VELAN

BELLOWS SEAL
GATE AND GLOBE

INSTALLATION & OPERATION MANUAL
1/2 – 12” (15 – 300 mm)
This manual has been prepared by Velan engineers, designers and maintenance personnel to assist you in obtaining many years of satisfactory service from your cast steel valves. It will also assist you in restoring your valve to the best working condition with a minimum of time and expense.

Velan valves are designed and manufactured based on many years of research and product development and are constantly being improved. Before beginning any major work, we recommend that you read this booklet carefully at least once to understand the valve’s physical condition.

Please note that if you do not understand the reason for the service problem, we suggest that you get in touch with your local Velan representative or call the Customer Service Manager for technical assistance.

Before beginning any major work, we recommend that you carefully check the nameplate on the valve and record the figure number to identify the type and size of valve. See the “Essential Features of Velan Valves” form on the following page for an explanation of Velan “Figure Numbers”.
1.2 INDEX OF REFERENCE MANUALS

The bellows seal manual is supplementary to the general maintenance manuals. Depending on the type of bellows seal valve that has been purchased, the user will need to refer to one of the following manuals:

CAST STEEL VALVE MANUAL - VEL-CSVM
FORGED STEEL VALVE MANUAL - VEL-SFVM
BOLTED BONNET FORGED STEEL VALVE MANUAL - VEL-FBBM
FORGED Y-PATTERN BONNETLESS GLOBE VALVES - VEL-FBGM

It is expected that anyone servicing a Velan bellows seal valve is familiar with the relevant general maintenance manual. The following table serves as a quick index to sections of the general service manuals referred to in the bellows seal manual.

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1.3 BELLOWS SEAL TROUBLESHOOTING

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<th>GENERAL PROBLEMS</th>
<th>SOLUTION</th>
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<td>Actuator has failed</td>
<td>Replace or repair actuator</td>
<td>Actuator Manual</td>
</tr>
<tr>
<td></td>
<td>Valve packed with debris</td>
<td>Flush or clean valve to remove debris</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Shaft key sheared</td>
<td>Determine cause of shearing and correct, replace shaft key</td>
<td>Contact Velan</td>
</tr>
<tr>
<td>SHAFT PACKING LEAKING</td>
<td>Bellows Failure</td>
<td>Replace bellows/stem/bonnet as one component along with yoke if required</td>
<td>Contact Velan</td>
</tr>
<tr>
<td></td>
<td>Gland bushing binding</td>
<td>Loosen gland nuts and readjust bushing</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Packing rings damaged</td>
<td>Depressurize valve and replace packing rings</td>
<td>General Manual</td>
</tr>
<tr>
<td></td>
<td>Packing worn out</td>
<td>Depressurize valve and replace packing rings</td>
<td>General Manual</td>
</tr>
<tr>
<td></td>
<td>Stem/packing chamber damage</td>
<td>Repair or replace stem</td>
<td>Contact Velan</td>
</tr>
<tr>
<td>VALVE LEAKING</td>
<td>Valve not fully closed</td>
<td>Close valve fully (DO NOT USE CHEATERS)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Debris trapped in valve</td>
<td>Cycle and flush to remove debris</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Actuator mechanical closure stops adjusted improperly</td>
<td>Adjust the stop for closure</td>
<td>Contact Velan for assistance</td>
</tr>
<tr>
<td></td>
<td>No full circumferential sealing contact</td>
<td>Lap seats</td>
<td>General Manual</td>
</tr>
<tr>
<td>JERKY OPERATION</td>
<td>Valve jams or is hard to close</td>
<td>May need pressure relief</td>
<td>Contact Velan</td>
</tr>
<tr>
<td></td>
<td>Valve does not open</td>
<td>Loosen packing, hand tighten to torque value in table, cycle and retighten</td>
<td>Contact Velan</td>
</tr>
</tbody>
</table>
1.4 RECOMMENDED LUBRICATION

