will act to catch the seat ring gasket and prevent it from falling into the body gallery or pipeline.
- c. Remove the seat ring by pulling it out of the valve body being sure to provide vertical support to the threaded rods to stabilize the seat ring during removal.
- d. If the seat ring gasket is stuck to the body bridge or seat ring, it must be carefully removed so as not to scratch or damage the seating surface. If the gasket is stuck on the body bridge, specific care must be taken to prevent the gasket from falling into the body gallery or pipeline.

## Seat Ring/Seat Ring Diffuser Removal (with TID)

1. Equip the TID with the appropriate seat ring diffuser removal adapter.
2. Perform a check to ensure that adapter and all connecting hardware is properly installed.



**Figure 7 - Seat ring/seat ring diffuser removal**

## Trim Disassembly

1. In order to separate the cage and plug S/A, stand the assembly up on a clean and level surface to rest on the bottom surface of the cage. The plug S/A is free to move within the cage, though it cannot be removed through the top of the cage.
2. Continue lowering the plug S/A until it too, is resting on the protective surface.
3. The cage may now be lifted straight up and away from the plug S/A.



**Figure 8 - Trim disassembly**



## Horizontal Orientation-Removal of Installed Trim-Cartridge Design:

Figure 6b shows the trim removal/installation tool mounted to the trim cartridge. Note that the entire assembly consisting of the plug, cage, set ring/diffuser is attached to the tool.

Follow steps 2-15 as detailed in Horizontal Orientation-Removal of Installed Trim.

## Trim Disassembly

1. Lower the assembly onto a clean workstation, resting the assembly on the cage OD.
2. To separate the diffuser from the assembly, back out the fasteners located on the cage OD near the seat ring. The diffuser OD must be supported by a crane or hoist during the process.
3. Carefully dis-engage the diffuser from the cage ensuring that both assemblies are supported
4. Once the diffuser/seat ring is removed from the assembly, lift the cage/plug assembly by the plug stem and re-set on the workstation so that the bottom of the cage and plug are at rest on the workstation.
5. Attach the hoist or crane being used to hoist the assemblies, to the lifting holes provided in the top of the cage. Once secure, lift the cage vertically to separate the cage and the plug. Note that the plug and cage are larger at the bottom than the top, so the cage needs to be lifted over the plug, using the lifting holes provided in the top surface of the cage.

## Valve Plug Seal Removal

Both metallic and graphite piston rings can easily be removed by separating the ends at the notch in the rings and carefully sliding them out of the groove. Because these parts are wear items and are extremely critical to the operation of the valve, fresh parts are highly recommended at all service opportunities.

## Nozzles

### Opening Nozzle Housing

If the SteamForm valve is shipped with the spray water nozzles installed, it is advisable to remove these critical devices during operations such as pipeline flushing and hydrostatic testing. Blank (blind) nozzles may be employed to separate hydrostatic test regions and protect important surfaces.

The valve nozzle housings must always be reassembled with a new set of gaskets.

Before disassembling, make sure the appropriate gaskets are available for replacement.

1. Remove the nozzle flange nuts from the nozzle housing (Figure 9).
2. Lift the nozzle housing flange from the nozzle housing.
3. Remove the nozzle flange gasket.
4. The nozzle holder may have a snug fit within the nozzle housing. For ease of removal of the nozzle holder, screw a bolt (per Table 2) into the exposed threaded connection to provide a lifting point. Pull nozzle holder to remove from nozzle housing.

5. Remove nozzle gasket from the bottom of the nozzle housing.

If installing an alternative nozzle, complete the following additional steps:

6. Install a new inner nozzle gasket in the gasket groove at the bottom of the nozzle housing.
7. Install the nozzle into the housing.
8. Install a new outer nozzle gasket in the gasket groove.
9. Mount the nozzle flanges and nuts to the housings.
10. Torque the nuts to the values indicated on the valve assembly drawing and to the required torquing sequence shown in Figure 9 in at least 6 equal torque steps (10%, 20%, 40%, 60%, 80%, and 100% of the prescribed value) unless otherwise specified

Nozzle C <sub>v</sub>	Lifting Bolt Size
0.4	1/4"
0.8	3/8"
1.5	1/2"
3.0	3/4"
5.0	1"
10.0	1-1/2"

Table 1 - Nozzle removal bolts

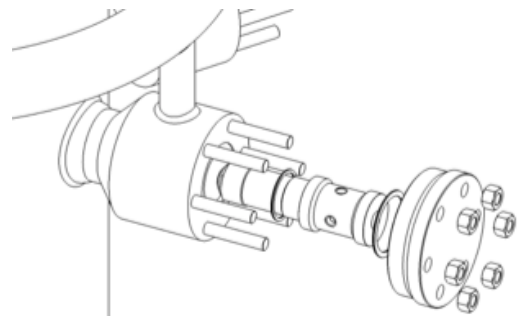


Figure 9 - Nozzle housing

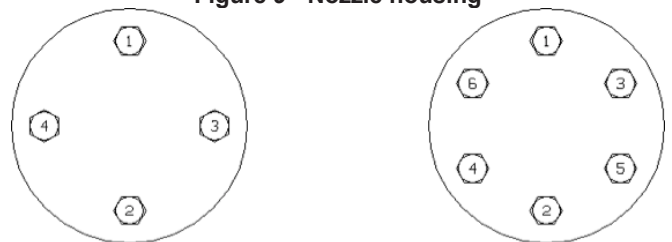


Figure 10 – Bolt torquing sequences for nozzle flanges

# Flushing Operations

Pipeline flushing is recommended to clean debris from the pipeline resulting from its construction. For each flushing operation, the appropriately configured flushing kit must be installed to protect the seat ring seating surface and to properly route the flushing media. SteamForm valves can have welded-in diffusers and therefore, flushing must be done in accordance with the procedures outlined below.

**Note: Valves using permanent (welded) diffusers must be flushed out the bonnet. Valves using removable diffusers can be flushed through the valve. In either configuration, specially designed trim parts must be utilized. See Figure 3 and more detailed description below.**

## Valves With Permanent (Welded) Diffusers:

Valves equipped with this configuration require flushing out through the valve bonnet, denoted as “Blow out” method. This is required to protect the small flow passages in the diffusers from damage to the debris found in the flushing condition. To conduct this procedure, the trim should be installed as described below and shown for “Blow out “ configuration on figure 3.

## Flushing Trim Installation

Flushing trim will consist of a blind seat ring, and a flushing cage, including the necessary gaskets (see Figure 3).

For SteamForm valves installed in a vertical orientation, follow procedure outlined below but do not use the TID or associated adapters.

1. Always use a crane or hoist if necessary to position the components.
2. Position the trim for installation into the valve body allowing enough access to the bottom of the blind seat ring to adhere the seat ring gasket in the following steps.
3. Apply a thin coat, or a series of spots, of Dow Corning Compound 111 or equivalent to the seat ring gasket groove. This will act as a temporary adhesive to hold the gasket in the groove when installed.
4. Place and center the seat ring gasket in the gasket groove.
5. Slowly lower the trim assembly into the valve body. As the seat ring reaches the base of the valve body gallery ensure that the seat ring seals on the body bridge.
6. A second gasket may need to be installed at the top of the trim. If so, install in the same manner as the seat gasket with compound 111.

For SteamForm valves installed in the horizontal orientation, the flushing trim will be installed in the following steps.

7. Install lifting hardware to a conveniently located lifting boss on the valve body. This will act as an anchor point for a come-along to pull the trim assembly into the valve.

8. Install the appropriate TID adapter to the assembled trim with the provided hardware. Use a crane or hoist if necessary to position the components.
9. Perform a check to ensure that the TID adapter and all connecting hardware are correctly installed.
10. Using a crane or hoist and the provided lifting hardware, connect the TID to the adapter and trim assembly.
11. If necessary, reposition the lifting hardware on the TID to accommodate the new CG of the combined TID, adapter, and trim assembly.
12. Perform a check to ensure that the TID, TID adapter, all connecting hardware, and all lifting hardware are correctly installed.
13. Using a crane or hoist, position the trim for installation into the valve body allowing enough access to the bottom of the blind seat ring to adhere the seat ring gasket in the following steps.
14. Apply a thin coat, or a series of spots, of Dow Corning Compound 111 or equivalent to the seat ring gasket groove. This will act as a temporary adhesive to hold the gasket in the groove when installed.
15. Place and center the seat ring gasket in the gasket groove.
16. Attach a come-along to the lifting hardware previously installed on the valve body. Attach the other end of this to a point on the TID.
17. Using the come-along, slowly ease the trim assembly into the valve body. As the seat ring reaches the base of the valve body gallery it may be necessary to manually leverage the assembly using the TID and other supporting apparatus (such as another come-along) to position the trim so that the seat ring will seal on the body bridge.
18. After the trim has been successfully seated onto the body bridge, reposition the lifting hardware on the TID to accommodate the change in CG of the TID and Adapter assembly if necessary. When doing this, ensure that the adapter and TID are still supported so that the trim and valve body are not providing significant support to the TID and adapter.
19. Detach the TID and adaptor from the trim and clear them from the work space.
20. A second gasket may need to be installed at the top of the trim. If so, install in the same manner as the seat gasket with compound 111.

