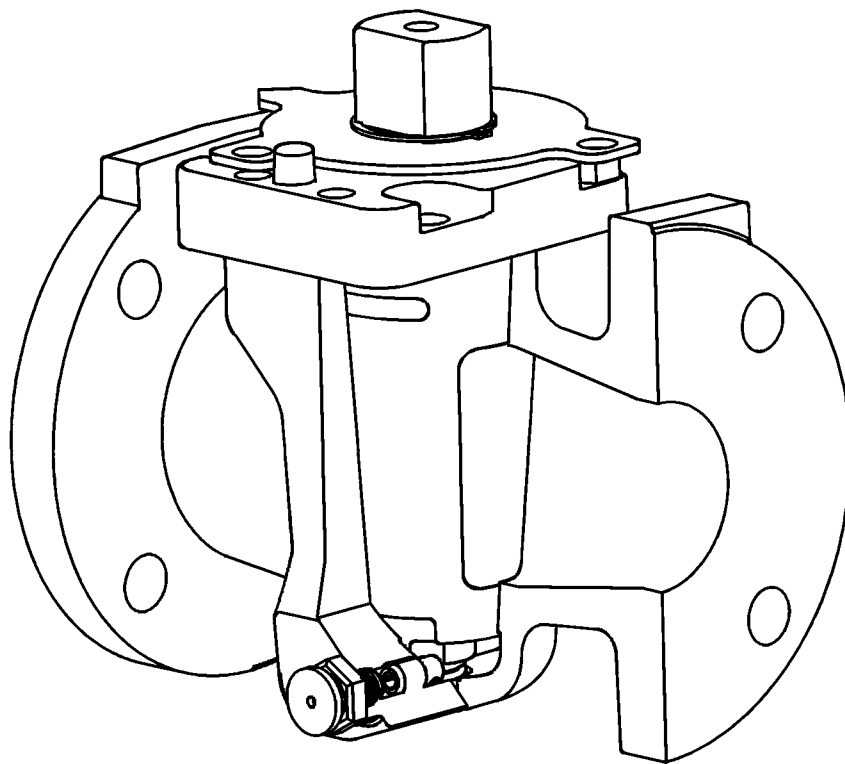


**Figure A114 and A115  
Super Nordstrom®  
Regular Pattern  
Iron Plug Valve  
Installation, Operation & Maintenance  
Manual**



## TABLE OF CONTENTS

<b>Section</b>	<b>Page</b>
<b>1. VALVE SELECTION</b>	
Introduction .....	4
Pressure-Temperature Rating .....	4
Bending Strength .....	4
Pressure Surge .....	5
Throttling Service .....	5
Temperature Changes .....	5
Over-pressurization .....	5
Trapped Pressure .....	5
Material Compatibility .....	6
Operating Effort .....	6
<b>2. SHIPPING AND STORAGE</b>	
Introduction .....	6
Handling .....	6
Storage .....	6
<b>3. INSTALLATION</b>	
Introduction .....	7
Inspection .....	7
Flanged Joint Assembly .....	7
Testing and Adjustment .....	9
<b>4. OPERATION AND MAINTENANCE</b>	
Introduction .....	9
Operation, Manual Valves .....	9
Operation, Power Actuated Valves .....	9
Fluid Dynamics of Shut Off Valve Operation .....	10
Noise .....	11
Maintenance .....	11
<b>5. SUPER NORDSTROM® IRON PLUG VALVE MAINTENANCE</b>	
Notice .....	12
Economics of Valve Repair .....	12
Customer Service .....	12
Field Service .....	12
Video Tapes .....	12
When You Call or Write .....	13
Introduction .....	13
Basic Construction Principles .....	13
Sealant System .....	14
Design Features .....	14
Valve Front Identification .....	14
Sealants .....	15
VXX Valve Purge .....	15

### TABLE OF CONTENTS (continued)

<b>Section</b>	<b>Page</b>
<b>5. SUPER NORDSTROM® IRON PLUG VALVE MAINTENANCE (cont.)</b>	
Sealant Injection Equipment .....	16
Valve Maintenance.....	16
Basic Sealant Injection .....	16
Valve Maintenance: Trouble Shooting.....	17
Detail Sketch: Wrench Operated Valve .....	23
Detail Sketch: Procedure for Tightening Capscrews.....	24
Contact Information .....	24

# 1. VALVE SELECTION

## **Introduction**

It is beyond the scope of this manual to make recommendations for specific applications because misapplication of a valve type could result in operating problems that adversely affect system safety and efficiency. This manual is intended to call attention to important considerations in the selection of valves. The manual addresses the important subjects of Shipping and Storage, Installation, and Operation and Maintenance. Observance of the recommendations and cautions offered herein will provide increased assurance of satisfactory valve performance.

The valve industry offers a wide variety of valve types and materials for use in industrial piping applications. There are usually several possible choices for a given application, any one valve may offer significant advantages and/or limitations compared to another valve. It is good practice to consult the manufacturer regarding specific requirements. The purchasing function includes the responsibility for securing the required valves at the lowest cost, but must also ensure that the valves purchased are in fact satisfactory for the intended service. The lowest total user (life cycle) cost criteria should be used only in choosing between alternatives that are known to satisfy the service requirement.

## **Pressure-Temperature Rating**

The pressure-temperature rating of the valve must be properly selected for the service requirement. If the service involves a temperature above 100°F (38°C), the valve pressure rating at the service temperature must be verified as meeting the requirements of the application.

If system testing will subject the valve to a pressure in excess of its working pressure rating, then the intended testing pressure and a statement explaining whether the test pressure is through the opened valve or a differential across the closed valve, should be included in the purchase specification.

Source Reference for Pressure-Temperature Ratings:

MSS SP-78      Cast Iron Plug Valves, Flanged and Threaded Ends

The standard Super Nordstrom<sup>®</sup> Regular Patten Iron Plug Valve has a maximum temperature rating of 350°F (177°C) due to the elastomeric seals. If the application temperature is above this temperature, consult your Flowserve Sulphur Springs Operations (SSO) Customer Service Department.

## **Bending Strength**

Piping systems are subject to mechanical constraints at fixed support points such as rigid nozzles, anchors, etc. Cold springing at assembly, system temperature changes, together with gravity, possible inertia loads, landslides, non-uniform subsidence in buried lines, etc. all potentially affect the bending moment at various points in the piping.

Valves are also subjected to the bending moment occurring in the adjacent pipe that is in addition to the normal pressure loading. Bending loads can cause deformation in valve bodies that can be detrimental to valve functional performance. It is therefore a recommended design practice to avoid locating valves at points of large bending loads.

In many cases, normal valve design practice results in a body strength greater than the strength of the adjoining pipe thereby providing inherent protection against valve damage. In other cases, piping conditions or systems designs may actually increase the possibility of harmful valve body deformation.

The following are examples of possible problems.

- a) Basic "standard" valves that are made into "venturi" type valves by providing enlarged end connections on the smaller standard basic valves.
- b) Any "standard" valve installed in heavy wall "overweight" piping where the extra thickness may cause the pipe to be stiffer and stronger than the valve.

Valve designs having a high body bending strength should be used if there is reason for concern regarding possible high bending loads.

### **Pressure Surge**

Closure of a valve in a flowing fluid line causes the velocity of the fluid to be reduced to zero. If the fluid is a relatively incompressible liquid, the inertia of an upstream column produces a pressure surge at the valve whose magnitude is inversely proportional to the time required for closure. The surge pressure is also proportional to the length of the upstream fluid column and the fluid velocity prior to closure initiation. If the application involves a long upstream line, a long downstream line, high velocity, and/or rapid closure, singly or in any combination, the possibility of an unacceptable pressure surge should be investigated.

