

GE Oil & Gas

# 21009 Series

Masoneilan\* Cage Guided Globe Valve  
Instruction Manual



THESE INSTRUCTIONS PROVIDE THE CUSTOMER/OPERATOR WITH IMPORTANT PROJECT-SPECIFIC REFERENCE INFORMATION IN ADDITION TO THE CUSTOMER/OPERATOR'S NORMAL OPERATION AND MAINTENANCE PROCEDURES. SINCE OPERATION AND MAINTENANCE PHILOSOPHIES VARY, GE (GENERAL ELECTRIC COMPANY AND ITS SUBSIDIARIES AND AFFILIATES) DOES NOT ATTEMPT TO DICTATE SPECIFIC PROCEDURES, BUT TO PROVIDE BASIC LIMITATIONS AND REQUIREMENTS CREATED BY THE TYPE OF EQUIPMENT PROVIDED.

THESE INSTRUCTIONS ASSUME THAT OPERATORS ALREADY HAVE A GENERAL UNDERSTANDING OF THE REQUIREMENTS FOR SAFE OPERATION OF MECHANICAL AND ELECTRICAL EQUIPMENT IN POTENTIALLY HAZARDOUS ENVIRONMENTS. THEREFORE, THESE INSTRUCTIONS SHOULD BE INTERPRETED AND APPLIED IN CONJUNCTION WITH THE SAFETY RULES AND REGULATIONS APPLICABLE AT THE SITE AND THE PARTICULAR REQUIREMENTS FOR OPERATION OF OTHER EQUIPMENT AT THE SITE.

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## Safety Information

### Important - Please read Before Installation

The 21009 Series Control Valves instructions contain **DANGER**, **WARNING**, and **CAUTION** labels, where necessary, to alert you to safety related or other important information. Read the instructions carefully **before** installing and maintaining your control valve. **DANGER** and **WARNING** hazards are related to personal injury. **CAUTION** hazards involve equipment or property damage. Operation of damaged equipment can, under certain operational conditions, result in degraded process system performance that can lead to injury or death. Total compliance with all **DANGER**, **WARNING**, and **CAUTION** notices is required for safe operation.



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



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



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



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



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

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

## About this manual

- The information in this manual is subject to change without prior notice.
- The information contained in this manual, in whole or part, shall not be transcribed or copied without 's written permission.
- Please report any errors or questions about the information in this manual to your local supplier.
- These instructions are written specifically for the 21009 Series Control Valves, and do not apply for other valves outside of this product line.

## Warranty

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

This instruction manual applies to the 21009 Series Control Valves.

## Life Period

The current estimated useful life period for the Masoneilan 21009 is 25+ years. To maximize the useful life of the product it is essential to conduct annual inspections, routine maintenance and ensure proper installation to avoid any unintended stresses on the product. The specific operating conditions will also impact the useful life of the product. Consult the factory for guidance on specific applications if required prior to installation.

