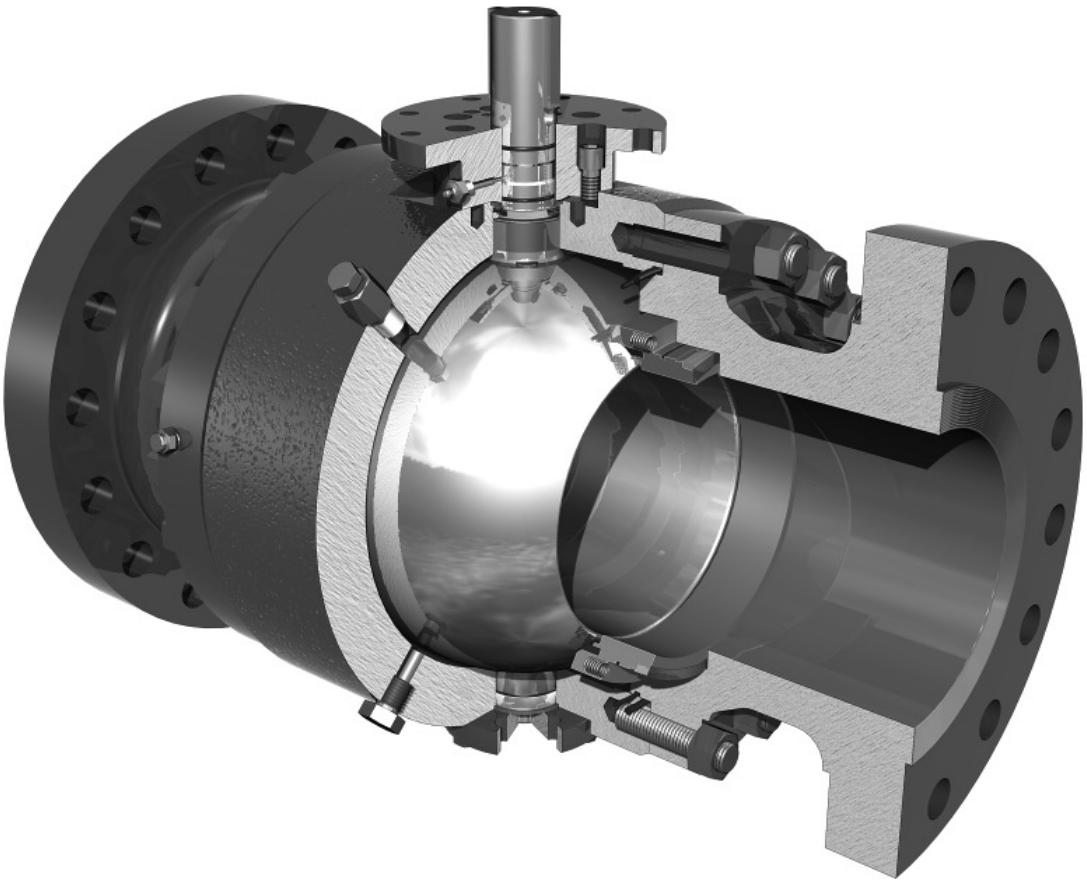
Installation, Operation and Maintenance Manual