Also to be considered are condensation induced pressure surges which occur when a fluid velocity change is caused by rapid condensation or when a slug of water is accelerated by contact with steam. An example would be when condensate collects on one side of a closed valve that has steam on the other side, then opening the valve will cause collapsing steam voids, sharp pressure surges and acceleration of condensate slugs. Condensation induced pressure waves can result in pressure pulses that are significantly higher than those produced by a sudden valve closure. In such events, non-shocks rated gray iron valves installed in steel piping systems are particularly vulnerable to catastrophic failure. Traps are required to prevent condensate accumulation and "blow-off" valves located at the low point in the system are needed to ensure condensate drainage. Operation and maintenance personnel must be aware of the function of these devices in relationship to the "shut-off" valve operation and the necessity for their being in proper working order.

### **Throttling Service**

Valves used to control the rate of fluid flow may be subject to severe fluid turbulence that can have the effect of creating a high-energy conversion within the valve and piping system. This energy conversion is usually indicated by high noise levels, either by cavitation of liquids or by shock waves from gases. (The noise in a water faucet is an example of a low-level cavitation noise.)

The possibility exists for mechanical damage to the valve and piping system when throttling of liquid flow results in severe and continuous cavitation conditions. Likewise, with gas flow under severe throttling conditions, shock waves can possibly result in damage to the system.

Flowserve SSO should be consulted on proper valve selection for throttling applications.

### **Temperature Changes**

Valve structural materials expand with rising temperatures and contract with falling temperatures. Generally, increasing temperature causes a decrease of mechanical strength that is regained on return to a lower temperature. A condition of non-uniform temperature in a structure may impose significant thermal stresses or distortion with possible adverse effect on valve performance.

The possibility of thermal stress fatigue should be considered in applications involving frequent temperature cycling. This possibility is increased by any one or a combination of the following: increasing temperature range, increasing temperature level, increasing rate of temperature change, increasing thermal conductivity of the fluid, increasing thickness of metal sections or increasing the number of cycles. In some cases, thermal cycling may also increase the tendency for stem seal leakage.

### **Over-pressurization**

Super Nordstrom<sup>®</sup> Regular Pattern Iron Plug Valve are not provided with a pressure relief device. It is the user's responsibility to provide a relief device as part of the system in which the valve will be used.

### **Trapped Pressure**

When a closed valve containing liquid is heated (e.g., from process condition, radiation or solar heating) the cavity pressure will increase due to volumetric expansion or vaporization of the liquid. Conversely, cooling an un-drained cavity below the freezing point may also result in volumetric expansion of the media. These expansions can result in extremely high pressures occurring in the valve.

The purchaser should consider the necessity of providing positive means for prevention of such over pressurization where these conditions can be anticipated.

### **Material Compatibility**

It is important that valve structural materials and lubricants be chemically compatible with the other piping system components, line fluids and the environment. Guidance should be obtained from informed sources such as Flowserve Nordstrom Valves representatives or the system engineers whenever there appears to be reason for such concern.

### **Operating Effort**

Manually operated valves are usually designed to require a reasonable amount of physical effort applied to a handle to open or close at rated working pressure. However, typical use of a valve may involve a lower working pressure thereby substantially reducing the differential pressure across a valve closure element and a resulting reduced operating effort.

In all cases, the purchaser should determine that the manually operated valves selected will be capable of being operated under the anticipated operating conditions by the personnel required to perform such operation. Flowserve Nordstrom Valves representative should be consulted for specific instruction on operating torques.

## **2. SHIPPING AND STORAGE**

### **Introduction**

Flowserve Nordstrom Valves recognizes the importance of maintaining the as-built condition of valves, and has prepared this section to call attention to important considerations in the handling of valves prior to installation.

Industrial valves as manufactured, tested, and ready for delivery to users, are typically well designed products that are properly fabricated and inspected and capable of giving satisfactory service. Valves enjoy a degree of inherent protection against degradation by impact, impingement or invasion of harmful materials after installation. However, the intervening period between the production test and the installation in line may involve substantial exposure to such degradation that can adversely affect the subsequent service performance of the valves.

Observance of the recommendations and cautions offered herein should provide increased assurance of satisfactory valve performance.

### **Handling**

Appropriate care in handling valves should be complementary to the degree of protection provided in preparation for transport. A basic consideration in handling valves should be to avoid damaging the protection provided for shipment. An obvious general rule is that valves should never be thrown or dropped. Valves whose size requires handling other than by hand should be "slung" or "rigged" carefully to avoid damage to exposed valve parts. Stems or wrenches (handles) should not be used as lifting or rigging points for valves.

### **Storage**

The problems to be considered in regard to storage are generally the same as those previously discussed relative to preparation for transport. The time element is important as conditions that would not be seriously harmful for a period of a few days could result in need for costly reconditioning if extended over weeks or months.

Valve end protectors should not be removed unless necessary for inspection and installation.

Protection against weather should be provided. Ideally, valves should be kept in-doors with actual valve temperatures always higher than the dew point.

Valves should be supported off the ground and/or pavement and protected by a watertight cover if outdoor storage is unavoidable.

### 3. INSTALLATION

#### **Introduction**

A most critical point in time in the life of an industrial valve is the moment of installation. The possibilities for degradation of the valve are numerous. Conversely, the exercise of proper care in this process will assure in-creased probability of trouble-free valve service.

This Section was prepared in order to provide useful information, warnings and reminders, in a format that will be helpful to all concerned. A judicious selection of these pages, delivered to the installation site with the valve itself, will provide the opportunity for the person having the greatest need to know to be informed or reminded of what is most important at the time such information can be the most useful.

#### **Inspection**

The testing and inspection required by applicable standards and specifications make it generally reasonable to assume that a new valve, about to be installed in a piping system, has been properly designed and manufactured. Nevertheless, it is important to recognize that in the transport, handling and storage of a valve between the time of manufacture and the time of installation, there are numerous possibilities for accident or error that could adversely affect valve performance.

It is therefore important to determine that the valve is in satisfactory condition before installation. The following points are generally applicable and may be helpful in avoiding subsequent valve problems.

- a) Carefully unpack the valve.
- b) Make a point of noting any special warning tags or plates attached to or accompanying the valve and take any appropriate action.
- c) Check the valve for any marking indicating flow direction. Make sure that the valve is installed in the proper flow orientation when a flow direction is indicated on the valve.
- d) Inspect the valve interior to the extent practical through the end ports. Make sure it is reasonably clean, free from foreign matter and harmful corrosion. Remove any special packing materials.
- e) If practical, actuate the valve through an open-close-open or close-open-close cycle. Inspect any significant functional features such as guides or seat faces that are made accessible by such actuation. Caution: Avoid contact with the valve closure element during cycling. It is usually desirable to leave the valve closure member in the position in which it was shipped following such inspection.
- f) Check the piping to which the valve is to be fastened for proper alignment, cleanliness and freedom from foreign materials immediately prior to valve installation.

#### **Flanged Joint Assembly**

Flanged joints depend on compressive deformation of the gasket material between the facing flange surfaces for tight sealing. The bolting must provide the mechanical force necessary to maintain the compressive stresses on the gasket, as well as resist the normal pressure forces tending to separate the joint. It should be recognized that with "brute force" alignment of misaligned flanges, sufficient bolting force may not be available to sustain the required gasket loading and to resist the load caused by the pressure separating force, resulting in a joint leakage problem. The following practices should be observed for satisfactory flange joint make-up.