### Note:

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

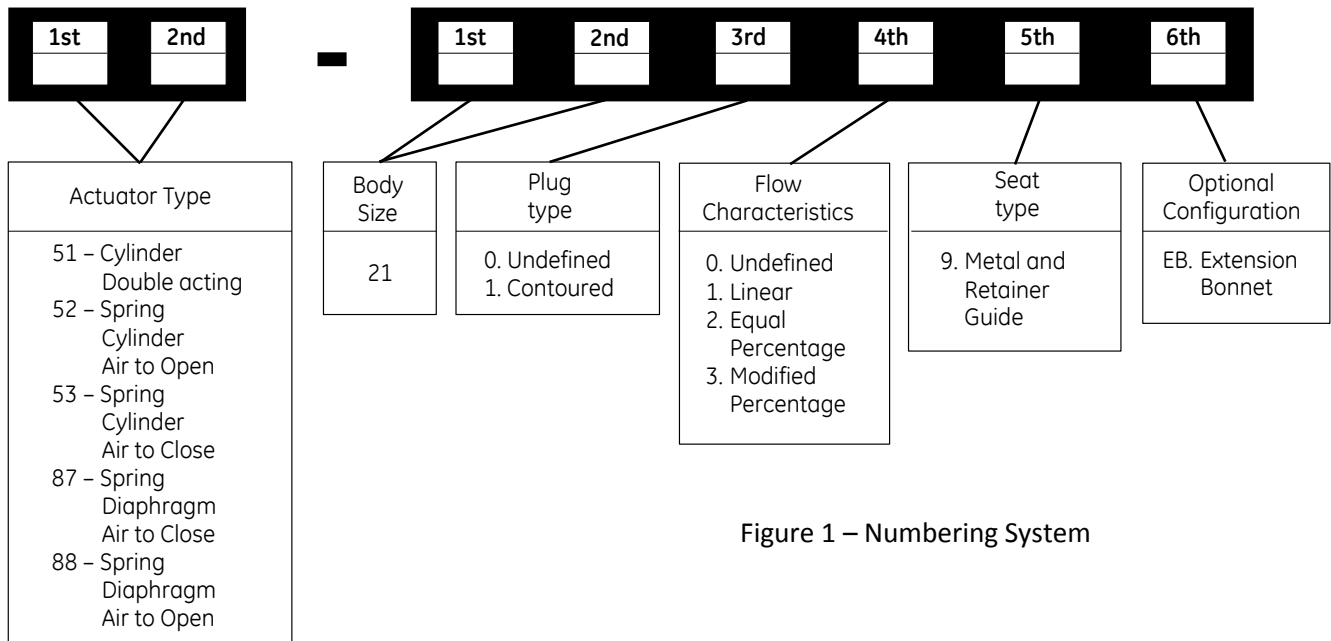


Figure 1 – Numbering System

## 1. Introduction

The following instructions should be thoroughly reviewed and understood prior to installing, operating or performing maintenance on this equipment. Throughout the text, safety and/or caution notes will appear and must be strictly adhered to, otherwise, serious injury or equipment malfunction could result.

GE has a highly skilled After Sales Department available for start-up, maintenance and repair of our valves and component parts.

Arrangements for this service can be made through your local GE's Masoneilan representative or sales department. When performing maintenance use only Masoneilan replacement parts. Parts are obtainable through your local representative or spare parts department. **When ordering parts, always include model and Serial Number of the unit being repaired.**

## 2. General

These installation and maintenance instructions apply to all sizes and ratings of the 21009 Series control valves regardless of the type of trim used.

21009 Series single ported Cage guided control valves are designed with built in versatility making them well-suited to handle a wide variety of process applications.

Standard construction offers a contoured plug (**21109 Series**) with a quick change seat ring. The heavy Cage plug guiding provides maximum support to ensure plug stability.

A series of reduced area trim is available to provide wide flow range capabilities in all valve sizes.

Tight Shutoff Class IV leakage is standard. Optional constructions meet IEC 534-4 and ANSI/FCI 70.2 Class V requirements.

Recommended spare parts required for maintenance are listed in the Parts Reference table on page 10. The model number, size, rating and serial number of the valve are shown on the identification tag located on the actuator. Refer to Figure 1 for the 21009 series numbering system.

## 3. Unpacking

Care must be exercised when unpacking the valve to prevent damage to the accessories and component parts. Should any problems arise, contact your local GE's Masoneilan representative or sales department.

## 4. Installation

- 4.1 Before installing the valve in the line, clean piping and valve of all foreign material such as welding chips, scale, oil, grease or dirt. Gasket surfaces should be thoroughly cleaned to ensure leak-proof joints.
- 4.2 To allow for in-line inspection, maintenance or removal of the valve without service interruption, provide a manually operated stop valve on each side of the 21009 Series valve with a manually operated throttling valve mounted in the by-pass line (See Figure 2).
- 4.3 The valve must be installed so that the controlled substance will flow through the valve in the direction indicated by the flow arrow located on the body.
  - With contoured plug : flow-to-open
- 4.4 For heat-insulated installation, do not insulate the valve bonnet. Take necessary protective measures relate to personal safety.

## 5. Air Piping

The actuators are designed to accept 1/4" NPT air supply piping. Use 1/4" OD tubing (4 x 6 mm) or equivalent for all air lines. If the **supply** air line exceeds 25 feet in length (7 meters) or if the valve is equipped with volume boosters, then 3/8" tubing (6 x 8 mm) is preferred. All connections must be free of leaks.

### CAUTION

Do not exceed supply pressure indicated on serial plate located on the yoke of the actuator.

## 6. Body Disassembly

Access to the internal components of the body should be accomplished with the actuator removed. To remove the actuator from the body, refer to the actuator instruction Ref. GEA19530 for a type 87/88 multi-spring actuator.

