



# EV-11 GATE VALVE INSTALLATION, OPERATION, AND MAINTENANCE MANUAL

NO.: K-1479

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## KEROTEST FACTORY EV-11 GATE VALVE INSTALLATION, OPERATION, AND MAINTENANCE MANUAL

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### 1 SCOPE

This installation, operation, and maintenance manual defines the procedures for proper use and common repairs on the EV-11 line of soft seat gate valves made by Kerotest Manufacturing Corp. This manual is only to be used by personnel familiar with this guide and operation of the EV-11.

### 2 PRODUCT DESCRIPTION AND FEATURES

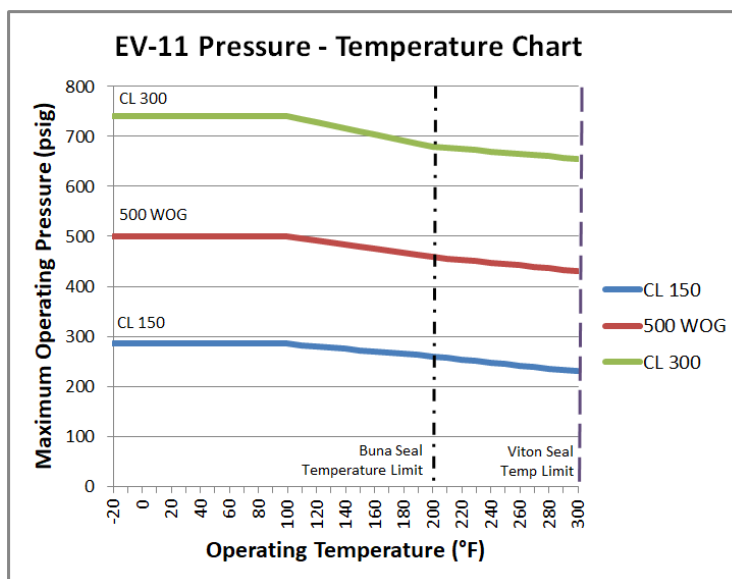
Below are some of the features of the Kerotest EV-11 gate valves:

- Low maintenance
- No gland tightening
- No lubrication required
- Full opening and compatible for hot tapping
- Bubble tight shut-off
- Low operating torque
- Field repairable
- Soft and resilient elastomer seat
- No conventional seats to damage – a one-piece rubber seal surrounds the top and sides of the gate
- Valve body has a smooth bottom with no cavity to accumulate debris
- Bidirectional installation and operation

The intent of this manual is to acquaint our customers with installation, operation, and maintenance/service repair techniques for EV-11 Gate Valves. EV-11 Gate Valves are cast steel valves with a rubber sealing seat used in natural/fuel gas distribution pipelines and are available in NPS 2 through NPS 12, in ASME/ANSI Pressure Classes 150 and 300 and intermediate pressure rating of 500 CWP maximum operating pressure (psi). The valve end connections are welded, flanged, and weld-by-flange. Temperature limits of the valves are -20°F to 300°F for Viton<sup>®1</sup> seals and -20°F to 200°F for Buna seals with allowable pressures as shown in Figure 1.

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<sup>1</sup> Viton<sup>®</sup> is a registered trademark of The Chemours Company



**Figure 1: EV-11 Pressure-Temperature Chart**

### 3 CAUTIONS AND WARNINGS

Within this document, you will see the following symbols.



- General Advisory Marking - for information or operational procedures, order of operation, etc.



- Caution Marking – note designates an action or step that may result in personal injury or death or equipment/property damage. Personnel performing activities should be fully aware of the hazards and take necessary steps to prevent any injuries, damage, or unsafe operating/repair conditions.

### 4 VALVE IDENTIFICATION

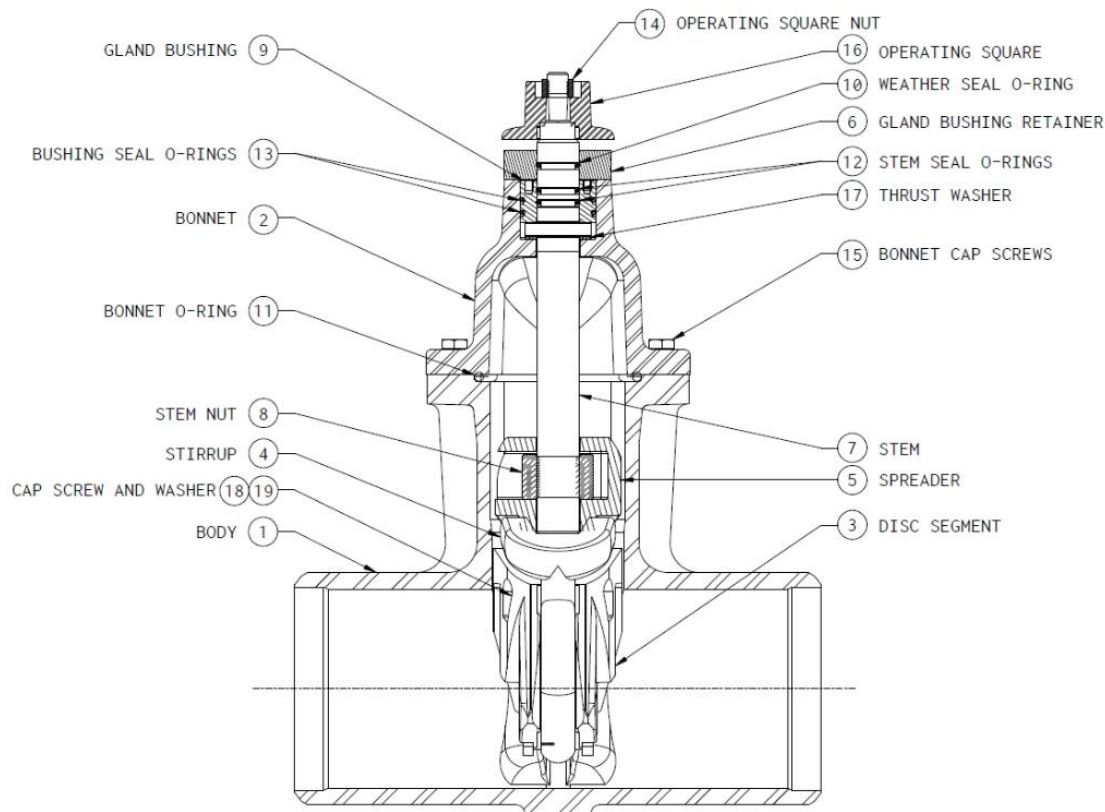
Each valve will have an identification nameplate attached with the following information:

- Manufacturing company
- ASME/ANSI pressure class, or intermediate pressure rating (such as 500 WOG or CWP<sup>2</sup>)
- Temperature and pressure ratings
- Body and stem materials
- Serial number<sup>3</sup>
- Date of manufacture
- EV-11 (name of the product line)

<sup>2</sup> Kerotest refers to valves marked 500 WOG (Water, Oil, Gas) and 500 CWP (Cold Working Pressure) as equivalent terms. This rating indicates the maximum operating pressure in psi at temperatures up to 100°F.

