



**brands you trust.**

Installation, Operation and  
Maintenance Manual  
**CRANE® Cast Steel Valves**





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## Warnings

1. All CRANE® Valves are designed and manufactured to be installed in applications where no more than 1g of force in excess of gravity is applied to the valve in any direction. This 1g force can be an effect of Traffic, Wind or Earthquake. CRANE® valves should not be used in applications that exceed 1g.
2. All piping system components are subject to certain levels of erosion and corrosion. As the valve wall thickness is the governing variable in overall service life, care should be taken to ensure that all valves and related piping components are of a suitable wall thickness for the given application. Periodic inspections should also be made as valves/components may wear over time. As a minimum, annual inspection of the Body and Bonnet wall thickness should be performed with calibrated measuring devices such as micrometers and/or ultrasonic thickness gauges. Severe applications may require additional inspection types and/or frequency. Additionally, valves should be inspected for general signs of component wear and/or damage caused by process media, i.e. steam cutting. This may include the removal of insulation and/or other coverings to ensure a proper inspection. All valves should also be cycled completely during these inspections to ensure proper operability. Care should be taken to ensure that this will not affect the operating system.
3. All CRANE® valves are designed for operation in clean media. This media should be free of all debris and particulate matter. Debris in the media may cause damage and/or reduced performance to the valve.
4. The style, size, pressure class and material selection of all valves are the responsibility of the piping system designer. CRANE® may offer suggestions in this area, however the selection process is solely the responsibility of plant designers. Plant designers should also take into account the specific effects that the process media will have on the valve wall thickness and corresponding service life and ensure that the selected material is compatible with the process media. It is the responsibility of the piping designer to ensure that valves are equipped with any necessary venting and/or draining capabilities.
5. Do not exceed 100% of the maximum pressure rating of the valve at any time during its operation. Pressure spikes beyond the valve's pressure rating are solely the responsibility of the user.
6. When operating any valve stand clear of any moving parts such as the stem and/or disc assembly.
7. All manually operated CRANE® valves are designed to be tightened by hand only. Do not apply excessive input torque via pipe wrenches "cheater bars" or other devices.
8. Motor operated valves should be left in their factory set condition, unless the system operating parameters dictate a change. If changes are necessary, they should be performed in small increments and then the valve operation inspected. When adjusting these settings, use only the lightest/lowest setting possible to achieve the desired performance. Excess torque and/or thrust in the motor settings, may damage or lockup the valve. Never remove a motor operator, gear operator or manual operating assembly from a valve while it is pressurized. The valve must be completely relieved of all pressure prior to this disassembly.
9. Care should be taken to ensure that electrical motors are wired correctly to the power source. Incorrect phasing of 3-phase wiring may cause valve/motor damage.
10. The operator of any valve should have an understanding of the effects of opening/closing the valve with regards to its role in the overall piping system. Operators of valves under pressure should take caution to ensure that the valve is in good operating condition prior to operating it under pressure.
11. Certain valve applications take place at elevated temperatures. Care should be taken in these instances to ensure that an operator does not touch any portion of the valve other than the handwheel. In severe temperature applications (300°F and above), insulation may be required on the valves to protect operators from the heat.
12. Certain processes utilize flammable, caustic and/or otherwise unstable media. Care should be taken in these circumstances to ensure the operator is aware of the specific health and safety risks associated with that medium.
13. All CRANE® valves should be operated within the pressure and temperature ranges listed in Table 2 of ASME B16.34. Under no circumstances should the valves be operated at conditions outside these tables. All piping systems should contain independent support mechanisms and should not utilize the valve as a sole means of support.
14. The estimated total lifespan of a CRANE® valve when installed within ideal boundary conditions is 20 years, however, this lifespan may vary widely dependent upon operating conditions.

## Warnings

15. All valve actuators shall be sized by referring to the specific relevant valve torque and thrust data published by CRANE®. Generic or standard valve information shall not be used.
16. It is the ultimate responsibility of the piping designer to ensure that each valve is sized appropriately for the given system parameters of pressure, temperature, flow rate, velocity, pressure drop, etc. and that the proper trim is specified for the system design parameters. Additionally it is the responsibility of the piping designer to ensure that the corresponding actuator sizing data is correct for the given application.
17. Valves other than globes should not be used for throttling applications. Severe damage may occur to other valve styles. When using globe valves for throttling, do not operate the valve continuously at less than 10% open.
18. All valves shall only be used within their defined boundary conditions. All standard materials of construction, including bolting are suitable for operation within the boundary conditions listed in Section 8.0 of this document. Care should be taken to ensure that all valves are not operated at conditions that exceed or deviate from the defined boundary conditions. The boundary conditions must be adhered to regardless of the piping system status, including but not limited to: Start-up, hydro-testing, chemical cleaning, system flushing, etc.
19. Valves are not suitable to serve as block valves during system hydrostatic pressure tests that exceed 1.1 times the cold working pressure.
20. Care should be taken around all valves as injury or damage may occur from the leakage of hot, high pressure and/ or caustic materials from a gasket and/or packing joint. Additionally, packing and/or gasket leaks may cause external corrosion damage to the valve.
21. When possible, gate valves should be relieved of maximum seating force when left in the closed position. By relieving this force, it may help prevent damage caused by excessive thermal stem expansion. Care should be taken however to ensure that the valve is not opened, only that the torque/thrust has been removed from the stem.
22. It is the responsibility of the user/owner of a plant to ensure that all valve operators are ordered to meet all applicable requirements and specifications.
23. Only valves that have been certified as fire safe shall be used in piping systems that may be exposed to fire.
24. Low Emission Packing is suitable for 100 ppm. Standard graphite packing is available, but valve will be in accordance to API 600 12th edition.
25. When operating manual valves, gloves should be worn to minimize the risk of injury to the hands.
26. In situations where manual valves are difficult to operate due to substantial torque requirements, it is recommended that the valve be supplied with a gear or motor operator.
27. All valves should be mounted with the stem vertical and the pipeline horizontal. Check valves may be installed in vertical pipelines only when the normal flow is in the upward direction. For any other orientation, please contact the factory.
28. Depending upon the specific application, normal lubricants may not be sufficient for higher temperature applications. In this case, higher temperature lubricants should be used in place of the standard type.
29. All valve packing glands should be tightened in an even manner. Care should be taken to ensure that the packing gland and/or gland flange do not contact the valve stem or stuffing box during tightening.
30. Gate valves are normally installed in horizontal pipe with vertical stem. They can also be installed other than vertical, but this may require special construction depending on valve size, service condition and medium. Different positions may cause poor valve operation, and/or a quick deterioration of the valve.
31. The preferred orientation of a gate valve is upright. The valve may be installed in other orientations, but any deviation from vertical is a compromise. It is best to consult Crane Engineering department during quotation review process as to remedial measures required (hardfacing of guides) when valves will be installed in a non-vertical orientation.
32. If a valve is to be installed in a non-vertical position, Take extra time during installation or repair to ensure that all pieces are functioning properly without the occurrence of any scratching. These precautions can help to avoid a costlier repair down the road that requires removal of the valve.

# General Valve Operation & Maintenance

## 1.0 THEORY OF OPERATION

**GATE VALVES** | Gate valves are designed to close off or open up the flow in a pipeline. The wedge is designed to completely stop flow and form a tight seal against pressure in either direction. In the open position, the wedge is completely out of the flow stream. Gate valves are not recommended for throttling use.

**GLOBE VALVES** | Globe valves are designed to close off, open up or throttle the flow in a pipeline. The disc is designed to completely stop flow and form a tight seal with pressure under the disc. In the 10% open position to full open position, globe valves are effective in throttling line pressure.

*NOTE: Continuous throttling at less than 10% open may cause excessive vibration, noise, wear and damage to discs and seats.*

**CHECK VALVES** | Swing check valves are designed to open by the system pressure in a line. The normal direction of flow in the line will open the valve, and any attempt by the flow to reverse will close the valve completely. The check valve typically does not require any outside force or signal to operate properly. Check valves allow flow in one direction only.

## 2.0 DESCRIPTION

This manual covers all CRANE® bolted bonnet valves. These valves are designed within the limits of ASME B16.34, API 600, API 623, and API 594. For the Operator and Mounting Topworks of these valves, the user is referred to the applicable Section in this manual. See Section 5.0 for Operation of Valves. This manual is for reference purposes only. Disassembly and maintenance of valves should only be performed by qualified personnel. Consult CRANE® for specific technical support.

For Specific information regarding a particular style of valve, please refer to the corresponding detailed Section.

## 3.0 INSTALLATION

When unpacking, care should be exercised in lifting and handling to avoid damage to valves or injury to personnel. Do not lift any valve by the handwheel or stem. Use lifting lugs or straps around the valve body. For specific Installation Information, please refer to Section G of this manual.

When installing, ensure that all foreign material is removed from the interior of the valve, including desiccants.

*NOTE: Do not remove protective end coverings until immediately prior to valve installation.*

*NOTE: Do not disassemble or modify a CRANE® valve in any way prior to installation. This will void the factory warranty if it occurs.*

When installing flanged or ring joint end flex wedge gate or globe valves into the line, it is advisable to have the valve slightly open to prevent the wedge from becoming “stuck” due to thermal expansion and to discourage damage to the seating surfaces. There is an exception to this with Butt-weld end valves, they should be installed in a lightly closed position. See Valve Installation Section G.

A protective paint may have been applied to the weld ends on some valves, and it should be removed before welding, unless it is a deoxaluminite paint which acts as a welding flux and does not need to be removed.

Use the smallest electrodes and the minimum amperage possible consistent with approved welding procedures. This will help to minimize warpage in the seat areas. Tack welds should be ground out before completing the root pass in that area.

Valves of carbon steel should be allowed to cool slowly. The valve may be covered with a heat-insulating blanket to promote slow cooling and limit the heat-affected zone. Appropriate industry standards should be followed for all PWHT.

Certain valve types are designed to function in a single direction (check valves, etc.) All markings should be noted on the valves. Arrows on the valves indicating flow direction should correspond with the system flow direction.

*NOTE: Ensure that all foreign material (dirt, weld slag, rocks, wood construction materials, weld rod, etc.) has been removed from the valve prior to and after installation. Foreign material is the primary cause of premature seat failures.*

## 4.0 WARRANTY

All CRANE® valves are backed by a full manufacturer's warranty against defects in materials or workmanship. It should be noted that any work or modification performed on a CRANE® valve must be authorized by CRANE® in order to retain the original factory warranty.

# General Valve Operation & Maintenance

## 5.0 OPERATING INSTRUCTIONS

CRANE® valves are designed for simplicity and ease of operation. To open a gate, globe, or stop check valve, turn the handwheel in a counterclockwise direction; continue turning until interference is felt; at this point, the valve will be fully open. To close the valve, turn the handwheel in a clockwise direction; continue turning until interference is felt; at this point, the valve will be fully closed. Swing, lift and tilting disc check valves are designed to be operated by line pressure only. When the upstream line is pressurized, flow will open the disc. When the pressure is reduced upstream, or if there is backpressure, the disc will close.

With some larger valves under conditions of high pressure, a rim pull of more than 250 lbs. may be required to achieve proper seating. **CAUTION! - These valves were designed to operate within the pressure and temperature limits of ASME B16.34. Do not exceed these limits.**

## 6.0 MAINTENANCE

Item to Inspect	Gate	Globe	Check
Check Stem threads for wear	•	•	
Check for Packing leaks	•	•	
Check body/bonnet joint for leaks	•	•	•
If conditions permit, operate valve	•	•	
Inspect all external connections	•	•	•
Ensure Stem and seal areas are free from debris	•	•	
Check all lubrication points	•	•	
Inspect condition of motor and/or gear operators (when used)	•	•	
Inspect valve for obvious damage	•	•	•

### 6.1 PREVENTATIVE MAINTENANCE AND PERIODIC INSPECTION

CRANE® recommends that periodic inspections be made of all valves. The frequency of these inspections will vary, depending upon the severity of service and frequency of operation of the valve. As a minimum, all valves should be checked quarterly to ensure proper operation and discourage the damage compounding effects of leakage. The following list details the specific valve types and areas requiring inspection and maintenance.