### CAUTION

Prior to performing maintenance on the valve, isolate the valve and vent the process pressure. Shut off the supply air line and the pneumatic or electric signal line.

### 6.1 Quick-Change Trim

After removing the actuator, disassemble the body using the following procedure:

- A. If there is a leak detection connection on the lateral NPT port of the bonnet, disconnect this piping as well.
- B. Remove body stud nuts (10).
- C. Remove bonnet (8), and plug stem (1) and plug (15) sub-assembly together as one unit.
- D. Since the cage (12), seat ring (13) and seat ring gasket (14) are held in place by the bonnet, they may now be removed.

**Note:** *Spiral wound gaskets (11 & 15) are standard in the 21009 Series design and it is imperative that new gaskets be installed each time the valve is disassembled.*

- E. Remove packing flange stud nuts (3), packing flange (4) and packing follower (5).
- F. Remove plug (15) and plug stem (1) sub-assembly from the bonnet (8).

### CAUTION

Care must be taken to avoid damage to the plug and plug guide.

- G. Remove old packing (6) [and optional lantern ring (7) if a leak detection connection has been installed]. Refer to Figure 4.
- H. All components may now be inspected for wear and service damage. After determining the maintenance required,

proceed to the appropriate Section of this instruction manual.

## 7. Maintenance & Repair

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

### 7.1. Lapping Seat

Lapping is the process of working the valve plug against the seat ring with an abrasive to produce a close fit. If valve leakage is excessive, lapping becomes necessary. The plug and seat ring seating surfaces should be free of large scratches or other defects, and the contact surfaces of the seats should be as narrow as possible. This may require dressing both parts in a lathe. The seating surface angle of the plug is 28 degrees and the seat ring is 30 degrees (relative to the centerline axis). A good grade of fine grinding compound is required for the lapping operation.

The compound should be mixed with a small quantity of lubricant such as graphite. This will slow the cutting rate and prevent tearing of the seating surfaces. The amount of lapping required depends on the materials, condition of seating surfaces, and accuracy of machining. If a short period of lapping does not visibly improve seating, there is usually no advantage in continuing as excessive lapping may result in rough seats. The only remedy is replacement or re-machining of one or both parts. When lapping new plugs and seat rings, begin with a medium fine (240 grit) and finish with a finer grade (600 grit).

**Note:** Lapping should produce a line contact area, not the entire surface, due to the difference in seat angles.

### CAUTION

Before lapping, the plug and stem sub-assembly must be concentric. (See pinning operation, section 7.5)

#### 7.1.1 Quick-Change Trim

1. Clean body gasket surface areas.
2. Install a new seat ring gasket (14) and insert seat ring (13) in the body.

**Note:** *Gasket (14) is temporarily placed to hold the seat ring during lapping.*

***It is imperative to use a new gasket or a test part having the same geometrical characteristics in order to ensure the correct position of the seat ring during lapping.***

***This gasket (or similar part) can be kept after lapping for future use.***

**The gasket used for lapping must not be reused for the body reassembly.**

3. Apply lapping compound at several spots equally spaced around the seating area of the seat ring.
4. Insert the cage (12) into the body.
5. Insert the stem and plug sub-assembly carefully into the body until it is seated.
6. Place bonnet (8) on the body.

## CAUTION

Ensure that the seat ring (13), cage (12) and bonnet (8) are properly aligned

7. Fasten the bonnet to the body using four body stud nuts (10) spaced equally apart. Apply slight pressure and tighten evenly.

## CAUTION

Do not tighten nuts to final torque specifications at this time. The bonnet is used temporarily for guiding purposes only.

8. Insert two or three pieces of packing into the packing box to assist in guiding the stem and plug during lapping.
9. Screw a drilled and tapped rod with a T-handle onto the plug stem and secure with a locknut (see Figure 3).

**Note:** As an alternative, drill a hole through a flat steel plate and fasten to the plug stem using two locknuts.

10. Apply slight pressure on the stem, and rotate the stem in short oscillating strokes (around 8 to 10 times). Repeat this step as necessary.

**Note:** The plug should be lifted and turned 90° each time before repeating Step (10). This intermittent lifting is required to keep the plug and seat ring concentric during lapping.

11. After completion of the lapping operation, remove bonnet and internal parts. The seating area of the seat ring and the plug must be cleaned of all lapping compound in preparation for reassembly.