<sup>3</sup> Serialization marking on tags began September 2014. As of February 2018, the serial number is also stamped directly on the body of the valve

## 5 VALVE COMPONENTS



**Figure 2: Valve Components**

**Table 1: Material Specifications**

Item	Part Name	Material
1	Body	Steel, ASTM A216, Grade WCB
2	Bonnet	Steel, ASTM A216, Grade WCB or Ductile Iron
3	Disc Segments	Ductile Iron, ASTM A536
4	Seal Member (Stirrup)	Buna-N or Viton
5	Spreader	Ductile Iron, ASTM A536
6	Gland Bushing Retainer	Steel
7	Stem	Ni. Pl. Steel or 416 Stainless Steel on later valves
8	Stem Nut	Manganese Bronze
9	Gland Bushing	Bronze
10	Weather Seal O-Ring	Buna-N or Viton
11	Bonnet O-Ring	Buna-N or Viton
12	Stem Seal O-Ring	Buna-N or Viton
13	Bushing Seal O-Ring	Buna-N or Viton
14	Operating Square Cap Screw or Nut	Alloy Steel
15	Bonnet Cap Screw	Alloy Steel, ASTM A193, Grade B7
16	Operating Square	Ductile Iron, ASTM A536
17	Thrust Washer	Bronze
18	Disc Segment Cap Screw	Alloy Steel
19	Washer	Brass (8" and smaller), Stainless Steel (NPS 10 and 12)



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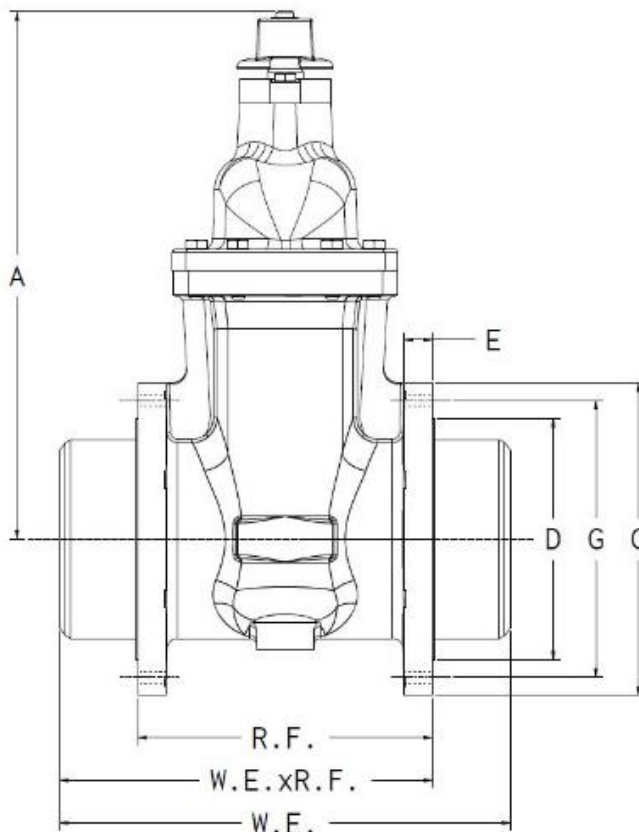
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## 6 DIMENSION DATA



All dimensions are in inches

**Table 2: Valve Dimensions and Data**

NPS Size	A	B* FLG	B* WE	B* WE x FLG	C	D	E*	Bore	G	Bolt Hole Dia.	No. of Bolts	Hand Wheel OD	Wgt FLG	Wgt WE	Wgt WE x FLG	Turns To Close
<b>Class 150–285 MOP (Face-to-face per ANSI B16.5 and B16.10 CL 150)</b>																
2	9.75	7.00	8.50	7.75	6.00	3.63	0.75	2	4.75	0.75	4	8	33	22	28	12
3	12.13	8.00	11.13	9.56	7.50	5.00	0.96	3	6.00	0.75	4	12	60	46	51	14.5
4	13.75	9.00	12.00	10.50	9.00	6.19	0.94	4	7.50	0.75	8	12	79	61	70	18.5
6	18.50	10.50	15.88	13.19	11.00	8.50	1.00	6	9.50	0.88	8	16	166	140	160	20.3 ^
8	22.38	11.50	16.50	14.00	13.50	10.63	1.13	8	11.75	0.88	8	16	308	278	291	25.8 ^
10	27.25	13.00	18.00	15.50	16.00	12.75	1.19	10	14.25	1.00	12	20	644	500	572	32.5
12	30.75	14.00	19.75	16.88	19.00	15.00	1.25	12	17.00	1.00	12	24	760	687	724	38.5
<b>500 CWP / Class 300–740 psi MOP (Face-to-face per ANSI B16.5 and B16.10 CL 300)</b>																
2	9.75	8.50	8.50	8.50	6.50	3.63	0.88	2	5.00	0.75	8	8	36	23	30	12
3	12.13	11.13	11.13	11.13	8.25	5.00	1.13	3	6.63	0.88	8	12	72	47	58	14.5
4	13.75	12.00	12.00	12.00	10.00	6.19	1.25	4	7.88	0.88	8	12	99	62	79	18.5
6	18.50	15.88	15.88	15.88	12.50	8.50	1.44	6	10.63	0.88	12	16	200	143	178	20.3 ^
8	22.38	16.50	16.50	16.50	15.00	10.63	1.63	8	13.00	1.00	12	16	375	278	335	25.8 ^
10	27.25	18.00	18.00	18.00	17.50	12.75	1.88	10	15.25	1.13	16	20	689	500	599	32.5
12	30.75	19.75	19.75	19.75	20.50	15.00	2.00	12	17.75	1.25	16	24	900	687	785	38.5

\* B (FLG & WE x FLG) and E dimensions include .062 (1/16) inch raised face thickness.

^ Valves produced prior to 1986 will have single ACME stem threads and the number of turns will be double.