**Warning! Do not remove or loosen the packing gland or bonnet bolts while the valve is pressurized.**

### 6.2 MAINTENANCE OF VALVE UNDER PRESSURE

If the above listed inspections reveal any indications, the following procedures are recommended:

*NOTE: Extreme care should be taken when working on any pressurized system!*

**6.2.1** If the stem packing is leaking, the eyebolt nuts on the gland flange should be tightened uniformly until the leakage stops. If the leakage continues or there is no adjustment remaining, additional packing must be installed or the packing must be replaced. (See disassembly procedure for appropriate Valve or Packing and Gasket Maintenance Section H) It should also be noted that the valve should be able to operate freely at all times. If the valve cannot operate due to excessive packing force, the packing has become worn and must be replaced during a system shutdown.

**6.2.2** The stem threads that are exposed to atmosphere should be periodically lubricated to reduce wear, operating torque, and to deter corrosion. Care should be taken to ensure that only the threaded portion of the stem is lubricated. CRANE® does not recommend the practice of lubricating the sealing area of the stem, in the absence of lantern rings or with the exception when lantern rings are installed. This practice tends to attract debris and foreign material, which can lead to stem or stuffing box damage.

**6.2.3** The yoke sleeve should be lubricated periodically through the grease fitting to ensure smooth operation. Lubrication should be inspected and revised at each application. Each installation may have specific requirements/ specifications regarding lubrication.

**6.2.4** If leakage develops at the body/bonnet joint of a bolted bonnet valve, the bonnet stud nuts should be tightened uniformly. This tightening should be done in accordance with the Bolting Torque Section E of this manual.

**CAUTION! Do not overstress the bolting. If leakage continues, the gasket should be replaced. (See the Bolting Torque Section E or the appropriate valve disassembly procedure.)**

**6.2.5** If normal inspection reveals a binding or galling action of valve operating parts, it is advisable to dismantle and inspect the valve parts during a system shutdown. Contact CRANE® prior to disassembling any valve.

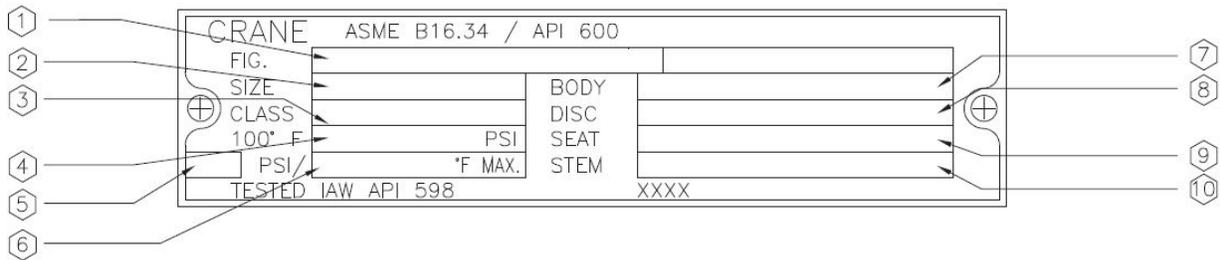
# General Valve Operation & Maintenance

## 7.0 IDENTIFICATION

All CRANE® valves are identified with a metal Tag that is riveted to the valve. This tag is usually found on the body/ bonnet joint area, or on the top plate area near the handwheel.

Explanation of Tag Markings		
1	Figure Number	Number identifying the valve's main features including material, class, trim, end connections, and operator type. See the following Sections for classification of Figure Numbers.
2	Size	Nominal pipe size (NPS) of the valve.
3	ASME B16.34 Class	Pressure class rating of the valve as defined in ASME B16.34, Section 2.
4	PSI @100°F	Pressure in psig at which the valve is rated to operate when the temperature does not exceed 100°F.
5	PSI @ Max °F	Maximum pressure at which the valve may be operated at the maximum temperature allowed by ASME B16.34, Table 2.
6	Max °F	Maximum temperature at which the valve may be operated within the limits of pressure allowed by ASME B16.34, Table 2.
7	Body	Body ASTM material grade designation.
8	Disc	Disc or Wedge trim material.
9	Seat	Seat trim material.
10	Stem	Stem material.
	XXXX	Country of Origin.

When performing any work, ordering spare parts, or requesting technical support, please refer to this tag. The Serial number is stamped on the valve flange ends. The Figure number (1) and Factory code (J###) cast on the side of the valve body are keys to proper valve identification.



Valves with a prefix "L" in figure number will have an API 624 tag riveted to the valve. This tag designates the valve meeting API 624 for low fugitive emissions.

# General Valve Operation & Maintenance

## 7.1 FIGURE NUMBER DEFINITION FOR GATE, GLOBE AND CHECK VALVES

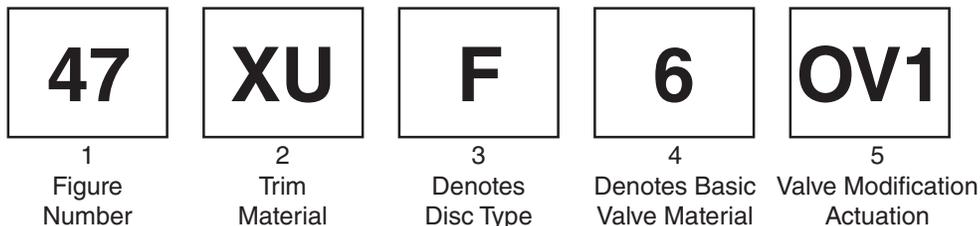


Figure Number Definition for Gate, Globe and Check Valves		
1	Figure Number	Basic Valve Figure Number (See Section 7.2 for details)
2	Trim Material	<u>API Trim Number:</u> 1 X 13% chrome stem (410), 13% chrome disc facing and seat ring facing 8 XU 13% chrome stem (410), 13% chrome disc facing with Stellite faced seat rings 12 LU 316 stem, 316 stainless and Stellite seat facing 11 AU Monel stem, Monel and Stellite seat facing 10 L 316 stem, 316 stainless seating surfaces 9 A Monel Stem, Monel seating surfaces 5 U 13% chrome stem (410), Stellite seat facing
3	Disc Type	F Flex-Wedge (Applies only to Gate Valves)
4	Basic Valve Material	Blank WCB 6 ASTM A217, WC6 9 ASTM A217, WC9 5 ASTM A217, C5 12 ASTM A217, C12 2 ASTM A352, LCC 8M ASTM A351, CF8M 8 ASTM A351, CF8
5	Valve Modification Actuation Suffix	<u>Special features are identified by this letter suffix, the most popular:</u> OV1 Gear Actuator OV2 Chainwheel Actuator OV3 Electric Actuator OV4 Pneumatic Actuator OV5 Hydraulic Actuator OV6 Other RJ Ring Joint

Note: Prefix "L" refers to API 624 compliance

# General Valve Operation & Maintenance

## 7.2 APPROPRIATE MAINTENANCE MANUAL SECTION FOR A GIVEN VALVE FIGURE NUMBER/STYLE

The following charts denotes the appropriate maintenance manual Section for a given valve figure number/style. Please note that the Sections listed are the specialized Sections only and pertinent general valve information is contained in other Sections of this manual. Please refer to table of contents for total listings.

### API 600 BOLTED BONNET - GATE VALVE, OS&Y

### Manual Section

Class 150, solid wedge gate valve	B
Class 150, flexible wedge gate valve	B
Class 300, solid wedge gate valve	B
Class 300, solid wedge gate valve w/double ball grease injector in seat and stuffing box	B
Class 300, flexible wedge gate valve	B
Class 300, flexible wedge gate w/double ball grease injector in seat and stuffing box	B
Class 600, solid wedge gate valve	B
Class 600, flexible wedge gate valve	B
Class 900, solid wedge gate valve	B
Class 900, flexible wedge gate valve	B
Class 1500, solid wedge gate valve	B
Class 1500, flexible wedge gate valve	B

### BUILT TO MEET THE REQUIREMENTS OF ASME B16.34 AND DESIGN PARAMETERS OF API 600 - BOLTED BONNET - GLOBE VALVE, OS&Y

Class 150, plug type disc globe valve	C
Class 150, plug type disc globe valve w/extra deep stuffing box	C
Class 300, plug type disc globe valve	C
Class 300, plug type disc globe valve w/extra deep stuffing box	C
Class 300, plug type disc globe with double ball grease injector in stuffing box and seat	C
Class 600, plug type disc globe valve	C
Class 900, plug type disc globe valve	C

### BUILT TO MEET THE REQUIREMENTS OF ASME B16.34 AND DESIGN PARAMETERS OF API 600 - BOLTED BONNET - SWING CHECK VALVE

Class 150, swing check valve	D
Class 150, swing check valve w/outside lever & weight	D
Class 150, swing check valve w/internal hinge pin	D
Class 150, severe service swing check valve	D
Class 300, swing check valve	D
Class 300, swing check valve w/outside lever & weight	D
Class 300, swing check valve w/internal hinge pin	D
Class 600, swing check valve	D
Class 600, swing check valve w/outside lever & weight	D
Class 600, swing check valve w/internal hinge pin	D
Class 900, swing check valve w/internal hinge pin	D
Class 1500, swing check valve w/internal hinge pin	D

# General Valve Operation & Maintenance

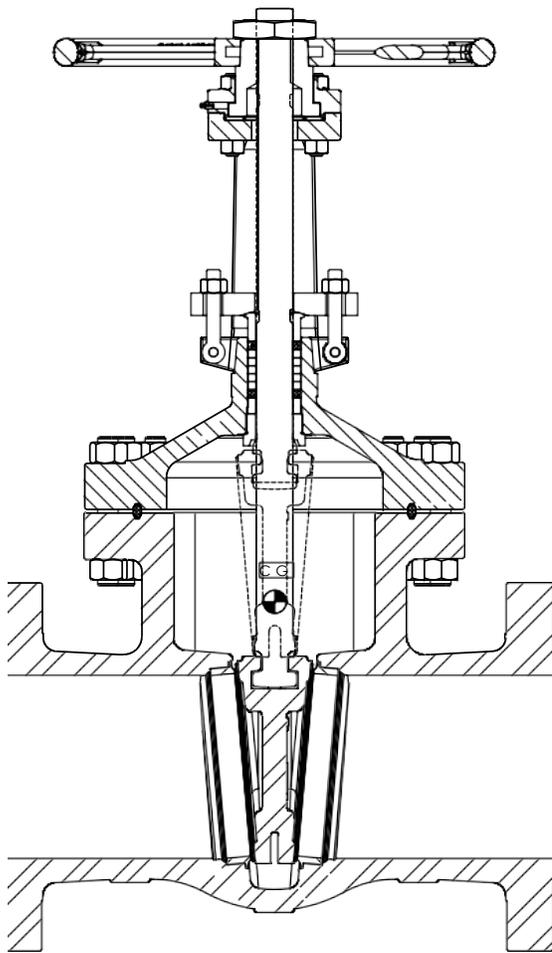
## 8.0 BOUNDARY CONDITIONS

The following chart denote the defined boundary conditions for all CRANE Energy Flow Solutions Valve products.