- a) Check the mating flange facings. Do not attempt to assemble the flanges if a condition is found which might cause leakage (e.g., a deep radial groove cut by a retracting cutting tool or a dent across the face caused by mishandling), until the condition is corrected
- b) Check the gasket materials. See ASME B16.5 for additional requirements for flange joints using low strength bolting, (e.g., gray iron flanges or Class 150 steel flanges). Metal gaskets (flat, grooved, jacketed, corrugated, or spiral wound), should not be used with these flanges.

### Types of Gaskets:

There are two basic styles of gaskets used – full-face gaskets and flat ring gaskets. Full-face gaskets cover the face of the flange and the bolting goes through them. Flat ring gaskets extend only to the bolting.

### What the Codes and Standards say about flanges and gaskets:

**ANSI B16.1** covers Class 125, 250, and 800 Cast Iron Flanges and Flanged Fittings. Information about these flanges is shown in the Nordstrom Iron brochure under *Drilling Templates, Flange Dimensions, and Bolting Data*.

**ANSI B16.1, Section 5.2** recommends the use of bolting conforming to ASTM A307 Grade B for installing items that have cast iron flanges. A footnote to this section reads as follows:

For Class 25 and Class 125 flanges note: The carbon steel bolts prescribed for the flanges in this standard are based upon using a flat “ring” gasket that extends to the bolts.

Where cast iron-to-cast iron flanges or cast iron to steel flanges are used with full-face gaskets, higher strength bolts may properly be used.

Where cast iron flanges are bolted to steel flanges and flat ring gaskets are used, carbon steel bolts prescribed in this standard shall be employed.

**MSS SP-92**, in part, reads as follows:

**Section 3.4c.** Cast iron flanges are less “forgiving” of improper installation than flanges of ductile materials. The use of lower strength bolting is recommended to reduce the possibility of overstressing the flanges by excessive flange bolt preload. Full-face gaskets on flat flanges provide desirable protection against flange breakage by over-torquing of flange bolts. A flat-face flange should not be installed against a raised face flange.

Good pre-assembly alignment is especially important in cast iron flange joints in order to assure that adequate gasket compression can be achieved without excessive bolting loads.

**Section 3.4d.** Check gasket material. For flange joints using low strength bolting, such as may be provided for iron flanges (see Section 3.4c above) or Class 150 steel, metal gaskets (flat, grooved, jacketed, corrugated, or spiral wound), should not be used. See ANSI B16.5 for additional requirements.

### In summary, all of this means that the following is to be considered:

1. Either full-face or flat ring gaskets may be used in conformance with recognized standards.
  2. The use of flat ring gaskets requires the use of low strength ASTM A307 Grade B bolting.
  3. The use of full-face gaskets should minimize flange breakage.
  4. Cast iron flange breakage is always a possibility if the mating flanges are not properly aligned.
- c) Check the gaskets for freedom from injurious defects or damage.
- d) Use care to provide good alignment of the flanges being assembled. Use suitable lubricants on the bolt threads. Sequence the bolt tightening to make the initial contact of the flanges and gaskets as flat and parallel as possible. Tighten the bolts gradually and uniformly to avoid the tendency to twist one flange relative to the other. Use of a torque wrench is helpful to ensure correct and uniform final tightening of the flange bolting. Parallel alignment of flanges is especially important when assembling a valve into an existing system. It should be recognized that if the flanges are *not* parallel, then it would be necessary to *bend something* to make the flange joint tight. Simply forcing the flanges together with the bolting may bend the pipe or it may bend *the valve*. Such conditions should always be brought to the attention of someone capable of evaluating the bending condition and the corrective measures that need to be taken. The assembly of certain “short pattern” valves between mating flanges requires that the installation be checked for any possibility of interference between the moving parts of the valve and the adjacent pipe, fitting, or valve.
- e) *Caution:* Torque wrenches should always be used to assure proper tightening of the flange bolting. If, in the tightening process, the torque on a given bolt has been increasing with each part turn and then is observed to remain unchanged or increase a much lesser amount with an additional part turn, that bolt is yielding. That bolt should be replaced and scrapped since it is no longer capable of maintaining the proper preload.



### **Testing and Adjustment**

It is reasonable to assume that a valve that has been properly inspected and installed will be in good condition and ready to operate. However, the actual operability of a valve can only be proved by test.

A first observation can be made by actuating the valve through an open-close-open or close-open-close cycle. If no obvious problems are observed, an actual test at pressure may then be applied while tightness and operability are checked.

It is common practice after the installation of a piping system to clean the system by blowing through the system with a gas or steam or flushing with a liquid to remove debris and/or internal protective films and coatings. It should be recognized that valve cavities may form a natural trap in a piping system and material not dissolved or carried out by the flushing fluid may settle in such cavities and adversely affect valve operation.

*Caution:* If the system is being cleaned with a cleaning material (gas or liquid) different from the line media, the effect of the cleaning material upon the valve sealant must be evaluated prior to use.

## **4. OPERATION AND MAINTENANCE**

### **Introduction**

An industrial valve, reasonably matched to a particular service application and properly installed in a piping system, can be expected to have a long service life with a minimum of attention. Unlike totally passive components such as pipe fittings, vessels, etc., valves are a special kind of “machinery” having moving and wearing parts. The satisfactory performance of these working parts depends on the long-term preservation of various highly finished surfaces. Therefore, it is important to give adequate attention to the specific requirements for proper operation and reasonable maintenance of all valves throughout their service life.

### **Operation, Manual Valves**

Most valves are actuated manually by causing rotational movement of a wrench, handle, etc. Care is required to assure that such movement is in the correct direction, is not too fast or too slow and is applied through the proper distance. The terminal positions, open and/or closed, have important functional significance.

Plug valves do not rely on stem actuating force to provide tight shut-off. However, the correct position of the closure element in these types of valves is very important. In some cases, the effort required to move the closure element might increase substantially during final approach to the closed position, giving a false impression of having reached the required position. Failure to get to and stop at the *full* closed position can result in leakage and consequent damage to the sealing elements.

Plug valves require correct positioning of the closure element to seal properly. Closing travel should not stop until a positive stop is reached or a position indicator reaches the “closed” position.

Purchase specifications requiring restrictive maximum forces to be applied on levers may also lead to damaging forces being applied to valves or actuators in actual practice as larger forces are sometimes applied in the field. Users should consider this fact in training of operating personnel.

### **Operation, Power Actuated Valves**

Functionally, closure performance characteristics and backseating considerations are associated with all valve types regardless of the means of operation. Satisfactory valve performance with power actuation requires appropriate programming of the various requirements and constraints into the actuator controls. Therefore, the actuator should be adjusted to deliver an adequate opening, running and closing force to suit the anticipated service conditions. For the position-sensitive valve types, the close control should be position controlled by external stops or limit switches. Be sure to read the actuator manufacturer’s operation manual for more detailed information.

Data required for selection and adjustment of power actuators should be delineated clearly in purchase specifications for actuated valves. This data shall include but not necessarily be limited to:

- a) Upstream pressure and differential pressure conditions at which both opening and closing shall be required. Specify direction if applicable. Additionally, specify if valve operation is required under high-flow “blow-down” conditions.
- b) Speed of operation required or the maximum time for opening and/or closing. Also, specify a minimum time if required due to fluid dynamics.
- c) Electrical power supply available (AC or DC voltage, phase, frequency) for electrical power actuators or controls. Operating conditions for reduced voltages should also be considered.
- d) Pneumatic pressure available for pneumatic actuators (cylinders or diaphragms). Also, specify fail-open, fail-closed, fail-as-is, or any special requirements.
- e) Requirements for position indication signals.

