CAMERON	ENGINEERING STANDARD	NO.: SP-054070-01
TITLE: INSTALLATION, OPERATION AND MAINTENANCE PROCEDURE FOR TOM WHEATLEY (TW) SWING CHECK VALVE WITH STANDARD NON-EXTENDED SHAFT		DATE: Jan 16 2010
		REV.: 01
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Overview

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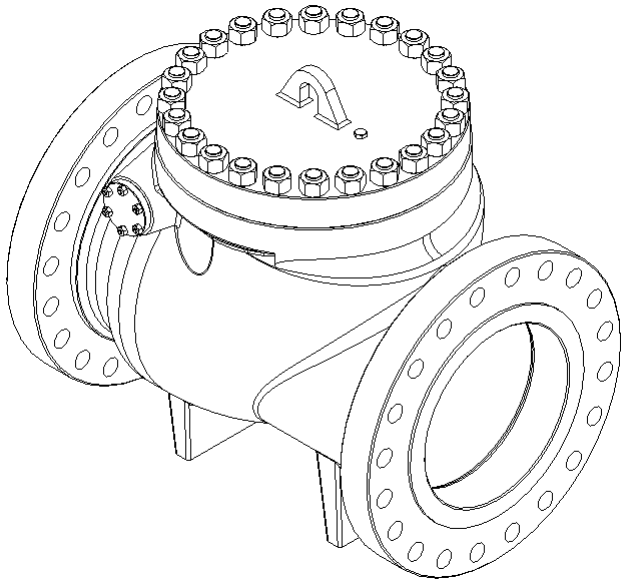
Contact: Engineering

Equipment: This operating and maintenance manual provides instructions for a Tom Wheatley swing check valve with a standard non-extended shaft.



WARNING: The following information, procedures, and instructions should be read completely and understood thoroughly prior to working with this equipment. Failure to do so may constitute abuse of the equipment and could result in serious injury to the operator.

Table of Contents

1.0. INTRODUCTION

The purpose of this document is to give instructions on the installation, operation, and maintenance of a Tom Wheatley swing check valve.

A Tom Wheatley swing check valve is designed to allow flow through a pipeline in only one direction and to close instantly when flow ceases to prevent back flow. This is accomplished by a free swinging clapper that pivots about a shaft. The clapper opens automatically when there is flow in the normal or preferred direction. When flow ceases the clapper returns to the closed position creating an instant barrier to reverse flow.

Tom Wheatley swing check valves are manufactured per the API-6D/ISO 14313 standard. Raised face and ring type joint flanges comply with the requirements of ASME B16.5 and ASME B16.47 as appropriate. Weld end valves comply with ASME B16.25 unless otherwise agreed with the customer.

All valves are full bore, full conduit design and will allow passage of various pipeline inspections gauges and spheres.

2.0. SAFETY

The following information, procedures, and instructions should be read completely and understood thoroughly prior to working with this equipment. Failure to do so may constitute abuse of the equipment and result in serious injury to the operator.

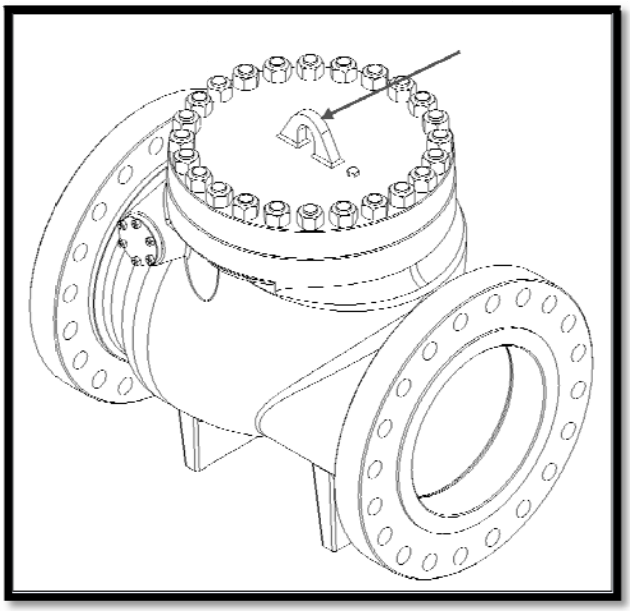
Cameron Tom Wheatley does not accept any responsibility for damage to people, property, or plant due to:

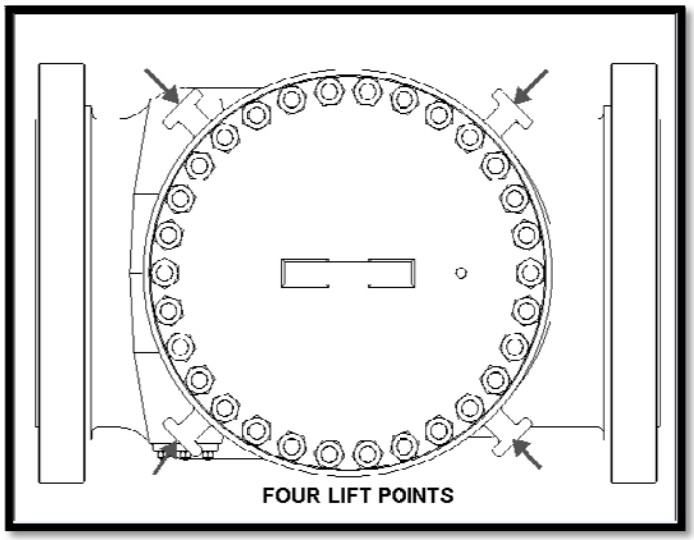
- Defective or incorrect installation
- Defective or incorrect maintenance of the valves by the client
- Incorrect use of the valves
- Using untrained personnel for maintenance operations that do not have a basic knowledge of valves
- Failure to comply with this manual and safety standards

2.1. Handling and Lifting

It is important that all handling operations are carried out by personnel trained in relation to the problems associated with handling heavy objects. Check the maximum lifting capacity of the cables available and the weights to be lifted.

The valve should be lifted using the lifting points shown in Figure 1.





2.2 Pressure Limitations

Tom Wheatley swing check valves are designed to operate at the pressure limits of the pressure classes designated in API-6D/ISO 14313. Exceeding those pressure limitations could result in damage to the valve and/or serious injury or death to personnel. Consult the nameplate that is attached to the valve body for the pressure limits of the valve.

3.0. PRESERVATION AND STORAGE

When valves have to be stored on site for a prolonged period of time before being installed in the pipeline, they should be stored in a dry place, under cover. The integrity of packaging and protective materials must be maintained. Valves are supplied with suitable caps or end covers to protect the internal parts of the valve. These caps should not be removed unless carrying out maintenance or inspection. Afterward the caps should be refitted. If valves are to be stored for more than 6 months, it is recommended that silica gel packets or other suitable desiccant be place inside the valve to absorb moisture.

Cameron suggests that when valves are to be stored for prolonged lengths of time, the following should be considered to insure the protection of the various components.

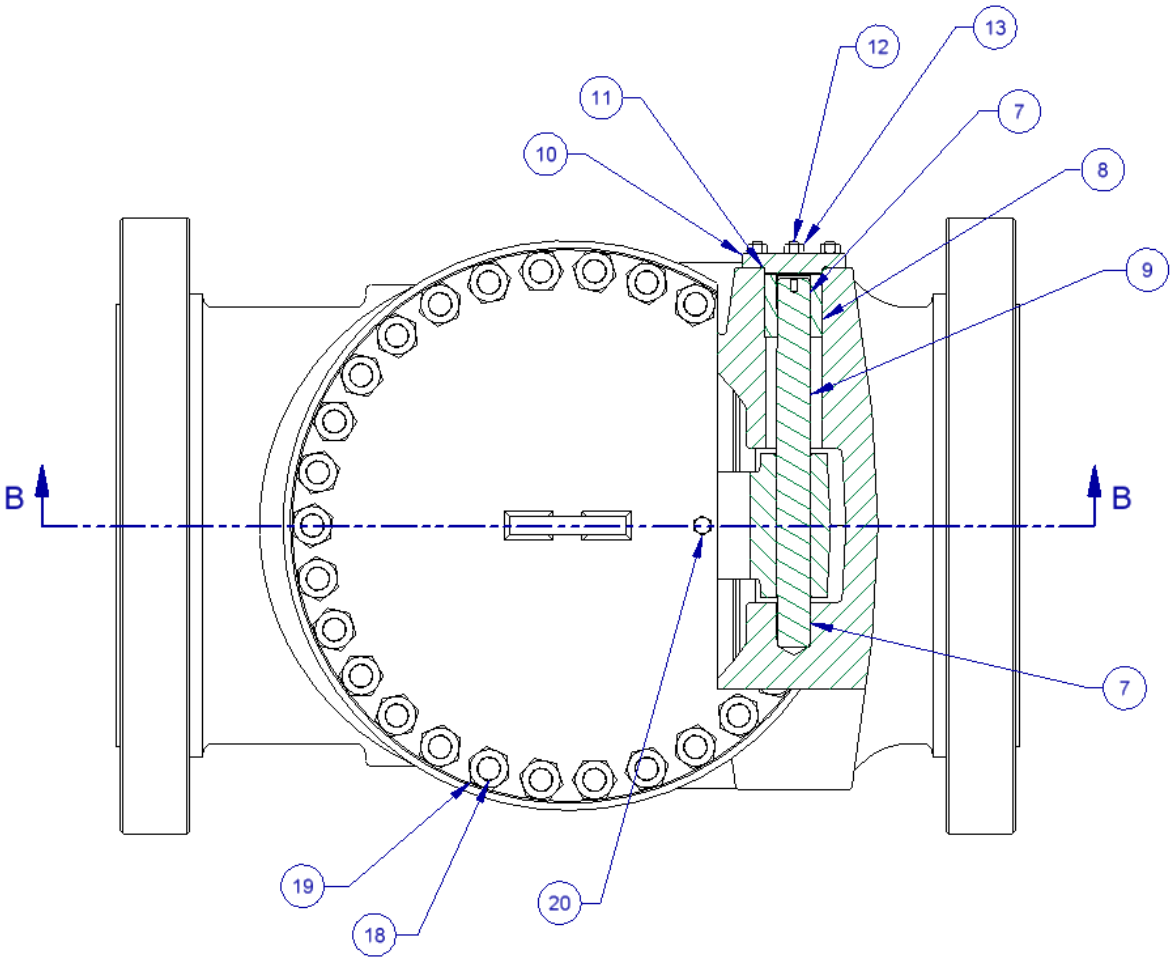
The body cavity can be protected by using Shell VPI #300, (powder or tablets), or COR-TAB brand tablets, in amounts listed in column 3 of Table 1. This material can be inserted in the pipe plug of the valve cover. It is recommended that more tablets be added every 6 months per Table 1 Column 3.