### 7.2 Plug Stem Pinning

Plug stem pinning in the field may be required for the following:

- Replacing existing plug and stem, or
- Replacing existing stem only

### - Replacing Plug and Stem

If it is necessary to replace the plug, then the plug stem must be replaced at the same time. The original pin hole in an existing stem will not provide the necessary fit, and might seriously impair the strength of the assembly.

### A. Reference marking on the Plug Stem

Measure the depth of the pilot recess in the plug (Dimension X in Figure 6), and make a reference mark on the plug stem at the same distance from the thread.

**Note:** While pinning is being performed, care must be taken not to damage the seating surface or plug guide. Always use a soft metal or plastic vice jaws with cylindrical features to hold the plug guide area (see Figure 6).

### B. Screwing Stem to Plug

- Hold the plug (with vise jaw assembly) in a vise.
- Lock two nuts against each other on the end of the new plug stem, and screw the stem **solidly** into the plug using a wrench on the upper nut.

When properly assembled, the reference mark (see Section A above) should be flush with the end of the plug guide.

### C. Drilling the new Parts

- **If the plug is already fully drilled** (typical for 440 C hardened stainless steel material or solid Stellite or Equivalent), then drill the stem to the same diameter (Diameter C in Figure 6) as the plug shank hole.
- **If the plug guide area has a center mark,**

Place the plug guide on a V-block and use a suitable drill size to either:

- Match the hole size in the plug, or
- Match Diameter C (see Figure 6)

Drill through the plug-stem assembly.

- **If the plug guide area does not have any hole or any center mark,**
  - Measure Dimension D based on the plug guide diameter and stem diameter (see Figure 6).
  - Place the plug guide on a V-block, and make a center mark on the plug guide area using a center punch.
  - Drill through the plug-stem assembly using a suitable size drill bit.

**In all cases after drilling:** Remove any burrs from the plug guide hole by making a slight chamfer.



## D. Pinning the Plug-Stem assembly

1. Select the correct size pin based on the plug guide diameter and stem diameter (see Figure 6). Apply a small amount of grease on the pin and hand assemble it into the hole in the plug.
2. Press fit the pin into the hole using a hammer. Complete the pinning operation by taking care to ensure that the pin is recessed by the same amount at both sides (see Figure 6).
3. After the plug has been pinned, it should be placed in a lathe to ensure it is concentric with the stem.

If the assembly is not running true, then the stem should be placed in a collet with the plug guide against it and the plug should be adjusted. Alignment of plug stem can be performed by means of a soft faced mallet.

### - Replacing existing Stem only

#### A. removing existing Pin and Stem

1. Place the plug guide on a V-block and use a drift punch to drive out the old pin.

**Note:** If it is necessary to drill out the pin, use a drill bit slightly smaller than the pin diameter.

2. Hold the plug guide in a vise (see note on opposite side of page).
3. Lock one nut against another at the end of the plug stem. Using a wrench on the lower nut, unscrew the stem from the plug. The stem is removed by turning it counter-clockwise.

#### B. Screwing Stem to Plug

Refer to step B of the previous section on "REPLACING PLUG AND STEM".

#### C. Drilling the new Stem

Place the plug guide on a V-block and use a suitable size drill bit to drill the stem (use the hole in the plug as a guide).

**Note:** If the hole in the plug guide has been slightly damaged while removing the old pin, choose a drill bit and a pin with a slightly larger diameter than the normal pin.

#### D. Pinning

Select the correct size pin based on the plug guide diameter and pin hole diameter. Proceed as described in part D of the previous section, taking care not to damage the plug guide area.

Ensure plug stem alignment following the pinning operation.

## 7.3 Packing Box

Packing box maintenance is one of the principle action items of routine servicing. Tightness of the packing is maintained by packing compression. Compression is achieved by evenly tightening the packing flange nuts (3) against the packing flange (4). Care must be taken not to over tighten as this could prevent smooth operation of the valve. If all compression is used up and the valve leaks, then new packing is required.

# CAUTION

Valve must be isolated and the pressure vented before performing packing box maintenance.

Proceed as follows :

### 7.3.1 Braided PTFE with Carbon or aramid Core (Standard)

**Note:** The Braided PTFE/Carbon or Aramid packing rings have a skive cut allowing packing replacement without disconnecting the plug stem from the actuator connector or actuator stem.