## Flushing Flange Installation

The flushing flange may be welded to additional piping components to direct the flushing fluid after exiting the valve body.

1. A new valve body gasket shall be installed in the valve body gasket groove following the same procedure as the seat ring groove, using compound 111.

# CAUTION

**If a crane is required, it is responsibility of OTHER to provide and operate the crane. Caution must be taken during crane operation. Any damage or injury caused during crane operation is not Baker Hughes's responsibility**

2. Using a crane or hoist and any appropriate lifting hardware, position the flushing flange (and any accompanying pipeline components), and install the flange over the body studs and onto the valve body face.
3. Install the body stud nuts, and tighten them in the sequence indicated in Figure 10 based on the number of bolts in the bolt pattern and torque to value indicated on the flushing assembly drawing in at least 6 equal torque steps (10%, 20%, 40%, 60%, 80%, and 100% of the prescribed value) unless otherwise specified.
4. **If metal-to-metal contact between the bonnet and body is not achieved at the torque value indicated on the assembly drawing, this is cause for rejection. STOP ASSEMBLY and consult factory. DO NOT EXCEED THE MAXIMUM TORQUE VALUES LISTED.**

The upstream pipeline may now be flushed in accordance with the operating conditions set forth by the customer.

Once the upstream pipeline has been cleaned of any debris that could cause damage to the diffusers, the entire system may be flushed through the diffusers (if present) to clean the remainder of pipeline. Downstream flushing trim will consist of an open seat ring, and a flushing cage, including the necessary gaskets. The flushing trim will be installed in the same manner described in the Flushing Trim Installation section for Upstream Flushing.

**Note: The water spray nozzles must be removed during any flushing activity.**

## Flushing Trim Removal (Post Upstream Flushing)

The flushing trim may be removed in the same manner as the functional trim. If the seat ring gasket is stuck to the body bridge or seat ring, it must be carefully removed so as not to scratch or damage the seating surface. If the gasket is stuck on the body bridge, specific care must be taken to prevent the gasket from falling into the body gallery or pipeline.

## Valves with Removable Diffusers:

Valves with fully removable diffusers may be flushed through the valve assembly using the special "flushing" trim as shown on Figure 3 for Blow Down applications. In this case the trim consists of the flushing cage and seat plus the flushing stem assembly and all related gaskets. Install the flushing cage and seat ring into the body using the same procedure as given for the valve with permanent diffusers, and as shown in Figure 3.

## Valve Bonnet and Hydro/Flushing Stem Installation

The hydro/flushing stem shall be installed through the bottom of the bonnet, the packing box, and the packing flange.

1. Install the quick release pin in the stem above the packing flange to secure the stem during assembly.
2. Follows steps outlined in bonnet assembly procedure.

The downstream pipeline may now be flushed in accordance with the operating conditions set forth by the customer.

## Flushing Trim Removal (Post Downstream Flushing)

Remove the bonnet in the same manner as described in Opening Pressurized Chamber section referring to the bonnet-specific instructions. The flushing trim may be removed in the same manner as the functional trim. If the seat ring gasket is stuck to the body bridge or seat ring, it must be carefully removed so as not to scratch or damage the seating surface. If the gasket is stuck on the body bridge, specific care must be taken to prevent the gasket from falling into the body gallery or pipeline.

# Hydrostatic Testing Operations

If the upstream pipeline is rated at a higher pressure class than the downstream pipeline, it will be necessary to employ a hydro trim as a pressure barrier. Refer to the hydro test assembly drawing for the proper trim configuration for hydrostatic testing and assemble as described. The upstream hydro trim kit will consist of a blind seat ring, and a hydro cage (which may also serve as the flushing cage). The hydro trim will be installed in the same manner described in Flushing Trim Installation.

When installing the trim for hydrostatic testing, the valve bonnet must also be installed as during downstream flushing. Follow the instructions in the previous section Valve Bonnet and Hydro/Flushing Stem Installation Section.

If however, the upstream and downstream pipelines are rated at the same pressure class, and are to be tested to the same pressure, the valve functional trim may be installed during hydrostatic testing. Refer to Final Assembly section for instructions on functional trim installation.

## Hydro Trim Removal (Post Upstream Hydrostatic Test)

The bonnet and hydro trim shall be removed in the same manner as summarized in Removal of Installed Trim section.

Remove the hydro/flushing stem by removing the quick-release pin at the top of the stem, and removing the stem from the bottom of the valve.

## Water Ring Hydrostatic Testing

The hydro assembly drawing will specify whether the water ring should require a separate hydrostatic test. DO NOT perform a water ring hydrostatic test with the functional nozzles as expected leakage and damage may occur to the functional nozzles. When the blank nozzles are installed, ensure that both the inner and outer gaskets are installed.

## Downstream or Full Pipeline Hydrostatic Testing – Functional Trim Installation

To perform a hydrostatic test of the downstream pipeline (or both the upstream and downstream pipeline if pipelines are of the same rating) the functional trim may be installed. The installation instructions are detailed in Final Assembly section.

If the water ring is to be hydrostatically tested in conjunction with the downstream pipe, it will be necessary at this point to remove the blank nozzles, and reinstall the flange with a new outer gasket. It is important to note that until hydrostatic testing has been fully completed; functional spray nozzles must not be installed.

# Valve Reassembly

## Pinning the Valve Plug

The valve plug assembly consists of a stem that is threaded into the valve plug. To secure this assembly, the stem is then pinned and tack welded to the valve plug.

If the valve plug or stem needs to be replaced, an entire assembly should be purchased from the factory to ensure product strength and integrity. Re-machining of these parts in the field can seriously impair the mechanical strength and integrity of the valve plug stem assembly.

## Vertical Orientation – Functional Trim Installation

1. After checking all sealing surfaces to ensure they are thoroughly clean, assemble the seat ring gasket to the seat ring using Dow Corning Compound 111 or equivalent to temporarily hold in place.
2. Assemble the seat ring or seat ring diffuser into the valve body using care to ensure the gasket remains in place in the seat ring groove. It may be necessary to secure the seat ring inside the valve body through either bolting or threading. The proper method can be determined by visual inspection or by contacting the factory.
3. For valves using a straight plug design (See Figure 4):
  - a. Install the cage into the valve body by seating it on top of the seat ring.
  - b. Then insert the valve plug, stem assembly including the seal rings and back-up rings if applicable, into the valve cage taking particular care not to damage the seal rings upon entry.
  - c. For models utilizing a conical spring(s), install the conical spring on top of the cage.
  - d. Install the body gasket inside the groove on top of the valve body and make sure it is centered with the valve.
4. For valves using a bell shaped design (See Figure 4):
  - a. With the valve plug assembly in a vertical orientation, center the cage over the valve plug and carefully lower it over the stem and valve plug assembly. Be sure not to damage the seal ring and make sure the seal ring in the plug groove stays positioned correctly.

- b. Insert the cage and plug assembly into the valve body.
- c. For models utilizing a conical spring(s), install the conical spring on top of the cage.
- d. Install the body gasket inside the groove on top of the valve body and make sure it is centered with the valve.

## Horizontal Orientation – Functional Trim Installation

### 1. Seat Ring/Seat Ring Diffuser Installation (with TID)

- a. Equip the TID with the appropriate seat ring diffuser installation adapter.
- b. Perform a check to ensure that adapter and all connecting hardware is properly installed.
- c. Attach the seat ring or seat ring diffuser to the TID adaptor/TID assembly using long threaded rod.
- d. A single nut may be hand-tightened to the seat ring adaptor, securing the adaptor to the seat ring
- e. Perform a check to ensure that the TID, adapter, and seat ring diffuser are all properly connected with all prescribed hardware.
- f. Lift the entire assembly, and adjust the lifting hardware to balance horizontally.
- g. Apply a thin coat, or a series of spots, of Dow Corning Compound 111 or equivalent to the seat ring gasket groove. This will act as a temporary adhesive to hold the gasket in the groove when installed.
- h. Place and center the seat ring gasket in the gasket groove.
- i. Carefully insert the whole assembly into the valve body, guiding the seat ring into the seat ring guide bore. Avoid contact with the body studs.
- j. If a seat ring diffuser is employed, remove the flanges covers from the jack points if available.
- k. Thread the diffuser support rods into the jacket points until contact is made. Apply 1 full turn after contact to support the diffuser (see Figure 7).
- l. Ensuring that the seat ring or seat ring diffuser will be properly supported, remove the seat ring diffuser from TID adaptor. The threaded rod may be double-nutted at the top to provide a point from which to loosen the seat ring connection.
- m. Remove all threaded rod.
- n. The TID assembly may now be carefully removed from the body and stored securely.

### 2. Trim Installation

- a. Install lifting hardware to a conveniently located lifting boss on the valve body. This will act as an anchor point for a come-along to pull the trim assembly into the valve.
- b. Install the TID adapter to the TID.
- c. Attach the trim to the TID and adapter assembly using a crane or hoist if necessary.
- d. If necessary, reposition the lifting hardware on the TID to accommodate the new CG of the combined TID, adapter, and valve trim assembly.
- e. Perform a check to ensure that the TID adapter and all connecting hardware and all lifting hardware are correctly installed.