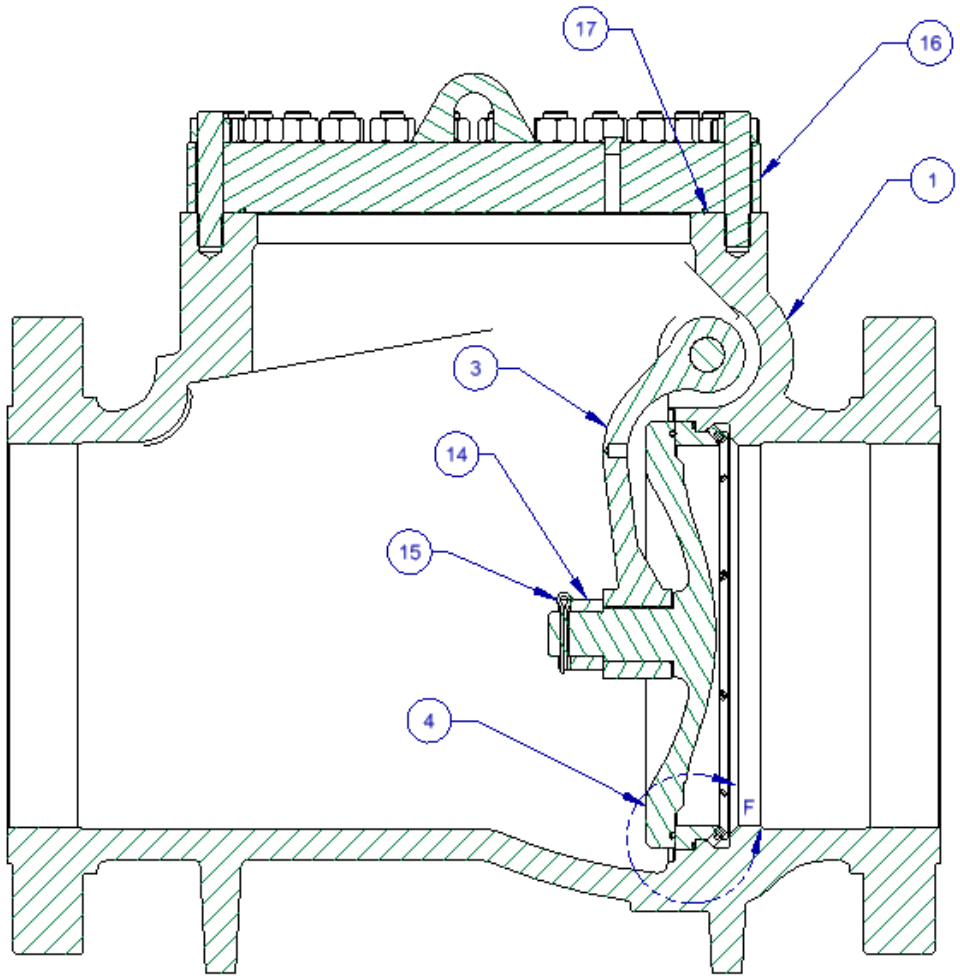
Table 1: Recommended amount of desiccant tablets for long term storage

Nominal Valve Size (IN)	Valve Thru-Bore Recommended Amount of Tablets (GRAMS)	Body Cavities Recommended Amount of Tablets (GRAMS)
2	.5	.5
4	.5	.5
6	.5	.5
8	1	.5
10	2	1
12	3	1
14	4	1
16	5	1
18	7.0	2
20	10	2
22	12	2
24	14	3
26	17	3
28	22	3
30	26	4
32	33	4
34	40	5
36	48	5
40	60	6
42	76	8
48	100	9
56	140	11

NOTE: EACH .5 GRAM TABLET WILL PROTECT 864 CUBIC INCHES

4.0. VALVE CONFIGURATION AND COMPONENTS

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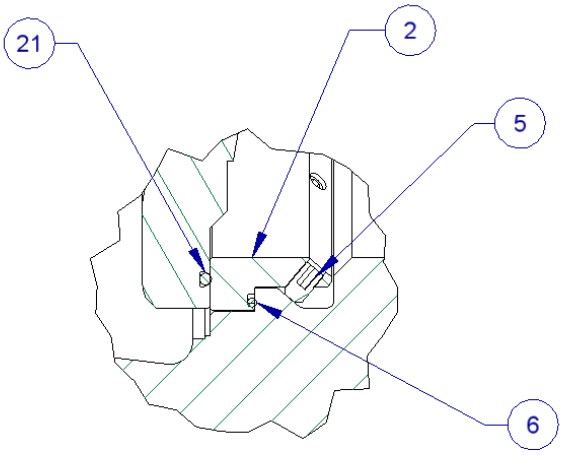
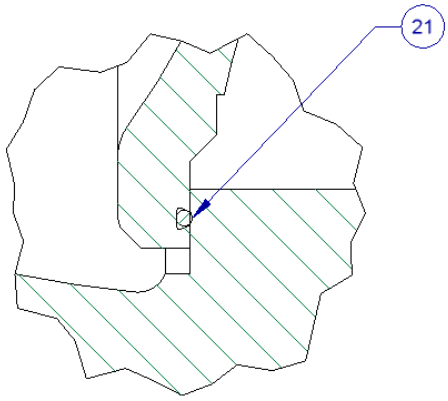


Renewable Seat



Integral Seat

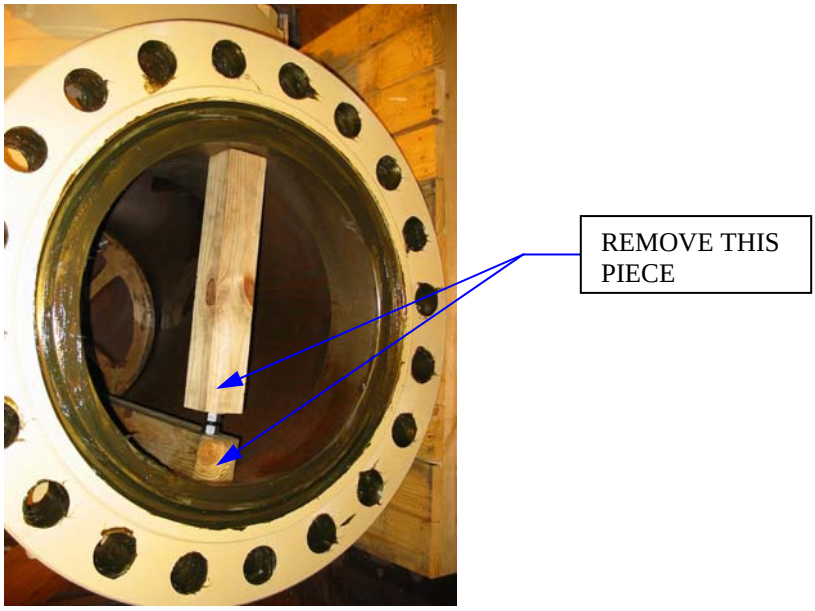
Table 2: Parts List

Item #	Description
1	Body
2	Renewable Seat (if supplied)
3	Arm
4	Clapper
5	Seat Set Screw (if supplied)
6	Seat O-ring (if supplied)
7	Bearing
8	Bearing Retainer
9	Shaft
10	Gland Body
11	Gland Body O-ring
12	Gland Body Stud
13	Gland Body Nut
14	Clapper Nut
15	Cotter Pin
16	Cover
17	Cover O-ring
18	Cover Stud
19	Cover Nut
20	Pipe Plug
21	Clapper O-ring

5.0. INSTALLATION AND PRE-COMMISSIONING

5.1. Unpacking the Valve

Remove the packing protective material. A wooden shipping member may have been placed inside the valve to immobilize the clapper during shipment. DO NOT install the valve until this component has been removed.



5.2. Installing the Valve in the Pipeline

When lifting or moving the valve, use the lifting points illustrated in Section 2.1.

For flanged end valves, install the valve in the pipeline with appropriate gaskets to seal the valve flanges to the pipeline flanges and fasten the valve in place.

For weld end valves, install the valve in the pipeline and weld with an appropriate weld procedure. Cameron-Tom Wheatley does not recommend welding procedures as this is the responsibility of the pipeline constructor.