<table>
<thead>
<tr>
<th>PART</th>
<th>LUBRICATION</th>
<th>APPLICATION</th>
<th>FREQUENCY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stem threads</td>
<td>Exxon: Ronex MP, Castrol MP or equivalent MP group (up to 650°F) Ronex Extra duty 2 (above 650°F)</td>
<td>Directly to threads</td>
<td>When threads appear dry</td>
</tr>
<tr>
<td>Yoke nut</td>
<td>Exxon: Ronex MP, Castrol MP or equivalent MP group (up to 650°F) Ronex Extra duty 2 (above 650°F)</td>
<td>Inject through grease fitting at hub of yoke</td>
<td>Concurrently with stem thread lubrication</td>
</tr>
<tr>
<td>Spline bushing</td>
<td>Sure Turn No. 1548016</td>
<td>Directly to threads</td>
<td>At valve assembly</td>
</tr>
<tr>
<td>All threaded parts except stem and yoke nut</td>
<td>- Anti-seize compound No. 425-A (Crane) or equivalent - Nickel Anti-Seize to MIL-A-90TE or MOLYKOTE P37 or nuclear grade nickel base “Never-Seez” N-9000</td>
<td>Thin coat on threads</td>
<td>On valve assembly only</td>
</tr>
</tbody>
</table>

Recommended lubricant subject to change without notice.

1.5 ROUTINE MAINTENANCE SCHEDULE FOR NUCLEAR VALVES

Generally, the valve(s) do not require routine maintenance or part replacement scheduling based on reliability and maintainability studies (see table below) done at US and Canadian Nuclear power stations. The routine maintenance of the valve(s) will depend on the accessibility of the valve as well as the number of times the valves is cycled open and closed.

However, due to the frequent cycling nature in ‘Combined Cycle’ plants (especially of DSS (daily start stop) category) the frequency of checks on the following must be continually monitored:

- **Bolt and stem lubrication**
- **Actuator settings**
- **Evidence of noise from actuator**
- **Possibility of over-pressurization**
- **Thermal binding**

ASME B16.34 and B31.1 require that the end user take adequate precautions against over-pressurization, thermal binding and therefore provide for equalization and warm-up lines.

Please use this table as a reference for your routine maintenance schedule.

<table>
<thead>
<tr>
<th>CHECK</th>
<th>FREQUENCY</th>
<th>EST. TIME</th>
<th>UNAVAILABILITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Check Live Load, Bonnet/Yoke Cap Screw, Torque Arm</td>
<td>Yearly</td>
<td>25 minutes</td>
</tr>
<tr>
<td>2</td>
<td>Check Body/Bonnet Studs</td>
<td>Every 4 years</td>
<td>2 Hrs</td>
</tr>
<tr>
<td>3</td>
<td>Remove Packings and replace</td>
<td>Every 5 years</td>
<td>2 Hrs</td>
</tr>
<tr>
<td>4</td>
<td>Remove Bonnet, Check Stem, Seats, polish, repack, etc.</td>
<td>Every 10 years</td>
<td>15 Hrs</td>
</tr>
<tr>
<td>5</td>
<td>Lubricate Actuator</td>
<td>Every 5 years</td>
<td>30 mins</td>
</tr>
</tbody>
</table>

Scheduled Unavailability: \(= 0.0003500\)
Unscheduled Unavailability: \(= 0.0003102\)
Total Unavailability: \(= 0.0006602\)
Availability per Valve: \(= 1-0.0006602\) \(= 0.9993398\) \(= 99.94\%\)
FOR SAFETY REASONS,
it is important to take these precautions before removing a valve from a line.

- Personnel making any adjustments on the valves should wear safety equipment normally used to work with fluid in the line where the valve is installed.

- Before removing the yoke bushing under pressure, the valve should be in fully open position in order to prevent injuries.

- Before removing a valve from a line, line pressure must be relieved with no exception.

- Velan valves can be equipped with a variety of manual gear, electric motor, hydraulic or pneumatic actuators. Generally, all pressure must be relieved from both sides of the valve before the actuator is removed.