## 7 ACCESSORIES

### 7.1 Locking Device

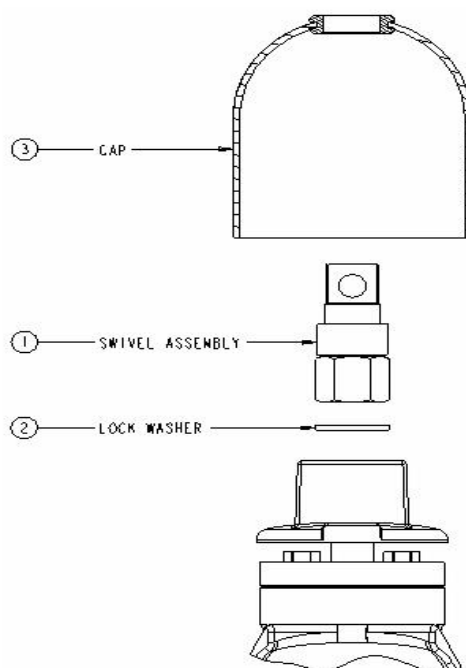
EV-11 valves can be ordered with a locking device installed or it may be installed by customers. This locking device prevents unauthorized users from changing the valve state (opened or closed) with a customer supplied lock. When installed, the lock and/or the cap may turn, but no torque is applied to the stem.

**Table 3: Locking Device Options**

Valve Size NPS	Valves built AFTER 9/1/1994	Valves built BEFORE 9/1/1994
2	54015672	54007513
3 – 4	54015680	54008180
6 – 8	54015698	54008446
10 – 12	54015706	54014261

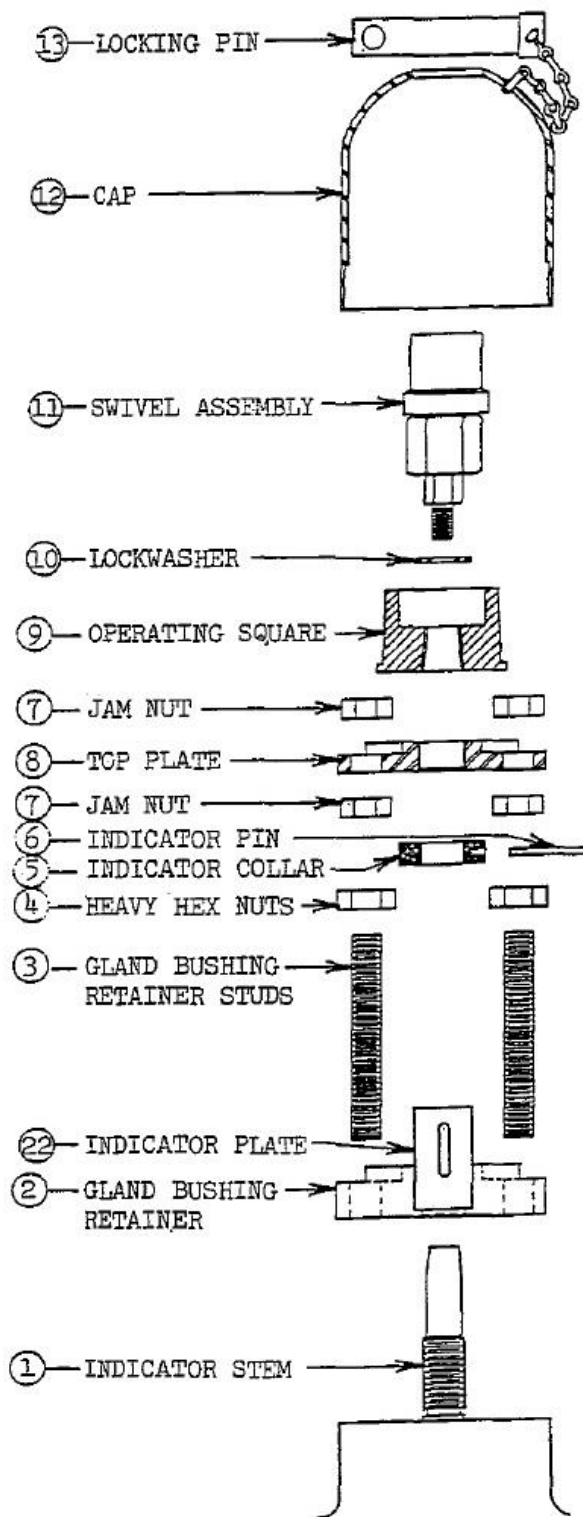
To install this device, perform the following (see Figure 3);

1. Remove nut which holds operating square in place and replace with swivel assembly (1). Keep the lock washer (2) on the assembly.
2. Place cap (3) on swivel assembly (1).
3. Attach a padlock (not furnished) to swivel assembly to complete locking device.



**Figure 3: Locking Device**

## 7.2 Position Indicator



1. Install indicator stem (1) as described in the applicable steps in Sections 11.3 and 11.4.
2. Install gland bushing retainer (2) with indicator plate (2A) attached.
3. Thread in gland bushing retainer studs (3) until the bottom is in tapped bonnet hole. Install heavy hex nuts (4) and tighten to torque specified in Table 9.
4. Temporarily install the operating square (9) and open valve fully. Remove operating square.
5. Thread indicator collar (5) on indicator stem (1) until the hole in the indicator collar aligns with the "0" position on the indicator plate (2A). Place indicator pin (6) through indicator plate (2A) and drive into the hole in the indicator collar (5) with a soft hammer.
6. Thread one jam nut (7) on each gland bushing retainer stud (3). Place top plate (8) over stem and gland bushing retainer studs. Thread a second jam nut (7) on each gland bushing retainer stud and then position the top plate (8) over the upper stem turndown, locking in the position with the four jam nuts (7).
7. Place the operating square (9) on the stem (1).
8. Thread swivel assembly (11) through washer (10) into stem (1).
9. Place cap (12) over swivel assembly (11) and insert locking pin (13) through hole in swivel assembly.
10. To complete the locking device assembly, attach a padlock (not furnished) to the locking pin.

**Figure 4: Position Indicator**





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### 7.3 Handwheel

If required, the 2" operating square may be removed and replaced with a handwheel.

**Table 4: Handwheel Options**

Valve Size NPS	Part Numbers for Given Handwheel Diameters (inches)						
	9	12	14	16	18	24**	30**
2	72530140						
3		72530165					
4		72530165					
6			72530173				
8				72530181		54003314	
10					72530199		54003777
12					72530199		

\*\* for valves built prior to 9/1/1994

### 7.4 Viton Sealing Stirrup

Class 150 and 500 CWP rated EV-11 valves come standard with Buna-N stirrup seals. If a customer requires the performance of a Viton® stirrup, these may be ordered at the time of valve purchase or may be installed in the field by following Section 11.4. Contact Kerotest for further details.

### 7.5 Stem Drive Extensions

EV-11 valves may require a permanently mounted stem extension for ease of operation. Kerotest offers a valve connecting coupling along with a top operator that a customer may join with 1-1/2 pipe, cut to the required length and welded to the fittings below.

**Table 5: Operating Square Extension**

Catalog No	Part Number	Description
9898-35	88392311	Top Operator
9898-34	72792856	Bottom Coupling

### 7.6 Coating

The EV-11 valve is ordered with either a zinc chromate gray primer coating or a two-component, high solids green epoxy coating. The gray primer will provide a limited indoor non-exposed protection against corrosion. It is the responsibility of the customer to provide long duration corrosion protection coverings or systems once installed per CFR 192 Subpart I.