The check valve must be installed in a pipeline with the arrow (located on the outside of the body) pointing in the direction of flow. Since it is gravity that swings the clapper to the closed position, angling the outlet upwards will increase the pressure drop through the valve at a given flow rate while angling the outlet downwards will decrease the pressure drop.

5.3. Hydrostatic Testing

Test valve in accordance with API-6D/ISO 14313.

The preferred method of filling the valve or pipeline is from the up-stream side of the check valve. The valve or pipeline should also be pressured from the up-stream side.

Caution: The valve clapper should never be tested to pressures exceeding the original factory seat pressure tests.

6.0. VALVE OPERATION

6.1. General Design

The check valve is provided with a standard non-extended shaft and gland cover plate. The clapper arm is free swinging. The clapper hangs in the closed position due to gravity and opens when fluid is flowing through the valve. The valve functions to allow flow in the normal (preferred) direction and prevent reverse flow automatically. No operator intervention is required.

6.2. Routine Maintenance

Tom Wheatley check valves have provided years of trouble free service with little or no maintenance. However, periodic visual inspections commensurate with the type of service and pressure rating are recommended.

6.3. Pigging Operations

CAUTION: Pigging operations must be conducted in the direction of primary flow.

The valve clapper is designed to withstand the impact of a pig during normal pigging operations. To minimize the effects of pigs impacting onto the clapper, a bumper nose on the pigs is strongly recommended. Scraper, cleaning, and gauging pigs can be passed through the valve. Multi cup pigs can be used. Their design shall ensure continuous support throughout the valve and they should be designed with the minimum of flow bypass.

6.4. Trouble Shooting

Malfunction	Probable Cause	Solution
Leak from the body/cover seal.	Seal is damaged.	Contact Cameron Tom Wheatley for replacement parts and /or service.
Leak from the body/gland seal.	Seal is damaged.	Contact Cameron Tom Wheatley for replacement parts and /or service.
Valve leaks internally to the upstream side.	1. Clapper seal is damaged. 2. Seat face or O-ring is damaged. 3. Debris stuck between the clapper and seat. 4. Debris in belly of valve inhibiting clapper movement.	1. Contact Cameron Tom Wheatley for replacement parts and /or service. 2. If possible, flush line or create flow through the pipeline to dislodge debris.

7.0. DISASSEMBLY AND REPAIR

7.1. Preparation for Disassembly of the Check Valve

7.1.1. Mark all components with alignment marks to assure proper orientation when re-assembling.

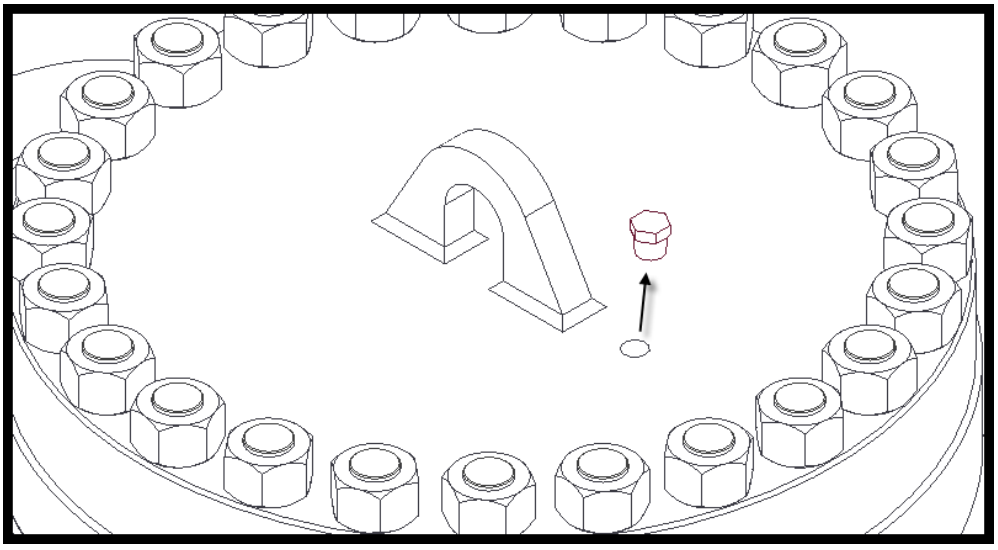
7.1.2. Gather tools necessary for disassembly of the valve. Hydraulic torque wrenches will be necessary to tighten the bolting on larger valve. A crane will be necessary to remove the cover and arm/clapper on larger valve. Please check with Cameron – Tom Wheatley on the weights of valve assemblies and parts.

7.1.3. See recommended spare parts list in Section 9.0 for spares. Contact Cameron – Tom Wheatley for specific parts numbers.

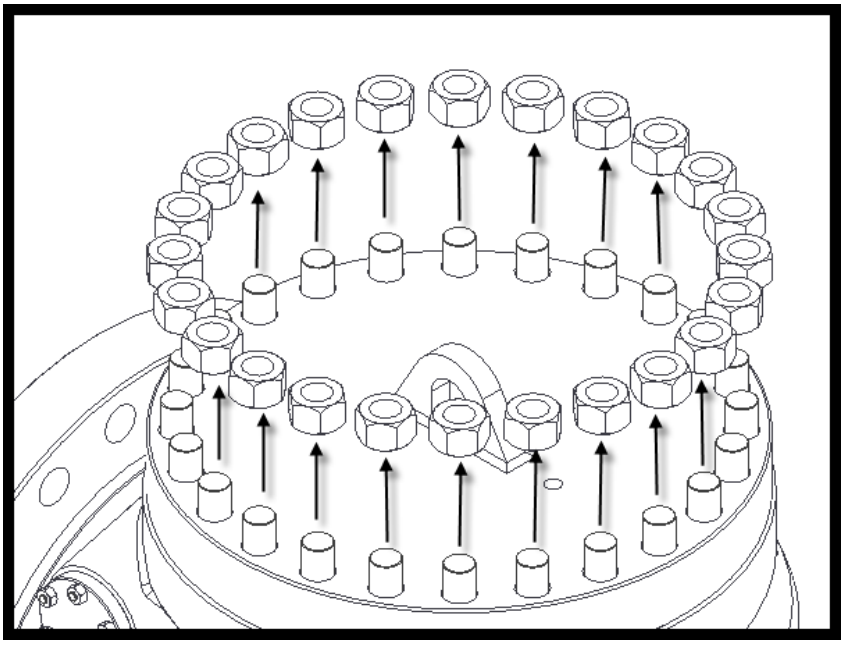
7.1.4. Light grease or 30 weight oil will aid reassembly of valve.

7.2. Disassembly of Cover

7.2.1. After line de-pressurization, carefully remove the vent plug located on top of the valve cover to release pressure that may be present.

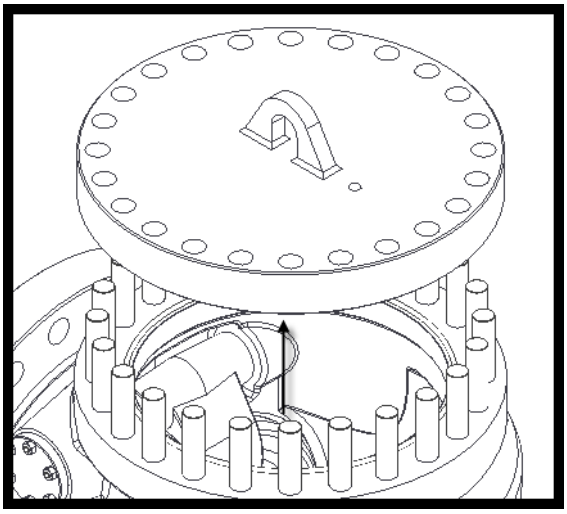


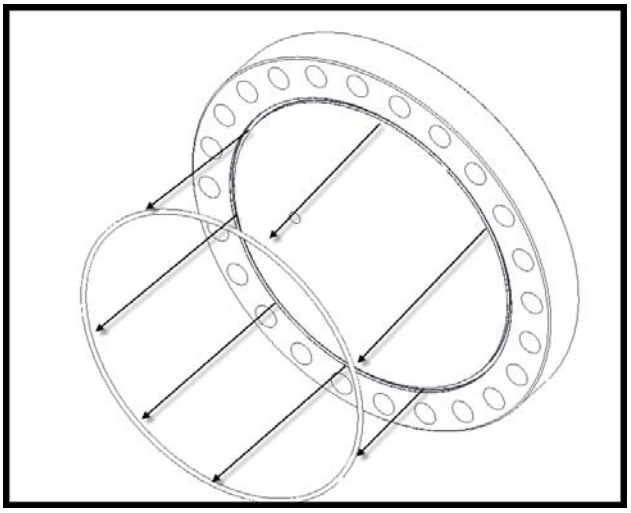
7.2.2. Remove cover nuts.