Boundary Conditions for Bolted Bonnet Products									
Scope of Product	½” through 36” Class 150 through 1500.								
Service fluid	<ul style="list-style-type: none"> <li>Water, steam, gas, or hydrocarbon compounds.</li> <li>Corrosive or toxic fluids when used within the parameters defined herein.</li> <li>No suspended solid material greater than 100 microns.</li> </ul>								
Service life	20 years or when corrosion significantly affects the wall thickness as defined by API 600 and ASME B16.34. This excludes normal maintenance parts such as packing, seals, gaskets and parts that move relative to each other e.g. seats, stems and bushings.								
Allowable pressure and temps.	Per Table 2 ASME B16.34.								
Materials for pressurized parts	<p>Only materials approved by relevant governing body may be used. Refer to the approved CE materials list. Appropriate material for service conditions to be based upon the following criteria:</p> <ol style="list-style-type: none"> <li>The design pressure and temperature.</li> <li>An acceptable service life consistent with the corrosion rate of the material at design conditions.</li> <li>Expected operating conditions within the defined pressure cycles, thermal cycles and flow velocity limits.</li> </ol>								
Packing and gasket materials	To be compatible with expected operating conditions.								
Method of operation	<ul style="list-style-type: none"> <li>Gate and Globe: Handwheel, Manual Gear, Motor Actuator, Air or Hydraulic cylinder Actuator.</li> <li>Check: self-actuation.</li> </ul>								
Frequency of operation	<ul style="list-style-type: none"> <li>Gate and Globe valves: not to exceed once per week or 50 per year.</li> <li>Check: N/A.</li> </ul>								
Installation orientation	<ul style="list-style-type: none"> <li>Gate and Globe: Stem vertical up in a horizontal pipe run.</li> <li>Check: Flow horizontal in a horizontal pipe run or Vertical up in a vertical pipe run.</li> </ul>								
Flow velocity	<ul style="list-style-type: none"> <li>To keep noise and erosion at or below reasonable levels, valves are not to be used for throttling service, and velocity is not to exceed the values shown in table below.</li> <li>Check valves should operate at or above the velocity indicated to stabilize the disc and avoid premature wear.</li> </ul> <p>Maximum flow velocity for gate, globe and check valves:</p> <table style="margin-left: 20px;"> <tr> <td>Gate</td> <td><math>300\sqrt{\bar{v}}</math></td> <td>T-globe</td> <td><math>120\sqrt{\bar{v}}</math></td> </tr> <tr> <td>Std check</td> <td><math>200\sqrt{\bar{v}}</math></td> <td>Clear way Check</td> <td><math>240\sqrt{\bar{v}}</math></td> </tr> </table> <p>Minimum flow velocity for check valves is <math>55\sqrt{\bar{v}}</math></p> <p>Where <math>\bar{v}</math> = Specific volume of flowing medium in ft<sup>3</sup>/lb</p>	Gate	$300\sqrt{\bar{v}}$	T-globe	$120\sqrt{\bar{v}}$	Std check	$200\sqrt{\bar{v}}$	Clear way Check	$240\sqrt{\bar{v}}$
Gate	$300\sqrt{\bar{v}}$	T-globe	$120\sqrt{\bar{v}}$						
Std check	$200\sqrt{\bar{v}}$	Clear way Check	$240\sqrt{\bar{v}}$						
Hydrostatic test	1.5 times the 100°F rating pressure in ASME B16.34 for the body material.								
Pressure cycles	Unlimited cycles < Design Pressure/3.								
Thermal cycles	Unlimited cycles < 30°F.								
Heat up/cool down rate	Not to exceed 100°F per hour for 2000 cycles.								
Pipe & support reactions	All reaction loads transmitted through valve ends. Cross section and Moment of Inertia of valve ends to be greater than that of the connecting pipe.								
External fire capability	Valve seats of standard product may be solid metal or may contain plastic inserts. Solid metal seats are not suitable for a sustained external heat source greater than 1500°F. Plastic inserted seats are not suitable for temperatures greater than 450°F.								
Wind and earthquake rating	1 g load in any direction.								
Vent or drain method	None.								

# **SECTION B**

## **Bolted Bonnet Gate Valves**



# Bolted Bonnet Gate Valves

## 1.0 GENERAL INFORMATION

For General Operation & Maintenance Information regarding this or any other CRANE® valve please refer to Section A of this manual.

## 2.0 COMPLETE DISASSEMBLY

**CAUTION!** Before disassembling any valve, ensure that all pressure has been removed from the line and from any cavities within the valve. Contact CRANE® before disassembling any valve.

**2.1 HANDWHEEL OPERATED VALVES** | Upon completion of the disassembly procedure listed below, the handwheel 12 may be separated from the stem nut 7, by removing the handwheel nut 13.

**2.2 GEAR AND MOTOR OPERATED VALVES** | Refer to Section J, Gear and Motor Information.

**2.3** | The following page contains a general disassembly and reassembly procedure. These procedures cover the bulk of the disassembly and reassembly process, for specific information regarding general valve information, actuators, packing and gaskets, etc., please refer to the appropriate Section.

## 3.0 MAINTENANCE OF DISASSEMBLED VALVES

**3.1** | Following the disassembly procedures listed below, examine the body cavity 1 for deposits of foreign material.

**3.2** | Examine seating surfaces of seat rings 4 and disc/wedge 3 for wear.

**3.3** | Examine stem 5, seal area, and threads for excessive wear. If excessive wear is evident, worn parts, or if necessary, the entire valve should be reconditioned or replaced.

**3.5** | CRANE® can offer complete replacement seal kits and spare parts for reconditioning. When ordering, always state the figure number, factory code, serial number and the valve body/trim material.

**3.6** | CRANE® also offers complete remanufacturing services to rework your valve. If you find this necessary, our nationwide network of CRANE® Valve Service Centers will remanufacture your valve to factory specifications.

## 4.0 LUBRICATION

**4.1** | Parts requiring lubrication are stem and stem Nut threads 5,7, entire gasket 14, and under all nuts 16 before torquing. Bonnet studs and nuts should be lubricated with an antisieze lubricant.

## 5.0 SPECIAL TOOLS AND INSTRUCTIONS

**5.1** | Recommended Bolting Torques are shown in Section E of this manual

**5.2** | No special tools are required for general valve maintenance.

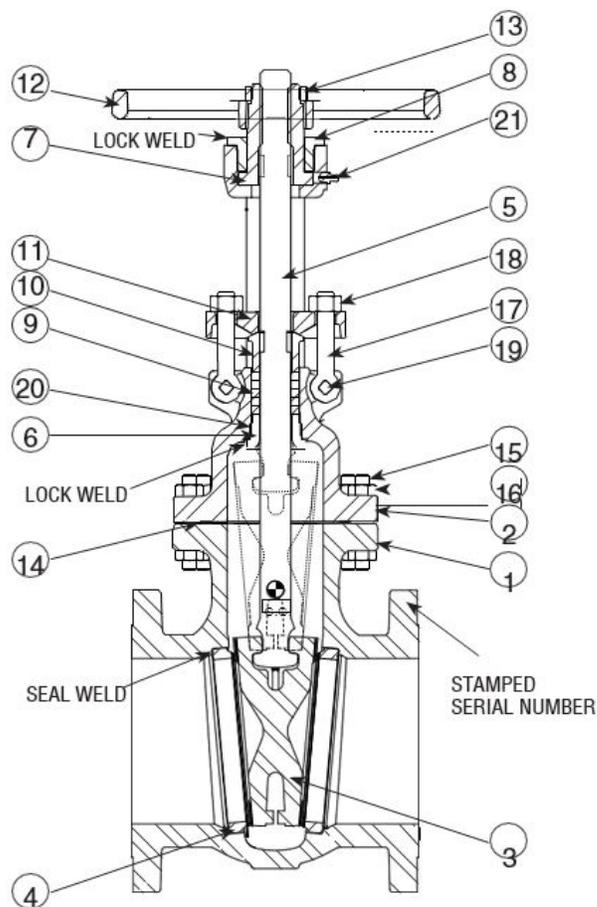
## 6.0 PREVENTATIVE MAINTENANCE

**6.1** | Refer to Section A of this manual for General Valve Maintenance Information.

# Bolted Bonnet Gate Valves Class 150, 300, 600 & 900 - All Sizes

## DISASSEMBLY

- Read the warning notice in Section 2.0 of these instructions.
- Loosen and remove the packing gland eyebolt nuts 18.
- Loosen and remove the bonnet nuts 16 and studs 15.
- Using a strap or similar device (when necessary) lift the bonnet assembly 2 up and away from the valve body 1. Note and mark the orientation of the disc/wedge to the valve body and seats.
- Remove the disc/wedge 3 from the stem 5.
- While holding the stem 5, turn the handwheel 12 in a clockwise direction to draw out the stem.
- Once the stem has been removed, the gland 10 and the gland flange 11 may be removed.
- Remove the packing 9 using a packing hook or similar tool. Care should be taken to ensure that there is no damage to the stuffing box surface.
- Remove the gasket 14 from the valve body.
- If necessary, remove the handwheel nut 13 and the handwheel 12.
- Remove the stem nut retainer 8. This may require the removal of set screws or the removal of tack welds, depending upon the valve configuration.
- Remove the stem Nut 7.
- Unless there is significant damage, the Backseat bushing 6 should not be removed.



## REASSEMBLY

- Clean all parts thoroughly. Lubricate the seating surfaces with a light oil to discourage galling during reassembly.
- Install a new gasket 14.
- Install new packing 9, if necessary. Also install gland 10 and gland flange 11.
- Install stem 5 into bonnet assembly.
- Reinstall the packing gland eyebolt nuts 18.
- Replace disc/wedge 3 onto stem.
- Install bonnet and wedge assembly into valve body 1, noting the previously made marks to indicate the wedge orientation in the body.
- Reinstall bonnet studs 15 and nuts 16.
- Tighten the bonnet studs to the values listed in Section E of this manual.

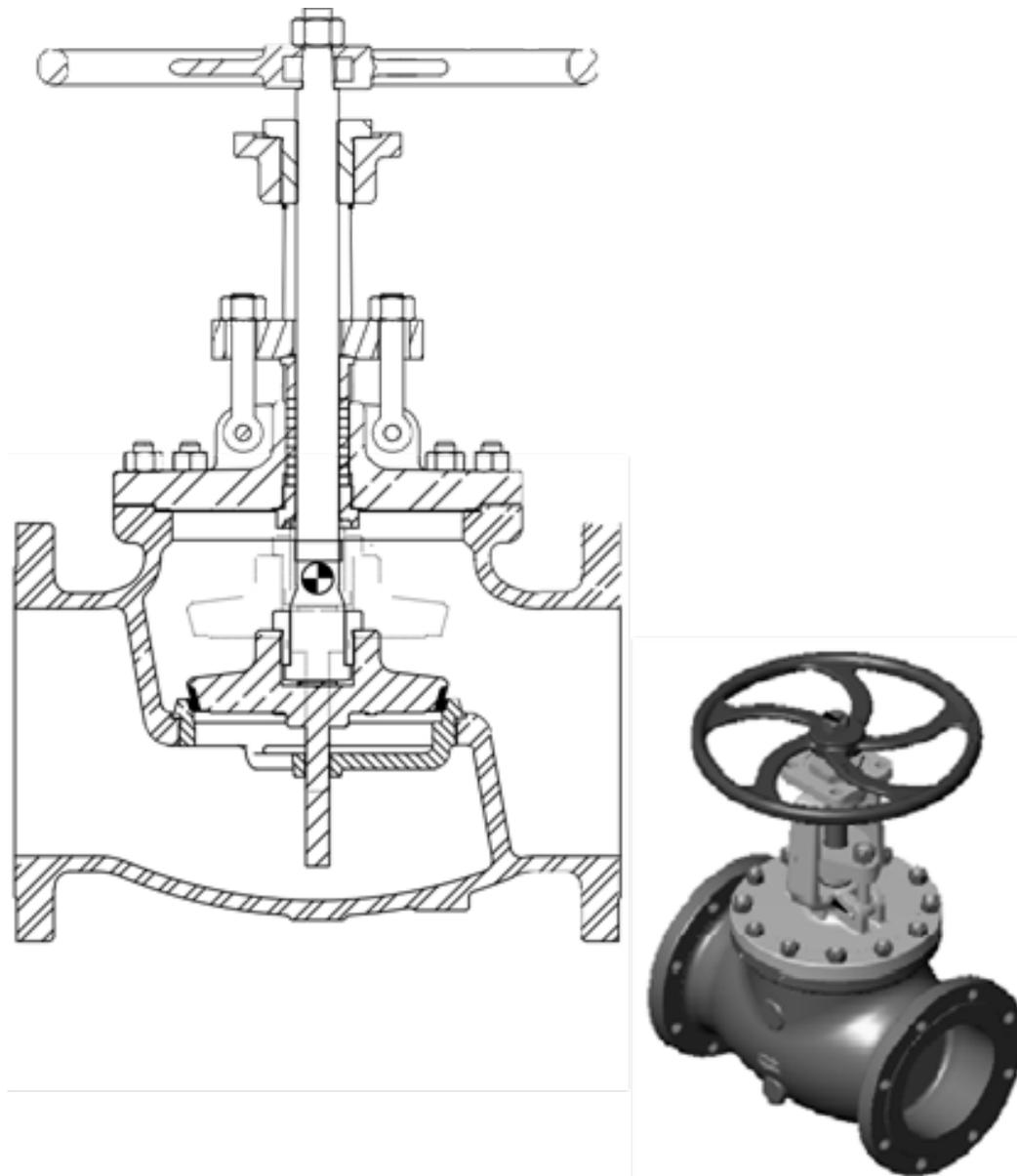
Item	Description	Item	Description
1	Body	12	Handwheel
2	Bonnet	13	Handwheel Nut
3	Disc	14	Gasket
4	Seat Ring	15	Bonnet Stud Bolt
5	Stem	16	Bonnet Stud Nut
6	Backseat Bushing	17	Eye Bolt
7	Stem Nut	18	Eye Bolt Nut
8	Stem Nut Retainer	19	Eye Bolt Pin
9	Packing	20	Spacer Bushing
10	Gland	21	Grease Fitting
11	Gland Flange	22	ID Tag (Not Shown)

If replacing packing for a valve qualified to API 624, please make sure to use API 622 Low Emission packing.