- A valve in the fully open position (backseated), should not be jammed-tight (overtorqued), to avoid thermal binding. It is our recommendation that the valve be removed 1/4 turn of the handwheel from the fully open position. This will also ensure that packing tightness is verifiable. In gear-operated valves, because of the backlash, it is difficult sometimes to ensure this position.

- Valve standards, such as API and MSS, caution users that successful completion of a backseat test should not be construed as a recommendation by the manufacturer that a valve may be repacked while it is under pressure.

- The backseat may be used as a means of stopping or reducing packing leakage until the packing can be replaced under no pressure. Removal of packing with the valve under pressure is at the owner's risk.

1. Warning on Over-Pressurization Relief

Under certain conditions, double-seated valves which have the integrate cavity filled with fluid and is subjected to increase in temperature can result in excessive buildup of pressure in the center cavity, leading to pressure boundary failure.

Such situations occur when liquid from condensation, testing fluid, leakage from upstream side, etc. accumulates in the center cavity. If this fluid is not relieved by some means, over-pressurization may occur. It is the responsibility of the purchaser to ensure that adequate precautions are taken against such an eventuality.

2. Warning on NACE Conversions

It is extremely important to ensure that valves, when converted to NACE trims in the field are done by Velan authorized service shops. Unauthorized conversions can result in failure to carry out post-weld heat treatment and result in severe stress cracks in non-stress relieved areas.

3. Warning on Conversion to Globe Stop Check

Velan globe valves cannot be automatically converted to glove stop check valves, without verifying design parameters in detail with Velan Engineering. Any unauthorized conversions may result in the jamming of the disc in the valve.

For further details on the above subjects, please contact the Customer Service Manager.
BELLOWS SEAL GATE VALVES

The bellows are sealed to the stem and the bonnet with precision welds. The welds need to be performed in close proximity to other valve parts, which can cause damage to the bellows, stem, backseat and packing if not done carefully. Velan does not recommend the replacement of a bellows in the field. If the bellows is damaged, indicated by leaking through the packing chamber, please contact Velan Field Engineering Services. Velan can supply the bellows/stem/bonnet and yoke (if required) as one pre-assembled component.

3.1 TYPES OF BELLOWS SEAL GATE VALVES

Bellows seal gate valves are made in variety of sizes to fit any application. Figures 3.1A & 3.1B show standard forged steel bellows seal gate valves from \( \frac{1}{2} \)" up to 6". Figure 3.1C shows a standard cast steel bellows seal gate valve from 2"-12". Figure 3.1D shows a specialty bellows seal gate valve with extended body. Velan also manufactures bellows seal gate valves with extended bonnets typically used in cryogenic conditions.

Figure 3.1A Compact Forged Steel Bellows Seal Gate Valve
Figure 3.1B  Forged Steel Bellows Seal Bolted Bonnet Gate Valve

Figure 3.1C  Cast Steel Bellows Seal Bolted Bonnet Gate Valve
Figure 3.1D  Forged Steel Bellows Seal Extended Body Gate Valve
III BELLOWS SEAL GATE VALVES

3.2 PARTIAL DISASSEMBLY – GASKET REPLACEMENT

Some bellows seal valves are designed with a gasket to improve sealing performance. Check assembly drawing to see if the specific valve has a gasket. If the valve is leaking through the body/bonnet joint connection, first check to see if the body bolts are torqued down to the required values. If the bolts are tight and the valve still leaks, the gasket may need replacement. Follow general maintenance manual safety instructions prior to any disassembly. If a valve is equipped with a gear or motor actuator, see actuator manual for actuator disassembly. Place matching marks on parts as disassembly progresses so that the orientation of parts can be maintained upon reassembly.

3.3 TOTAL DISASSEMBLY

Total disassembly will require the forged steel valve maintenance manual. Read safety warnings prior to any disassembly. Refer to drawings in section 3.1.

NOTE: For seal welded bonnet bellows seal valves, Velan offers a special weld removal tool. The tool fits onto the bonnet of the valve and is free to rotate on the stem. The tool holds a grinder in place. The operator is then able to reduce the distance between the grinder and valve shoulder until the weld has been completely eliminated. The advantages of this tool are its ease of use and its precision which reduces the likelihood that the valve will be damaged during welding. If the tool is not available, the weld can be removed using a standard 90° grinder.