7.2.3. Attach lift line with bolted shackle to the lift eye located on the cover.

7.2.4. Carefully lift the cover clear of the valve body and remove the cover seal.

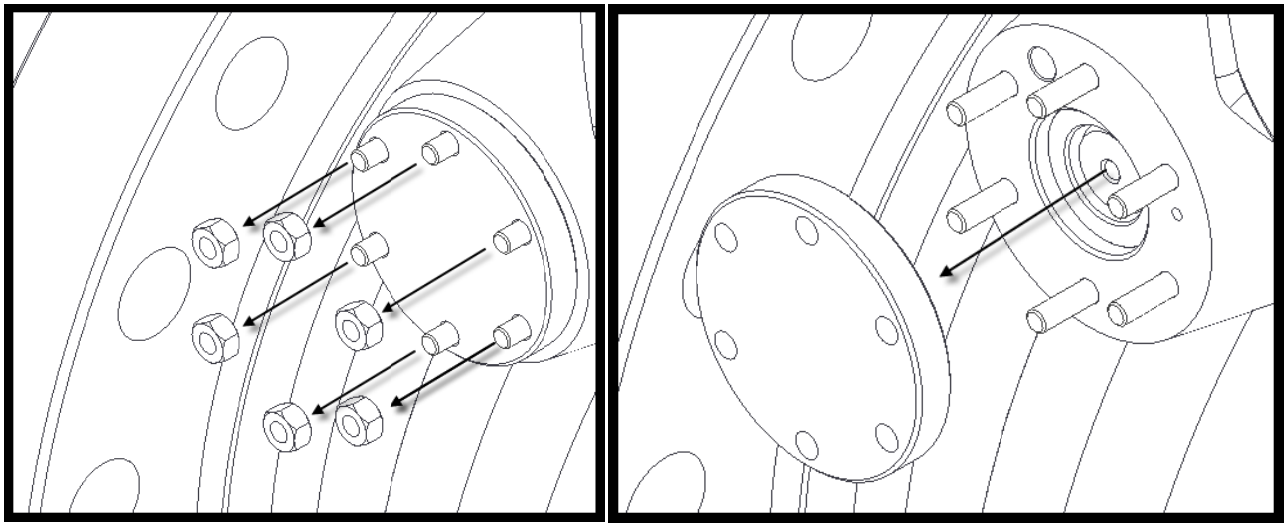




7.3. Disassembly of Shaft/ Gland Plate

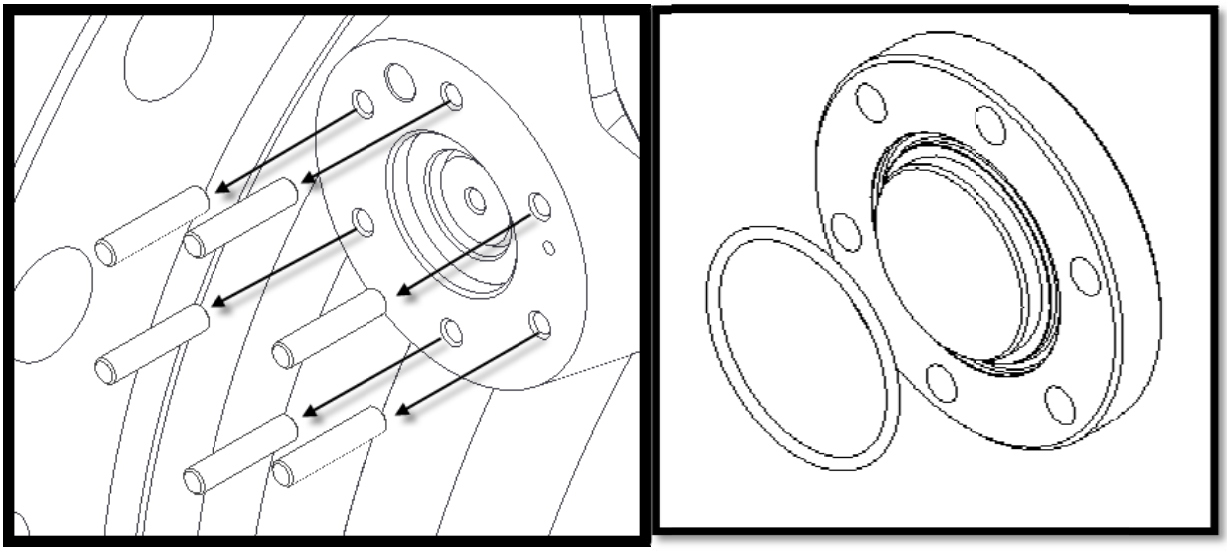
7.3.1. Loosen and remove gland cover nuts.

7.3.2. Remove gland cover plate from side of valve.



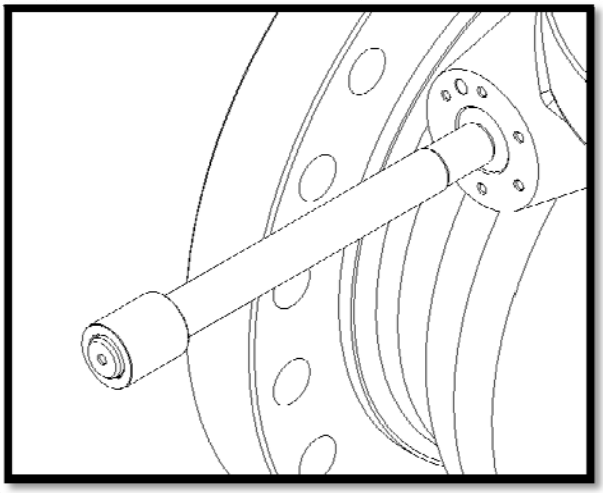
7.3.3. Extract studs from valve body.

7.3.4. Remove the gland cover seal for inspection and cleaning.

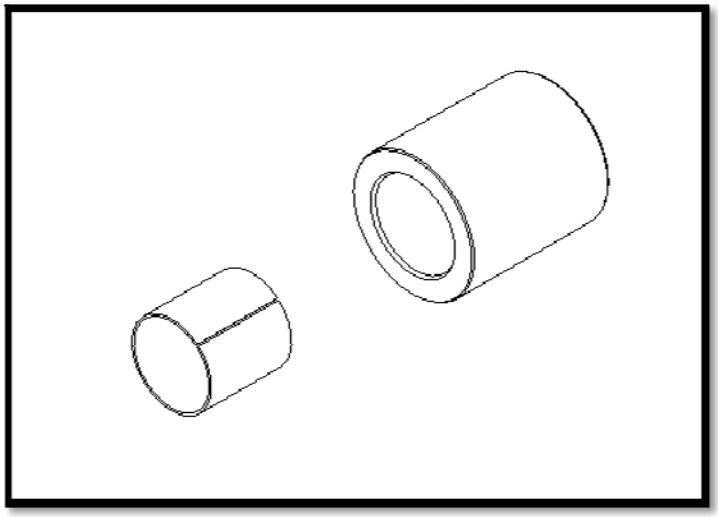


7.3.5. Attach a crane sling or strap to the arm-clapper assembly and use the crane to support its weight allowing it to slightly "float" to ease the extraction of the shaft.

7.3.6. Extract the shaft and bearing retainer from the body by using an eyebolt or other pulling device. Spacers may have been used to center the clapper to the valve bore, mark spacer in order to assembly the valve correctly. Care should be taken to prevent damaging the sealing surface of the clapper and loss of any spacers that may have been used.



7.3.7. Remove the bearing from the bearing retainer for inspection and cleaning.



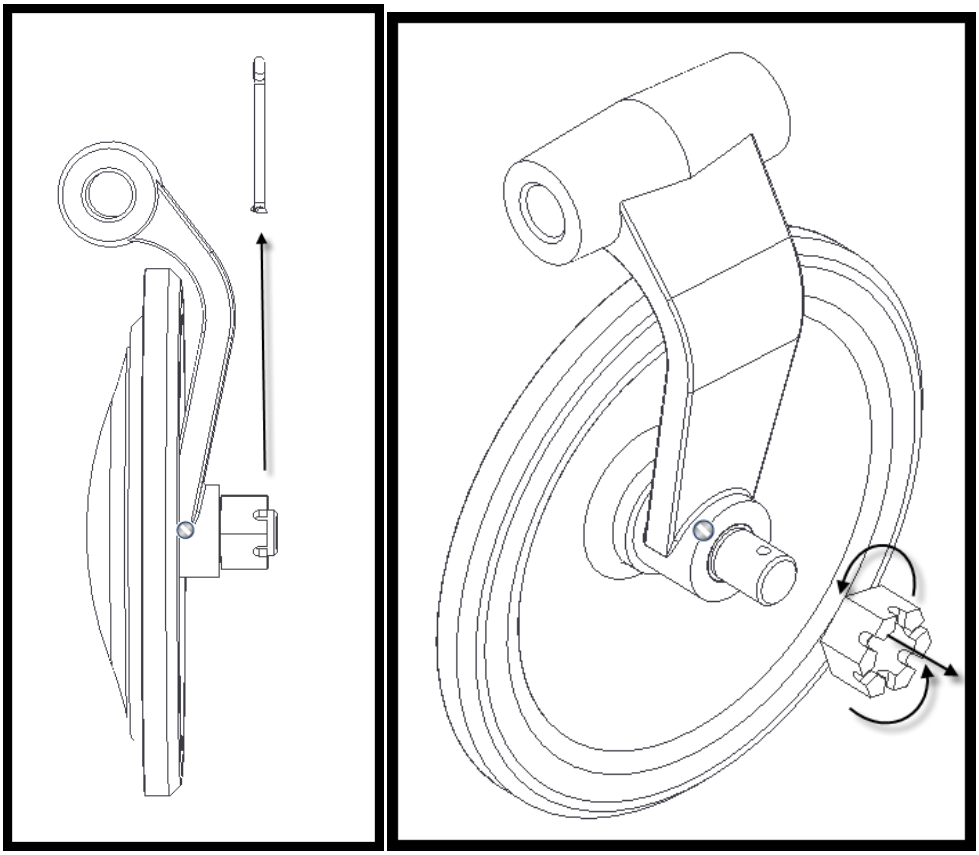
7.4. Disassembly of Arm/Clapper

7.4.1. Carefully lift the arm/clapper assembly free from the valve body using the sling previously attached. Care should be taken to prevent damaging the sealing surface of the clapper. (Not shown in image)