Actuator selection and adjustments should normally be made by Flowserve, SSO, based on published literature and/or technical advice of the actuator manufacturer. Flowserve, SSO, should be consulted when a manually operated valve must be retrofitted with a power actuator.

*Caution:* Some valve actuators, when sized to provide specified loading, may have much higher output at maximum switch or control settings and therefore be capable of damaging valves if misadjusted. Valve and actuator manufacturers instructions should be followed closely to prevent overloading valve stems, backseats and other structural parts. Successful operation of power-operated valves requires a diligent coordination of the skills and efforts of the valve specifier, Flowserve, SSO, and the actuator manufacturer. Most applications are problem-free, but miscommunication can lead to unreliable operation at one extreme and possible valve or actuator damage at the other extreme.

### **Fluid Dynamics of Shut-off Valve Operation**

A flowing fluid in a piping system has mass and velocity. Anything that causes a moving mass to change its velocity will experience a reacting inertia force in proportion to the magnitude of the mass and the rate of the imposed velocity change.

However, in the flow of gases the reacting inertia forces are inherently moderated by the compressibility of the fluid that permits the instantaneous velocity change to be effectively limited to the mass of fluid in the immediate vicinity. This, in addition to the self-cushioning capacity of the fluid column in the upstream pipe, effectively precludes any significant problem of pressure surge in rapidly closed valves in gaseous fluid piping.

In contrast, the inertia of the fluid column in a liquid pipeline is not so easily overcome. Its relative incompressibility provides no such cushion or proximity-limiting mechanism. The entire upstream fluid mass is required to be decelerated at once by the closing valve and the resulting pressure surge may be of sufficient magnitude to cause structural damage.

An additional potential problem can occur *downstream* from the closing valve. This may be described as fluid column rupture and involves the inertia of the fluid column carrying it away from the closed valve with the proximate space being occupied by a bubble of the fluid vapor or, simply, a substantial vacuum. If there is sufficient backpressure in the line, the fluid column will reverse its velocity and close the void created by the fluid column rupture and causes another pressure surge when it reaches the valve.

It should be recognized that pressure surge intensity is roughly proportional to the length and velocity of the fluid column upstream of the closing valve and inversely proportional to the time taken to close the valve. Fluid column rupture and return surge intensity is proportional to the same condition on the other side of the valve in addition to the backpressure in that section of piping. Therefore, a slow closing is helpful in limiting the magnitude of the pressure surge phenomena.

In large long distance liquid pipelines it is critically important to evaluate pressure surge possibilities and to establish limits on the speed of closure of the flow shut-off valves. In operating such valves or setting the speed of operation of power-actuated valves, design limits on speed of closure should be conscientiously observed.

Rapid closure of a valve in any flowing liquid pipeline can cause a substantial pressure surge that may manifest itself in a sharp “bang” or possibly a series of “bangs”. This is frequently referred to as water hammer. This phenomenon can occur in

any flowing liquid line and is not limited to waterlines. Rapid closing of a shut-off valve in a flowing liquid line should be avoided especially during the last part of the stem travel.

### **Noise**

There are many different valve-operating conditions that can result in noise. Such noise may be “normal” considering the nature of the fluid and the pressure, temperature and velocity of flow. There may be a “wind” noise in a flowing gas line. There may be clear or hoarse whistling sounds resulting from the shape of the flow passage, including the flow path through a valve. Cavitating conditions in a liquid line can cause a “white noise” that ranges from a whisper to a sound like rocks and gravel, to a deafening roar. There may also be mechanical noises as a result of movement of internal “things” acted on by the flowing fluid. Some of these noises may be relatively harmless insofar as system integrity and performance are concerned. Mechanical damage in lines with compressible fluid is generally limited to points of sonic or supersonic velocity, or where a vortex resonance with an internal component causes movement and wear or breakage.

Vortex resonance with an internal component may also cause problems in liquid service. In addition, noise may be evidence of cavitation which has the potential for causing mechanical, damage, including massive erosion of the metal walls of a valve or pipe walls and/or other internal components.

A full technical discussion of all of the sound-generating mechanisms is beyond the scope of this document. Nevertheless, it is recommended that an evaluation be made of any condition of remarkable noise in a piping system at least to the point of understanding its cause. If a valve is involved, a determination should be made as to whether the valve is the source or just happens to be the location of the noise. Usually, if the valve is the source, the noise can be “tuned” by slightly “throttling” the valve.

Mechanical or high intensity fluid noise in the vicinity of a valve may be a warning of potentially serious trouble. Expert assistance should be obtained from system engineers or the valve manufacturer to determine the cause and evaluate possible need for action.

Noise emitted from a closed valve is a special case that may indicate seat leakage requiring repair. A whistling sound may indicate severe erosion of seating surfaces while “gurgling” or “popping” sounds may signify less severe leakage.

### **Maintenance**

Valves are properly considered to be a hybrid structure, a combination of a pressure vessel and operating machinery. Maintenance procedures therefore, must reflect the requirements of the occasional opening or closing of the “machinery” and the predominant operating condition of the valve where pressure is continuously applied and nothing is moving. The important performance parameters are pressure boundary integrity, actuating effort required and internal leak tightness. Maintenance should logically address the importance of preserving these performance parameters.

Valves that remain in one position for long periods of time may be hard to operate and/or not function as well as when originally installed. This reduction of operability can result from either a loss of effective lubricants, aging of packing, surface corrosion of moving parts, or an accumulation of deleterious solids. In some applications it may be desirable to schedule periodic partial or full cycle exercising of such valves.

Pressure boundary integrity requires basically sound pressure containing parts, a pressure tight static seal at assembly joints and in most cases, an effective working seal between a moving stem and the valve body. Maintenance of pressure boundary parts and the static seal of assembly joints are not usually considered to be a problem. However, continuous monitoring is recommended to confirm that problems do not occur. The need for paint protection against corrosion of exposed piping should be obvious from normal observations of the system.

## 5. Super Nordstrom® Regular Patten Iron Plug Valve

### Notice

This manual is intended as a basic maintenance and reconditioning guide for Super Nordstrom® Regular Pattern Iron Plug Valve. Before working on any Nordstrom Valves or related product, the reader should review and fully comply with this manual and its warnings and with the reader's company safety procedures.

If anything in this manual is unclear, contact the Flowserve SSO Customer Service Department for assistance.

Flowserve SSO and its employees are in no way responsible for damage to property or for personal injury or death that may result through the use or misuse of any Nordstrom Valve product, publication, audio or visual aid.

### Economics of Valve Repair

Whether a used valve justifies repair is an individual matter and should be decided by comparing the probable cost of repair with the cost of purchasing a new, valve for replacement. Naturally, the cost of repair will depend upon the amount of work involved and the cost of parts, if any are required.

The reclamation of Super Nordstrom® iron valves of all sizes and figure numbers is usually worthwhile when the condition of the valve is such as to require only cleaning, inspection, and re-assembly with new elastomeric seals.

In severe cases, the valve body may require re-boring and fitting an oversize plug. Repairs of this extent are not normally economically justified for valves of small sizes.

### Customer Service

If at any time you require assistance from Flowserve in the maintaining of your Super Nordstrom Valves, feel free to call your **Customer Service Representative**, at the appropriate number listed on the back cover of this manual.

Or write us at:

**Flowserve Sulphur Springs Operations**  
1511 Jefferson Street  
Sulphur Springs, Texas 75482  
USA

Or FAX us at: (903) 439-3411

### Field Service

Our **Sales Representatives** are the best in the business. They can provide you with technical information about your Super Nordstrom Iron Plug Valve, and are available to visit your facility to conduct general maintenance seminars.