# SECTION C

## Bolted Bonnet Globe/ Stop Check Valves



*\* For illustration purposes only, Globe design supplied may or may not include plug guide.*

# Bolted Bonnet Globe Valves

## 1.0 GENERAL INFORMATION

For General Operation & Maintenance Information regarding this or any other CRANE® Valve please refer to Section A of this manual.

## 2.0 COMPLETE DISASSEMBLY

CAUTION! Before disassembling any valve, ensure that all pressure has been removed from the line and from any cavities within the valve. Contact CRANE® before disassembling any valve.

**2.1 HANDWHEEL OPERATED VALVES** | Upon completion of the disassembly procedure listed below, the handwheel 50 may be separated from the yoke sleeve 31, by removing the handwheel nut 54.

**2.2 GEAR AND MOTOR OPERATED VALVES** | Refer to Section J of this manual for specific Gear and Motor Information.

**2.3** | The following page contains a general disassembly and reassembly procedure. These procedures cover the bulk of the disassembly and reassembly process, for specific information regarding general valve information, actuators, packing and gaskets, etc., please refer to the appropriate Section.

## 3.0 MAINTENANCE OF DISASSEMBLED VALVES

**3.1** | Following the disassembly procedures listed below, examine the body cavity 10 for deposits of foreign material.

**3.2** | Examine seating surfaces of seat ring 11 and disc 71 for wear.

**3.3** | Examine stem 70, seal area and threads for excessive wear.

**3.4** | If excessive wear is evident, worn parts, or if necessary, the entire valve should be reconditioned or replaced.

**3.5** | CRANE® offers complete replacement seal kits and spare parts for reconditioning. When ordering, always state the figure number (or stock number) and serial number of the valve and the body material.

**3.6** | CRANE® also offers complete remanufacturing services to rework your valve. If you find this necessary, our nationwide network of CRANE® Valve Service Centers will remanufacture your valve to factory specifications.

## 4.0 LUBRICATION

**4.1** | Parts requiring lubrication are stem and yoke sleeve threads 70, 31, entire gasket 55, and under all nuts 16 & 17 before torquing. Bonnet studs and nuts should be lubricated with an antisieze lubricant to promote ease of future disassembly.

## 5.0 SPECIAL TOOLS AND INSTRUCTIONS

**5.1** | Recommended Bolting Torques are shown in Section E of this manual

**5.2** | No special tools are required for general valve maintenance.

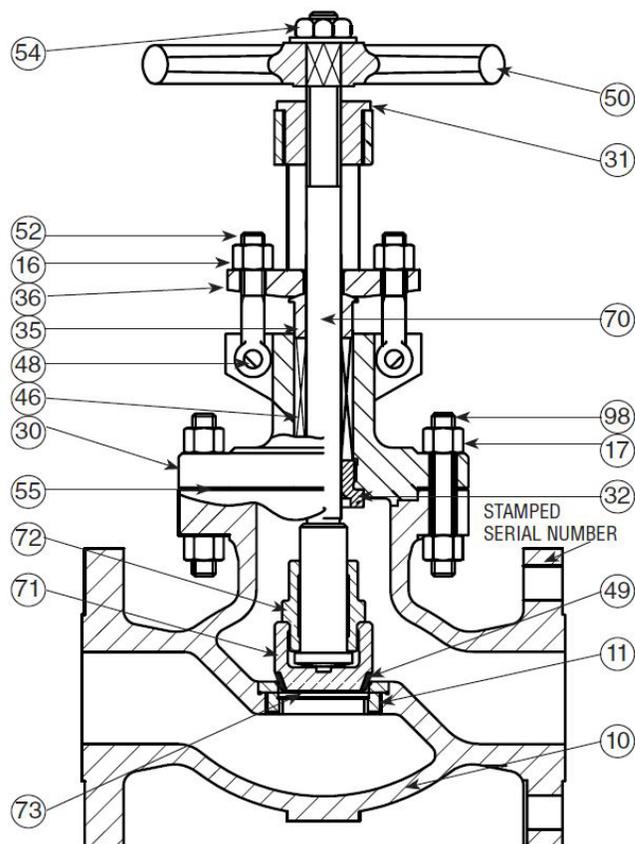
## 6.0 PREVENTATIVE MAINTENANCE

**6.1** | Refer to Section A of this manual for General Valve Maintenance Information.

# Bolted Bonnet Globe Valves Class 150, 300, 600 & 900 - All Sizes

## DISASSEMBLY

- Read the warning notice in Section 2.0 page of these instructions.
- Loosen and remove the packing gland bolts 16.
- Loosen and remove the bonnet nuts 17 and studs 98.
- Using a strap or similar device (when necessary) lift the bonnet assembly 30 up and away from the valve body 10.
- Remove the disc 71 from the stem 70 by grinding off the tack welds 48 on the lock nut 72 or by removing the disc pin 49.
- Remove the wheel nut 54 and the handwheel 50.
- Remove the stem 70 by turning it until it is free of the yoke sleeve 31.
- Once the stem has been removed, the gland 35 and the gland flange 36 may be removed.
- Remove the packing 46 using a packing hook or similar tool. Care should be taken to ensure that there is no damage to the stuffing box surface.
- Remove the gasket 55 from the valve body.
- If necessary, remove the yoke sleeve 31 by unscrewing it counterclockwise. Note it may be necessary to remove set screws, depending upon valve configuration.
- The bonnet stem bushing 32 should not be removed unless damaged.



## REASSEMBLY

- Clean all parts thoroughly. Lubricate the seating surfaces with a light oil to discourage galling during reassembly.
- Install a new gasket 55.
- Install new packing 46, if necessary. Also install gland 35 and gland flange 36.
- Install stem 70 into bonnet assembly.
- Reinstall the packing gland nuts 16.
- Replace disc 71 and lock nut 72 on to stem.
- Replace disc pin 49, if provided
- Install bonnet and disc assembly into valve body 10.
- Reinstall bonnet studs 98 and nuts 17.
- Tighten the bonnet studs to the values listed in Section E of this manual.

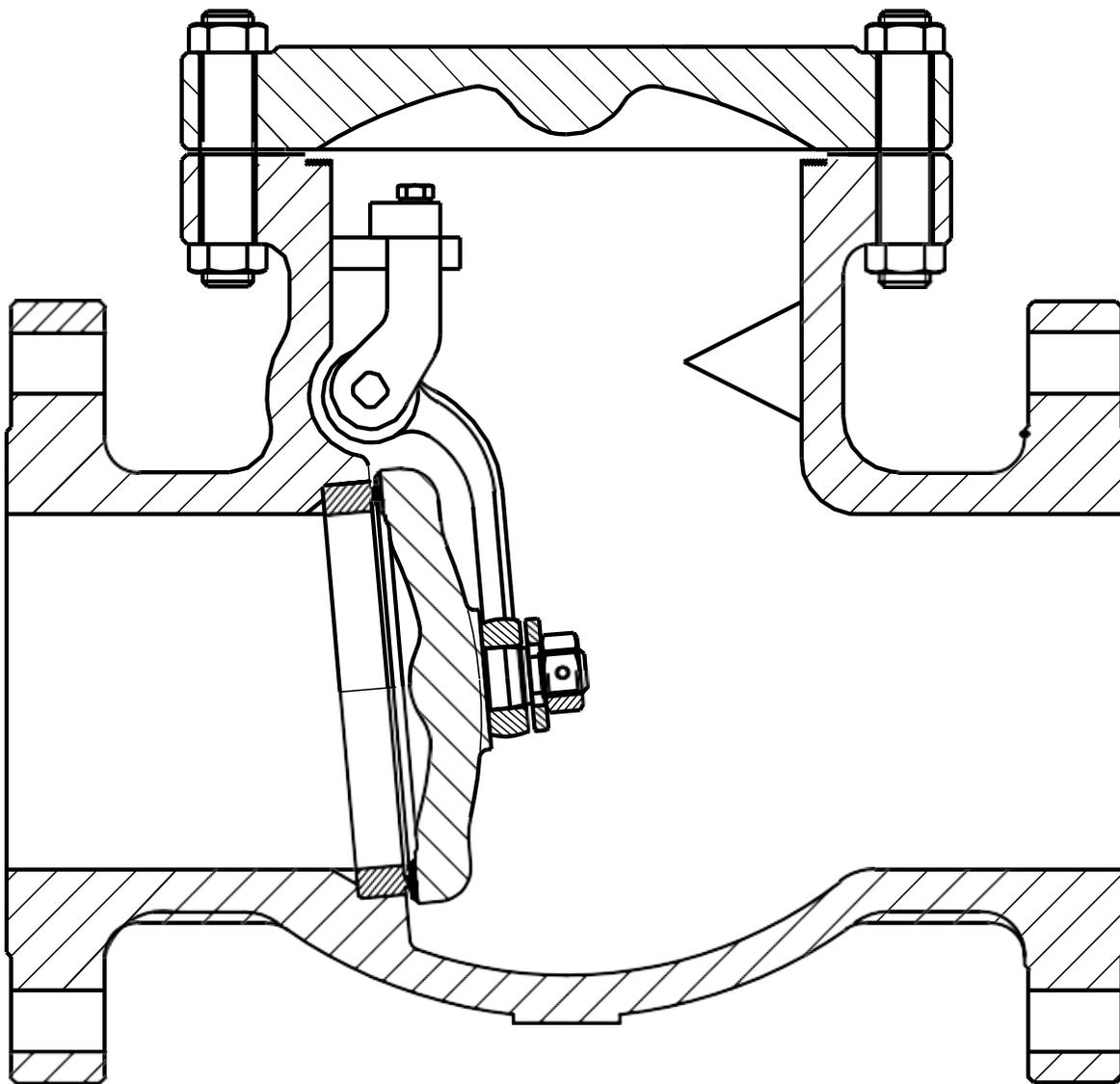
Item	Description	Item	Description
10	Body	49	Disc Pin
11	Seat Ring	50	Handwheel
16	Nut	52	Eye Bolt
17	Nut	54	Wheel Nut
30	Bonnet	55	Gasket
31	Yoke Sleeve	70	Stem
32	Bonnet Stem Bushing	71	Disc/Plug
35	Packing Gland	72	Lock Nut
36	Gland Flange	73	Thrust Washer
46	Packing	98	Bonnet Studs
48	Eye Bolt Pin		

If replacing packing for a valve qualified to API 624, please make sure to use API 622 Low Emission packing.



# SECTION D

## Bolted Bonnet Swing Check Valves



*For illustration purposes only. Design supplied may be internal hung or have hinge with external plug access.*

# Bolted Bonnet Swing Check Valves

## 1.0 GENERAL INFORMATION

For general information regarding this or any other valve please refer to Section A of this manual.

## 2.0 COMPLETE DISASSEMBLY

**CAUTION!** Before disassembling any valve, ensure all pressure has been removed from the line and from any cavities within the valve. Contact CRANE® before disassembling any valve.

### 2.1 HANDWHEEL OPERATED VALVES (IF APPLICABLE)

Upon completion of the disassembly procedure listed below, the handwheel may be separated from the yoke sleeve, by removing the handwheel nut.