7.4.2. Place the arm/clapper assembly such that the clapper sealing face is on a flat surface.

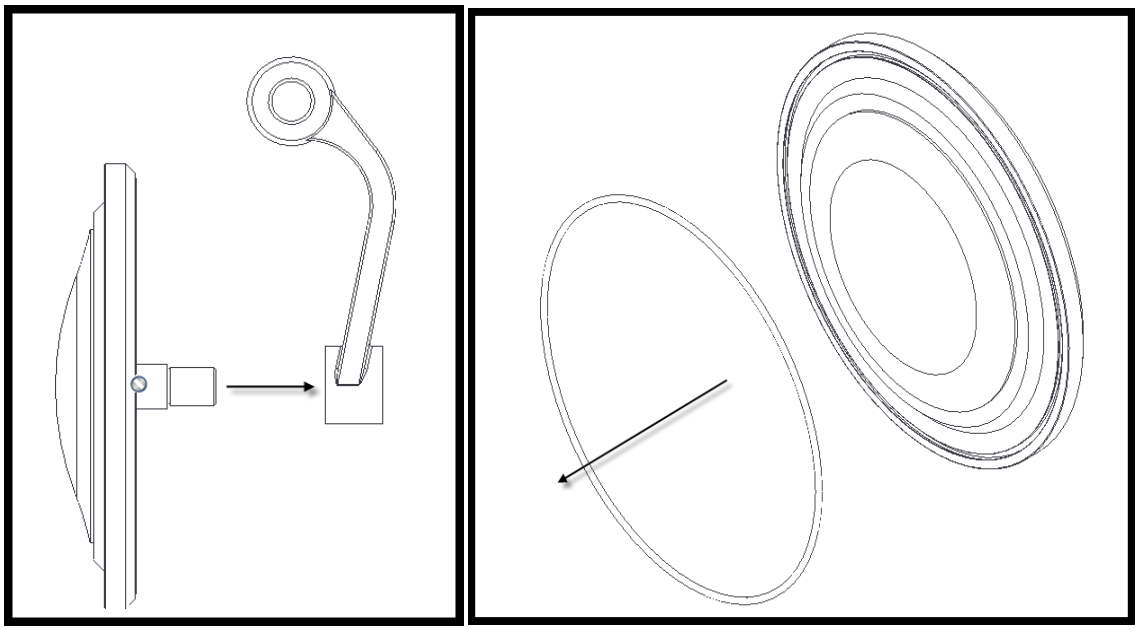
7.4.3. Remove cotter pin by straightening bent ends. (Note: image below shows cotter pin ends unbent)

7.4.4. Unthread slotted nut.

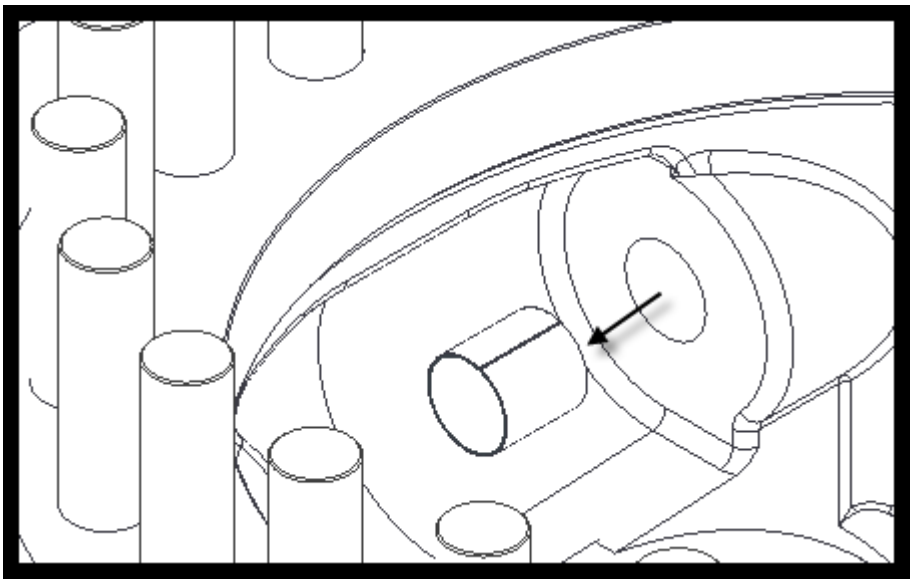


7.4.5. Remove clapper arm from clapper.

7.4.6. Remove the seal for inspection and cleaning.

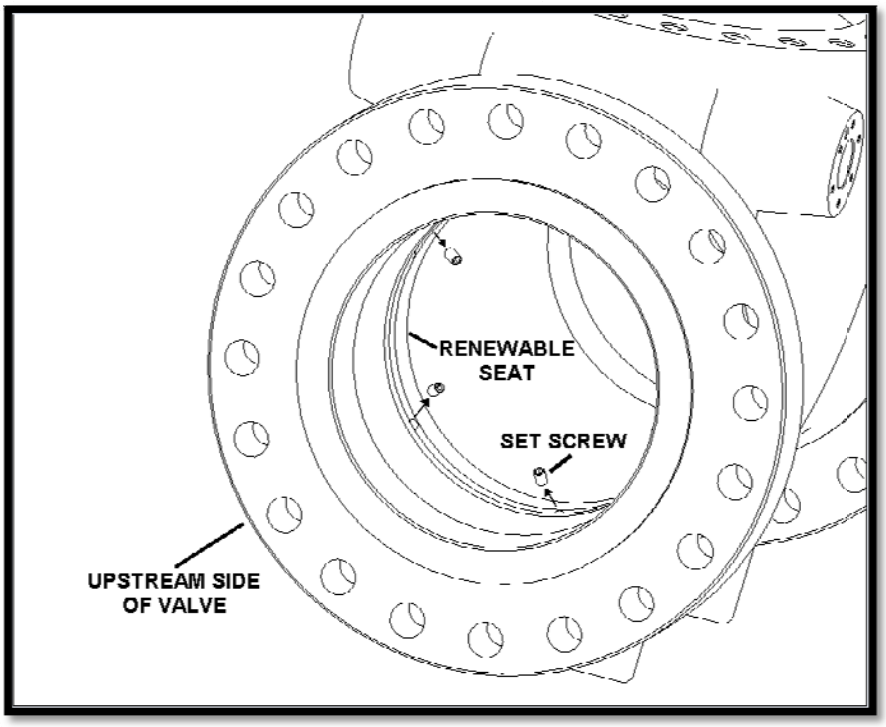


7.4.7. Remove bearing from blind end of shaft bore.



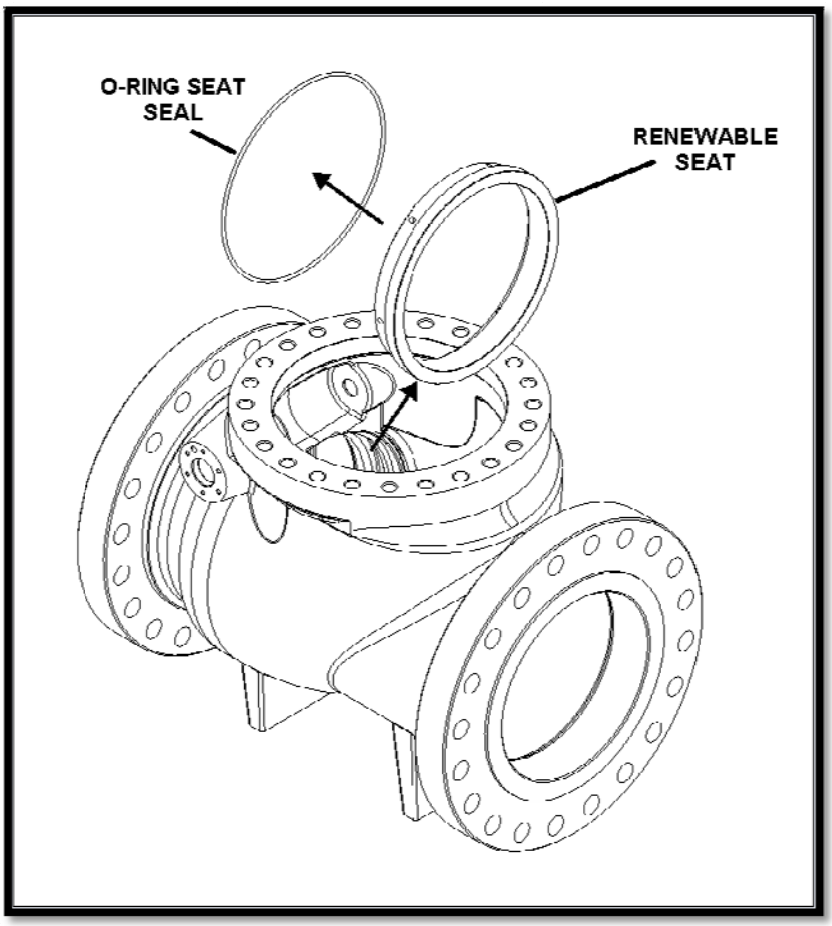
7.5. Disassembly of Renewable Seat (if so equipped)

7.5.1. Loosen and remove the seat setscrews.



7.5.2. Remove the seat from the seat pocket. Be careful not to damage the sealing surface of the seat.

7.5.3. Inspect the seat O-ring seal for damage and remove if necessary.



7.6. Inspection and Repair

7.6.1. Inspect all seals and sealing surface areas on cover, body, and clapper, and gland cover for any damage, inclusions, or any other imperfections. Replace seals and parts as required.