A. Follow the steps in the forged steel manual for gate valves until you have separated the bonnet from the valve body. If seal welded, only the seal weld can be removed. If necessary, proceed to separate the bellows from the stem according to the steps B & C. This should only be done if advised by Velan Field Engineering Services.

B. In order to disassemble the stem, the seal weld between the bellows and the stem or disc coupling must be removed. Use the bellow collar as a guide to remove the seal weld with a hand grinder.

NOTE: Velan does not recommend the reuse of bellows. It is better to grind more from the bellow collar than the bonnet or stem.

C. Remove bellows from stem.

D. Remove stem by turning it out of the yoke nut. When the stem is disengaged from the yoke nut, pull it out through the bottom of the yoke/bonnet assembly.

E. Disassembly is now complete. Valve is ready for inspection, repair and replacement of damaged parts.

3.4 ASSEMBLY

The reassembly procedures are not as detailed as the disassembly procedures since, in most cases, the reverse procedure is required. Refer to general maintenance manual prior to any assembly. It is important to follow basic cleanliness and lubrication requirements.

i. Place wedge on T-head of stem. Make sure that the marked side of the wedge matches the marked side of the seat in the body. This is extremely important on valves with welded in seats to ensure optimum sealing.

ii. Place a new gasket in the recess on the top mounting face of the body.

iii. Line up the bonnet-yoke assembly with the body and lower into the body. CAUTION: Do not damage the gasket when aligning a heavy bonnet assembly on the valve body.

iv. Apply recommended lubricant to the body-bonnet studs and then install the body-bonnet nuts. Tighten the nuts down to the required torque. Do not tighten body-bonnet nuts with wedge in fully closed position.

v. Torque down packing flange as specified in required manual.

vi. Mount torque arm on stem.

vii. Verify operation by cycling at least three times from fully open to fully closed position.
BELLOWS SEAL GLOBE VALVES

The bellows are sealed to the stem and the bonnet with precision welds. The welds need to be performed in close proximity to other valve parts, which can cause damage to the bellows, stem, backseat and packing if not done carefully. Velan does not recommend the replacement of a bellows in the field. If the bellows is damaged, indicated by leaking through the packing chamber, please contact Velan Field Engineering Services. Velan can supply the bellows/stem/bonnet and yoke (if required) as one pre-assembled component.

In general, there are three types of bellows seal globe valve sold by Velan. These are the bolted bonnet, the threaded bonnet and the bonnetless y-pattern. The bolted bonnet and threaded bonnet valve designs also vary depending on whether they are cast steel or forged steel. Most bellows seal valves are seal welded between the body and bonnet so that every flow path is closed. Thus a bellows seal valve typically will only leak when either a weld has cracked or the bellows has failed.

**NOTE:** Valve strokes on bellows seal valves may be shorter than on standard valves, especially so in the case of the Y-_pattern. Do not over-torque a valve when closing and opening.

4.1 TYPES OF BELLOWS SEAL GLOBE VALVES

Bellows seal globe valves are made in a variety of styles to suit any application. Figures 4.1A & 4.1B show standard forged steel bellows seal globe valves from \( \frac{1}{2}'' \) - 10". Figure 4.1C shows a cast steel bellows seal globe valve. Figure 4.1D shows a forged Y-Pattern bellows seal globe valve.
VI  BELLOWS SEAL GLOBE VALVES

**Figure 4.1B**  Forged Steel Bellows Seal Bolted Bonnet Globe Valve

**Figure 4.1C**  Cast Steel Bellows Seal Bolted Bonnet Globe Valve

**Figure 4.1D**  Forged Steel Bellows Seal Y-Pattern Globe Valve
4.2 GLOBE VALVE EXPLODED VIEW

Figure 4.2 shows an exploded view of a standard cast steel bellows seal globe valve.