**2.2 GEAR AND MOTOR OPERATED VALVES** | Refer to Section J of this manual for specific Gear and Motor Information.

**2.3** | The following page contains a general disassembly and reassembly procedure. These procedures cover the bulk of the disassembly and reassembly process, for specific information regarding general valve information, actuators, packing and gaskets, etc., please refer to the appropriate Section.

## 3.0 MAINTENANCE OF DISASSEMBLED VALVES

**3.1** | Following the disassembly procedures listed below, examine the body cavity 10 for deposits of foreign material.

**3.2** | Examine seating surfaces of seat ring 11 and disc 71 for wear.

**3.3** | Examine hinge 40 and hinge pin 41 for wear.

**3.4** | If excessive wear is evident, worn parts, or if necessary the entire valve should be reconditioned or replaced.

**3.5** | CRANE® offers complete replacement seal kits and spare parts for reconditioning. When ordering, always state the figure number (or stock number) of the valve and the body material.

**3.6** | CRANE® also offers complete remanufacturing services to rework your valve. If you find this necessary, our nationwide network of CRANE® Valve Service Centers will remanufacture your valve to factory specifications.

## 4.0 LUBRICATION

**4.1** | Parts requiring lubrication are; entire gasket 55, and under all nuts 16 before torquing. Bonnet studs and nuts should be lubricated with an antisieze lubricant to promote ease of future disassembly.

## 5.0 SPECIAL TOOLS AND INSTRUCTIONS

**5.1** | Recommended Bolting Torques are shown in Section E of this manual

**5.2** | No special tools are required for general valve maintenance.

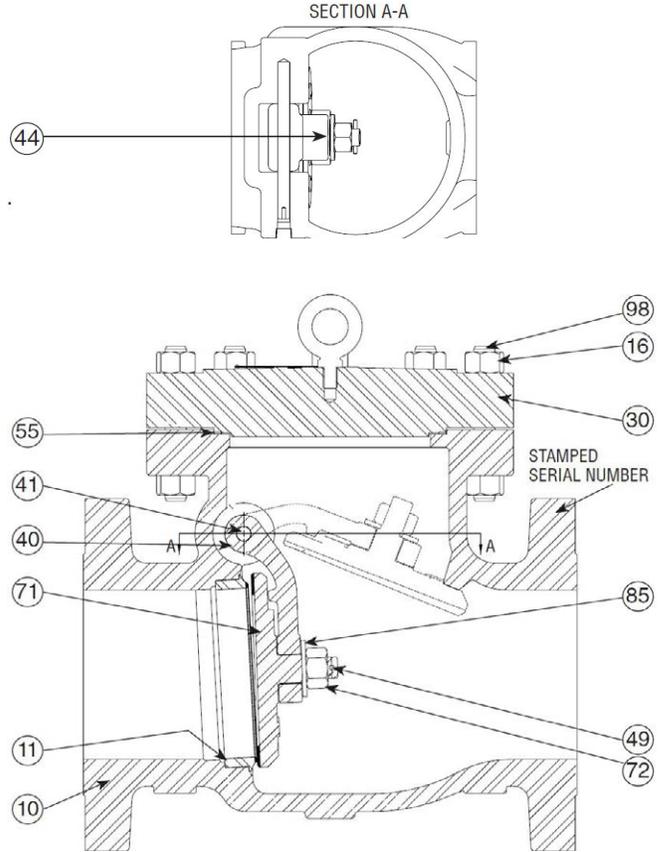
## 6.0 PREVENTATIVE MAINTENANCE

**6.1** | Refer to Section A of this manual for General Valve Maintenance Information.

# Bolted Bonnet Swing Check Valves Class 150, 300, 600 & 900 - All Sizes

## DISASSEMBLY

- Read the warning notice in Section 2.0 of these instructions.
- Loosen and remove the bonnet nuts 16 and studs 98.
- Remove and discard the gasket 55.
- Remove the disc nut retention system 49. This may include the disc nut pin and or a tack weld.
- Remove the disc nut 72 disc washer 85 and disc 71. Care should be taken to ensure that the disc is not damaged upon removal.
- Remove the hinge mount
- Remove the hinge and disc assembly from the valve.  
Note the position and quantity of any shims or spacers (when used).
- If necessary, remove the hinge pin 41 from the hinge 40.



## REASSEMBLY

- Clean all parts thoroughly.
- Reinstall hinge/disc assembly in reverse order
- Care should be taken to reinstall/apply any lock devices on the disc to disc nut connection.
- Install a new gasket 55.
- Tighten bonnet fasteners to the values listed in Section E of this manual.

Item	Description	Item	Description
10	Body	49	Disc Nut Pin
11	Seat Ring	55	Gasket
16	Nut	71	Disc
30	Cover/Bonnet	72	Disc Nut
40	Hinge	85	Disc Washer
41	Hinge Pin	98	Stud
44	Hinge Mount		



# SECTION E

## Bolting Torque Valves



# Bolting Torque Data

## 1.0 GENERAL INFORMATION

For General Valve Operation & Maintenance Information please refer to Section A of this manual. This Section details the specific torque values recommended by CRANE® for bolting used in all CRANE® products.

## 2.0 STANDARD PROCEDURES

**CAUTION! The torque values in this section only apply to the body bonnet joints and flange joints. Please reference section H for packing torques.**

**2.1** | Always use new bolting materials.

**2.2** | Verify that the materials are compatible with the process system as well as any temperature or pressure requirements. Note that bolting materials can have minor identification changes which may have a substantial impact on performance, ie. B7M vs. B7.

**2.3** | Whenever allowed by system and process parameters, use appropriate lubrication to ensure even tightening of the bolting materials. For higher temperature applications, the use of an “Antisieze” compound may be necessary to promote future disassembly.

## 3.0 ASSEMBLY AND MAINTENANCE OF FLANGED JOINTS

When a flanged joint is assembled, each of the component parts is subject to tensile or compressive stresses of varying magnitude. In the great majority of cases, it is adequate to tighten the bolts sufficiently to withstand the test pressure without leakage.

The maximum allowable stress values for bolting given in the various codes such as ASME Boiler and Pressure Vessel Code and the ASME Code for Pressure Piping are design values to be used in determining the minimum amount of bolting required.

A distinction must be recognized between the design value and the bolt stress that might actually exist or that might be needed for conditions other than the design pressure. The initial tightening of the bolts is a pre-stressing operation, and the amount of bolt stress developed must be within proper limits to insure, on the one hand, that it is adequate to provide against all conditions that tend to produce a leaking joint and, on the other hand, that it is not so excessive that yielding of the bolts and/or flanges can produce relaxation that also can result in leakage.

The first important consideration is the need for a joint to be tight in the hydrostatic test. An initial bolt stress of some magnitude

greater than the design value therefore must be provided. If it is not, further bolt strain develops during the test which tends to part the joint and thereby, to decompress the gasket enough to allow leakage. It is evident that an initial bolt stress higher than the design value may, and in some cases must, be developed in the tightening operation. This practice is permissible, as pointed out in Appendix S, Section VIII, Division 1 of the ASME Boiler and Pressure Vessel Code, provided it includes necessary and appropriate provision to insure against excessive flange distortion and gross crushing of the gasket.

Investigation of field-erected flange joints has indicated that the probable bolt stress developed manually, when using standard wrenches on alloy steel bolts is:

$$S = \frac{45,000}{\sqrt{d}}$$

Where S is the bolt stress and d is the nominal diameter of the bolt.

Experience indicates that these stresses are satisfactory for ASME B16.5 flanges and will comply with the requirements as set forth in the preceding paragraphs. It can be seen that smaller bolts will have excessive stress unless judgement is used in pulling up on them. On the other hand, it will be impossible to develop the desired stress in very large bolts by ordinary hand wrenching. Impact wrenches may prove serviceable, but if not, resort may be had to such methods as preheating the bolt or using hydraulically-powered bolt tensioners. With some of these methods, control of the bolt stress is possible by means inherent in the procedure, especially if effective thread lubricants are employed, but in all cases, the bolt stress can be regulated within reasonable tolerances by measuring the bolt elongation with suitable extensometer equipment. Generally, simple wrenching without verification of the actual bolt stress meets all practical needs, and measured control of stress is employed only when there is some special or important reason for doing so.

It is possible for the bolt stress to decrease after initial tightening, because of slow creep or relaxation of the gasket, particularly in the case of the “softer” gasket materials. This may be the cause of leakage in the hydrostatic test, in which case it may suffice merely to retighten the bolts. A decrease in bolt stress can also occur in service at elevated temperatures as a result of creep in the bolt and/or flange gasket material, with consequent relaxation. When this results in leakage under service conditions, it is common practice to retighten the bolts, and sometimes a single such operation, or perhaps several repeated at long intervals, is sufficient to correct the condition.

(Abstracted in part from Appendix S, Section VIII, Division 1 of the ASME Boiler and Pressure Vessel Code.)

# Bolting Torque Data

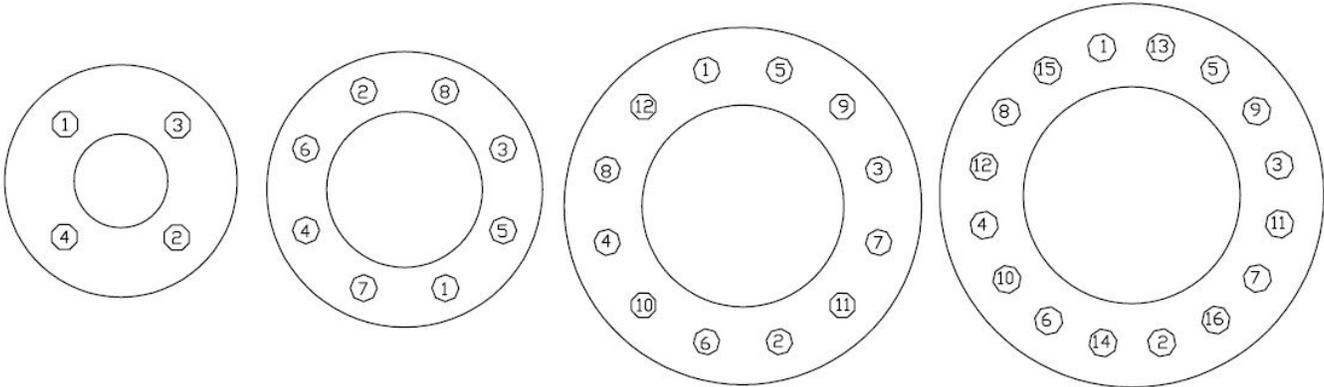
## 4.0 TORQUE VALUES

All values are listed in foot/pounds (ft/lbs.) A range is supplied. All bolting torques are based upon use of well lubricated bolting.

ASTM A193, Gr B7, B8, B8m and K-500 Bolting									
Bolt Diameter (inches)	No. of Threads (per inch)	Minor Diameter (inches)	Area Tensile Stress (sq. inches)	30,000 psi		45,000 psi		60,000 psi	
				Torque (ft/lbs)	Tension (lbs)	Torque (ft/lbs)	Tension (lbs)	Torque (ft/lbs)	Tension (lbs)
1/4	20	.1887	.0318	4	654	6	1431	8	1908
5/16	18	.2443	.0524	8	1572	12	2439	16	3144
3/8	16	.2983	.0775	12	2325	18	3488	24	4650
7/16	14	.3499	.1063	20	3189	30	4784	40	6378
1/2	13	.4056	.1419	30	4257	45	6386	60	8514
9/16	12	.4603	.182	45	5460	68	8190	90	10920
5/8	11	.5135	.226	60	6780	90	10170	120	13560
3/4	10	.6273	.334	110	10020	165	15030	220	20040
7/8	9	.7387	.462	170	13860	255	20790	340	27720
1	8	.8466	.606	260	18180	390	27270	520	36360
1 1/8	8	.9716	.790	375	23700	565	35550	750	47400
1 1/4	8	1.0966	1.000	525	30000	790	45000	1050	60000
1 3/8	8	1.2216	1.233	715	36990	1,075	55485	1425	73980
1 1/2	8	1.3466	1.492	925	44760	1,395	67140	1850	89520
1 5/8	8	1.4716	1.78	1,200	53400	1,800	80100	2400	106800
1 3/4	8	1.5966	2.08	1,500	62400	2,250	93600	3000	124800
1 7/8	8	1.7216	2.41	1,850	72300	2,775	108450	3700	144600
2	8	1.8466	2.77	2,260	83100	3,390	124650	4525	166200
2 1/4	8	2.0966	3.56	3,260	106800	4,890	160200	6525	213600
2 1/2	8	2.3466	4.44	4,500	133200	6,750	199800	9000	266400
2 3/4	8	2.5966	5.43	6,025	162900	9,040	244350	12050	325800
3	8	2.8466	6.51	7,875	195300	11,815	292950	15750	390600

# Bolting Torque Data

## 4.0 BOLTING SEQUENCE



# SECTION F

## Long Term Storage of Valves



# Long Term Storage of Valves

## 1.0 GENERAL INFORMATION

For General Operation & Maintenance Information regarding for valves, please refer to Section A of this manual.