In addition, Nordstrom maintains a highly skilled staff of **Service Representatives** who provide maintenance assistance over the telephone, or visit your facility to conduct maintenance seminars or to assist you in the maintenance and repair of your Super Nordstrom® Iron Plug Valve.

### Video Tapes

It is often difficult to assemble the appropriate people for training. Nordstrom has produced a series of videotapes that allow training at your convenience. For your Super Nordstrom® Iron Plug Valves, we suggest:

- *Operation and Maintenance of Nordstrom 400-D Handgun and Hypregun-Plus*

To obtain copies of this training video, contact your Flowserve Sales Representative or Customer Service Representative.

## When You Call or Write...

Be sure you provide the correct information and/or part numbers for your Super Nordstrom® Iron Plug Valve. Over the years there have been design changes due to our continuing effort make a great valve even better. It is very important that we are provided the information necessary to correctly identify your valve.

The valve Size and Figure number (including any prefix or suffixes) can be located on the valve and are needed to ensure that the correct parts or information are provided. The design condition of the valve, such as pressure, temperature, line media, sealant, etc. is also useful information.

## Introduction

The maintenance procedures outlined in this manual are designed to help you reestablish quick and easy operation, drop-tight shutoff, and a long service life of your Super Nordstrom® Regular Pattern Iron Plug Valve.

*Some procedures listed in this manual can be performed with the valve in-line and under pressure while others require that the valve be removed from line pressure before performing. Those procedures that require the valve to be removed from line pressure will be so noted.*

*Pressure can become trapped in the valve body cavity even after line pressure has been removed.*

Before removing pressure-retaining parts, be sure to:

- Cycle the valve once line pressure has been removed, and
- Stand away from the valve when removing the Cover.

*A number of procedures in this manual may cause flying debris that may cause eye injuries. Safety glasses should be worn at all times while repairing and maintaining Super Nordstrom Iron Plug valves.*

*The procedures described in this manual are intended only for Super Nordstrom, Regular Pattern (four bolt cover), Iron Plug Valves. Do not follow these procedures for any other brand or type of valve.*

## Basic Construction Principles

So that you may develop a plan of proper maintenance, it is best to understand the basic principles involved in Super Nordstrom iron plug valves.

The lubricated plug valve was invented by Sven Nordstrom in 1914, and basically represented an application of *Pascal's Law of Hydraulics* to the dry plug cock. Mr. Nordstrom created a valve sealant system to prevent taper lock in plug valves and enable the valve closure member to be operated easily. Over the years, as valve services became more severe and as technology improved, several design improvements were made. However, the basic principle of the use of Pascal's Law has not changed and continues to be used in the sealant systems of lubricated plug valves today.

All Nordstrom Lubricated Plug Valves use the same basic principles of design. In the Super Nordstrom Regular Pattern (Four Bolt Cover) Iron Plug valve, these principles consist of a *body, plug and stem, cover, adjustment member, and sealant*. The function of each of these items is as follows:

1. The **Body** connects the valve to the pipeline. The body also mates with the **Plug** to form a pressure vessel, capable of operation under various pressures and temperatures.
2. The **Plug and Stem**, integral one to the other, act as a rotating closure device. The Plug has a tapered surface designed to mate with the body taper bore to provide tight shut-off.
3. The **Cover** prevents external leakage and is designed to allow a finite floating of the plug.
4. The **Adjustment Member** is provided so the position of the Plug can be set in the proper relation to the Body. In the case of the Super Nordstrom Regular Pattern (Four Bolt Cover) Iron Plug Valve, the cover is the Adjustment Member.

5. **Sealant** is an integral part of all lubricated plug valves and has three functions:

- To ensure bubble-tight shut-off on hard-to-hold line media by acting as a secondary seal against seat leakage.
- Provides a flexible and renewable secondary seat, eliminating the need to force fit or replace sealing parts to obtain a seal.
- Applies Pascal's Law by providing the hydraulic means necessary to push the plug from its tapered seat in the body.

### **Sealant System**

Nordstrom Valves Sealant functions as an integral part of the lubricated plug valve. Sealant is *the* basic improvement over the dry plug cock. In order for sealant to be effective, the valve requires a system of internal channels - the *Nordstrom Sealdport Grooving System*.

The Nordstrom Sealdport Grooving System provides complete shut-off of line media regardless of the flow direction of material through the valve. Nordstrom Valves can be lubricated with the plug in any position while the valve is subjected to line pressure. With the plug in the closed position, the downstream port is completely surrounded by a film of Sealant between the body and plug seating surfaces. When rotating the plug between the open and closed positions, the grooves exposed to the valve flow passages are disconnected from the sealant system.

By maintaining a periodic sealant injection schedule, the Sealdport grooving system will sustain a pressurized sealant system regardless of whether the valve is in the open, closed, or throttled position.

### **Design Features**

To better understand the Super Nordstrom® Regular Pattern Iron Plug valve, listed are the principal design features. Refer to page 24 for illustrations.

1. **Stem and Plug** –Stems have wrench flats that align the wrench handle with the flow passage of the Plug, thus becoming a visible position indicator. The Stem and Plug is treated with a low friction coating to reduce the overall valve torque. **Tapered Plug**- individually matched to each body to achieve the best possible fit. The sealant grooves in the plug match the sealant grooves in the body to form the Sealdport groove system.
2. **Stem Seals** – O-rings are used for stem sealing.
3. **Balance Spring** – mechanically balances the plug to provide lower and predictable operating torques.
4. **Sealant Injection Fitting** - permits restoration of damaged seats for drop-tight shut-off. The side-mounted design allowing the sealant to flow directly under the plug thus provides for a more effective plug jacking action. In addition, the side-mounted design makes the valve more adaptable for actuation.
5. **Stem Weather Seal** - specially constructed to protect the stem-to-cover joint from hostile environments that can lead to corrosion.

### **Valve Front Identification**

This manual will periodically refer to the valve front. For clarification, the front of the valve will be the sealant injection fitting side of the valve.

**Note:** Refer to page 24 in the Technical Data section for a parts list and cross-sectional view of a "typical" valve.

## **Sealants**

Valve sealant is a viscous material that resists chemical attack and the dissolving characteristics of line media. Sealant performs four specific functions in a lubricated plug valve.

1. **Drop-Tight Seal** - To secure an absolutely tight seal, the film of sealant works to form a seal between the body and plug. This seal is formed by sealant transmitted in a system of grooves around each port. With proper selection of sealant for your particular service, this tight seal can be retained over a wide range of temperatures and pressures.
2. **Lubrication** - A protective film of sealant prevents metal-to-metal contact of the bearing surfaces of the valve by filming over bearing surface irregularities. The film of sealant permits the plug and body of a plug valve to glide smoothly over each other allowing the valve to operate easily.
3. **Renewable Seat** - Sealant is a structural part of the valve that provides a flexible and renewable seat. There is no need to disassemble the valve or remove it from the line to repair the seats. Injection of sealant is all that is required.
4. **Plug-Jacking** - The fundamental operating principal of the traditional plug valve design lies in the application of Pascal's Law. Sealant, under pressure developed by the injection of sealant, supplies the hydraulic means for lifting the plug from its tapered seat in the valve body thus allowing the plug to float freely in the body and allow easy operation.

A regularly scheduled sealant injection program will allow your Super Nordstrom® Iron Plug Valves to operate more easily and will extend the service life of your valves.

Flowserve SSO supplies many different types of sealant for use in plug valves. When selecting Sealant for your specific services, please refer to Flowserve SSO's sealant brochure, or consult your Flowserve SSO Customer Service Representative.