The standard two component, high solids epoxy coating is generally applied 4 to 8 mils dry film thickness (DFT) unless specified by the customer.

If a valve appears corroded prior to installation, particularly on the internal components, contact Kerotest to determine if the valve can be installed.



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## 8 FACTORY TESTING

To be certain that all valves shipped from the factory are bubble tight, they are subjected to the following tests.

**Table 6: Minimum Production Test Parameters**

<b>Table 6a: Hydrostatic Shell Test</b>						
<b>Valve Size NPS</b>	<b>Class 150 (285 psi MOP)</b>		<b>500 psi CWP</b>		<b>Class 300 (740 psi MOP)</b>	
	<b>Time (minutes)</b>	<b>Pressure (psig)</b>	<b>Time (minutes)</b>	<b>Pressure (psig)</b>	<b>Time (minutes)</b>	<b>Pressure (psig)</b>
2 – 4	2	450	2	875	2	1125
6 – 10	5	450	5	875	5	1125
12	15	450	15	875	15	1125

<b>Table 6b: Hydrostatic Seat Test *</b>						
<b>Valve Size NPS</b>	<b>Class 150 (285 psi MOP)</b>		<b>500 psi CWP</b>		<b>Class 300 (740 psi MOP)</b>	
	<b>Time (minutes)</b>	<b>Pressure (psig)</b>	<b>Time (minutes)</b>	<b>Pressure (psig)</b>	<b>Time (minutes)</b>	<b>Pressure (psig)</b>
2 – 4	2	315	2	550	2	815
6 – 10	5	315	5	550	5	815
12	5	315	5	550	5	815

\* Time Listed Per Each Side

<b>Table 6c: Air Shell and Air Seat ** Test</b>						
<b>Valve Size NPS</b>	<b>Class 150 (285 psi MOP)</b>		<b>500 psi CWP</b>		<b>Class 300 (740 psi MOP)</b>	
	<b>Time (minutes)</b>	<b>Pressure (psig)</b>	<b>Time (minutes)</b>	<b>Pressure (psig)</b>	<b>Time (minutes)</b>	<b>Pressure (psig)</b>
2 – 4	2	80 – 100	2	80 – 100	2	80 – 100
6 – 12	5	80 – 100	5	80 – 100	5	80 – 100

\*\* Time Listed Per Each Side

The above tests equal or exceed those valve tests required by API 6D.

Note: valves built before changes to US CFR in July 2006 were rated and tested as follows:

Class 150 – 275 psi MOP

Class 300 – 720 psi MOP



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## 9 STORAGE, HANDLING, AND INSTALLATION

### 9.1 Storage

Store the valve carefully before installation, preferably in a well-ventilated, dry place, on a shelf or a wooden grid/pallet, preferably in the original packaging, to protect it from ground water and moisture. Leave flange and port protectors in place to provide limited internal corrosion and contamination protection.

Protect the valve from sand, dust, and water when storing or transporting.

When properly stored, the EV-11 has a shelf life greater than 10 years.

### 9.2 Handling



**CAUTION:** For heavy large valves, use rated lifting slings or straps. The valve or valve assembly must not be lifted by the operating square or handwheel. Most EV-11 valves with the operating square facing up are top-heavy and can shift or rotate in the sling.

Dropping or incorrect lifting of the valve can result in personal injury or damage to nearby equipment or property.

If pressure testing is performed prior to pipeline installation, exercise extreme caution with methods, tools, and procedures for capping and securing the valve.

### 9.3 Installation

#### 9.3.1 General Notes on Installation



**CAUTION:** Incorrect installation may result in serious personal injury or damage to nearby equipment or property. These instructions must therefore be followed carefully when installing the valve.



**Note:** The valve must only be installed in intended applications. Valves should be installed with the wedge in the closed position.

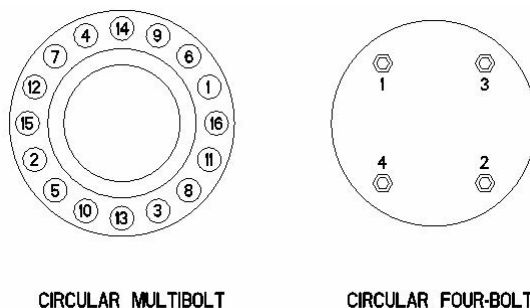
Prior to installation, remove port and flange protectors and check that the inside of the valve is clean and free of corrosion.

For valves located at the end of a pipeline, it is recommended to install a short pipe pup with a pressure rated cap to the valve outlet to reduce potential corrosion issues and gas leaks caused by unintended operation. Following installation, the pup and cap section should be pressurized to match the main pipeline.

#### 9.3.2 Flanged End Valves

- End flanged dimensions conform to ASME B16.5.
- The length of the valve must be the same as the distance between the flanges in the pipe line, taking into consideration the gasket.
- Standard end flange facing is .062 (1/16") raised face with phonographic finish. Some valves may be ordered with a flat face finish. Contact Kerotest or your distributor for further information and availability of flat face finished valves. Flat face finished valves are slightly shorter than standard faced valves.

- Bolting and gasketing practice conforming to ASME B16.5 is suggested. The bolts and gaskets used on installation must be selected to match operating conditions, temperature, pressure and medium. Gasket dimensions must be compatible with sealing faces of the flanges.
- End flange bolts should not be fastened in consecutive order. Each one tightened should be 180° opposite the previous one (see Figure 5). Two passes should be made. Once pass for half tightness and final pass for full tightness. A confirmation pass should be performed on the bolts in a clockwise pattern to verify that all bolts are fully tightened. ASME PCC-1 can provide guidelines for assembly of bolted flanges. If a tightening method is not specified, the tightening pattern described in APPENDIX B: BONNET SCREW TIGHTENING PROCEDURE can be used.



**Figure 5: Bolt Torquing Pattern Examples**

### 9.3.3 Butt Weld End Valves



**Note:** In order that the elastomer sealing stirrup is not affected during the welding operation, the valve should be in the open position. Protect the stirrup and sealing surface from weld splatter.

- Valve ends are machined per ANSI B16.25
- Valves should be installed using either the electric arc or oxy-acetylene welding methods by welders and procedures qualified in accordance with section 6, section 12, Appendix A or Appendix B of API Std 1104, section IX of the ASME Boiler and Pressure Vessel Code (ASME BPVC), or equivalent.
- Valve bodies are carbon steel (ASTM A216, GR WCB). Type 7018 Welding Rod is suggested for welding these valves in the pipeline.

### 9.3.4 Butt Weld End X Flange End Valves

- Refer to Butt Weld End Valves and Flanged End Valves for installation.