- f. Using a crane or hoist, position the trim for installation into the valve body allowing enough access to the bottom of the seat ring to adhere the seat ring gasket in the following steps.
  - g. Apply a thin coat, or a series of spots, of Dow Corning Compound 111 or equivalent to the seat ring gasket groove. This will act as a temporary adhesive to hold the gasket in the groove when installed.
  - h. Place and center the seat ring gasket in the gasket groove.
  - i. Attach a come-along to the lifting hardware previously installed on the valve body. Attach the other end of this to a point on the TID.
  - j. Using the come-along, slowly ease the trim assembly into the valve body. As the cage reaches the seat ring, it may be necessary to manually leverage the assembly using the TID and other supporting apparatus (such as another come-along) to position the trim so that the seat ring lip will slide into the cage.
  - k. After the trim has been successfully seated onto seat ring, reposition the lifting hardware on the TID to accommodate the change in CG of the TID and Adapter assembly if necessary. When doing this, ensure that the adapter and TID are still supported so that the trim and valve body are not providing significant support to the TID and adapter.
  - l. Detach the TID and adaptor assembly from the trim and clear them from the work space.
  - m. Install the conical spring so that it slants downward towards the center of the trim.
6. Install all fasteners around the perimeter OD of the diffuser so that the fasteners engage the slotted section of the diffuser/seat ring
  7. Hand tighten the fasteners so that the parts are centered to one another. Verify the assembly is secure
  8. Connect the TID adapters to the cage top surface and the TID retraction unit
  9. Attach the TID device to a crane or hoist and lift vertically
  10. Position the lifting and balancing hardware to the TID to accommodate the required lifting power and Cg and verify all connections
  11. Lift the assembly slightly to verify Cg and lifting power, and the integrity of all the fasteners

#### Trim Installation

1. Using a crane or hoist, position the trim assembly for installation into the valve body
2. Apply a thin coat of Dow Corning 111 or equivalent to the seat ring gasket groove to hold the gasket in position temporarily while the trim is being installed
3. Install the gasket into the groove
4. Attach the lifting hardware to the “come along”
5. Slowly ease the trim cartridge into the valve body. As the seat ring reaches the body seat counterbore, it may be necessary to jostle the trim into position so that the assembly will continue to slip into the body as required
6. After the trim has been successfully seated into the body, reposition the lifting hardware and counterweight to accommodate the reduced load and new Cg.
7. Detach the TID and adapter from the trim cartridge and clear from the workplace
8. Install the balance of parts including the conical spring and gaskets as required

### Bonnet Mounting

1. Remove any existing packing installed in the valve bonnet and discard.
2. A new bonnet gasket shall be installed in the gasket groove in the valve body in the same manner as the seat ring groove using compound 111.
3. Using a crane or hoist and any appropriate lifting hardware, position the valve bonnet, and install it over the stem and onto the body studs and valve body face.
4. Grease the threads of the valve body studs and the bearing surfaces of the body stud nuts.
5. Assemble the body stud nuts by hand. Hand-tighten the nuts evenly so that the internal parts are held in place. The face of the bonnet should be parallel to the upper face of the body
6. Further tighten the stud nuts in the sequence indicated in **(Figure 11)** based on the number of bolts in the bolt pattern and torque to value indicated on the valve assembly drawing in at least 6 equal torque steps (10%, 20%, 40%, 60%, 80%, and 100% of the prescribed value) unless otherwise specified.

#### Horizontal Orientation-Functional Trim Installation-Trim Cartridge Option

##### Pre-Assemble all Trim Parts

1. Secure valve plug assembly on a clean flat surface such that the bottom of the plug rests flat on the surface and the stem extends vertically
2. Lift the cage over the plug using a hoist or other lifting device and the holes provided on the top of the cage.
3. Lower the cage over the plug until the lower portion of the cage rests on the workstation
4. Lift the plug/cage assembly vertically from the stem and then lower the assembly back on to the workstation so that the parts are horizontal. Secure the parts on the workstation
5. Lift the diffuser/seat ring vertically using the OD of the diffuser as a lifting surface and lower into position to interface to the cage

# CAUTION

If metal-to-metal contact between the bonnet and body is not achieved at the torque value indicated on the assembly drawing, this is cause for rejection. STOP ASSEMBLY and consult factory. DO NOT EXCEED THE MAXIMUM TORQUE VALUES LISTED.

7. Verify proper stud and nut installation by visual inspection. Fewer than two studs threads and greater than three stud threads above the nut is cause for rejection.

## Bolt Torquing

Figure 11 details the tightening sequence for the bonnet/body bolts torques for an 84003 Series SteamForm. Evenly apply torque to the body nuts to the amount specified in the assembly drawing for this specific valve.

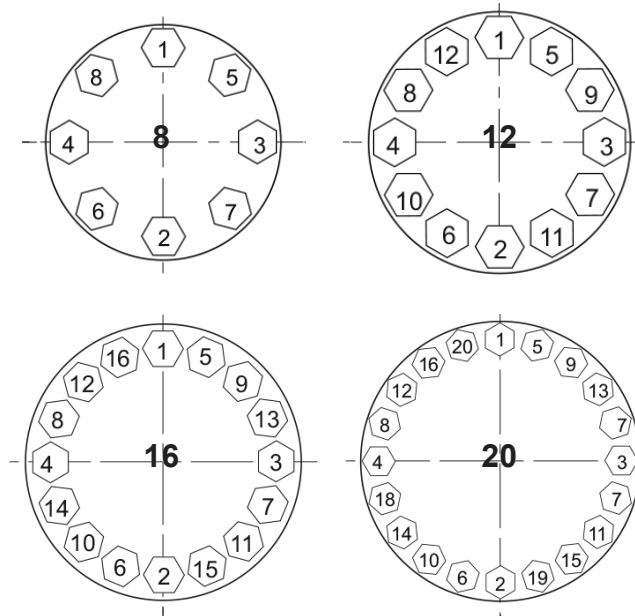


Figure 11 - Bolt torque sequence

## Packing Installation

After valve maintenance, a new packing kit must be installed.

1. Inspect the stem and packing box for cleanliness and proper surface finish. Parts can be cleaned with a suitable solvent.
2. Ensure that there are no nicks or scratches on the stem which shall be cause for rejection.
3. **Note: A properly Electro Chemically etched part number on the stem will have no adverse effect on the performance of the packing.**
4. Install the guide bushing inside the packing box followed by all other packing elements as indicated in Figure 12. A total of seven rings make up the packing, "Item A" represents the two anti-extrusion (split packing) rings that sandwich the five "Item B," graphite rings.
5. The skive cuts should be staggered between consecutive packing rings by approximately 120 degrees.
6. Gently press the packing into the packing box.
7. Install the packing follower over the stem onto the packing set.
8. Lubricate the packing studs indicated in the assembly drawing with Chesterton 725 or equivalent and install them into the bonnet.
9. Install the packing flange over the stem and packing studs and onto the follower.
10. Lubricate the packing nuts with Chesterton 725 or equivalent and screw them onto the studs over the flange.
11. At this point, the nuts should only be finger tight. For service use, tighten the nuts as described in Figure 11

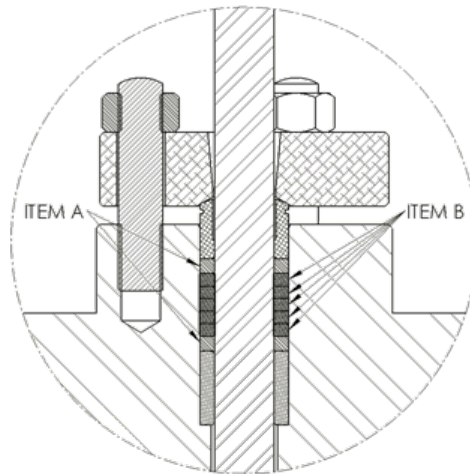


Figure 12 - Packing box cross section

# Nozzle Assembly

Desuperheating performance is reliant upon water injection of the SteamForm spray nozzles. The nozzle must maintain an aerosol spray effect, and a hollow cone spray pattern. Weld slag, rust, and other debris in the water lines can disturb the nozzle spray pattern and can result in poor water injection and temperature control. Periodic inspection of the spray nozzle's water pattern should be conducted to ensure nozzle performance. Refer to the instructions under

"Inspecting Nozzle Performance" for the detailed test procedure.

To assemble the nozzles into the valve:

1. After inspecting the surfaces of the nozzle housing for any damage or debris, install the nozzle gasket into the bottom of the nozzle housing.
2. Securely install the nozzle holder into the nozzle housing. The nozzle holder should fit flush with the housing surface, otherwise remove the nozzle holder and confirm the nozzle is clean from debris.
3. Install the nozzle flange gasket into the groove on the nozzle housing.
4. Place the nozzle housing flange over the nozzle flange studs. Securely tighten the nozzle flange nuts to the factory suggested torque.

## CAUTION

**The nozzle assembly is screwed and locked in place using a high temperature adhesive to prevent part from coming loose due to thermal expansion caused by the steam line. This assembly should not be disassembled, and must be purchased as a complete assembly.**

# Valve Maintenance and Repair

The purpose of this section is to provide recommended maintenance and repair procedures. These procedures assume the availability of standard shop tools and equipment.