## 2.0 STORAGE

The following recommendations are for preparing valves and their accessories for Long Term Storage. They are necessary to maintain the valves in proper condition prior to installation into the pipeline. By following these procedures, abrasive and corrosive substances can be prevented from affecting valve performance.

It is the purchaser's responsibility to take the necessary precautions for the protection of valves in storage.

**2.1 AS SHIPPED CONDITION |** Valves are packaged with a moisture resistant closure on the valve ends. Where size permits, plastic plugs or caps are used. On larger size valves, wood covers are sealed with tape and securely attached with metal bands. On valves with pipe flanges the wooden covers are secured with bolts. All other openings are covered with plastic caps or plugs. Parts packaged separately are secured in packaging from the factory to prevent damage during handling and storage. These parts are to be stored off the ground in an area protected from the weather.

**2.2 RECOMMENDED STORAGE FACILITIES |** The following are a list of storage types in order of most preferred to least preferred:

1. Enclosed weather tight building with a concrete floor.  
Enclosed building with a dirt floor. Valves must be on pallets.
2. Open air, valves on pallets on a concrete floor covered with a tarpaulin (this is not recommended for more than six months)
3. Open air, valves on pallets on a dirt floor and covered with a tarpaulin (this is not recommended for more than six months)

**2.3 INSPECTION |** Periodic inspections should be performed on all stored valves and parts. The frequency of these inspections should be determined by the type of storage facilities and weather conditions. At a minimum, all parts and valves should be inspected every 4-6 months. Inspect for dirt, moisture or any other type of contamination. If any is found the valve is to be thoroughly cleaned and dried. Repeat the above listed packaging procedure to ensure the valve is weather tight.

Slight external rusting may occur on valves stored outside. This will have little or no effect on their performance. If units are stored for more than 6 months we recommend that gate and globe valves be cycled open to close every 6 months to keep the packing from adhering to the stem and to help lubricate the stem and yoke.

Heavy internal rust however, may be harmful and must be corrected.

**2.4 PREPARATION FOR INSTALLATION INTO THE PIPELINE |** Inspect valves as per the above instructions and remove any contamination, assuring that the valve is clean and dry. Re-torque all bolting to factory specifications to compensate for possible bolt relaxation, which may occur during long storage. **Check to ensure the gland flange has its initial alignment, perpendicular to the stem,** and is not impinging on the stem. Ensure that all foreign material has been removed from the valve.

# SECTION G

## Valve Installation



# Valve Installation

## GENERAL INFORMATION

For general valve information, please refer to Section A of this manual.

### 1.0 INTRODUCTION

By exercising proper care in the installation of CRANE® valves, the probability of trouble-free service will be enhanced. 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, which may affect valve performance.

All valves should be handled/installed in such a manner as to comply with all applicable state, local and federal safety regulations including, but not limited to OSHA regulations. Personal Protective Equipment (PPE) should also be used in compliance with all regulations.

### 2.0 INSPECTION AND HANDLING

Before installation of the valve, it is important to determine that the valve is in satisfactory condition. It may be helpful to observe the following points, in order to avoid subsequent valve problems:

**2.1 |** Carefully unpack valve and note any special warning tags or identification plates attached to the valve; take appropriate action.

**2.2 |** Check the valve for any markings indicating flow direction. If flow direction is indicated, appropriate care should be exercised to install the valve in the proper flow orientation. Check valves and non-return valves are uni-directional and must be installed in the proper orientation.

**2.3 |** Inspect the valve interior through the end ports to determine that it is clean and free from foreign matter and/or harmful corrosion. Remove any special packing materials (blocks to prevent disc movement) or packages of desiccant. The wedge/discs of weld end gate/globe valves should be lightly closed during welding of the valves into the pipeline.

**2.4 |** Check the pipeline to ensure that it is properly aligned and supported. Expansion joints or bends should be installed in the pipeline to compensate for expansion and contraction.

**2.5 |** Only qualified riggers should handle the valves. The pick

up point for all CRANE® valves is by the use of a strap or chain around the neck area of the valve body. Do not pick up CRANE® valves by use of straps or chains on or around the handwheels, yoke, bevel gear, motor or cylinder operator, or any override attachment. Do not pick up a valve by the packing bolting or other interior connections. After the weight of the valve is supported by a strap or chain around the neck of the valve body, other lines may be attached for steadying the valve in place during installation.

**2.6 |** Immediately prior to valve installation the interior of the piping (to which the valve is to be attached) should be checked for cleanliness and freedom from foreign materials.

**2.7 |** Due to the multiple transit and storage points experienced by most valves between the factory and the end-user installation, bolting can undergo relaxation due to vibration and temperature variation as well as potential handling impacts. Therefore, it is best practice to re-torque the body/bonnet bolts prior to installation as per factory specifications.

## Valve Installation

### 3.0 INSTALLATION

All valves should be installed in such a manner as to prevent exposure to excessive vibration and process flow turbulence. Check valves specifically are subject to increased turbulence and wear due to their position in a piping system. **At a minimum, bolted bonnet check valves should have 10 pipe diameters of straight pipe immediately upstream of the valve and they should not be placed close to pumps, valves or other fittings.**

When CRANE® valves with bevel gear, motor or air cylinder operators are mounted in a position other than with the valve stem in a vertical position, contact CRANE® for specific instructions.

**3.0.1 PREPARATION FOR INSTALLATION INTO THE PIPELINE** | Inspect valves as per the above instructions and remove any contamination, assuring that the valve is clean and dry. Re-torque all bolting to factory specifications to compensate for possible bolt relaxation, which may occur during long storage. Ensure that all foreign material has been removed from the valve.

**3.1 WELD END VALVES** | Welded joints when properly made, provide a structural and metallurgical continuity between the pipe and the valve body. For socket weld joints it is usually required that the weld fillet have more cross sectional area than the pipe. Butt welds usually require full penetration and thickness at least equal to that of the pipe. If a pipe of a high strength alloy is welded to a valve with body material of lower mechanical strength, the weld usually must taper to a compensating greater thickness at the valve end, or the valve must have a matching high strength welded-on extension or "pup".

**CAUTION! All welding should be in accordance with any Code or jurisdictional regulations applicable to the piping system construction and with complete and approved welding procedures, and inspected as required by applicable specification. The following items are a general overview of sound welding practice:**

**3.1.1** | Check material markings on pipe and valve to confirm they are as specified.

**3.1.2** | Inspect welding end surfaces, dimensions, and cleanliness. Correct any condition that might interfere with assembly and satisfactory welding.

A protective paint may have been applied to the weld ends on some valves, and it should be removed before welding, unless it is a deoxaluminite paint which acts as a welding flux and does not need to be removed.

**3.1.3** | If backing rings are to be used, check to confirm that ring material is compatible with pipe and valve materials, check individual rings for fit and cleanliness.

**3.1.4** | Determine that the prescribed welding parameters including preheating and post weld heat treating if required, are in accordance with the approved welding procedure.

**3.1.5 INSPECT VALVE-PIPE END ALIGNMENT; ADJUST IF AND AS REQUIRED.** | Valves should be in a slightly closed position when welding in-line. This is opposite the normal recommended installation for flanged or threaded valves, which is to leave the valves in a slightly open to fully open position. The reasoning behind slightly closing the valve has to do with the welding installation. When welding valves in-line an electrode is connected to the valve body and the opposite electrode feeds the weld metal across the gap between the valve and the pipeline. If the electrode connected to the valve body is connected on the opposite side of the valve from where the welding is being performed than if the valve is left in an open position the current from the valve electrode to the welding electrode can arc across the gap between the valve disc/wedge and potentially damage or tack weld across the seating surfaces.

**3.1.6** | Securely tack weld.

**3.1.7** | Complete weld, using approved welding procedure.

**3.2 FLANGED VALVES** | Pipe flanged joints depend on tight sealing and compressive deformation of gasket material between facing flange surfaces. The bolting must provide the mechanical force necessary to maintain the necessary compressive stresses on the gasket, as well as resist the normal pressure forces tending to separate the joint. It should be recognized that bolting force used for "brute force" alignment of misaligned flanges will not be available to sustain gasket loading and pressure force loading, and the result may be a joint leakage problem.

**3.2.1** | Check mating flange facings. If a condition is found which might cause leakage, (e.g. a deep radial groove or cut), do not attempt to assemble until the condition is corrected.

## Valve Installation

**3.2.2** | Check bolting for proper size, length and material.

**3.2.3** | For flange bolting for steel flanges ASME Class 400 or higher, high strength material (usually B - 7) is required. The proper matching of flanges, bolting and gaskets is important.

**3.2.4** | Check gaskets for obvious defects or damage.

**3.2.5** | Use care to provide good alignment of flanges being assembled. Use suitable lubricants on bolt threads. When assembling, sequence the bolt tightening (in a star pattern) to make initial contact of flanges and gaskets as flat and parallel as possible. Tighten gradually and uniformly to avoid tendency to twist one flange relative to the other. Use of torque wrench is important to assure correct and uniform final tightening of flange bolting.

**3.2.6** | Parallel alignment of flanges is especially important in the case of assembly of a valve into an existing system.

It should be recognized that if the flanges are not parallel, in such instances, 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. In large diameter piping particularly, such conditions should always be brought to the attention of someone capable of evaluating the bending conditions, and corrective measures taken as needed.

**3.2.7** | **CAUTION! As indicated above, torque wrenches should be used for 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. Such bolt should be replaced and scrapped. See Section E for Torque Values.**

**3.2.8** | Repeat the process at second valve end. Again apply wrench at end of valve to which pipe is being assembled.

### 4.0 TESTING AND ADJUSTMENT

**4.1** | When a valve has been properly inspected and installed, it is reasonable to assume it will be in good condition and ready to operate. Nevertheless, it is at this time that the valve is at the end point of its more vulnerable phase. Operability can be proven only by test.

**4.2** | At this point valves having adjustable stem seals should be checked to determine that packing has been properly installed and gland bolting has its initial adjustment. Additional adjustment should be determined according to need as valve operability is checked and as system pressure is introduced.