7.6.2. Clean all surface areas throughout valve body and components before reassembly including bolt holes, shaft bore, etc.

7.6.3. Lubricate seals and seal grooves before installing seals. Note that the shaft bearings are designed to operate dry and do not need lubrication.

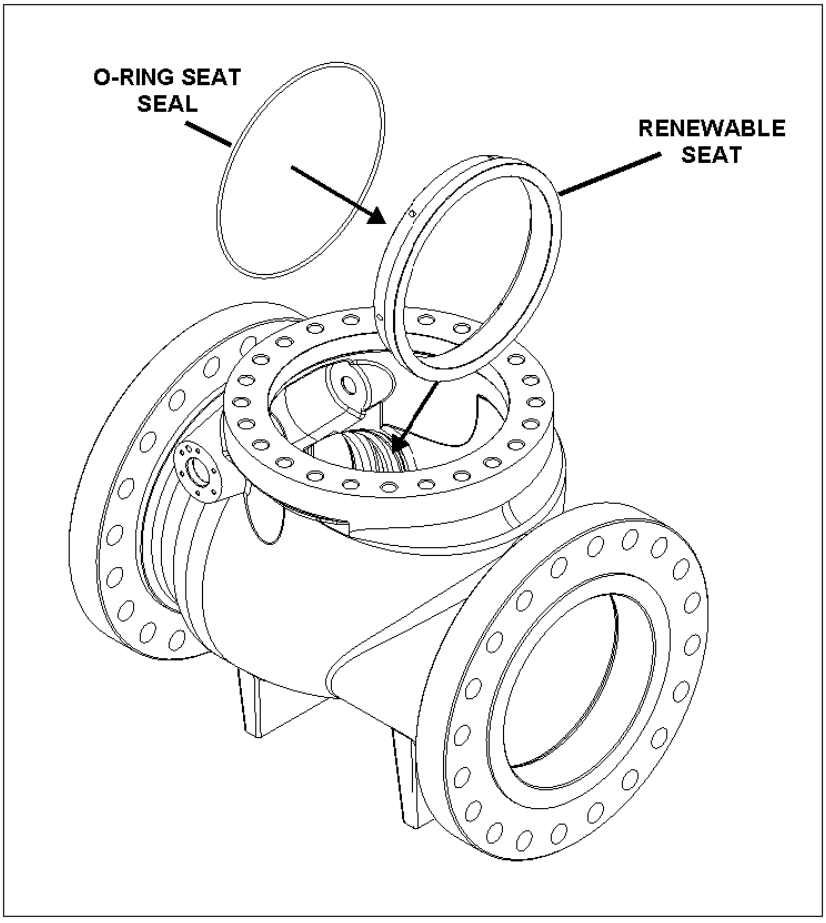
8.0 RE-ASSEMBLY OF VALVE

8.1. Re-assembly of Renewable Seat (if so equipped)

8.1.1. Insert the seat seal into the groove on the back of the seat.

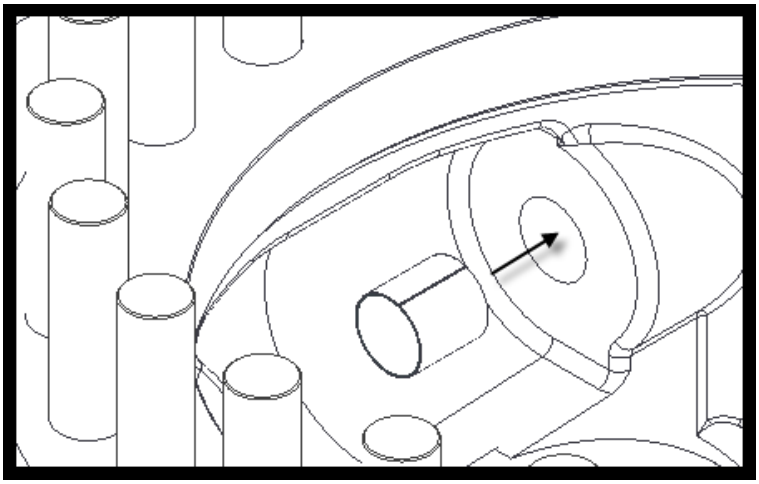
8.1.2. Insert the seat into the valve and install into the seat pocket in the body.

8.1.3. Assemble and tighten the seat set screws into the seat. Tighten the screws evenly in a star pattern. Torque the screws according to the table in Appendix A.

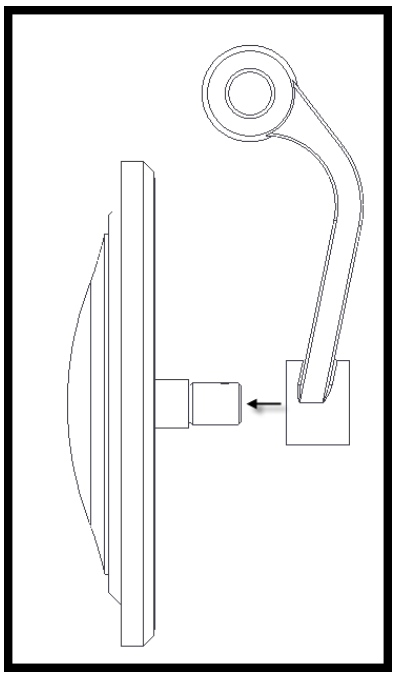


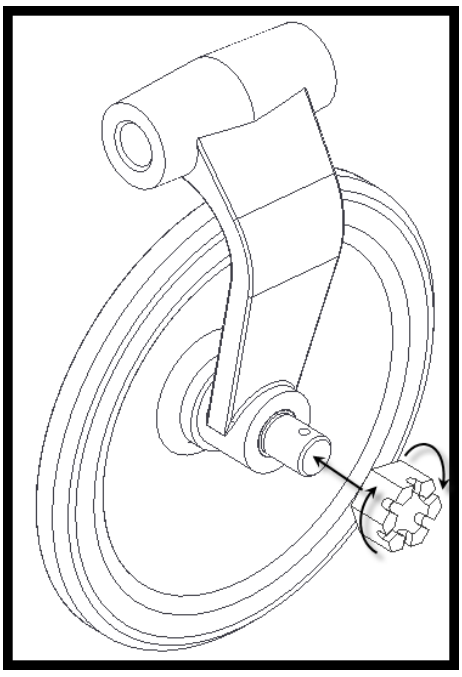
8.2. Re-assembly of arm/clapper

8.2.1. Insert bearing into blind end of shaft hole.



8.2.2. Place clapper arm over clapper and assemble slotted nut with slots facing away from arm. Rotate slotted nut until one of the slots aligns with the hole in the clapper stem while leaving a clearance of approximately 0.07” between the clapper and the arm.



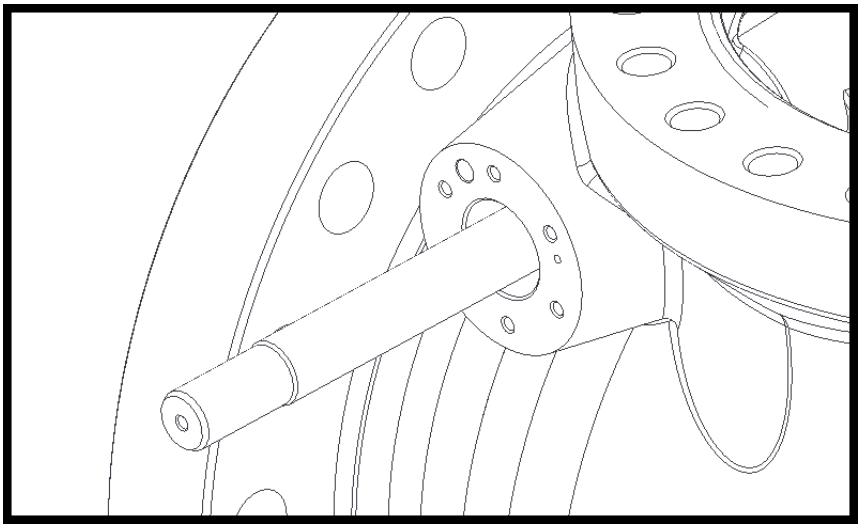


8.2.3. Insert new cotter pin through slotted nut and clapper. Bend ends of pin to assure the nut cannot unthread.

8.2.4. Attached sling to arm/clapper assembly. Carefully lift the arm/clapper assembly and place into the valve body using the sling previously attached. Care should be taken to prevent damaging the sealing surface of the clapper.