## Packing Box

Tight sealing within the packing box is obtained by compression of the packing. Compression must be achieved by evenly tightening the packing flange nuts on the packing flange. Periodic re-tightening of the packing flange nuts may be required to maintain proper sealing.

## CAUTION

**Be careful not to over tighten the packing as this could prevent proper operation of the valve. If leakage persists after maximum packing compression, then the packing needs to be changed.**

## PTFE Packing

Kevlar™/PTFE, carbon/PTFE and pure PTFE packing rings are cut in such a way that they can be replaced without having to separate the valve plug stem from the actuator stem.

1. Unscrew and remove the packing flange nuts.
2. Lift the packing flange and packing follower up along the valve stem.
3. By means of a puller, remove the packing being careful not to damage the seating surface of the packing box or the valve plug stem.
4. Replace the packing rings, placing the cut in each ring about 120° apart from the adjacent ring. Press rings in one at a time.
5. Reassemble the packing follower and the packing flange.
6. Tighten the packing flange nuts without over compressing the packing rings.
7. Put the valve back into service and check for leakage. Tighten packing flange nuts as required.

## Valve with Graphite Packing

To replace Graphite packing, it is necessary to separate the valve plug stem from the actuator stem.

1. Remove the packing flange nuts from the packing flange studs.
2. Lift the packing flange and packing follower up along the valve stem.
3. By means of a puller, remove the packing being careful not to damage the seating surface of the packing box or the valve plug stem.
4. Replace the packing. Press a back-up ring (carbon/graphite/Inconel braided ring) into the bonnet. Next press the expanded graphite rings into the packing area one at a time. Press an additional back-up ring into packing area.
5. Reassemble the packing follower and the packing flange.
6. Tighten the packing flange nuts without over compressing the packing rings.
7. Open and close the valve several times then retighten the packing as required.
8. Put the valve back into service and check for leakage. Tighten packing flange nuts as required.

## Valve Plug Seal Installation

### Model 844XX (Auxiliary Pilot Plug) and 845XX (Metal Seal Ring)

1. Install the back-up ring onto the plug using care not to damage the ring on any sharp surfaces. The back-up ring does not require lubrication; however, a light coating of compatible lubricant will help install the seal.
2. Install the seal ring over the back-up ring.
3. Ensure that the ring cuts are diametrically opposed (180 degrees apart) - (see Figure 13).

**Note: When the plug assembly is installed into the cage bore, the lead in angle of the cage will compress the ring into place. If the seal ring is not compressed a ring compression tool may be required for proper installation.**



### Model 849XX (Graphite Seal Ring)

These valves are also equipped with an inner and outer ring arrangement. The inner metal ring has a straight cut and the outer ring is made of graphite.

1. Replacement graphite seal rings are supplied in a closed ring form, and a notch must be cut before being assembled to the plug.
2. Using a sharp blade, make a notch in the graphite ring. Hold the ring on either side of the notch between the thumb and index and bend until it breaks.
3. Using a very fine file, adjust each end of the ring so that its external circumference corresponds to the internal circumference of the inside diameter of the cage.
4. To adjust the length of the ring correctly, insert the new graphite ring into the cage with the ring against the inner wall of the cage (allowing for minimum play between the two ends of the ring).
5. First assemble the inner metal ring into the cage groove, and then assemble the graphite ring over the metal ring. Be careful not to damage the parts.

**Note: The cuts on each ring should be placed approximately 180° apart.**

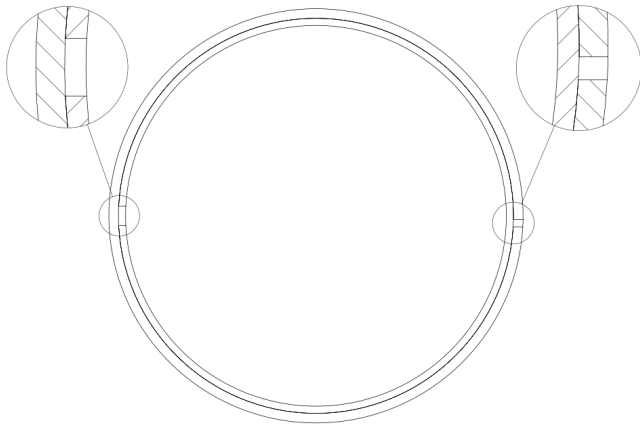


Figure 13 - Piston Ring installation

## CAUTION

The valve plug assembly is screwed, pinned and tack welded into the main plug body to ensure the plug assembly and tolerance are met. Baker Hughes Masoneilan highly recommends avoiding field maintenance of this part. The plug assembly should be purchased as a complete assembly consisting of the pilot and stem assembly, the main plug body housing, springs and locking mechanism. However, should urgent field repair be required, please follow the instructions below.

**Note :** The pilot plug/stem assembly, once removed from the pilot plug S/A, must be purchased as a complete assembly. This part is comprised of the valve stem and the installed, pinned and straightened pilot plug.

## Pilot Balanced Plug Disassembly (Model 844XX)

**For trim size 3" or 4" (80 or 100 mm), disassembly of Pilot Balanced Plug with Belleville Springs**

1. Position the assembly in a press. It is extremely important that the stem, pilot, and pilot balanced plug are straight, concentric, and aligned axially in the press otherwise, stem buckling or other damage may occur.
2. Slowly compress the assembly until the pilot is no longer in contact with the pilot retainer.
3. Locate the ends of the snap ring and using a screwdriver, pry one of the ends of the snap ring in towards the center and begin to work the snap ring out of the snap ring groove by rotating the ring to thread it out of the groove.
4. Once the snap ring has been freed from the pilot balanced plug, carefully decompress the assembly and remove the pilot plug/stem assembly.

**For trim size 6" to 24" (150 to 600 mm), disassembly of Pilot Balanced Plug with Coil Springs**

1. Grind or machine the peened/tack-welded areas.
2. Position the assembly in a press. It is extremely important that the stem, pilot, and pilot balanced plug are straight, concentric, and aligned axially in the press otherwise, stem buckling or other damage may occur.
3. Slowly compress the assembly until the pilot is no longer in contact with the pilot retainer.
4. Using a punch and hammer, loosen the pilot retainer and remove it from the pilot balanced plug.
5. Carefully decompress the assembly and remove the pilot plug/stem assembly.

## ⚠ CAUTION

The pilot balanced plug assembly is spring loaded and therefore, disassembly can be dangerous if not executed with care. A press or lathe must be used to securely compress the pilot spring so that the retainer or snap ring can be safely removed. Furthermore, when handling the assembly, ensure that all hard-faced surfaces are protected.

Valve Size		Pilot Dismounting Screw Sizes			
		Qty.	Length		Diameter
in.	mm		in.	mm	
6	150	2	2.25	57	3/8"- 16 UNC 2A
8	200	2	2.50	63.5	
10	250	2	2.75	70	
12	300	3	4.00	101.5	
16	400	3	4.00	101.5	

Table 3 - Pilot dismounting screw sizes

## Pilot Balanced Plug Reassembly (Emergency application only).

1. Install the coil spring or Belleville springs into the pilot balanced plug per the pilot balanced plug assembly drawing.
2. Insert the pilot plug and stem assembly into the pilot balanced plug.
3. Slide the threaded pilot retainer or the spiral snap ring over the stem.
4. Install the assembly in a press and ensure that the stem, pilot, and pilot balanced plug are straight, concentric, and aligned axially. Again, be careful to protect the stellite surface of the pilot balanced plug.
5. Carefully press the stem and pilot down towards the pilot seat just enough to install the retaining ring or spiral snap ring.
6. Install the specified ring. The snap ring can be spun into the groove. If installing a threaded pilot retainer, tighten until the ring seats and peen or tack weld per the plug sub assembly drawing to fix the pilot retaining ring.
7. Remove the assembly from the press.

## Critical Parts

Prior to reassemble; examine parts carefully for any scratches, unusual wear, or other damage.

## Guiding Surfaces

Guiding surfaces of the cage, valve plug, guide bushing, plug stem, and auxiliary pilot plug must be checked. See Figures 14 and 15. If there is only slight wear indications, then gently use a light abrasive such as fine (600 grit) sandpaper, to smooth out guiding surfaces. Parts with greater damage or wear on the guiding surfaces must be replaced.