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

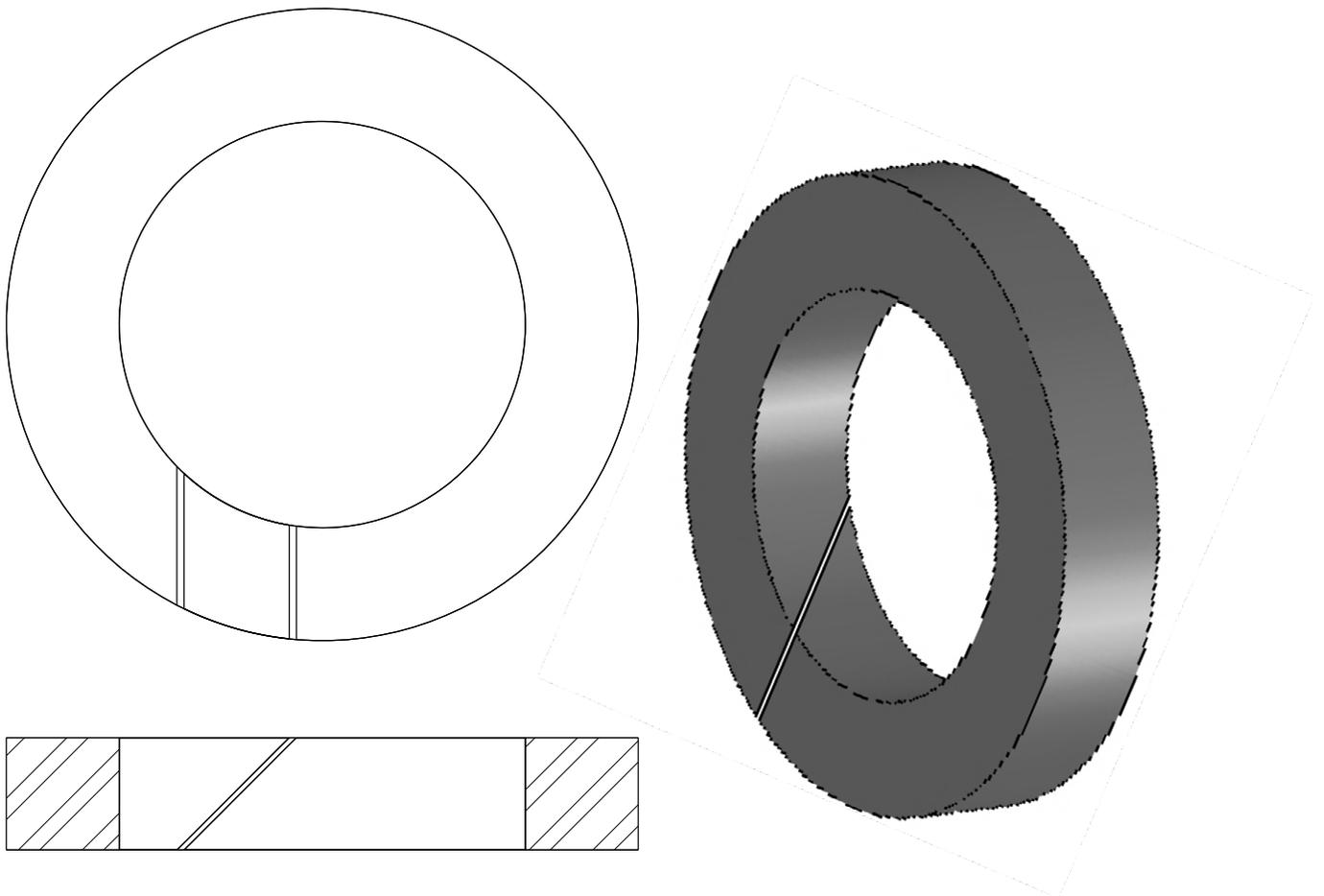
**4.4** | It is a fairly common practice after the installation of piping systems to clean the systems by blowing with gas or steam or flushing with a liquid to remove debris and/or internal protective films and coatings. It should be recognized that valve cavities may form a natural trap in a piping system and material not dissolved in or carried out by the flushing fluid may settle in such cavities and adversely affect valve operation. Also, abrasive material carried by a high velocity fluid stream may cause serious damage to seating surfaces. Again, great care should be taken to ensure that the valve is free of all debris prior to operation.

**4.5** | Upon installation, new valve lubrication should be applied to all lubrication points.



# SECTION H

## Packing and Gasket Maintenance and Valve Lubrication



# Packing and Gasket Maintenance and Valve Lubrication

## 1.0 GENERAL INFORMATION

For General Valve Operation & Maintenance Information please refer to Section A of this manual.

## 2.0 PACKING MAINTENANCE

**2.1** | Inspection of the valve stem/bonnet seal should be an essential part of routine monthly valve maintenance inspections.

**2.2** | If inspection indicates the seal is leaking, the bolts holding the gland flange should be tightened uniformly (one-quarter of a turn at a time) until leakage stops. CAUTION!! Extreme care should be taken when working on or around any pressurized equipment. Tightening of bolting beyond this point results in over-compression of the packing against the stem, thereby producing excessive wear and loss of packing material. If difficulty is experienced in achieving satisfactory sealing without producing excessive stem friction, it may be desirable to increase or to replace the packing material.

**2.3** | If gland travel is fully taken up and leakage does not stop, a careful examination of the stem should be undertaken. Operation of a valve on a regular basis will minimize corrosion between the stem and packing material. Any deterioration of the stem surface which is in contact with the stem seal or packing (such as dents, scratches, pitting or general corrosion) must be recognized as a probable cause of leakage problems. The valve stem should be examined to determine if it has become bent or misaligned. If any of the above conditions exist, the stem must be refinished or replaced. If the stem is undamaged and the valve continues to leak, addition to or replacement of the packing is necessary.

**2.4** | Consult factory for any further packing related concerns.

## 3.0 PACKING INSTALLATION & INSTRUCTIONS

**3.1** | Manually open and close valve several times to ensure all parts are working smoothly under pressure and to help “set” the packing.

**3.2** | After several days, inspect valve for leakage. Slight adjustment may be required.

**3.3** | The following suggestions apply if Chevron type Teflon packing is used:

**3.3.1** | Ensure that sections of the lips of the rings are not turned over.

**3.3.2** | Ensure that the packing rings are facing in the direction of the medium being sealed - whether it is liquid or gas.

## 4.0 GASKET MAINTENANCE

*NOTE: The following information refers primarily to valves that have been repaired/reconditioned previously. It is always a sound practice to inspect and maintain all sealing areas.*

Inspection of the valve body/bonnet joint should be a part of routine maintenance inspection after installation and start-up. Flanged valves should have the flange ends inspected at the same time. In addition to improper gasket installation procedure, thermal changes, pressure changes, vibrations etc also may cause leakage. If re-torquing of the bolting does not stop the leakage, the flanged joint should be unbolted and the gasket carefully examined.

Observation	Possible Remedies
Gasket corroded	Select replacement material with improved corrosion resistance.
Gasket extruded excessively	Select replacement material with better cold flow properties, select replacement material with better load carrying capacity - i.e., more dense.
Gasket grossly crushed	Select replacement material with better load carrying capacity, provide means to prevent crushing the gasket by use of a stop ring or redesign of flanges.
Gasket mechanically damaged due to overhang of raised face or flange bore	Review gasket dimensions to insure gaskets are proper size. Make sure certain gaskets are properly centered in joint.
No apparent gasket compression visible	Select softer gasket material. Select thicker gasket material. Reduce gasket area to allow higher unit sealing load. Inspect flange dimensions.
Gasket Substantially on O.D. than I.D.	Indicative of excessive “flange rotation” or bending. Alter gasket thinner dimensions to move gasket reaction closer to bolts to minimize bending movement. Provide stiffness to flange by means of back-up rings. Select softer gasket material to lower required seating stresses. Reduce gasket area to lower seating stresses
Gasket unevenly compressed around circumference.	Improper bolt up procedure followed. Make certain proper sequential bolt up procedures are followed.
Gasket thickness varies periodically	Indicative of “flange bridging” between bolts or warped flanges. Provide reinforcing rings for flanges to better distribute bolt load. Select gasket material with lower seating stress. Provide additional bolts if possible to obtain better load distribution. If flanges are warped, re-machine or use softer gasket material.

"If packing or gasket is changed without Crane consultation, warranty can be voided."

# Packing and Gasket Maintenance and Valve Lubrication

## 5.0 GASKET INSTALLATION PROCEDURES

Regardless of the type of gasket being used or the materials of construction, certain basic procedures must be followed during assembly to ensure proper operation.

While these comments may seem elementary, they are extremely important in achieving a satisfactory seal and minimizing the time required to successfully make up joints. The procedures should be followed whether bolt stresses will be achieved with ordinary stud wrenches, preheating studs, using tensioning devices, using torque wrenches, or using hydraulic wrenches.

**5.1 |** Inspect the gasket seating surfaces. Look for tool marks, cracks, scratches or pitting by corrosion and make sure that the gasket seating surface is proper for the type of gasket being used. Radial tool marks on a gasket seating surface are virtually impossible to seal regardless of the type gasket being used, therefore every attempt must be made to minimize them.

**5.2 |** Inspect the gasket. Make sure the material is as specified, look for any possible defects or damage in the gasket.

**5.3 |** Inspect and clean each stud or bolt, each nut, each washer, and the facing on the flanges against which the nuts will rotate. Look for severe galling, pitting, etc. If any of the above mentioned items are damaged beyond repair, replace the damaged item.

**5.4 |** Lubricate all thread contact areas and nut facings. The importance of proper lubrication cannot be over-stressed. No joint should be made up without the proper lubricant being applied to the threaded surfaces and to the nut facings. When flanges will be subjected to high temperatures, the use of an anti-seize compound should be considered to facilitate subsequent disassembly.

**5.5 |** With raised face and flat face installation, loosely install the stud bolts on the lower half of the flange. Insert the gasket between the flange facing to allow the bolts to center the gasket on the assembly. Install the balance of the bolts and nuts and bring all to a hand-tight or snug condition.

**5.6 |** If the gasket is being installed in a recess or a groove, center the gasket midway into the recess or the groove. If the joint is vertical it may be necessary to use some cup grease or a few dabs of gasket cement or some other adhesive compatible with the process fluids, to keep the gasket in position until the flanges are tightened.

**5.7 |** Torque the bolts up to a maximum of thirty percent of the final torque value required following the sequence recommended. See Section E for bolting sequence and torques. Number bolts so that torquing requirements can be followed. With any gasket material, it is extremely important to follow a proper bolting sequence. If this sequence is not followed, the flanges can be cocked. Then, regardless of the amount of subsequent torquing, they cannot be brought back parallel. This problem, of course, is maximized on metallic gaskets more so than on non-metallic.

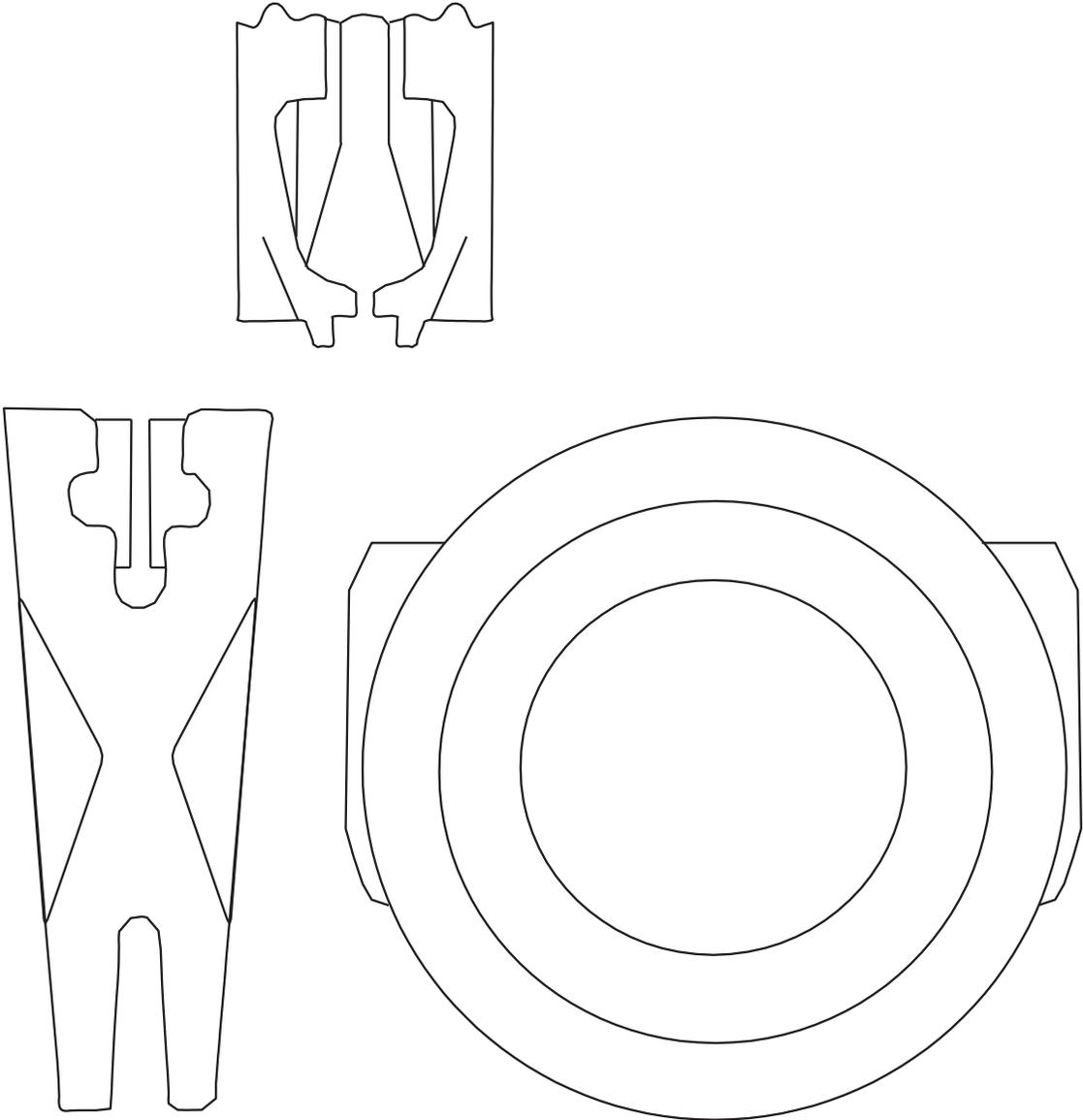
**5.8 |** Repeat step 5.7, increasing the torque to approximately 50 to 60 percent of the final torque required.