## **VXX Valve Purge**

VXX Valve Purge, a non-hazardous formulation, was developed for cleaning valves in-line, returning them to service without disassembly, and eliminating down time. Periodic injection of VPX into a valve flushes debris from the sealant system and allows sealant to flow more freely. See procedures on pages 21 and 22.

## **Sealant Injection Equipment**

So that Sealant injection can be performed easily, Flowserve SSO offers five designs of heavy-duty valve sealant injection equipment.

1. 400-D Hydraulic Hand Gun - uses "J" stick sealant and Gun Pak sealant
2. Hypregun-Plus 5Q - uses a 5-Quart can of sealant
3. Hypregun-Plus 5G - uses a 5 Gallon pail of sealant
4. 400-A Screw Prime Hand Gun - uses "K" stick sealant and cartridge sealant
5. 400-B 5 Gallon Bucket Pump - uses the contents of a 5-Gallon pail of sealant

For additional information about Nordstrom Sealant Injection Equipment, refer to the appropriate sealant injection equipment brochure.

## **Valve Maintenance**

**Note:** The procedures described in this manual are intended for use on valves that are in-line.

### **Proper valve performance depends on . . .**

- A periodic program of Sealant injection to maintain adequate sealant pressure in the valve to ensure positive shut-off and smooth operation.
- Selecting the correct Nordstrom Valves Sealant for the valve service conditions. Because of variations in the line media, product temperature, line pressure, and frequency of valve operation, proper sealant selection is essential. An "all purpose" valve sealant or lubricant does not exist. Only the correct Nordstrom Valves Sealant can assure proper valve performance.

- The proper application of the correct sealant. Knowing how to correctly inject sealant will keep your Super Nordstrom® Iron Plug valve in proper working order without removing it from the line.

**Be sure to remember:**

1. Sealant injection may be performed with the valve in-line and under pressure.
2. Never attempt to attach or detach the 400-D Hand Gun or Hypregun-Plus while the gun hose is pressurized.

**Basic Sealant Injection**

*High pressures are generated during sealant injection. It is recommended that safety glasses and thick leather gloves be worn during sealant injection.*

1. Before injecting sealant into the valve, determine if the valve is fully open or closed. While the Super Nordstrom® plug valve can be lubricated with the plug in any position, either the full open or the full close position allows the Sealport groove system to completely distribute the pressurized sealant to the valve seating surfaces. However, if an incompressible fluid is present in the valve, it is recommended that sealant be injected when the valve is in the full open position. (See Caution under Valve Maintenance – Troubleshooting.
2. Locate the Sealant Injection Fitting on the side of the valve. Remove any debris from the face of the sealant fitting and attach your sealant injection device to the fitting. Be careful not to damage the fitting in any way. A smooth contact surface is necessary to ensure an adequate seal is formed between the button head coupler and the Sealant Fitting.
3. Inject sealant following the operating instructions for the injection equipment that you are using.
4. There are four gauge scenarios that will help you determine valve seat leakage problems. Once you have identified the applicable gauge scenario, you can apply the appropriate maintenance procedures, found in the specific valve maintenance manual, to ensure your valves are operating at their peak.
  - **Gauge Scenario One:** The gauge does not indicate a pressure increase above the initial pressure required to inject sealant into the valve. Assuming your injection equipment is operating correctly, there are two possible problems: a) the sealant system is not full, or b) the seat is leaking. Leakage may be caused by too loose an adjustment or damage to the valve's seating areas.
  - **Gauge Scenario Two:** As sealant is injected, the gauge indicates a gradual increase in pressure until an initial plateau is reached, then at some point the pressure increases to a higher plateau and abruptly falls back to a lower level. This scenario indicates that the valve is receiving sealant properly, the valve sealant system has filled, and the plug has moved off the seat. Even though this scenario shows the plug has moved off the seat, it is still possible that the valve may be difficult to operate. Operation difficulties may be caused by too tight an adjustment or stem corrosion,
  - **Gauge Scenario Three:** This scenario is much like Scenario Two except the sealant pressure gauge reaches a plateau and remains at that point as the injection equipment is operated, even after you have injected more than enough sealant to fill the valve. This scenario signals one of two quite different conditions. If the plug is not locked in the body taper, then the plug may be unseated and additional sealant is simply bypassing the plug. This is normal and indicative of a properly maintained and well pressurized valve. However, if the plug is locked in the taper and cannot be operated, this indicates that the plug or valve body may be damaged and sealant is bypassing the sealing surfaces. In Scenario Three, it is also possible for the valve to be difficult to operate. The likely causes are the same as with Scenario Two: a) too tight an adjustment or b) stem corrosion,
  - **Gauge Scenario Four:** The gauge indicates a continual rise in pressure as sealant is injected, but never indicates a pressure decrease. This scenario indicates three possible problems: a) the valve sealant fitting is faulty, b) the sealant system is blocked, or c) the plug has seized in the body taper.





5. Open and close the valve several times while continuing to inject sealant. If conditions do not allow you to fully open or close the valve, rotate the plug back and forth (approximately 20 degrees) several times.
6. After you have completed the injection of sealant, relieve the pressure within the injection equipment and remove it from the Sealant Fitting.

### **Valve Maintenance: Troubleshooting**

This section lists common problems you may encounter with the Super Nordstrom® Iron Plug valve, the probable causes, and solutions that should remedy the situations. The listed procedures are intended to serve as guides to remedy conditions you may encounter when performing maintenance on your valve. The procedures, as well as information shown in the Tables of this manual are based on factory valve assembly procedures. Precise estimates of field conditions are not feasible. Judgment and experience must be applied when working on valves in actual field site conditions.

It is highly recommended that sealant be injected into the valve prior to proceeding. Gauge scenarios, as detailed earlier, will help you focus on specific solutions to remedy your valve problem. Your sealant injection equipment should be operating properly prior to diagnosing valve problems.

It should be noted that field adjustment of the plugs position with respect to the body is not possible with the Super Nordstrom® Iron Plug Valve. Thus, problems associated with the valve's adjustment are not addressed by the procedures contained in this manual.

**Caution:** *If a non-compressible fluid is trapped in the center cavity of the plug, when the valve is in the closed position, injecting sealant at high pressures or high volumes can cause the plug to lock in place. This can also cause the Cover Bolts to yield, thus producing Cover leakage.*

#### **Problem: Valve seat leakage**

##### **Cause 1: Insufficient sealant in the valve**

**Solution:** The lack of sufficient sealant to adequately fill and pressurize the sealant system is the most common problem associated with seat leakage. Inject the correct amount of sealant into the valve and again check for seat leakage. (See Gauge Scenario Two in order to determine if the correct amount of sealant has been injected into the valve.)

##### **Cause 2: Damaged plug**

**Solution:** A simple way to determine if the plug is damaged is to rotate the plug 180 degrees to place the upstream seat into the downstream position. The following procedure is a temporary solution to the seat leakage problem and the valve should be identified for replacement.

- a) With the valve in the full open or full closed position, remove the Retaining Ring and the Stop Collar.
- b) Rotate the valve Stem 180 degrees.

- c) Install the Stop Collar (remember to position it so the valve will turn clockwise to close and counterclockwise to open) and the Retaining Ring.
- d) Inject sealant - see pages 17 and 18.

**Problem: Operation Difficulties****Cause 1:** Insufficient sealant in the valve

**Solution:** The lack of sufficient sealant to adequately fill and pressurize the sealant system is the most common problem associated with a valve being hard to operate. Inject the correct amount of sealant into the valve and again check the operating torque of the valve. (See Gauge Scenario Two in order to determine if the correct amount of sealant has been injected into the valve.)