- A. Loosen and remove packing flange nuts (3).
- B. Lift the packing flange (4) and packing follower (5) up the valve stem.

**Note:** They may be taped in place to keep them out of the way before proceeding.

- C. By means of a hooked instrument , remove packing (6) ensuring not to damage the sealing surfaces of the packing box or plug stem.

**Note:** On valves equipped with an optional lubricator connection, the lantern ring (7) must also be removed to gain access to lower packing rings.

- D. Replace packing rings (6).

**Note:** Assemble and compress rings one at a time into packing box. The skive cut of each packing ring must be placed about 120 degrees apart.

**Note:** On valves equipped with an optional lubricator connection, refer to Figure 7 for correct amount of rings to place under the lantern ring (7).

- E. Replace packing follower (5) and packing flange (4).

- F. Replace and tighten packing stud nuts (3).

# CAUTION

Do not overtighten.

- G. Place valve back in service and only tighten packing as necessary to stop external leakage.

**Note:** In an emergency, string packing may be used as a temporary repair only. It must be replaced with the correct packing as soon as possible.

### 7.3.2 Flexible graphite rings (optional-See Figure 5)

**Note:** Flexible graphite packing rings replacement may require disconnecting the plug stem from the actuator stem and removal of the actuator if rings are not skive cut.

- A. Remove actuator from the body S/A. Refer to actuator instruction Ref. GEA19530 for a type 87/88 actuator.
- B. Loosen and remove packing flange nuts (3).
- C. Remove packing flange (4) and packing follower (5) from the plug stem.
- D. By means of a hooked instrument, remove packing (6) ensuring not to damage the sealing surfaces of the packing box or plug stem.

**Note:** On valves equipped with an optional lubricator connection, the lantern ring (7) must also be removed to gain access to lower packing rings.

- E. Replace new packing set (6); first assemble a back-up ring (Graphite Filament Yarn braided ring), then the flexible graphite rings (smooth rings), and finally another braided back-up ring (refer to Figure 5).

**Note:** Assemble and compress rings one at a time into packing box.

**Note:** On valves equipped with an optional lubricator connection, refer to Figure 7 for correct arrangement according to valve size.

- F. Assemble packing follower (5) and packing flange (4).
- G. Assemble and tighten packing stud nuts (3).

## CAUTION

Do not overtighten.

- H. Proceed to appropriate instructions for actuator and valve assembly adjustment.
- I. Place valve back in service and only tighten packing as necessary to stop external leakage.

## 8. Valve Body Reassembly

After completion of the required maintenance, the valve should be reassembled using the following procedures:

**Note:**

If any of the following steps were completed during maintenance, then proceed to the next step.

### 8.1 Quick-Change Trim

- A. Clean all gasket mating surfaces.

- B. Install seat ring gasket (14) and seat ring (13).

**Note:** Spiral wound gaskets (11 & 13) are standard in the 21009 Series design. It is imperative that a new gasket be installed each time the valve is disassembled.

- C. Install cage (12).
- D. Carefully install plug and stem assembly.

**Note:** Valve should be lapped before final assembly. See Section 7.3.

- E. Install body gasket (11).
- F. Assemble bonnet (8) and body stud nuts (10) and tighten. Bonnet must be positioned so the packing flange studs are at 90° to the flow center line.

## CAUTION

Care must be taken to ensure that the cage, seat, and bonnet are properly aligned in the body. Cage should be installed with parts at lower end, near seat ring. Tighten nuts (10) until metal to metal contact is obtained with proper bolt torque. Refer to Figure 8 for proper bolt torque and tightening sequence specifications.

- G. Insert packing (6) [and lantern ring (7) on valve equipped with an optional lubricator or lead detection connection. Refer to Section 7.6 for proper packing assembly procedure for standard or optional designs.
- H. Install packing follower (5) and packing flange (4).
- I. Install packing flange stud nuts (3).

## CAUTION

Do not overtighten (See Section "7.6. Packing Box")

- J. If a leak detection connection was installed, connect it on the lateral NPT port in the bonnet. If not, ensure that the 1/4" NPT plug remained in place (Figure 4).
- K. For actuator assembly and plug stem adjustment, proceed to the actuator instruction Ref. GEA19530 for a type 87/88 multi-spring actuator.

## 9. Actuator

### 9.1 Types 87/88 actuators

Refer to Instruction Ref. GEA19530 for removal, maintenance, assembly and adjustment.