**5.9 |** Continue with a star pattern of re-torquing all studs or bolts to the desired amount until no further rotation of the nuts can be achieved. This may require several re-torquings since as one stud is torqued it will relieve the stress on the adjacent stud until such time as equilibrium is achieved.

**5.10 |** On high-pressure, high-temperature applications, it is recommended that the flanges be re-torqued to the required stress after 24 hours at operating pressures and temperatures to compensate for any relaxation or creep that may have occurred.

# SECTION I

## Proper Fitting of Wedge Gate Valves



# Proper Fitting of Wedge Gate Valves

## GENERAL INFORMATION

For general information regarding this or any other valve please refer to Section A of this manual.

## 2.0 INTRODUCTION

Fitting of gate valve wedges has a direct effect on the overall performance and longevity of the valve. Occasionally, wear or damage may facilitate the need to refit a gate valve. It is recommended that this operation be entrusted only to an experienced valve mechanic. Although it is recommended that this operation be performed in the shop, with correct equipment and proper care, it can be done with the valve in place. The following are suggested procedures and inspection points:

## 2.0 PROCEDURE

**2.1** | New gate valve wedges are furnished with material left on each side to allow for custom fitting. The amount varies with valve sizes from .025" to .050" per side. Insert the wedge into the body after body seats have been finished and check the following points.

**2.1.1** | Adequate finish for fitting. Wedge rides high in body seats. If this is not convenient, use inside calipers to check minimum distance between seats in the body and outside calipers to measure minimum distance across seats of wedge at the toe (bottom). Wedges should be polished/lapped to a minimum of 32 rms. Preferred finish is approximately 12 rms.

**2.1.2** | Adequate guide clearance to permit seat face contact. Some valves are designed to allow the wedge to be inserted one way only (wide and narrow guides). Otherwise, select the most advantageous orientation of the wedge in the body. Match mark the body and wedge to ensure proper orientation.

**2.1.3** | Check that the center line of the wedge and body seats are oriented such that the stem T-head has proper clearance to align itself at assembly.

**2.1.4** | Mount the wedge in a machine (grinder, boring mill or lathe), on a 10° angle face plate (adjustable or not). Center line of the seat face must be parallel to the guides.

**2.1.5** | By trial and error, plus minute adjustments of the wedge angle and the orientation of its center line, fit the wedge to the body seats, by removing small amounts of surface material from the wedge.

**2.1.6** | To check the fit, hang the wedge on a dummy stem (or appropriate fixture), insert it into the body, noting any lean of the wedge relative to the body guides and the guide clearance. Hit the end of the dummy stem with a hammer to seat the wedge and mark the body seat on the wedge. A sharp blow on the bottom of the body will free the wedge from the body seats. To emphasize the position of the seal, a thin film of Prussian Blue can be put on the wedge seat face prior to inserting into the body.

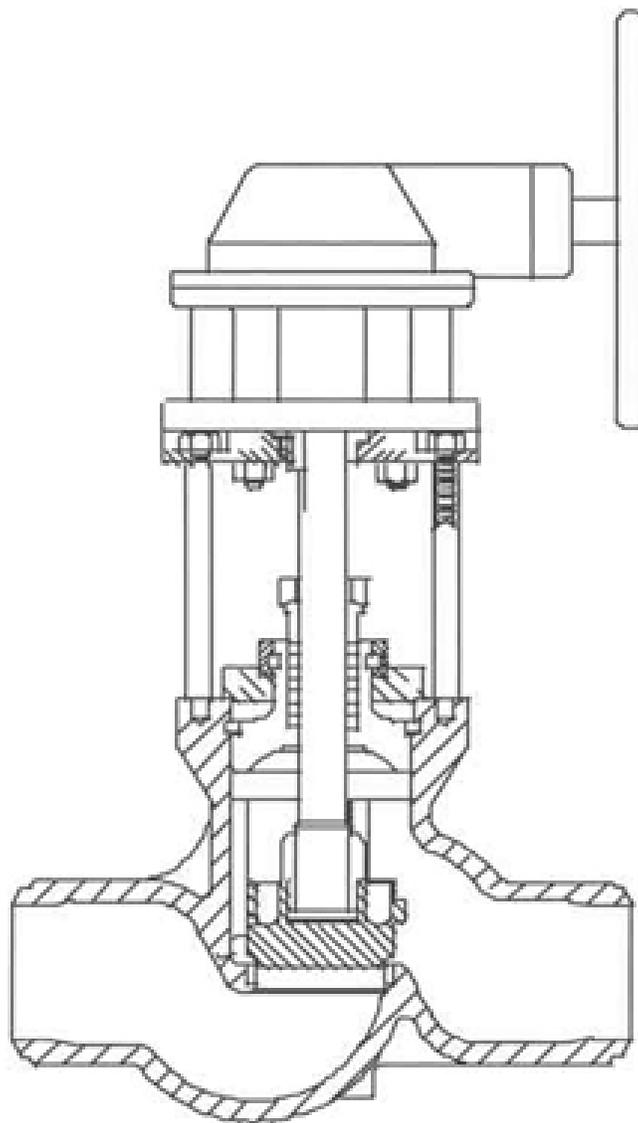
**2.1.7** | When the wedge is finally fitted to the body and is resting between the seats (not hammered into place), there should be a small clearance at the toe (bottom), depending on the size and pressure class of the valve (body flexibility).

Suggested Toe Clearance	150	Valve Size 300 & 400	600 & up
.0005 - .001	up to 4"	up to 6"	1 1/2" - 2"
.0015 - .003	5" - 12"	8" - 16"	All
.003 - .005	14" - 16"	18" up	--
.005 - .007	18" up	--	--

The ideal fit is with the wedge seal uniform and narrow (approx. 1/8") all around. The seal on the wedge should be below the center of the wedge face (wedge riding high). See Figure 1 below. There should be sufficient guide clearance so that the wedge can seat on both sides. Also, there should be adequate T-head clearance to permit the wedge and stem to be self-aligning.

# **SECTION J**

## **Gear and Motor Actuated Valves**



# Gear and Motor Actuated Valves

## 1.0 THEORY OF OPERATION

Most valves, which are located in an accessible environment, are actuated by a manual handwheel mounted directly on top of the valve. When the valve size or differential pressure is so great that the handwheel size cannot keep the operating handwheel pull within customer reasonable limits, then a bevel gear should be mounted on the top-works. In addition, many customers require remote operation or operating times that are not possible with manual handwheels, in this case Electric Motor Actuators (EMO's) can be used.

*NOTE: Actuator limit and torque settings are factory set during valve testing for ASME cold working pressure tests. Additional adjustment may be required in the field. Contact CRANE® with any questions.*

**WARNING! Do not use excessive air wrench torque or snipes on handwheels as the gearing or valve stem could be damaged!**

## 2.0 INSTALLATION

**Warning! Ensure that the electric motor actuator is wired correctly and phased properly prior to operation. Do not allow the valve to travel in the wrong direction (when phased is reversed). This can result in damage to the valve and void all valve warranties.**

The actuation process should be performed in the stem vertical position. Check the disc position/alignment and perform a manual pre-actuation open and close cycle test prior to actuating the valve.

## 3.0 MAINTENANCE

The gear or electric actuator itself should never require disassembly and it is recommended that this be done only by the Actuator manufacturer. If it becomes necessary to disassemble the valve, the actuator assembly must be removed first.

The preferred orientation for CRANE® gear and motor actuated valves is in horizontal pipelines with the stem in a vertical position. When installed in any other position, motor actuated valves should be supported by means of a support clamp around the motor mounting plate. Please contact CRANE® when specifying an actuated valve with an orientation different than that listed above.

### 3.1 Preventive Maintenance

**3.1.1** | With the actuator removed from the valve, examine the stem and actuator drive nut for thread wear, galling or binding.

**3.1.2** | If excessive wear is evident, worn parts should be replaced.

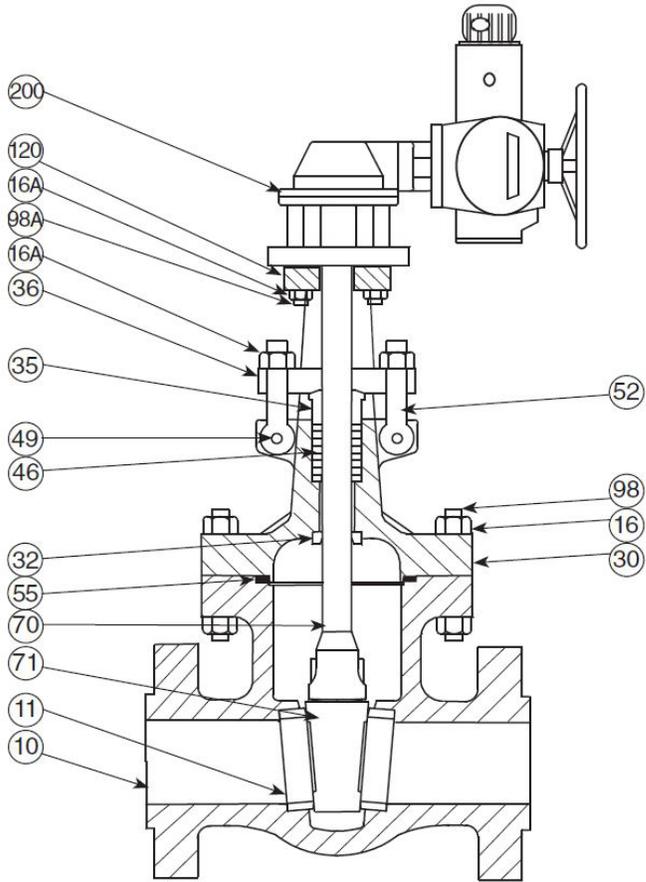
# Gear and Motor Actuated Valves

## DISASSEMBLY

- Remove operator mounting bolts or stud/nuts 16A and 98A from mounting plate or mounting adapter 120.
- Attach a support sling around operator 200 and prevent rotation.
- Turn handwheel closed to turn operator off from stem and then lift gear operator off. In the case of an Electric Motor Operator it may be necessary to disengage or “declutch” the motor before using the manual handwheel. The Electric Motor Operator manufacturer’s manual should detail this procedure.
- Remove spacer and coupling if used. (Not shown)
- NOTE: Prior to the disassembly of any valve equipped with an Electric Motor Operator, ensure that all electrical sources have been disconnected and the appropriate lockout/tagout procedures have been used.
- Proceed with disassembly instructions given in the appropriate valve maintenance instructions.

## ASSEMBLY

- Install spacer and coupling if used. (Not shown)
- Lift gear operator carefully over valve stem and while preventing operator from rotating, turn handwheel open until operator aligns over mounting holes.
- Loosely install mounting bolts or stud/nuts 16A and 98A on mounting plate or mounting adapter 120 and then check that stem 70 operation does not bind.
- Torque mounting bolts or stud/nuts 16A and 98A while valve is in open position.
- Set torque and limit switches in accordance with the instruction manual for the applicable operator.
- For all gate and globe style valves upon valve closing, the torque switch should be set to trip first.







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