**PARTS DESCRIPTION**

1. Body
2. Bonnet
3. Stem Nut (Yoke Nut)
4. Handwheel Key
5. Housing Cover
6. Stem
7. Packing Ring
8. Housing Cover Cap Screws
9. Packing Flange Nut
10. Packing Flange Stud
11. Gland Bushing
12. Packing Flange
13. Bellows
14. Disc
15. Stem Disc Pin
16. Handwheel
17. Handwheel Nut
18. Body Bonnet Stud
20. Yoke Bonnet Cap Screw
21. Torque Arm
22. Torque Arm Key
23. Torque Arm Cap Screw
24. Yoke

*Figure 4.2 Typical Exploded View - Bellows Seal Globe Valve*
4.3 PARTIAL DISASSEMBLY – GASKET REPLACEMENT

Some bellows seal valves are designed with a gasket to improve sealing performance. Check assembly drawing to see if the specific valve has a gasket. If the valve is leaking through the body/bonnet connection, first check to see if the body bolts are torqued down to the required values. If the bolts are tight and the valve still leaks, the gasket may need replacement. Follow safety instructions prior to any disassembly. If a valve is equipped with a gear or motor actuator, see actuator manual for actuator disassembly. Place matching marks on parts as disassembly progresses so that the orientation of parts can be maintained upon reassembly.

4.4 PARTIAL DISASSEMBLY OF GLOBE VALVES

Total disassembly will require the relevant general maintenance manual. Read safety warnings prior to any disassembly. Refer to drawings in Section 4.1 during disassembly.

NOTE: For seal welded bonnet bellows seal valves, Velan offers a special weld removal tool. The tool fits onto the bonnet of the valve and is free to rotate on the stem. The tool holds a grinder in place. The operator is then able to reduce the distance between the grinder and valve shoulder until the weld has been completely eliminated. The advantages of this tool are its ease of use and its precision, which reduces the likelihood that the valve will be damaged during welding. If the tool is not available, the weld can be removed using a standard 90° grinder.

A. Follow steps in general maintenance manual up to point where bonnet has been separated from body (at seal weld if valve is seal-welded). In case of y-pattern, remove all top works, open the valve partially. Grind-off bonnet seal weld. NOTE: Velan can offer special seal weld cutting tool. After the weld has been removed, unscrew the bonnet counter clockwise and remove complete belows seal assembly through top of yoke opening. The valve is now ready for parts replacement and/or repairs. Make sure to follow safety warnings in section 3 of given manual.

B. Valve seat is now ready for inspection.

NOTE: Only disassemble valve further if advised to by Velan Field Engineering Services.

C. Remove Disc

i. High Pressure Disc

1. The connection between the stem and the disc is made by the use of a disc union and the stem collar or disc coupling. To remove this connection, break the tack welds using a saw or a small chisel.

2. Unscrew the disc union from the disc and pull the disc off the stem.

ii. Low Pressure Disc (see figure 4.3)

1. The connection between the stem and the disc is made by the use of a stem-disc pin. The pin goes through the stem and disc and is locked in place by the disc hole being peened on both ends.

2. Remove the stem disc pin by removing the peening on one side of the disc.

3. Push the pin out through the side of the disc where the peening has been removed. Once pin has passed through the stem, the disc can be removed.

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**Parts Description**

- 6 - Stem
- 21 - Disc
- 33 - Stem Disc Pin

**Figure 4.3 Low Pressure Disc**
D. Remove torque arm.
E. Remove packing flange nuts and packing rings.
F. In order to disassemble the stem, the seal weld between the bellows and the stem or disc coupling must be removed. Use the bellows collar as a guide to remove the seal weld with a hand grinder.
   **NOTE:** Velan does not recommend the reuse of bellows. It is better to grind more from the bellows collar than the bonnet or stem.
G. Remove bellows from stem.
H. Remove stem by turning it out of the yoke nut. When the stem is disengaged from the yoke nut, pull it out through the bottom of the yoke/bonnet assembly.
I. Disassembly is complete. Valve is now ready for inspection, repair and replacement of damaged parts.