**Cause 2:** Minor Stem corrosion

**Solution:** Lubricate the Stem-to-Cover joint.

1. Remove the Retaining Ring and Stop Collar.
2. Remove the Weatherseal and inspect it for signs of damage. If the Weatherseal is damaged, replace it. Check for corrosion on the stem or internal surface of the cover.
3. If corrosion exists, dam the area around the Stem-to-Cover joint with a heavy grease or stick grade valve sealant.
4. Introduce penetrating oil into the Stem-to-Cover joint. Allow the penetrating oil to saturate for a minimum of 24 hours. Periodically operate the valve. (Care in selecting the correct type of penetrating oil must be made to ensure O-ring damage does not occur. If you feel the O-ring damage may have occurred, replace the O-ring by following the step in Cause 3 below.)
5. If the valve becomes operable, clean the Stem-to-Cover joint of excess penetrating oil.
6. If penetrating oil does not free the valve, clean the Stem and inside surface of the Cover as described in Operation Difficulties, Cause 3.
7. Coat the area under the Weatherseal with lithium base grease.
8. Install the Stop Collar (remember to position it so the valve will turn clockwise to close and counterclockwise to open) and the Retaining Ring.

**Cause 3:** Severe Stem corrosion

**Solution:** Remove corrosion from the Stem and interior surface of the Cover.

1. Remove the Retaining Ring and Stop Collar.
2. Remove the Weatherseal and inspect it for signs of damage. If the Weatherseal is damaged, replace it. Check for corrosion on the Stem or internal surface of the Cover.
3. If corrosion exists, attempt to lubricate the Stem-to-Cover joint as described in Operation Difficulties, Cause 2. If this does not work, continue with Step 4.

***Remove line pressure from the valve before performing the following procedures.***

4. Remove the Cover Bolts and Cover.
5. Remove the O-rings from the Cover.

6. Remove internal corrosion from the Cover by scraping and/or the use of #120 emery cloth. Care should be exercised to ensure not to damage any O-ring seal surfaces.
7. Remove Stem corrosion by scraping and/or the use of #120 emery cloth. Care should be exercised to ensure not to damage any O-ring seal surfaces.
8. Apply a thin film of sealant on all internal surfaces of the Cover.
9. Inspect the O-rings for damage and replace as necessary. Install the O-rings into O-ring grooves in the cover.
10. Ensure that the shim, if present when the valve was disassembled, is in place. Replace the Cover.
11. Apply an anti-seize compound to the Cover Capscrews and install. Use the bolting torque guidelines as referenced on page 26 of this manual.
12. Apply lithium base grease to the bottom of the Weatherseal and replace.
13. Install the Stop Collar (remember to position it so the valve will turn clockwise to close and counterclockwise to open) and the Retaining Ring.

**Problem: Blockage of sealant system.**

**Cause 1:** Sealant groove blockage

**Solution:** Some sealant can harden in the valve sealant system if not properly maintained. Hardened sealant can prevent or reduce the flow of sealant injected into a valve. To clear the valve sealant system of hardened sealant, inject VXX Valve Purge.

1. Inject VXX Valve Purge liberally into the valve using sealant injection equipment. If possible, the valve should be operated several times during application.
2. Allow the VXX Valve Purge to remain in the valve for an extended time with periodic valve operation.
3. Repeat Steps 1 and 2.
4. Inject an excess amount of the appropriate valve sealant into the valve.
5. If valve operation is improved by this procedure but the valve is still not operating properly, repetition of this procedure may be required.
6. Under conditions of severe sealant deterioration, VXX Valve Purge may not be capable of dislodging sealant residues and valve disassembly and physical cleaning may be required.

**Cause 2:** Sealant Fitting blockage

**Solution:** In the event no sealant is being injected into the valve even though the sealant equipment is pressurized, the Sealant Fitting may be blocked and should be replaced.

**CAUTION:** *The following procedures should be performed with extreme caution. Make sure the sealant fitting is pointed away from your body before attempting. Heavy leather gloves should be worn during these procedures.*

1. Check for sealant pressure behind the Sealant Fitting by pressing the center button of the fitting with a small punch or screwdriver. If a small amount of fresh sealant is released through the Sealant Fitting center button, the fitting is accepting sealant and operating properly.

If the center button of the Sealant Fitting cannot be depressed the Sealant Fitting is faulty or clogged with debris and/or hardened sealant and should be cleaned or replaced. Proceed to Step 2.

If a steady stream of sealant or line fluid is ejected from the Sealant Fitting, the Check Valve is not operating properly and should be flushed or replaced. See Blockage of Sealant System, Cause 3.

***Before replacing a faulty Sealant Fitting, remove the valve from line pressure.***

2. First, test for trapped pressure below the Sealant Fitting by carefully unscrewing it while attempting to move the fitting back and forth. If pressure is present, continue to move the fitting back and forth until the pressure is relieved. Do not remove the fitting until all pressure is relieved.
3. Once the fitting is removed, attach the sealant injection equipment to the fitting and inject sealant. If sealant does not flow from the fitting, the fitting is faulty and must be replaced. If sealant can be pumped through the fitting, the problem may be with the Check Valve or valve sealant-grooving system.
4. Replace the Sealant Fitting, if necessary.

**Cause 3: Check Valve blockage**

**Solution:** Check Valve blockage may be the result of debris or hardened sealant not allowing the Check Valve ball to move off its seat. Inject sealant and/or VXX Valve Purge before continuing with this procedure. If this fails to stop the check valve from leaking, remove the sealant fitting as described in Cause 2, Step 2.. Flush or replace the Check Valve if the solution to Sealant System Blockage, Cause 1 and 2 are unsuccessful.

***Before replacing a faulty Check Valve, the valve must be removed from the line.***

1. Remove the Sealant Fitting as described in Cause 2.
2. Using a .188" square tool or an ¼" allen wrench, remove the Check Valve.
3. Once the Check Valve has been removed, clean the removal area of all debris and check for thread damage. Failure to do so may allow contaminants to enter the valve sealant system and damage the sealing surface of the Plug and/or Body.
4. Lubricate the new Check Valve threads with light machine oil.
5. Install a new Check Valve using a thread sealant, not teflon tape, on the threads prior to installation.
6. Replace the Sealant Fitting using a thread sealant, not teflon tape, on the threads prior to installation.
7. Inject sealant into the valve.

**Problem:** Cover leakage.

**Cause 1: Damaged Gasket**

**Solution:** Replace the Gasket as described below. It is recommended that the old Gasket be replaced with new parts when the Cover is removed from the valve.

***The valve must be removed from line pressure before removing the Cover.***

1. Make sure there is no internal pressure trapped inside the valve. Operate the valve one complete quarter-turn cycle, and then place the valve in the full open position.
2. Remove the Retaining Ring and Stop Collar.
3. Remove the Cover Bolts and the Weatherseal.

4. Remove the existing O-rings and thoroughly clean the Cover. Be sure there is no pressure trapped in internal cavities of the valve (refer to the Introduction on Page 2). Operate the valve one complete quarter-turn cycle, and then put the valve in the full open position.
5. Remove the Retaining Ring and the Stop Collar.
6. Remove the Weatherseal.
7. Loosen and remove the Cover Bolts.
8. Remove the cover. The Stem and Plug may come out of the valve when the cover is removed. This is due to the friction forces that exist between the Cover O-rings and the Stem and Plug. If this occurs, remove the Stem and Plug from the Cover and place it back into the body. Be sure that the balance spring is properly positioned.
9. Carefully remove the Gasket (elastomeric seal) and all traces of it from the valve Body.
10. Apply a film of sealant on the entire surface of the large end of the plug.
11. Place the new Gasket onto the Body.
12. Examine the Stem and Plug O-rings (in the cover) and replace if damaged. Lubricate the O-rings, with valve sealant or other suitable lubricant, and place the Cover on the valve.
13. Lubricate the Cover Bolts with a quality thread lubricant.
14. Insert the Cover Bolts, but do not screw the bolts all the way down.
15. Tighten the Cover Bolts, using the appropriate torque values from Table 1 and the procedure for *Tightening Capscrews and Nuts* on page 26.
16. Install the Stop Collar (remember to position it so the valve will turn clockwise to close and counterclockwise to open) and the Retaining Ring.
17. Inject sealant - see pages 17 and 18.