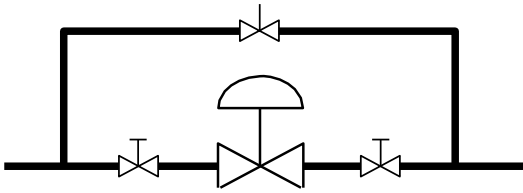


Figure 2 - Typical Install

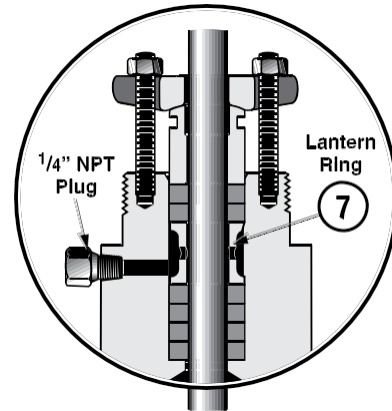


Figure 4 - Lubricator Connection (Option)

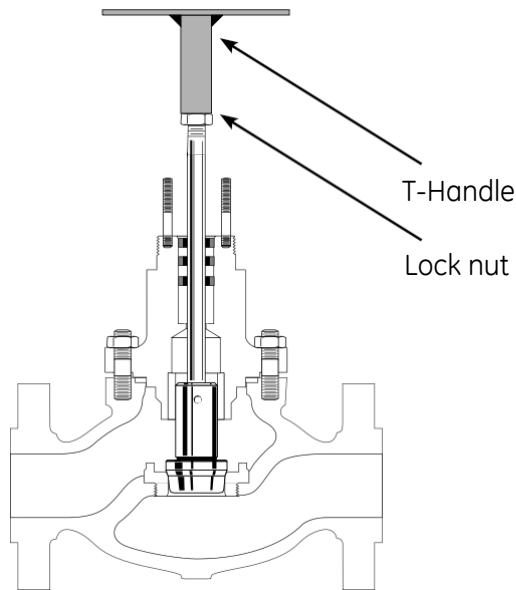


Figure 3 - Seat Lapping Device

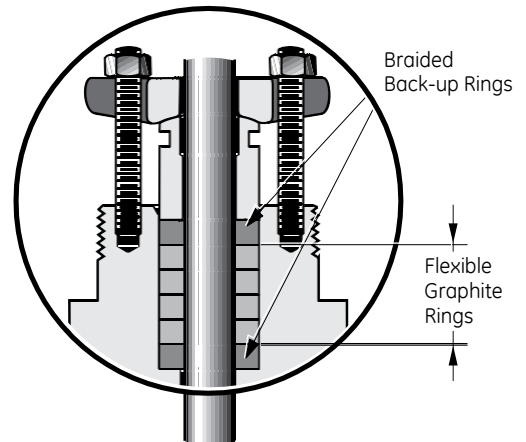


Figure 5 - Flexible graphite rings arrangement (Option)

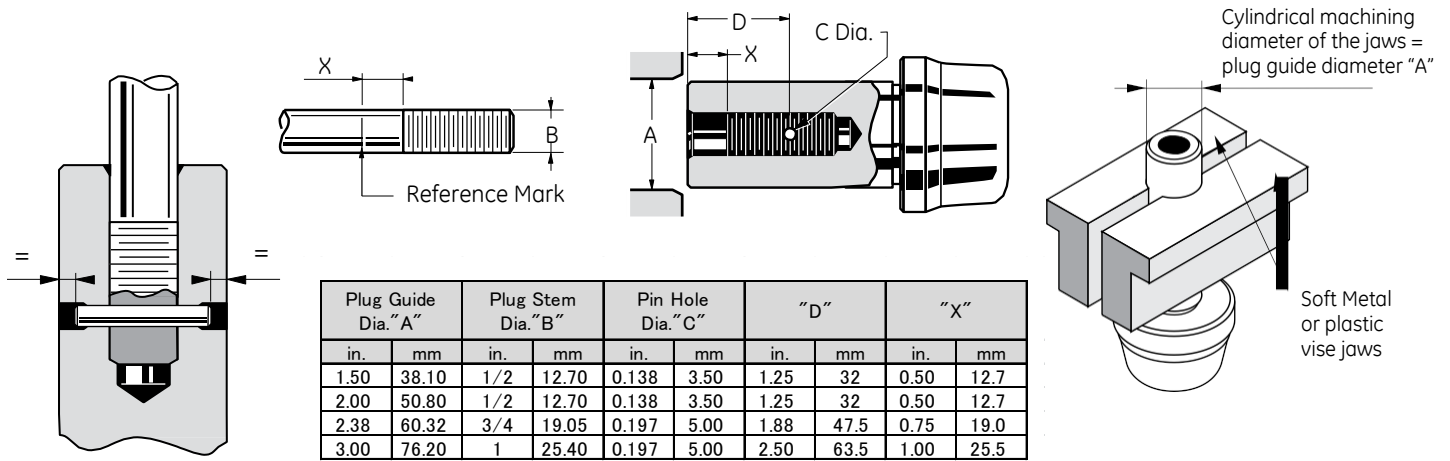
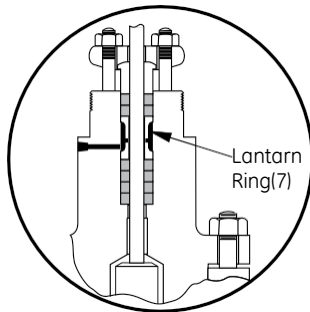