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### 10 OPERATION

#### 10.1 General Valve Operation

- Standard valves are equipped with a 2" operating square and can be operated with an adaptor tool or wrench.
- Standard valves operate clockwise to close and counterclockwise to open. See Table 2 for the number of turns to fully open/fully close. See Table 7 for full closing torque.
- If valves are in the open position in a pipeline for an extended time period, there is a chance that sediment or dirt may collect inside the valve. When these valves are to be closed, it should be done slowly. The valve should not be closed completely but "throttled" for a short time in order that the turbulence created will flush away any sediment or dirt that might have settled in the valve.



**Note:** In the event of an emergency, the above method need not be followed, as the valve should be closed as quickly as possible.

#### 10.2 Operating Torque

Valves are designed to operate at the prescribed torque values below in Table 7.

#### 10.3 Critical Torque

Excessive or unlimited torque will ultimately cause a structural failure of the valve. Table 7 indicates the torque value where valve failure will occur.

Table 7: Valve Torque Values			
Valve Size NPS	Maximum Operating Torque (ft-lbs)	Overtorque Until Failure (ft-lbs)	Min Safety Factor**
2	50	260	5.2
3	100	350	3.5
4	100	350	3.5
6	200	590	3.0
8	200	590	3.0
10	375	1180	3.1
12	375	1180	3.1

\*\* Minimum Safety Factor = Minimum Stem Failure Torque / Operating Torque

#### 10.4 Pressure Drop

Valve pressure drop (equivalent length in feet of pipe) and Cv (Flow Coefficient) are indicated below for the listed sizes.

Table 8: Pressure Drop and Cv		
Valve Size NPS	Equivalent Length in Feet of Pipe	Cv
2	1.8	294
3	2.5	689
4	1.7	1661
6	5.7	2782



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### 11 REPAIR SERVICE



**Note:** If the service methods described below do not solve the problem, call Customer Service Representative at Kerotest Manufacturing at (412) 521-4200, email Sales at [sales@kerotest.com](mailto:sales@kerotest.com), or contact your local Sales Representative.

#### 11.1 Product Bolt Torques

The table below shows the nominal torque values for the screws used in an EV-11 valve and are referenced in various service conditions discussed.

Table 9: Assembly Torque Values (ft-lbs)				
Valve Size NPS	Disc Segment Cap Screws	Bonnet Cap Screws	Gland Bushing Retainer Cap Screws	Operating Square Cap Screw
2	10	80	80	30
3	50	80	80	30
4	50	80	80	30
6	50	80	80	30
8	70	170	80	30
10	125	280	80	30
12	225	280	80	30

#### 11.2 Shut-Off or Seat Leak

During closing, the disc assembly is lowered into the valve body until the rubber stirrup contacts the body surface. Further rotation of the valve stem compresses the rubber stirrup against the body seating surface and forces the spreader to compress the rubber stirrup outward against the body in the neck area, thus providing a bubble tight seal around the neck and bore of the valve. If seat shut-off is unattainable within the operating torque range indicated in Table 7, there may be some debris trapped between the body and the rubber stirrup.

If valve shutoff does not occur using normal operation, fully open the valve, then count the number of turns to close until it stops. If the turn count is less than the number shown in Table 2, then there may be an obstruction.

Reopen the valve 4 to 8 turns and then retry to obtain seat shut-off. If stirrup damage is indicated or suspected, the valve should be serviced as described in Section 11.4.

#### 11.3 External Stem Packing Leak and Replacement Procedure

Valve leaks are generally caused by the failure of the stem packing seal, typically from worn packing or utilizing a valve outside of packing temperature limitations.

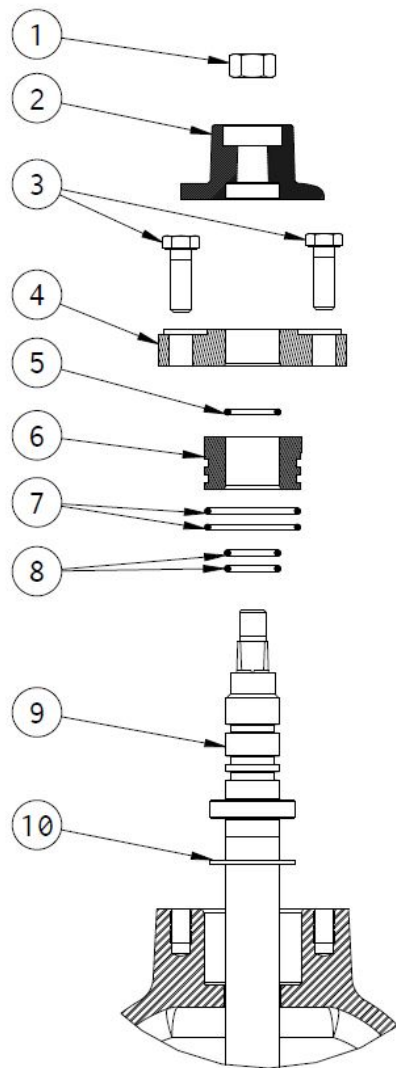


**CAUTION:** These procedures may remove the Gland Bushing Retainer from the valve while under operating pressure, exposing the operator to potential personal injury or damage to nearby property if the steps are not followed explicitly. Only authorized service associates should perform this repair.



**Note:** Repairs should only be made using Kerotest repair parts listed in Table 10 of this document.

### 11.3.1 Condition 1: Valve Under Pressure



- Using Figure 6, open valve fully. Apply an additional opening torque equal to the operating torque to stop gas flow between the thrust washer (10) and the stem shoulder.
  - Remove nut (1), and operating square (2). Earlier designs have a bolt and washer in place of the nut.
  - Remove all gland bushing retainer cap screws (3). (If gland bushing retainer rises as cap screws are loosened, apply more torque to the valve in the open direction.)
  - Remove gland bushing retainer (4) and weather seal O-ring (5).
  - Remove gland bushing (6).
- A. Nylon gland bushing (furnished prior to 1986)
1. Drill two 0.172 (11/64) diameter holes in bushing 180° apart, midway between ID and OD of bushing and 0.44 (7/16) inch deep.
  2. Screw in two #10 self-tapping screws (provided in service kit) and pull the gland bushing from bonnet.
- B. Bronze gland bushing
1. Screw two hex cap screws into threaded holes in top of bushing and pull gland bushing from bonnet. (NPS 2, 3, and 4 valves use #10-24 UNC thread. NPS 6 and 8 valves use 1/4-20 UNC thread. NPS 10 and 12 valves use 5/16-18 UNC thread).
- Remove gland bushing O-rings (7) from the gland bushing and the two stem seal O-rings (8) from the stem.