**Cause 2:** Non-compressible fluid trapped in port of plug while in the closed position.

**Solution:** Allow pressure to self-relieve over a period of time. If Cover leakage continues, follow procedures as described in Cause 3.

**Cause 3:** Loose bolting.

**Solution:** Tighten the cover bolting to the torque and order as listed on page 24 of this manual.

1. Examine the body to cover joint and if the Cover Seal has extruded between the Cover and the Body, follow the steps in Damaged Gasket.
2. Remove the Retaining Ring and Stop Collar
3. Tighten the Cover Capscrews to the torque shown in Table I, *Torque Values for Pressure Retaining Bolting*, on page 24.
4. Inject Sealant - see pages 17 and 18.

5. Install the Stop Collar (remember to position it so the valve will turn clockwise to close and counterclockwise to open) and the Retaining Ring.
6. If leakage continues, then it is probable that the Cover Gasket has been damaged. These can be replaced only when the valve is out of service. Procedures for replacing the Gasket are described in Cover Leakage Cause 1.

**Problem:** Leakage at the Stem.

**Cause 1:** Line pressure is bypassing Stem O-rings.

**Solution:** Replace Stem O-rings

*Line pressure must be removed from valve before changing Stem O-rings.*

1. Make sure there is no internal pressure trapped inside the valve. Operate the valve one complete quarter-turn cycle, and then place the valve in the full open position.
2. Remove the Retaining Ring and Stop Collar.
3. Remove the Cover Capscrews and the Weatherseal.
4. Remove the existing O-rings and thoroughly clean the Cover.
5. Install the new Stem O-rings.
6. Examine the Stem Weatherseal and replace it if necessary. Apply sealant to the inside diameter of the Cover.
7. Install the Cover. The stop lug should be point to the front of the valve (over the Sealant Fitting).
8. Lubricate the Cover Capscrews with a good quality thread lubricant and install.
9. Tighten the Cover Capscrews as described on page 24 of this manual.
10. Install the Stop Collar (remember to position it so the valve will turn clockwise to close and counterclockwise to open) and the Retaining Ring.
11. Inject sealant - see pages 21 and 22.

**Problem:** Sealant Fitting leakage.

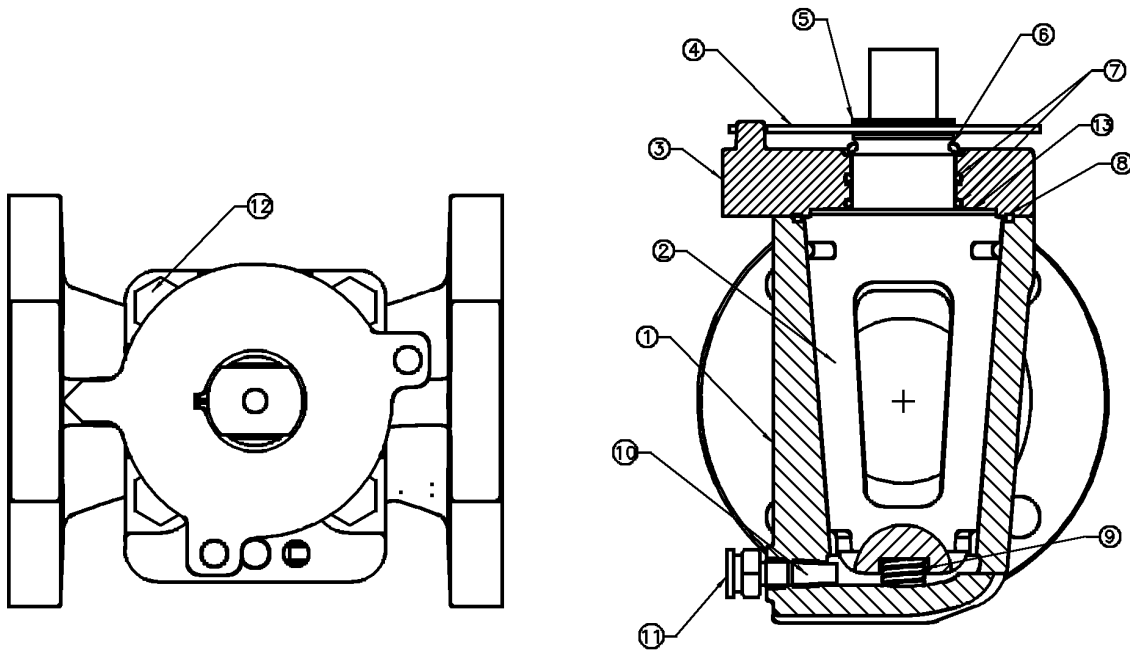
**Cause:** Line pressure bypassing Check Valve.

**Solution:** Leakage at the Sealant Fitting indicates there is leakage around or through the Check Valve (located behind the Sealant Fitting). . Follow the Steps as listed in Cause 3 of Sealant System Blockage

**Problem:** Check Valve leakage.

**Cause:** The Check Valve ball is not seating properly.

**Solution:** Clean or replace the Check Valve. Follow the Steps as listed in Cause 3 of Sealant System Blockage.

**Detail Sketch:**

No.	Item Description
1	Body
2	Stem and Plug
3	Cover
4	Stop Collar
5	Retaining Ring
6	Weather Seal
7	Stem O-rings
8	Cover Seal
9	Balance Spring
10	Check Valve
11	Sealant Injection Fitting
12	Cover Capscrew
13	Shim (if present)

## **Technical Data: Procedure for Tightening Capscrews**

**Note:** This procedure is intended only as a guide. It is impossible for Flowserve SSO to know actual field-site conditions, so your judgment and experience must be exercised. Use of a torque wrench is recommended.

1. Inspect applicable parts to be sure that:
  - a) Tapped holes are clean, dry, and free of foreign matter.
  - b) Threads are free of nicks, grit, and burrs.
2. Apply a quality thread lubricant on the threads of the Capscrews / Nuts, or the tapped holes, and the contact face of the Capscrews / Nuts.
3. Install all Capscrews / Nuts by hand. Engage the threads at least 1/2 of the diameter before using a wrench.
4. Hand-tighten the Capscrews / Nuts in a crisscross pattern. This is to avoid cocking the parts.
5. Tighten the Capscrews in a crisscross pattern to the 2<sup>nd</sup> Intermediate torque value specified in the Table.
6. Repeat Step 5, tightening the Capscrews to the full torque value as shown in Table.
7. Re-check the torque on all Capscrews. If the torque is less than the minimum shown, tighten them to the full torque.

Valve Size	Intermediate		Final	
	1 <sup>st</sup>	2 <sup>nd</sup>	Min.	Max.
½	HT	5	12	15
¾	HT	5	12	15
1	HT	5	12	15
1½	HT	5	12	15
2	HT	5	12	15
2½	HT	20	28	32
3	HT	20	28	32
4	HT	35	54	60

HT indicates hand tighten

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