### 4.5 GLOBE VALVE ASSEMBLY

The reassembly procedures are not as detailed as the disassembly procedures since, in most cases, the reverse procedure is required. Refer to general maintenance manual and read safety warnings prior to any assembly. It is important to follow basic cleanliness and lubrication requirements.

i. For cast steel valves, follow section 7.5 in the Cast Steel Valve Manual
ii. For forged steel valves, follow section 7.3 in the Forged Steel Valve Manual
iii. For forged steel bolted bonnet valves, follow section 7.6 in the Forged Steel Bolted Bonnet Valve Manual
iv. For y-pattern valves, follow section 5.6 in the Forged Y-Pattern Bonnetless Globe Valve Manual
### MANUFACTURING PROGRAM

<table>
<thead>
<tr>
<th>Valve Product Line</th>
<th>Size</th>
<th>Pressure Class</th>
<th>Applicable Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forged pressure seal and bolted bonnet gate, globe and check valves</td>
<td>2 – 24 50 – 600</td>
<td>PS: ASME 600 – 4500 BB: ASME 150 – 1500</td>
<td>ASME B16.34</td>
</tr>
<tr>
<td>Small forged steel gate, globe and check valves</td>
<td>¼ – 2 8 – 50</td>
<td>ASME 150 – 2500</td>
<td>API 602, 606 ASME B16.34</td>
</tr>
<tr>
<td>Forged steel Y-pattern globe valves</td>
<td>¼ – 4 15 – 100</td>
<td>ASME 900 – 4500</td>
<td>ASME B16.34</td>
</tr>
<tr>
<td>Cast steel gate, globe and check valves</td>
<td>2 – 60 50 – 1500</td>
<td>ASME 150 – 1500</td>
<td>API 600</td>
</tr>
<tr>
<td>Cast stainless steel gate, globe and check valves</td>
<td>¼ – 24 15 – 600</td>
<td>ASME 150 – 300</td>
<td>API 603 ASME B16.34</td>
</tr>
<tr>
<td>Dual plate check valves</td>
<td>2 – 72 50 – 1800</td>
<td>ASME 125 – 2500</td>
<td>API 594</td>
</tr>
<tr>
<td>All stainless steel knife gate valves</td>
<td>2 – 36 50 – 900</td>
<td>150 psi</td>
<td>TAPPI TIS 405-8 MSS SP-81</td>
</tr>
<tr>
<td>Memory seal ball valve</td>
<td>¼ – 24 8 – 600</td>
<td>ASME 150 – 600 600 – 4000 WOG</td>
<td>ASME B16.34</td>
</tr>
<tr>
<td>General purpose ball valve</td>
<td>¼ – 12 8 – 300</td>
<td>Up to 300</td>
<td>Up to ASME B16.34</td>
</tr>
<tr>
<td>Metal-seated ball valves</td>
<td>¼ – 24 15 – 600</td>
<td>ASME 150 – 4500</td>
<td>ASME B16.34</td>
</tr>
<tr>
<td>Butterfly valves</td>
<td>3 – 36 80 – 900</td>
<td>ASME 150-300</td>
<td>API 609</td>
</tr>
<tr>
<td>Bellows seal gate and globe valves</td>
<td>½ – 12 15 – 300</td>
<td>ASME 150 – 2500</td>
<td>ASME B16.34</td>
</tr>
<tr>
<td>Cryogenic gate, globe, check, ball and butterfly valves</td>
<td>½ – 48 10 – 1150</td>
<td>ASME 150 – 1500</td>
<td>ASME B16.34</td>
</tr>
</tbody>
</table>

### SALES OFFICES

**U.S.A.**
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  - Tel: (802) 864-3350
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  - Franklin, TN 37064
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  - Fax: (615) 599-3250

**Germany**
- VeLan GmbH
  - D-47877 Wlich
  - Tel: (49) 2154/6703-0
  - Fax: (49) 2154/6703-99

**Canada**
- Velan’s valve distributors are located worldwide.

**MANUFACTURING PLANTS**

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- Velan’s valve distributors are located worldwide.

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