**Figure 6: Stem Packing Diagram**



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- Lubricate new O-rings and gland bushing with a suitable valve lubricant.
- Install new gland bushing O-rings (7) on the gland bushing (6).
- Install two stem seal O-rings (8) in bottom two O-ring grooves of stem.
- Install the gland bushing, chamfered end first, over the stem and into the bonnet. Use sufficient lubricant and care to ensure that the O-rings are not pinched or damaged while installing the bushing. Be sure to remove both self-tapping screws (or hex cap screws) prior to installing the gland bushing.



**Note:** the final portion of the gland bushing may be pressed into the bonnet with the gland bushing retainer. Continue to follow the remaining steps.

- Install the weather seal O-ring (5) in the top O-ring groove of the stem.
- Place the gland bushing retainer (4) on the stem, being careful not to pinch or damage the weather seal O-ring. Install the cap screws (3) and torque as specified in Table 9.



**Note:** If the retainer is being used to press the gland bushing into the bonnet, make sure that the cap screws are pulled down evenly.

- Install operating square (2) and nut (1). Earlier designs have a bolt and washer in place of the nut.

### 11.3.2 Condition 2: Valve Under Zero Pressure

The steps required to replace the stem and gland bushing seal O-rings are the same as listed in Condition 1, except that it is not necessary to fully open the valve.



**Note:** It is not recommended that the stem be used to push the gland bushing from the bonnet by rotating the stem in the closed position. If this is attempted, the stem may be unthreaded from the stem nut, allowing the stem nut to fall from its pocket in the disc assembly, and requiring disassembly of the valve.

**Table 10: Packing Repair Kit Part Numbers**

Valve Size NPS	Part Number
2	54006721
3 & 4	54006747
6 & 8	54006762
10 & 12	54006788





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### 11.4 Stirrup Servicing Procedure

1. Depressurize valve completely. Place the disc assembly in approximately the half open position.



**Note:** The parts referenced in the following steps are illustrated in Figure 7.

2. Remove all bonnet hex-head cap screws (1) and remove bonnet (2) with the disc assembly (3) through (8) from the valve body (10).
3. By turning the disc assembly, unthread assembly from valve stem. Remove stem nut (4) from pocket in spreader (3) and place aside to prevent damage or dirt contamination.



**Note:** NPS 2 valves do not utilize a stem nut. The spreader (3) is tapped and threads directly onto the stem.

4. Remove all the hex socket head cap screws (5) and disc seal washers (6) from the disc segments (7). Pry the bottom edges of the disc segments apart, separating the disc segments (7), the stirrup (8), and the spreader (3).
5. Prior to reassembly, clean and inspect all parts for wear or damage. Lubricate sparingly, all threads and all rubber parts with a suitable valve lubricant.
6. Install the stirrup (8) over the spreader (3). Insert one disc segment (7) at a time into the stirrup. This is best done by first inserting the lip on the upper edge of the disc segment into the stirrup (next to the spreader) and then rotating the bottom edge into the stirrup while maintaining an upward pressure as indicated in the exploded figure. If necessary, a dull, flat bladed screwdriver may be used to aid in assembly. Be certain that the spreader ears are positioned in the disc segment pocket.
7. When both disc segments are in the proper position, install the disc seal washers (6) and hex socket head cap screws (5) and tighten to the disc segment cap screw torque specified in Table 9.

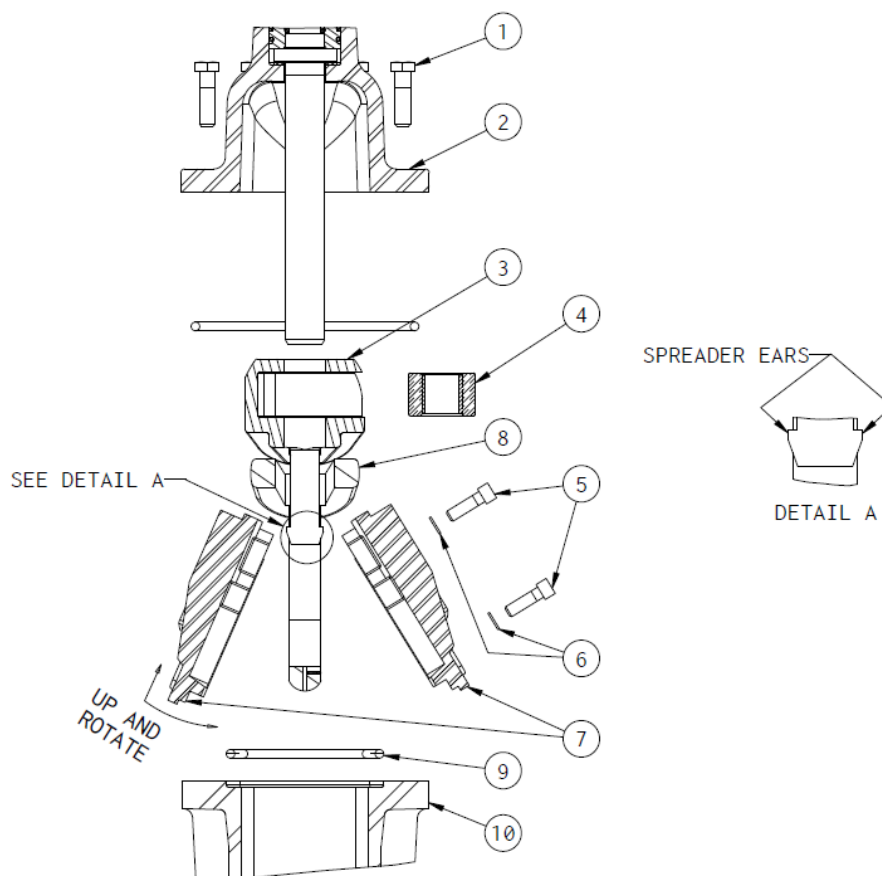


**Note:** Kerotest's current policy is to supply these items (stirrup, spreader, disc segments, disc seal washers, and hex socket head cap screws) as an assembly only, due to past cases of improper assembly and updated designs.

**Table 11: Disc Segment and Stirrup Service Kit Part Numbers**

Valve Size NPS	Pressure Class	Kit PN	Material
2	CL150 / 500 CWP	54009964	BUNA
2	CL300	54006879	VITON
3	CL150 / 500 CWP	54010012	BUNA
3	CL300	54010004	VITON
4	CL150 / 500 CWP	54010061	BUNA
4	CL300	54010053	VITON
6	CL150 / 500 CWP	54005343	BUNA
6	CL300	54005426	VITON
8	CL150 / 500 CWP	54005350	BUNA
8	CL300	54005459	VITON
12	CL300	54005731	VITON

8. Insert the stem nut (4) into the pocket of the spreader (3) and thread the disc assembly onto the valve stem. Position the disc assembly approximately halfway up the stem.
9. Position the bonnet seal O-ring (9) into the machined O-ring groove. The O-ring groove is in the valve body on NPS 2 through 8 valves and in the bonnet on NPS 10 and 12 valves. Use sufficient lubricant to hold the O-ring in position during final assembly.
10. Guide the disc assembly into the valve body and slowly lower the bonnet onto the valve body, being careful not to pinch or roll the bonnet seal O-ring. It is recommended that the bonnet be lowered to within .25 (1/4) inch of contact with the body and then install several of the hex head cap screws (1) loosely. These screws will then act as guides to ensure that the bonnet goes on straight and contacts the body squarely, eliminating the possibility of rolling or pinching the O-ring (9).
11. Install the remaining hex head cap screws (1) and tighten in a progressively torqued cross pattern, as described in APPENDIX B: BONNET SCREW TIGHTENING PROCEDURE, to the bonnet cap screw torque specified in Table 9.