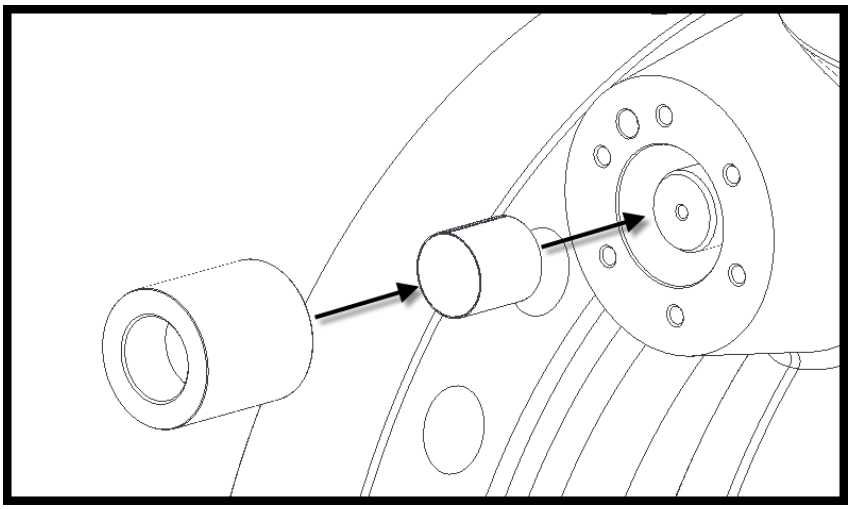
8.3. Assembly of Shaft

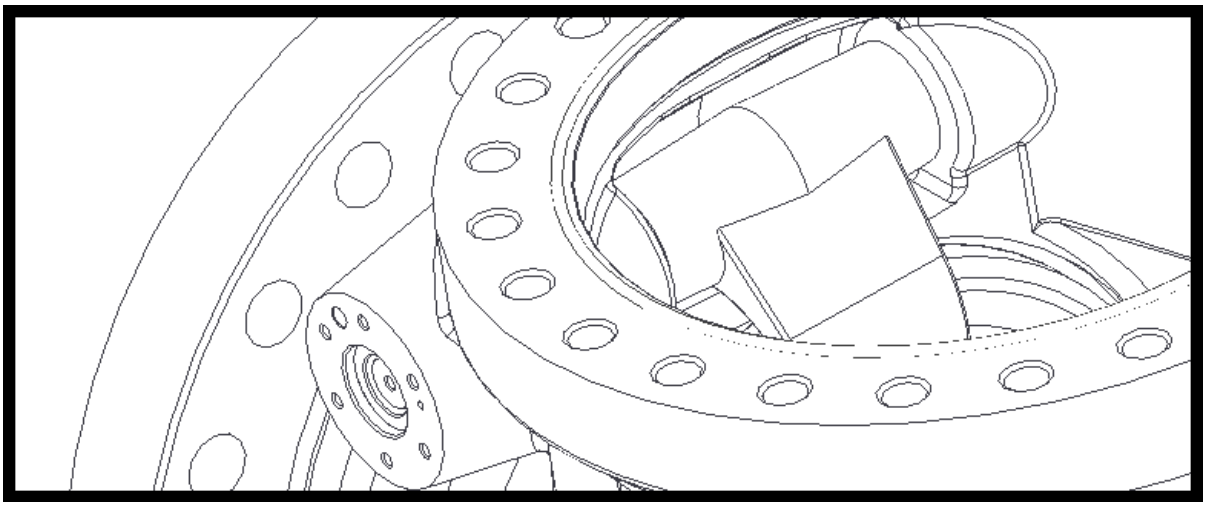
8.3.1. Insert shaft into the valve body through the arm and into the blind end of the shaft bore.



8.3.2. Place any spacer in their appropriate side while sliding the shaft through the valve body and clapper arm.

8.3.3. Insert the other bearing into the bearing retainer and insert into the shaft bore.





8.4. Assembly of Gland Plate

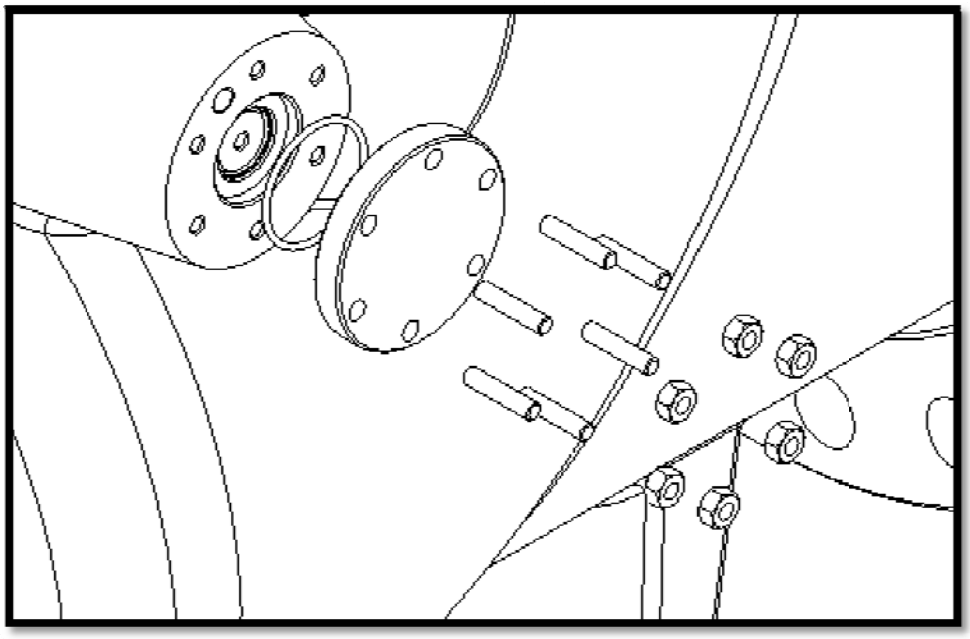
8.4.1. Check for any damage, inclusions, or other possible imperfections on the seal of the gland plate.

8.4.2. Insert appropriate studs onto side of valve body.

8.4.3. Insert gland plate with O-ring onto valve body by aligning studs with the bolt holes.

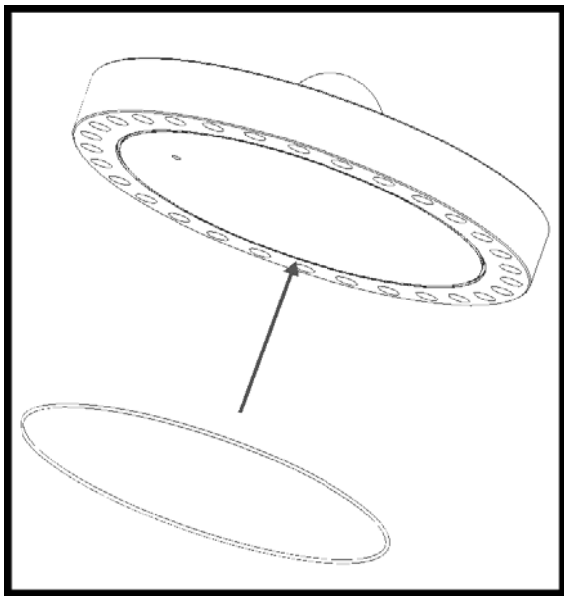
8.4.4. Assemble and torque nuts per Tom Wheatley Engineering Standard SK-4-133 or Table 4 in Appendix A.

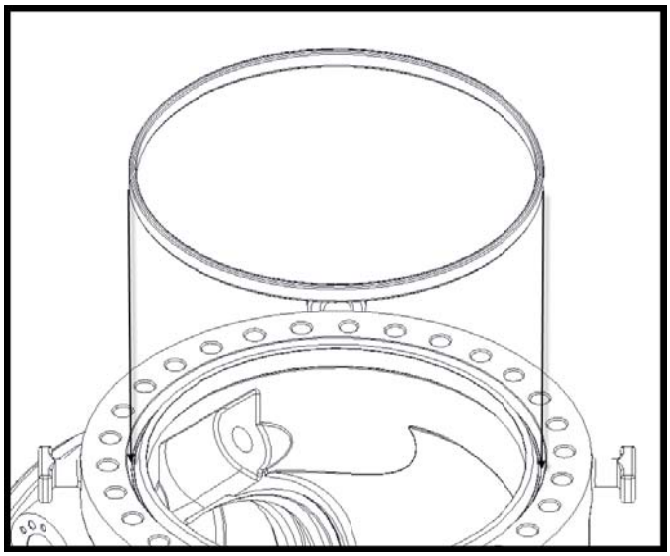
8.4.5. Remove sling from arm clapper.



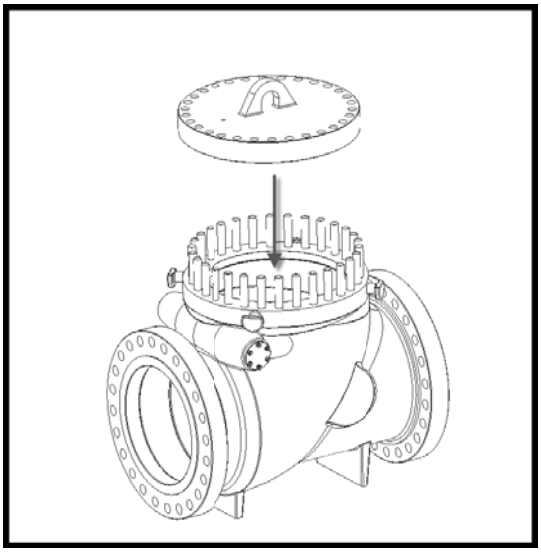
8.5. Assembly of Cover

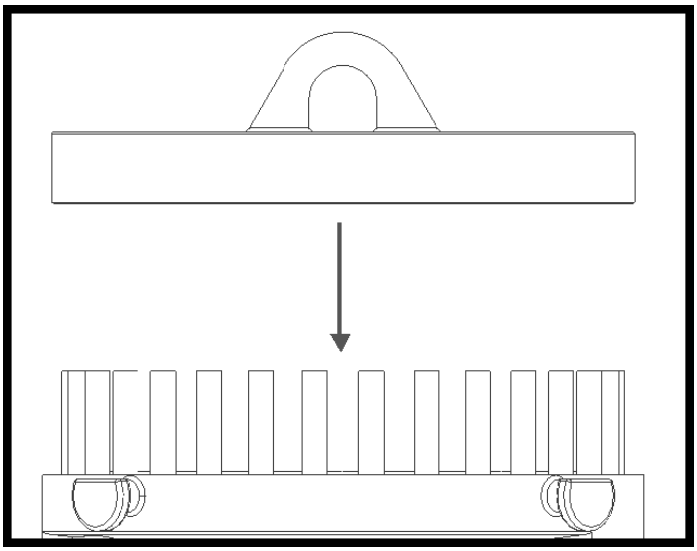
8.5.1. For soft cover seals, place seal into its appropriate groove in the cover. For metal ring gasket seals, place the ring gasket into the groove in the top of the body.