**Note: The guide surfaces may be case-hardened using a complex and proprietary process. These parts should be re-finished or replaced by factory authorized sources.**

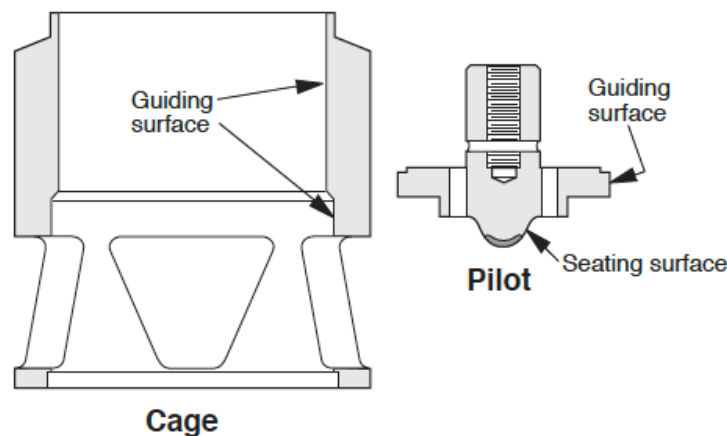


Figure 14 - Cage guiding surface

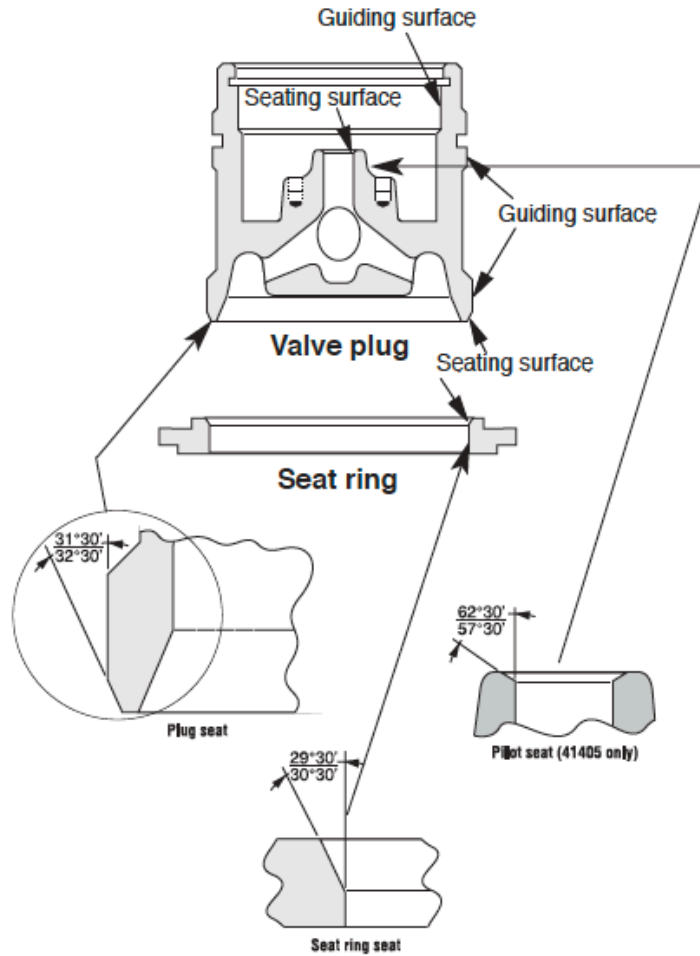


Figure 15 - Plug guiding surface

## Seating Surfaces

These surfaces, noted on Figure 15, are stellite over complex base materials. Because of very close tolerances, these operations are conducted well before any of the final dimensions are machined on the parts. For these reasons, parts with damaged seating surfaces should be considered for replacement.

## Gaskets

Gasket seating surfaces must be free of dents, scratches, and corrosion. Metal gasket glands should have a radial or circular serration pattern with a surface roughness of 63 to 250 RMS. Clean mating surfaces as required and replace any non-conforming parts. Spiral-wound gaskets must always be replaced after disassembly.

## Seal Rings

Back-up rings, retaining ring, and conical springs can be reused if they are free of scratches, erosion, corrosion, or other damage.

However, given the critical nature of this application, it is strongly suggested that all seal rings are replaced at each service interval.

## Valve Plug

If the valve plug needs to be repaired see instructions for Valve Reassemble.

## Conical Springs

Most of these valves use one or more conical springs. If these parts show any sign of wear or distortion or surface blemishes, they should be replaced.

## Inspecting Nozzle Performance

Follow the disassembly instructions shown under the “Opening Nozzle Housing” section.

1. With the nozzle holder removed from the nozzle housing, plug the threaded holes in the side of the nozzle housing using threaded plugs as listed in Table 4 (nozzle plug size).
2. Connect a water source to the threaded connection shown in Table 5 (lifting bolt size).
3. Apply pressure to the water line and observe the spray pattern of the nozzle. The spray pattern should be uniform and consistent around the perimeter of the nozzle head.
4. If nozzle spray pattern is disturbed, continue flushing procedure with higher pressure water to determine if nozzle can be unblocked.
5. If problem persists, contact the Baker Hughes Masoneilan factory for a replacement nozzle assembly.

**Note:** The water pressure must be a minimum of 30 PSIG above the steam pressure in the downstream desuperheater to ensure the nozzle will overcome the spring coefficient and spray properly.

Nozzle C <sub>v</sub>	Threaded Plug Size	No. of Plugs Required
0.4	1/8"	2
0.8	1/8"	3
1.5	1/4"	3
3	1/4"	5
5	3/8"	4
10	1/2"	6

Table 4 - Nozzle plug size

## Replacing Nozzle Assembly

The SteamForm spray nozzles are carefully assembled and calibrated to provide the specified performance. When replacing nozzles that have become blocked or damaged, only disassemble the parts noted in the following instructions.

1. Remove the spray nozzle holder, shown in Figure 16, from the nozzle housing.
2. Break the tack weld attaching the spray nozzle assembly to the nozzle holder.
3. Unscrew the nozzle assembly from the nozzle holder.

### CAUTION

The nozzle assembly, shown in Figure 17, is screwed together and locked in place using a high temperature adhesive to prevent the part from coming loose due to the thermal expansion caused by the steam line. This assembly should not be disassembled, and must be purchased as a complete assembly.

4. Inspect the inside of the nozzle holder to ensure it is clean and free of any debris.
5. Screw replacement nozzle assembly into nozzle holder.
6. Tack weld nozzle assembly to nozzle holder to ensure nozzle does not unscrew while in line.

*Note: To prevent blockage of the small nozzle orifices, an inline strainer must be installed upstream of the valve. Table 4 provides a list of recommended strainer sizes.*

Nozzle C <sub>v</sub>	Strainer Mesh Size
0.4	200
0.8	200
1.5	100
3	100
5	100
10	50

Table 5 - Recommended strainer size

### WARNING

Failure to install the appropriate strainer can result in blockage of nozzle. This can impact heat sensitive systems.

## Parts Reference For SteamForm 84003 Series SteamForm

Item No.	Description
1	Body
2	Bonnet
3	Body Stud
4	Body Nut
5	Guide Bushing
6	Packing S/A
7	Packing Follower
8	Packing Flange
9	Packing Flange Stud
10	Packing Flange Nut
11	Cage
12	Plug
13	Pilot Spring
14	Auxiliary Pilot Plug
15	Retaining Ring
16	Stem
17	Grooved Pin
18	Seat Ring
19	Seat Ring Diffuser
20	Diffuser
21	Conical Spring
22	Body Gasket
23	Seat Ring Gasket
24	Seal Ring
25	Nozzle S/A
26	Nozzle Holder
27	Nozzle Gasket
28	Nozzle Flange Gasket
29	Nozzle Housing Flange
30	Nozzle Flange Stud
31	Nozzle Flange Nut
32	Flow profiler/Lo-dB plate