**Figure 7: Stirrup Servicing**

### 11.5 External Bonnet Seal Leak

Another possible cause for an external leak could be a failure at the seal between the valve bonnet and body.



**Caution:** When a bonnet leak is detected, do not attempt to re-tighten the existing bonnet bolts and, do not attempt to operate the valve since loads applied could cause damaged bolts to break.

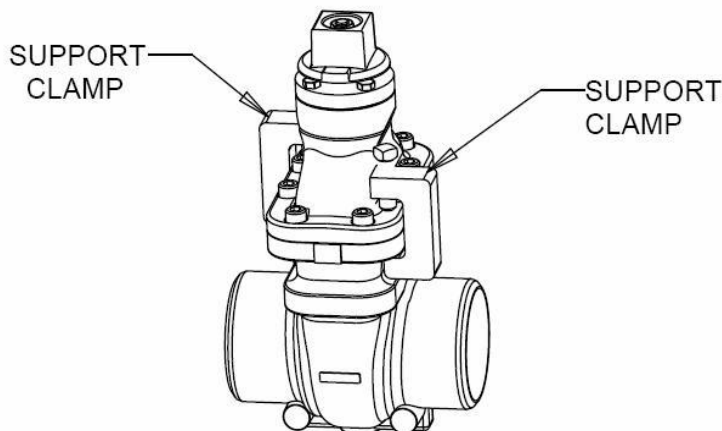
Since the bonnet joint utilizes an O-ring as the sealing member, the seal is not dependent upon bolt torque. If bonnet joint leakage occurs, the bonnet must be removed as described in the first 2 steps of Section 11.4. The bonnet seal O-ring should then be inspected for nicks, cuts or other damage and the O-ring seal areas of the bonnet and body should be inspected for damage or dirt and then repaired or cleaned. If the O-ring is damaged, replace it with a new O-ring using the part numbers listed in Table 13. Reinstall the O-ring and bonnet as described in Section 11.4, starting at step 9.

### 11.6 Use of Service Bolt Clamps for Bonnet Leaks

Support clamps are temporary service tools used to hold the bonnet onto the valve body during operation and installed at first indication of damaged or broken bonnet bolts. They are not intended as a long term or permanent solution. Proper replacement of the bolts should be scheduled at the earliest possible time.

<b>Table 12: Bolt Replacement Support Clamps</b>	
<b>Clamp Part Number</b>	<b>Compatible Valve Sizes (NPS)</b>
72544794	2 and 3
72544802	4 and 6
72546092	8, 10, and 12 <sup>1</sup>

<sup>1</sup> This support clamp is not required for bolt replacement.



**Figure 8: Support Clamp Installations**




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1. If using these clamps, initially place one in between the two bolts that are closest to the leak location or to the broken bolt. Another clamp should be placed on a diametrically opposite location on the bonnet. See Figure 8.
  2. Replace the bolts on either side of both clamps, tightening the new bolts to the bonnet screw torques listed in Table 9. Then move both clamps in between the next two bolts to be replaced. Remember to always keep both clamps diametrically opposite of each other.
-  **Note:** Kerotest part numbers for bonnet bolts are listed in Table 13.
3. After replacing all of the existing bonnet bolts, if the leakage has stopped, the repair is complete, and the valve is ready for service.
  4. If the leakage continues, refer to Section 11.5.

**Table 13: Bonnet Bolt, Stem, and Seal Part Numbers**

Valve Size NPS	Bonnet Bolt PN	Bolt Qty	Bolt Description	Standard Stem PN	Bonnet Seal PN
2	54004890	4	1/2-13X1.50,GR8 Hex Cap	54015235	54000344
3	54004890	6	1/2-13X1.50,GR8 Hex Cap	54015243	54001169
4	54004890	6	1/2-13X1.50,GR8 Hex Cap	54015250	54002217
6	54004908	8	1/2-13X1.75,GR8 Hex Cap	54015268	54002944
8	54004916	8	5/8-11X2.00,GR8 Hex Cap	54015276	54003454
10	54004924	12	3/4-10X2.75,B7 Hex Cap	54015284	54004106
12	54004924	12	3/4-10X2.75,B7 Hex Cap	54015292	54004585

### 11.7 Broken Stems

This can be due to one of two possibilities: External damage (i.e., backhoe, etc.) or if the valve, when in the full open or full closed position, is over-torqued (see Table 7: Valve Torque).

#### 11.7.1 Valve Operation with Broken Stem

The valve stem is designed to shear at a minimum cross-sectional area at the top of stem. This should enable you to utilize a pipe wrench on the remainder of stem protruding above the gland. If the torque necessary for the pipe wrench exceeds the minimum stem failure torque per Table 7, care should be taken when operating at these levels. Follow the steps in Section 11.2 to clear any debris that may prevent the valve from fully closing.

The applicable sections of 11.3 and 11.4 should be used to replace the broken stem.



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### 11.8 Service Parts Ordering Procedure

Proper identification of replacement parts or valves will improve deliveries and eliminate order-processing errors.

When ordering replacement parts and the service part numbers are not identified in the reference tables, first identify the part from the illustration in the introduction. Locate the valve size, pressure class rating, and serial number or date code off the identification tag.

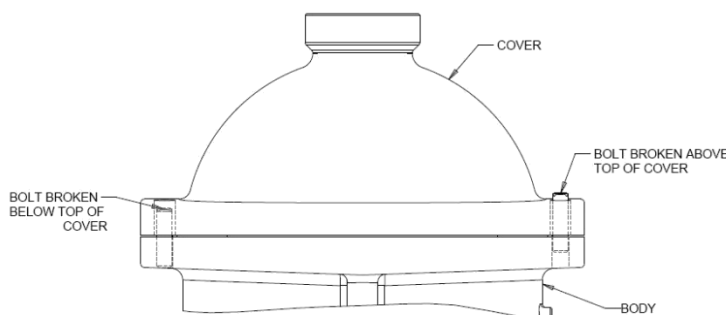
A typical replacement part order should read as follows:

3 Pieces – Stem for 8" Class 150 (or 285 MOP), Serial Number, Date 5 18

## APPENDIX A: BROKEN BOLT REMOVAL

### Information and Background

If a bolt is not broken below the top of bonnet flange shown in Figure 9, a small chisel or punch could be used to try and extract the bolt.