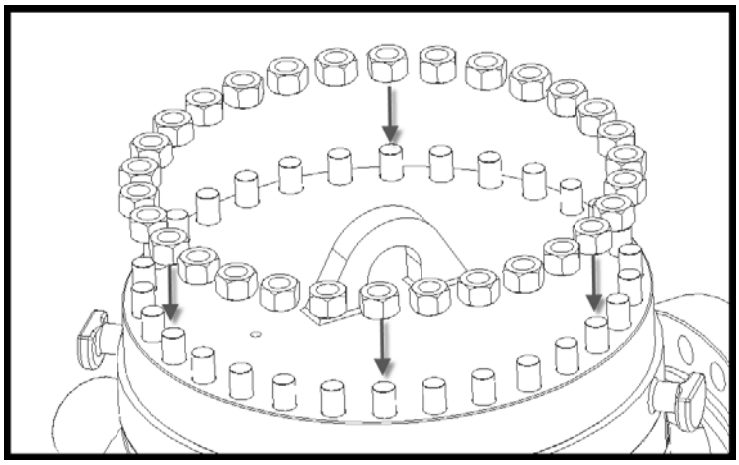


8.5.2. Lower valve cover onto the valve body, making sure alignment marks line-up.





8.5.3. Tighten cover nuts in a star pattern to assure uniform loading of cover seal. Cover nuts should be tightened per Tom Wheatley Engineering Standard SK-4-133 or Table 4.



For ring type gaskets, A gap of ⅛" to ¼" will be visible after tightening. See below:

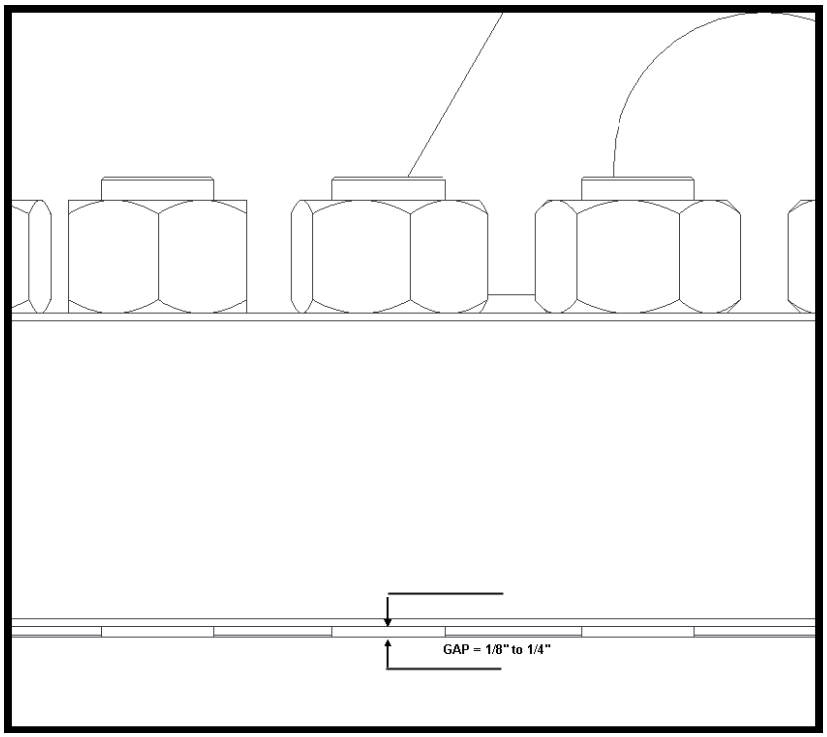
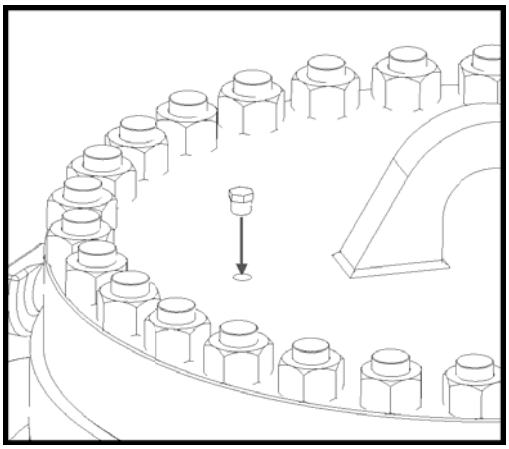


Figure 1: Gap of 1/8" to 1/4" for RTJ gasket assembly after tightening.

8.5.4. Apply Teflon to threads on pipe plug. Insert pipe plug into appropriate hole located on valve cover and tighten per Table 5.



9.0 RECOMMENDED SPARE PARTS

Table 3: Spare Parts

1	RENEWABLE SEAT (IF SUPPLIED)
2	SEAL, COVER
3	SEAL, CLAPPER
4	SEAL, SEAT
5	SEAL, GLAND BODY

APPENDIX A – TABLES

Table 4: Tightening Torques for Nuts/Studs and Socket Head Cap Screws

Stud Size (Unified Thread)	Torque (Ft·Lb)			Torque (N·M)		
	Dry	Lubed[1)]	Teflon	Dry	Lubed[1)]	Teflon
1/4 – 20 UNC	3	2.5	1.2	4	3	2
3/8 – 16 UNC	10	7	4	14	9	5
1/2 – 13 UNC	60	55	30	81	75	41
5/8 – 11 UNC	120	105	60	163	142	81
3/4 – 10 UNC	210	190	105	285	258	142
7/8 – 9 UNC	340	300	170	461	407	231
1 – 8 UNC	510	450	250	692	610	339
1 1/8 – 8 UN	750	660	360	1,017	895	488
1 1/4 – 8 UN	1,050	900	500	1,424	1,221	678
1 3/8 – 8 UN	1,400	1,250	650	1,899	1,695	882
1 1/2 – 8 UN	1,850	1,650	850	2,509	2,238	1,153
1 5/8 – 8 UN	2,200	1,950	1,000	2,984	2,645	1,356
1 3/4 – 8 UN	3,050	2,650	1,400	4,137	3,594	1,899
1 7/8 – 8 UN	3,750	3,300	1,750	5,086	4,476	2,374
2 – 8 UN	4,600	4,050	2,100	6,239	5,493	2,848
2 1/4 – 8 UN	6,600	5,800	3,050	8,952	7,867	4,137
2 1/2 – 8 UN	9,100	8,000	4,150	12,342	10,850	5,629
2 3/4 – 8 UN	12,300	10,900	5,600	16,682	14,784	7,595
3 – 8 UN	16,000	14,200	7,300	21,701	19,259	9,901
3 1/4 – 8 UN	20,000	18,200	9,300	27,126	24,685	12,614
3 1/2 – 8 UN	25,600	22,800	11,600	34,721	30,924	15,733
3 3/4 – 8 UN	31,800	28,200	14,300	43,130	38,248	19,395
Metric thread [2)]						
Stud Size (Metric)	Torque (Ft·Lb)[3)]	Torque (N·M)(Lubed[1)])		Stud Size (Metric)	Torque (Ft·Lb)[3)]	Torque (N·M)(Lubed[1)])
M8×1.25	17	23		M52×3.00	4,544	6,164
M10×1.50	33	45		M56×4.00	5,482	7,436
M12×1.75	58	79		M60×4.00	6,819	9,249
M14×2.00	82	111		M64×4.00	8,374	11,358
M16×2.00	128	174		M68×4.00	10,164	13,786
M18×2.50	175	238		M72×4.00	12,172	16,509
M20×2.50	251	340		M76×4.00	14,409	19,542
M22×2.50	346	469		M80×4.00	16,924	22,954
M24×3.00	433	588		M85×4.00	20,458	27,747
M27×3.00	642	871		M90×4.00	24,455	33,169
M30×3.50	867	1,177		M95×4.00	28,899	39,196
M33×3.50	1,020	1,383		M100×4.00	32,972	44,719
M36×3.00	1,410	1,912		M105×6.00	36,522	49,535
M39×3.00	1,825	2,476		M110×4.00	40,598	55,063
M42×3.00	2,307	3,128		M120×4.00	53,126	72,055
M45×3.00	2,880	3,906		M150×6.00	102,165	138,567
M48×3.00	3,530	4,788				

(Based on bolt pre-stress of 50,000 lbs/in^2, for ASTM A193 B7/B7M, A320 L7/L7M, or equivalent, value can be ±10%)

1) For studs and nuts coated with anti-seize lubricant
2) Data from Cameron UTP562
3) For Teflon coated studs and nuts, use half of values for lubed or per bolting manufacturer's instruction

TABLE 2
PIPE PLUG RECOMMENDED TORQUE (FT-LBS)

SIZE	HEX & SQUARE HEAD
1/16	12
1/8	20
1/4	50
3/8	100
1/2	150
3/4	250
1	350
1-1/4	450
1-1/2	575
2	789