**Table 6 - Parts reference for SteamForm 84003 Series SteamForm**



Figure 16 - Spray nozzle holder

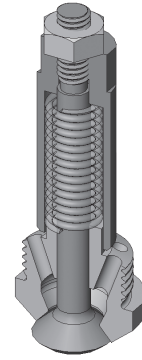


Figure 17 - Spray nozzle assembly

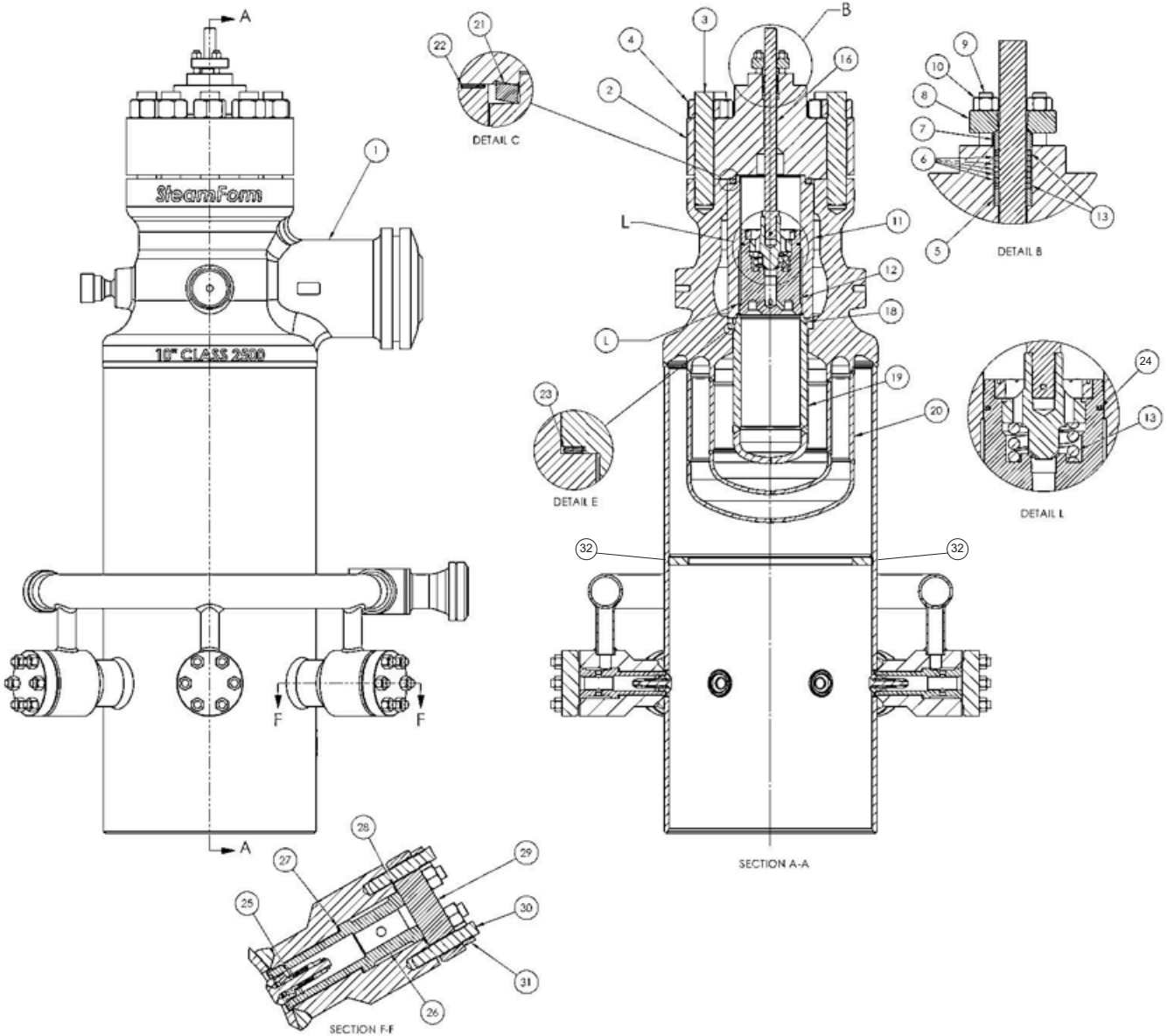
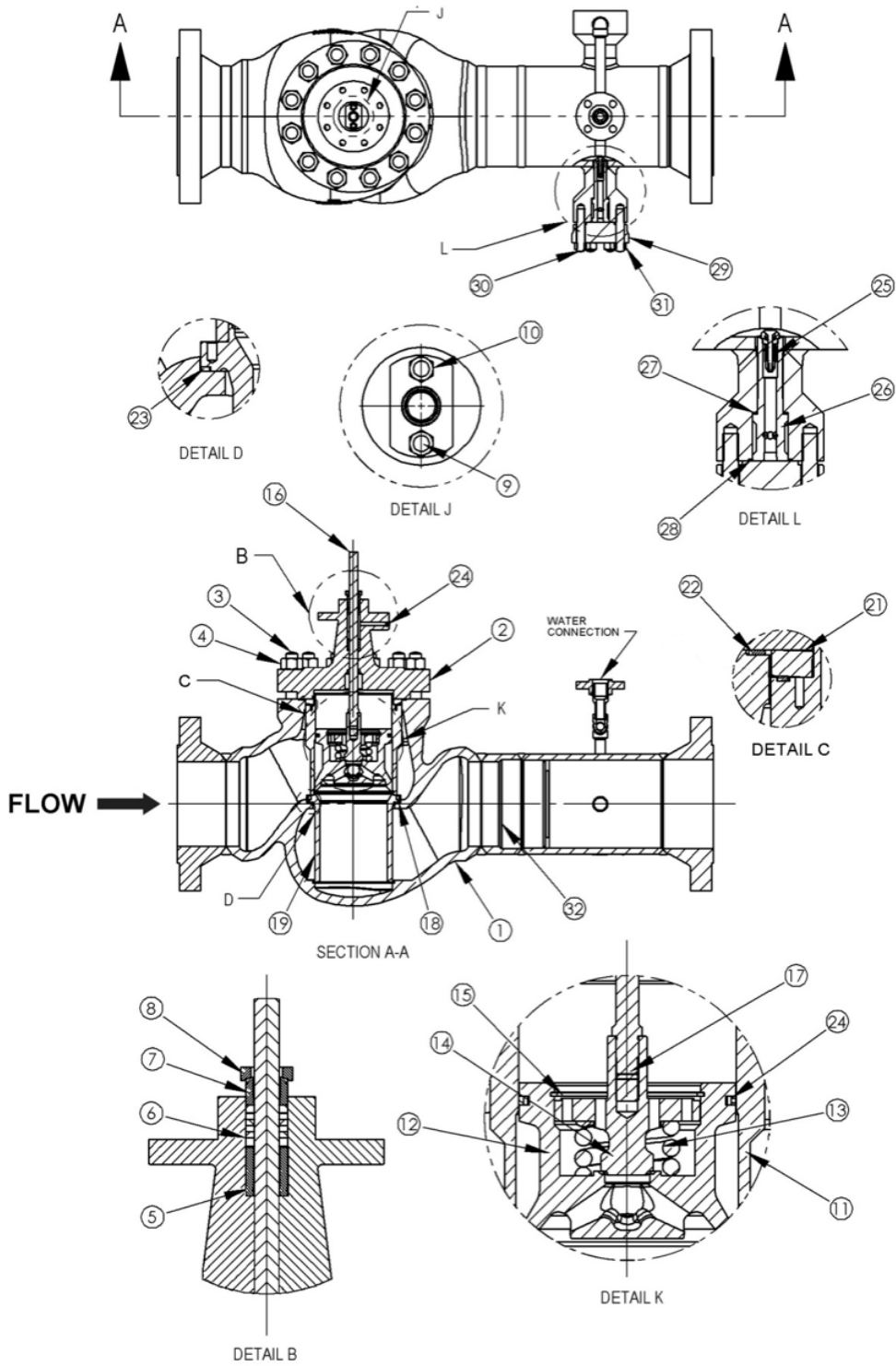


Figure 18 – 4-Stage angle body SteamForm valve with pilot plug design, drop in diffuser second stage and welded diffusers for stages 3 and 4.



**Figure 19 – 3-Stage globe valve body SteamForm with pilot plug design, drop in diffuser second stage and Lo-dB plate for stage 3.**



# Actuation

Type 87/88 Multi-Spring Diaphragm Actuators

## Connecting Type 87 (Air to Extend) No. 6 Actuator (Figure 20)

1. Tightly assemble the hex nuts onto the plug stem.
2. Push down the actuator, and screw on the yoke nut at the same time. Then assemble the bottom stem connector. As soon as it becomes possible, insert the valve stem into the actuator stem. The stem must be inserted far enough so that when there is no air in the actuator, the valve plug does not touch the seat.
3. Tighten the yoke nut.
4. Supply air to the actuator at the final pressure.
5. Use the pointer to set the travel scale to the valve open position.
6. Supply the actuator with air at a sufficiently high pressure to obtain a travel equal to the nominal travel of the valve.
7. Unscrew the plug stem until the valve plug is in contact with the seat. Do not turn the valve plug on the seat as this could damage the sealing surfaces.
8. Screw the hex nuts as far as they will go and check that operation is correct.

## Connecting Type 88 (Air to Retract) No. 6 Actuator (Figure 20)

1. Tightly assemble the hex nuts onto the plug stem.
2. Push down the actuator, and screw on the yoke nut at the same time. Then assemble the bottom stem connector. As soon as it becomes possible, insert the valve stem into the actuator stem. The stem must be inserted far enough so that when there is no air in the actuator, the valve plug does not touch the seat.
3. Tighten the yoke nut.
4. Unscrew the valve plug stem until the valve plug comes into contact with the seat. Do not turn the valve plug on the seat as this could damage the sealing surfaces.
5. Supply air to the actuator until the stem has travelled at least .40 inches (10 mm).
6. Unscrew the plug stem by the number of turns N1 specified in Table 7.  
**Note: For model 844XX valves, use the N2 values in Table 7 to ensure seating tightness of the pilot plug.**
7. Screw the hex nuts as far as they will go and check that operation is correct.
8. Use the pointer to set the travel scale to the valve closed position.

Plug Stem Diameter	N1 (turn)	N2 844XX (turn)	in	mm
1"	1.25	4.75	0.09	2.3
3/4"	1.25	4.25	0.08	2
5/8"	1.5	3.5	0.08	2
1/2"	1.5	3	0.075	1.9

Table 7 - Type 88, air to retract - valve seating



**Connecting Type 87 (Air to Extend) No. 10, 16 and 23 Actuators (Figure 20)**

1. Tightly assemble hex nut onto the plug stem.
2. Screw the top stem connector assembly tightly onto the actuator stem.
3. Push down the actuator, and screw on the yoke nut at the same time. Then assemble the bottom stem connector assembly by screwing until it comes into contact with the hex nut.
4. Push down the actuator and tighten the yoke nut.
5. Supply the actuator with air at the initial pressure indicated on the spring scale.
6. Position the stem connector assembly at distance "X" indicated in Table 8.
7. Use the pointer to set the travel scale to the valve open position.
8. Supply the actuator with air at a high enough pressure to obtain a travel equal to the nominal travel of the valve.