Figure 6 – Plug Stem Pinning

Packing box with Kevlar PTFE Packing Rings



Valve Size		Quantity of Packing Rings(6)					
					Expanded Graphite W/ backup Rings		
inch	mm			Total			Total
3 to 4	80 to 100			6			7
6 to 8	150 to 200			7			7

Packing box with Flexible Graphite packing rings and Back-up Rings

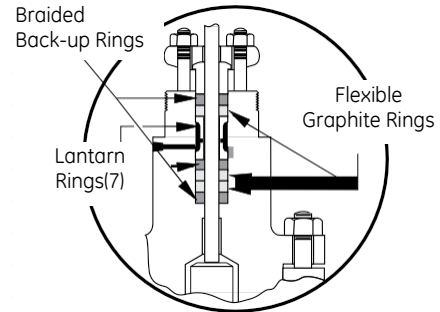


Figure 7 – Packing Ring arrangements with optional Lubricator Connection

## Assembly Torque requirements

Vavle Size		ASME CLASS	Bolting Requirements		Torque Requirements		
					Minimum	Maximum	Pre-Load
inch	mm		Qty.	Size(inch)	daNm	daNm	daNm
3	80	2500	8	1-1/2"-8UN-2A	54.2	284.8	15.6
4	100	2500	8	2"-8UN-2A	317.0	444.0	22.3
6	150	900	8	1-1/4"-8UN-2A	31.9	162.7	13.6
		1500	8	1-3/4"-8UN-2A	241.0	315.0	17.1
8	200	900	8	1-1/2"-8UN-2A	54.2	284.8	15.6
		1500	12	1-3/4"-8UN-2A	241.0	315.0	17.1

- Notes:
1. Do not exceed Maximum Torque values listed.
  2. Tighten in increments until required torque levels are reached.
  3. Reject assembly if metal-to-metal contact is not achieved after reaching Maximum Torque.
  4. Torque requirements shown are for standard B7 studs and 2H nuts.