**Figure 9: Bonnet Broken Bolt Diagram**

When a bolt is broken down below the flange, an easy out screw extractor must be used to extract it. If available, a left-handed drill bit will sometimes remove the bolt during drilling.

The centers of these bolts are softer than the outer threaded edges. A sharp drill bit will easily penetrate the bolt with or without cutting oil. Cutting oil is preferred because it reduces the likelihood of sparks occurring during drilling.

A good quality center punch will be needed. Bolts should be punched and drilled as close to the center of the bolt as possible.

Kerotest offers a Bolt Repair Tool Kit, Part Number 72631146. This kit includes all necessary punches, drill bits and easy-outs for removing bonnet bolts on valve sizes NPS 2 through 8.

### EV-11 Bolt Removal Procedure

1. Secure bonnet to body with the appropriate clamps listed in Table 12.
2. Spray penetrating oil (not provided) on bolt surface.
3. Tap bolt with a hammer 3 to 4 times to loosen rust around threads.
4. Position punch at the center of the bolt and tap 3 to 4 times.
5. Apply cutting oil (not provided) to bolt surface.
6. Drill a shallow hole .25 (1/4) to .38 (3/8) inches deep into bolt head with proper size cobalt bit (see Table 14: Bonnet Bolt Removal Chart).
7. Tap easy-out into drilled hole until tight. Turn counterclockwise to remove bolt.

**Table 14: Bonnet Bolt Removal Chart**

Valve Size NPS	Easy Out Screw Extractor	Drill Bit Size (inch)
2 – 6	#3	.19 (3/16)
8	#4	.25 (1/4)
10 – 12	#5 (not in kit)	.27 (17/64) not in kit



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### APPENDIX B: BONNET SCREW TIGHTENING PROCEDURE

When tightening the bonnet screws or all-thread and nuts, use an incremental torque tightening procedure in the cross-pattern outlined below (taken from ASME PCC-1 – 2010, Table 2 and Table 4 respectively):

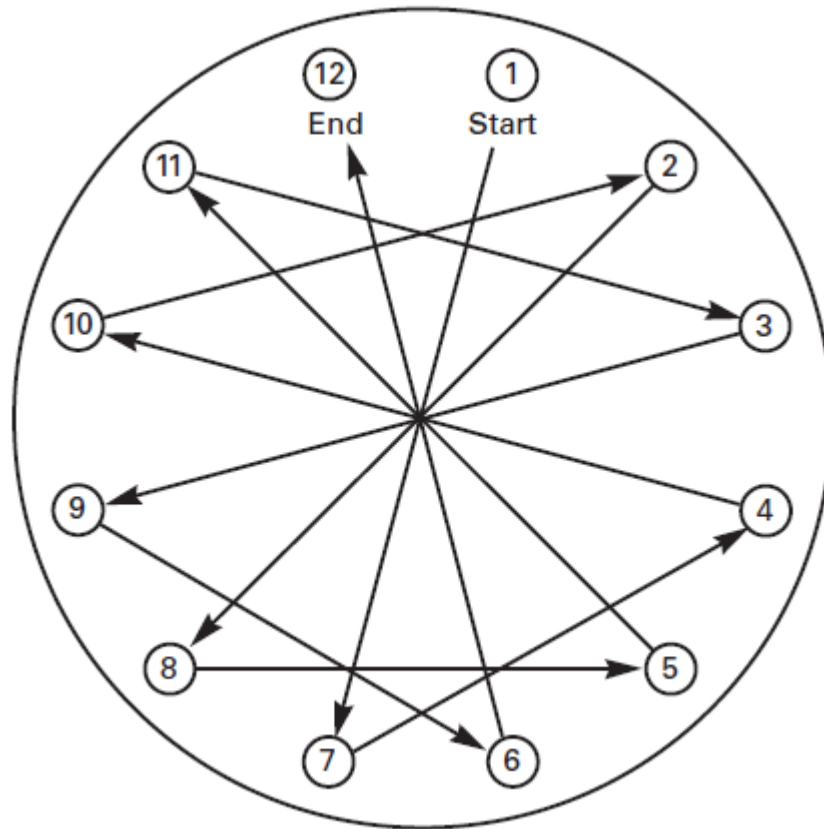
#### Incremental Tightening Procedure:

1. Hand-tighten, then “snug up” to 10 ft-lb to 20 ft-lb (not to exceed 20% of Target Torque, see Table 9). Check flange gap around circumference for uniformity. If the gap around the circumference is not reasonably uniform, make the appropriate adjustments by selective tightening before proceeding.
2. Tighten to 20% to 30% of Target Torque (see Table 9). Check flange gap around circumference for uniformity. If the gap around the circumference is not reasonably uniform, make the appropriate adjustments by selective tightening/loosening before proceeding.
3. Tighten to 50% to 70% of Target Torque (see Table 9). Check flange gap around circumference for uniformity. If the gap around the circumference is not reasonably uniform, make the appropriate adjustments by selective tightening/loosening before proceeding.
4. Tighten to 100% of Target Torque (see Table 9). Check flange gap around circumference for uniformity. If the gap around the circumference is not reasonably uniform, make the appropriate adjustments by selective tightening/loosening before proceeding.
5. Continue tightening the bolts, but on a circular clockwise pattern until no further nut rotation occurs at the final Target Torque value. For indicator bolting, tighten bolts until the indicator rod retraction readings for all bolts are within the specified range.
6. Time permitting, wait a minimum of 4 hours and repeat Step 5; this will restore the short-term creep relaxation/embedment losses. If the flange is subjected to a subsequent test pressure higher than its rating, it may be desirable to repeat this round after the test is completed.

#### Cross-Pattern Tightening Sequences:

Number the bolt holes sequentially in a clockwise direction moving around the valve. Using the Incremental Tightening Procedure, tighten the bolts using the correct pattern from Table 15.

Table 15: Cross-Pattern Tightening Sequences					
No. of Bolts	Sequentially Clockwise Sequence				
4	1-3-2-4				
6	1-4-2-5	3-6			
8	1-5-3-7	2-6-4-8			
10	1-6-3-8	4-9-2-7	10-5		
12	1-7-4-10	2-8-5-11	3-9-6-12		
14	1-8-5-12	3-10-7-14	2-9-6-13	4-11	
16	1-9-5-13	3-11-7-15	2-10-6-14	4-12-8-16	
18	1-10-6-15	3-12-8-17	4-13-9-18	2-11-7-16	5-14
20	1-11-6-16	3-13-8-18	5-15-10-20	2-12-7-17	4-14-9-19



**Figure 10: Example Pattern for 12-Bolt Tightening Sequence**





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