**Note: For model 844XX valves, reduce the travel by Value as indicated in Table 9.**

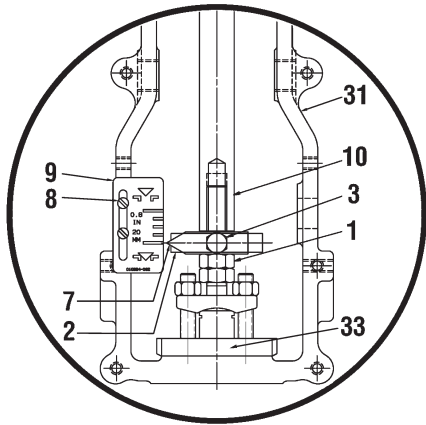
9. With the plug correctly positioned on the seat, unscrew the bottom stem connector assembly until it comes into contact with the top stem connector. Tighten the socket head cap screws, hex nut and lock nut and check that the operation is correct.

**Connecting Type 88 (Air to Retract) No. 10, 16 and 23 Actuator (Figure 20)**

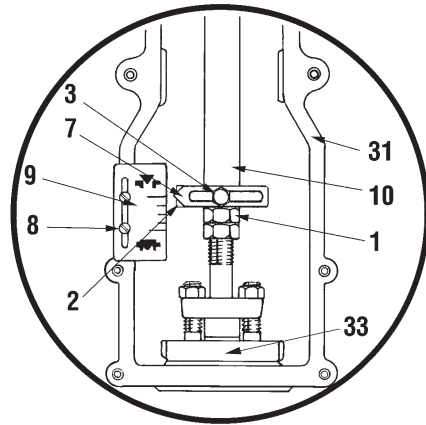
1. Supply the actuator with air to retract stem.
2. Unscrew the top stem connector in accordance with dimension "X" in Table 8.

3. Tightly assemble hex nut onto the plug stem.
4. Tightly screw the top stem connector assembly onto the actuator stem.
5. Push down the actuator, and screw on the yoke nut at the same time. Then assemble the bottom stem connector assembly by screwing until it comes into contact with the hex nut.
6. Push down the actuator and tighten the yoke nut.
7. With the plug correctly positioned on the seat, unscrew the bottom stem connector assembly to bring it into contact with the top stem connector.
8. Supply air to the actuator until the stem has travelled at least 0.40 inches (10 mm).
9. Unscrew the top stem connector by the number of turns N1 specified in Table 6 then lock manually with hex nut.  
**Note: For model 844XX valves, use N2 values in Table 7 to ensure seating tightness of the pilot plug.**
10. Release the pressure in the actuator. Use pointer to set the travel scale to the actuator supply pressure so that the two stem connectors come into contact. Then tighten the socket head cap screws, hex nut, and lock nut.
11. Shut off the closed valve pressure and check that operation is correct.

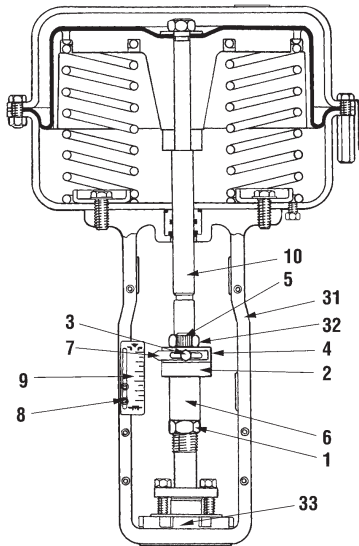
**Note: The detailed installation instructions for Actuators model 51/52/53 are provided in the Instruction Manual 31188.**



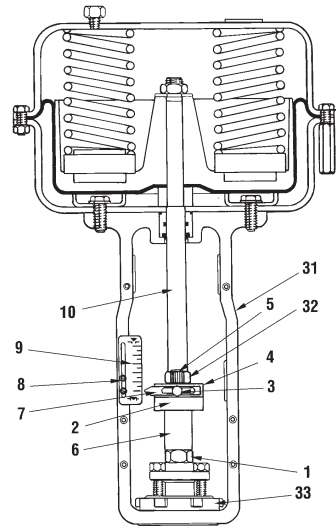
**Type 87 Air to Close  
No. 6**



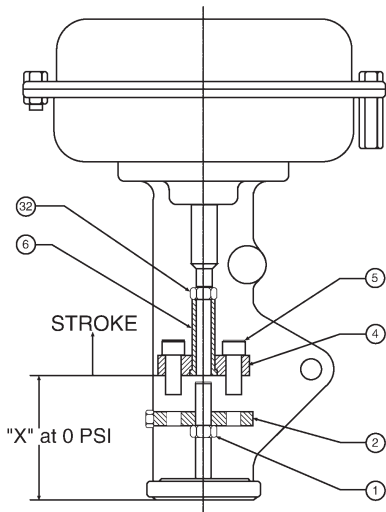
**Type 88 Air to Open  
No. 6**



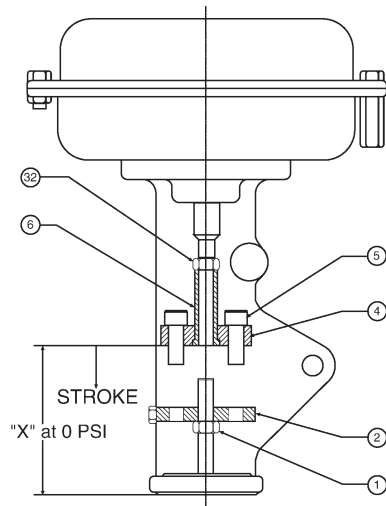
**Type 87 Air to Close  
No. 10-16-23**



**Type 88 Air to Open  
No. 10-16-23**

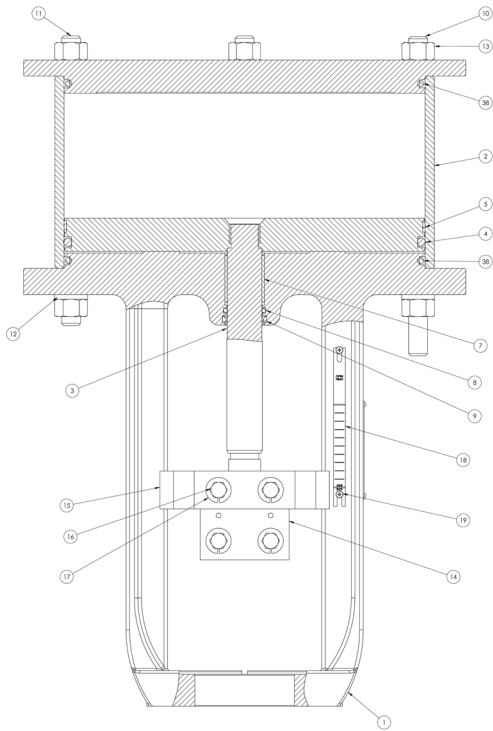


**Model 87 Actuator  
Air to Extend (Close)**

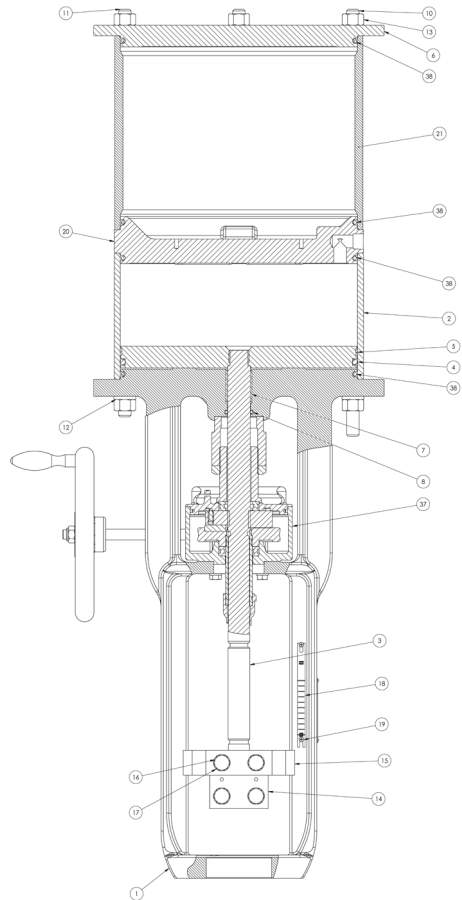


**Model 88 Actuator  
Air to Retract (Open)**

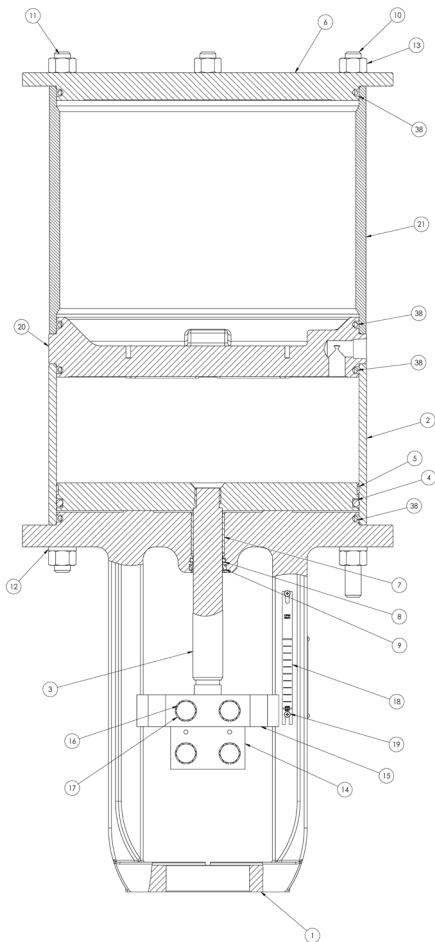
**Figure 20 - Actuator Models 87/88 options for reference only.**