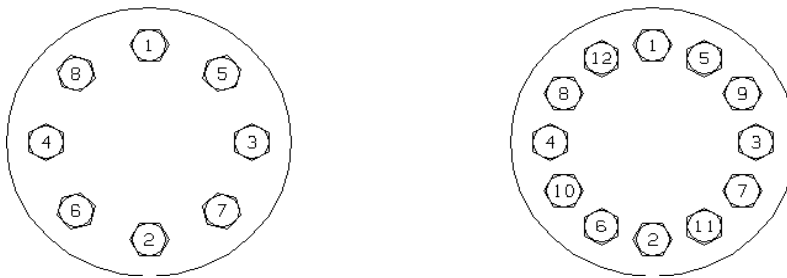


Figure 8 - Bolting Torques and Tightening Sequence

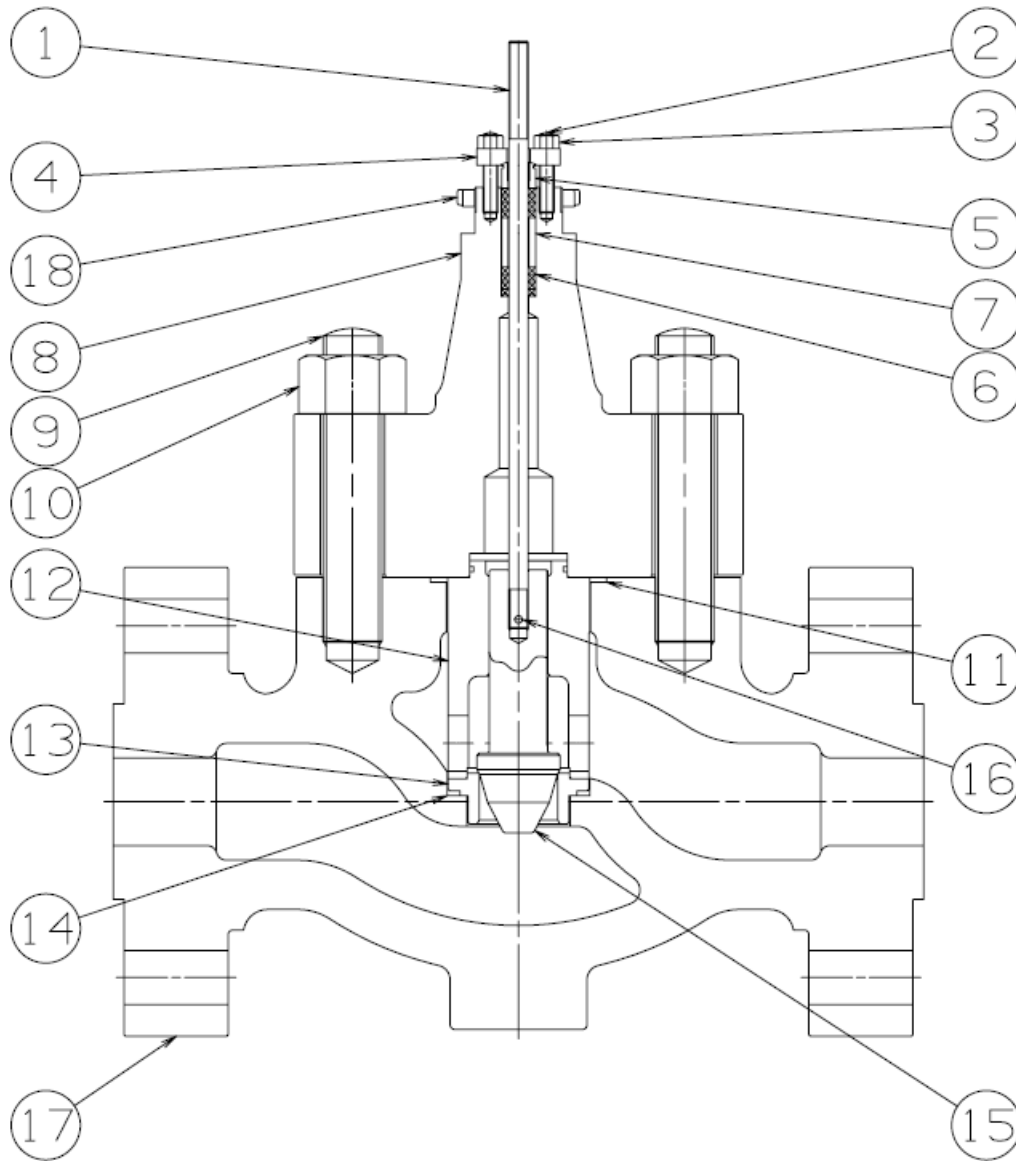


Figure 9 – 21009 Series Cage Guided Globe Valve

ref.	Part name	ref.	Part name	ref.	Part name
1	1 Plug Stem	9	Body Stud	17	Body
	2 Packing Flange Stud	10	Body Stud Nut	18	Drive Nut
	3 Packing Flange Stud Nut	1	11 Body Gasket		
	4 Packing Flange	1	12 Cage		
	5 Packing Follower	1	13 Seat Ring		
1	6 Packing	1	14 Seat Ring Gasket		
	7 Lantern Ring(optional)	1	15 Plug		
	8 Bonnet	1	16 Plug Pin		

1 Recommended spare parts.

# DIRECT SALES OFFICE LOCATIONS

## AUSTRALIA

Brisbane:  
Phone: +61-7-3001-4319  
Fax: +61-7-3001-4399

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