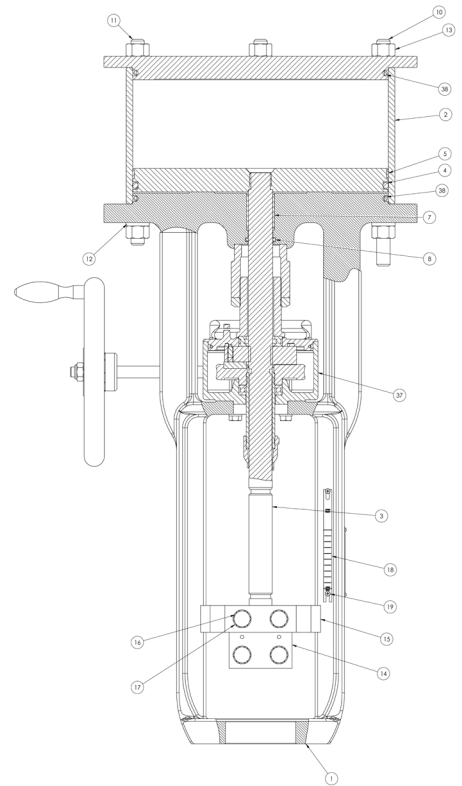
**Model 51 Double Acting  
Without handwheel without volume chamber**



**Model 51 Double Acting  
With handwheel with volume chamber**

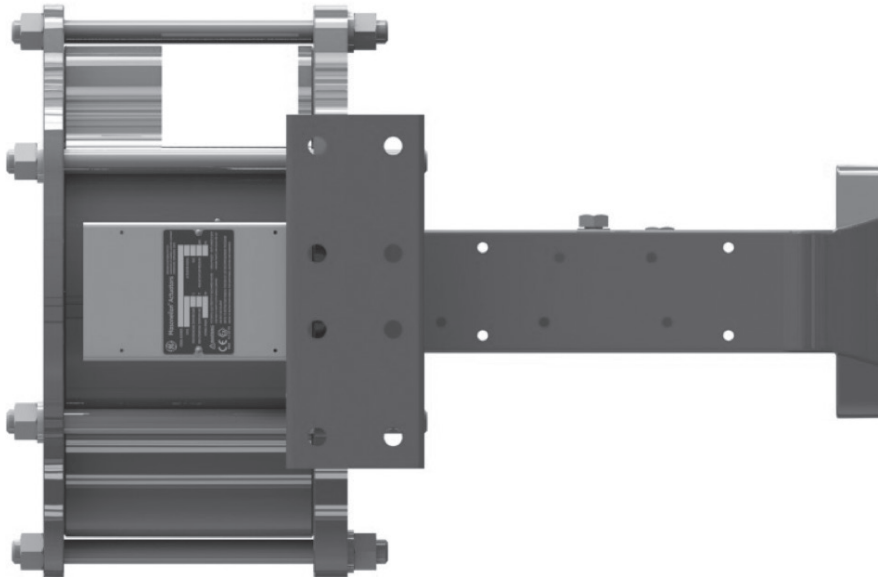
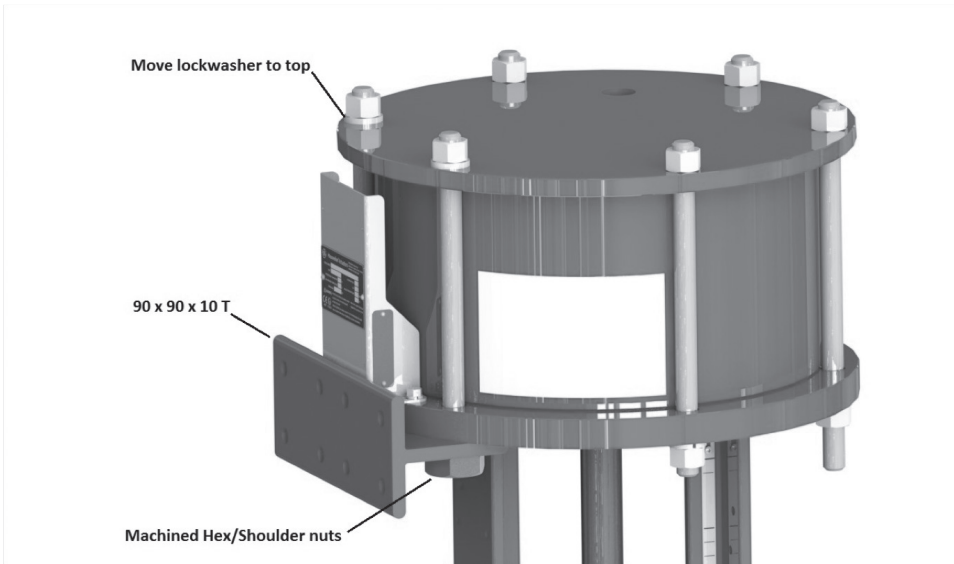


**Model 51 Double Acting  
Without handwheel with volume chamber**

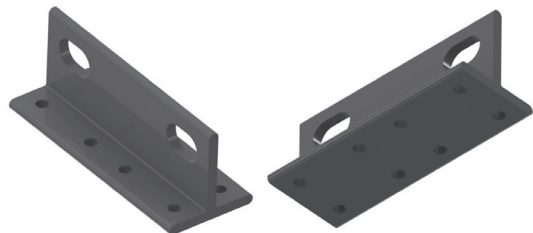


**Model 51 Double Acting  
With handwheel without volume chamber**

**Figure 21 - Actuator Models 51/52/53 options, for reference only.**



**Machined Shoulder Nut**



**90mm X 90 mm X 10 mm Structural steel "T" shape hot rolled**

**Figure 22 - Actuator Models 51/52/53 - Horizontal mounting support.**

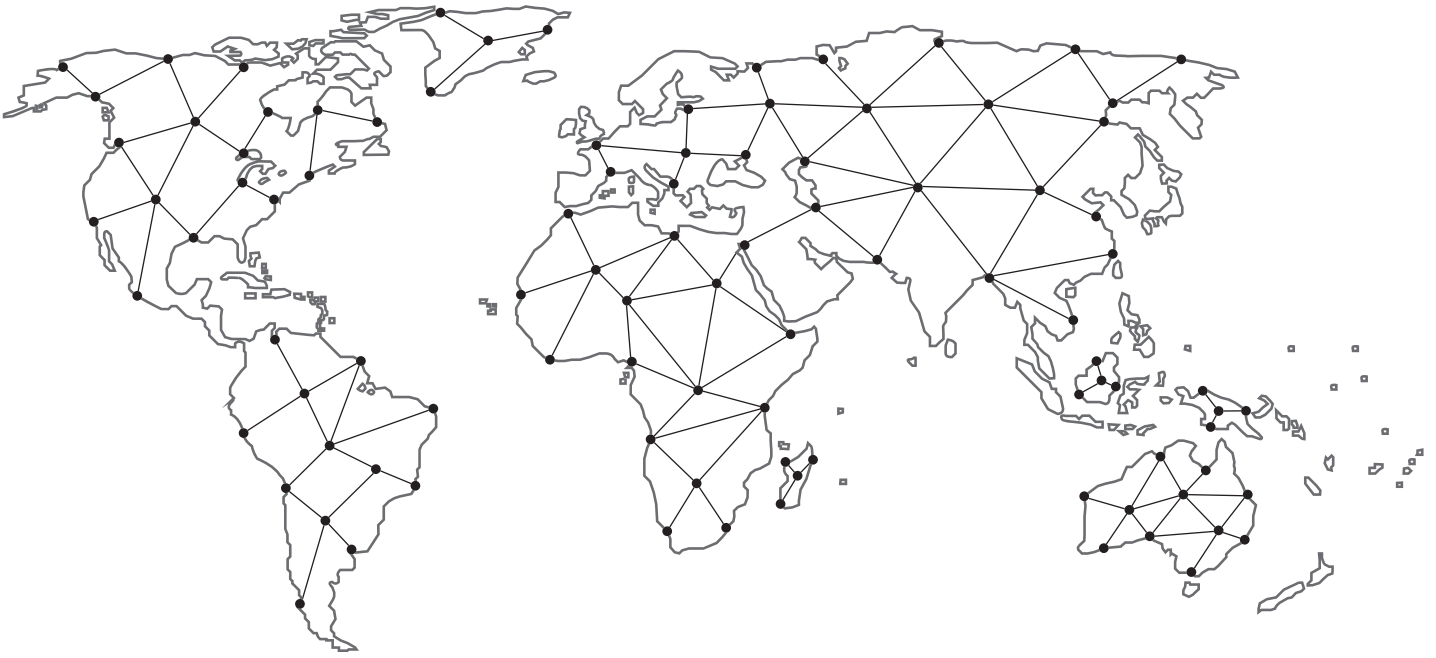
## Notes

# Notes

## Notes

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