TK® Hi-Integrity Trunnion Mounted Ball Valve



TK®

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TK® HI-INTEGRITY TRUNNION MOUNTED BALL VALVE

SCOPE

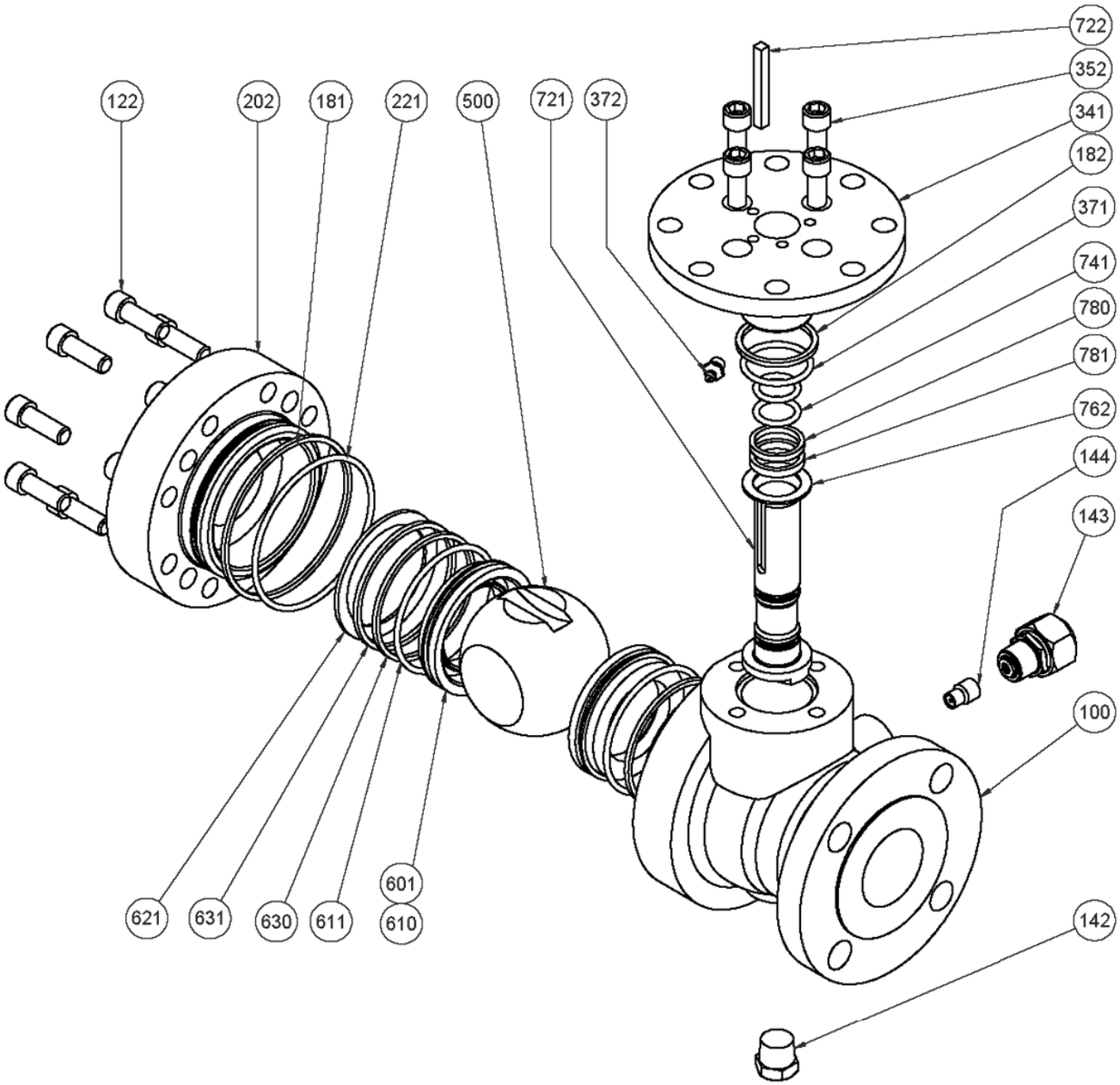
The TK Valve is designed and manufactured to provide trouble free service and a long service life. This manual provides the relevant information that is required for the successful operation of standard and fire safe (end entry) TK Valves. Please note the drawings within this manual are for illustration purposes only.

		API-6D Valve Pressure Class					
Valve Size in Inches	1.5″	150	300	600	900	1500	2500
	2″	150	300	600	900	1500	2500
	3″	150	300	600	900	1500	2500
	4″	150	300	600	900	1500	2500
	6″	150	300	600	900	1500	2500
	8″	150	300	600	900	1500	2500
	10″	150	300	600	900	1500	2500
	12″	150	300	600	900	1500	2500
	14″	150	300	600	900	1500	2500
	16″	150	300	600	900	1500	2500
	18″	150	300	600	900	1500	
	20″	150	300	600	900	1500	
	22″	150	300	600	900	1500	
	24″	150	300	600	900	1500	
	26″	150	300	600			
	28″	150	300	600			
	30″	150	300	600			
	32″	150	300	600			
	34″	150	300	600			
	36″	150	300	600			

		API-6A Valve Pressure Class		
Valve Size in Inches	2-1/16″	2000	3000	5000
	3-1/8″	2000	3000	5000
	4-1/16″	2000	3000	5000
	7-1/16″	2000	3000	5000
	9″	2000	3000	5000
	11″	2000	3000	5000

BILL OF MATERIALS

Figure 1 – TK Valve – Two piece Non-Trunnion Mounted Ball Valve



Sizes:

Studded Outlet - Non-Trunnion (Seat Supported Ball)

- 2″ x 1.5″ class 150
- 2″ x 2″ class 150
- 3″ x 2″ class 150

Studded Outlet - Trunnion Mounted Ball

- 3″ x 3″ class 150
- 4″ x 4″ class 150
- 6″ x 4″ class 150 (short pattern)

Flanged End - Non-Trunnion (Seat Supported Ball)

- 1.5″ X 1.5″ class 1500
- 2″ x 1.5″ class 300, 600, 900 & 1500
- 2″ x 2″ class 300
- 3″ x 2″ class 300

NOTES	ITEM	QTY	DESCRIPTION
	100	1	Body
1	122	*	Body Socket Head Cap Screws
2	123	*	Body Studs
2	124	*	Body Stud Nuts
	142	1	Body Drain Plug
	143	1	Body Sealant Fitting
	144	1	Body Ball Check Valve
	181	1	Body Adapter Bore Fire Seal
	182	1	Body Bonnet Bore Fire Seal
5	183	1	Body Trunnion Bore Fire Seal
	202	1	Adapter (Closure)
	221	1	Adapter O-ring
	341	1	Gear Bonnet
	352	*	Gear Bonnet Socket Head Cap Screws
	371	1	Gear Bonnet O-ring
	372	1	Gear Bonnet Zerk Fitting
5	400	1	Trunnion Flange
5	451	4	Trunnion Flange Hex Head Cap Screws
	500	1	Ball
3	601	2	Seat Insert
	610	2	Seat
	611	2	Seat Holder O-ring
	621	2	Seat Holder Flat Spring
	630	2	Seat Holder Fire Seal
	631	2	Seat Holder Fire Seal Compression Ring
	721	1	Gear Stem
4	722	1	Gear Stem Key
	741	2	Stem O-ring
	762	1	Stem Thrust Washer
	780	1	Stem Fire Seal
	781	1	Stem Fire Seal Compression Ring
5	820	1	Trunnion
5	840	1	Trunnion Bushing
5	860	1	Trunnion Thrust Disc

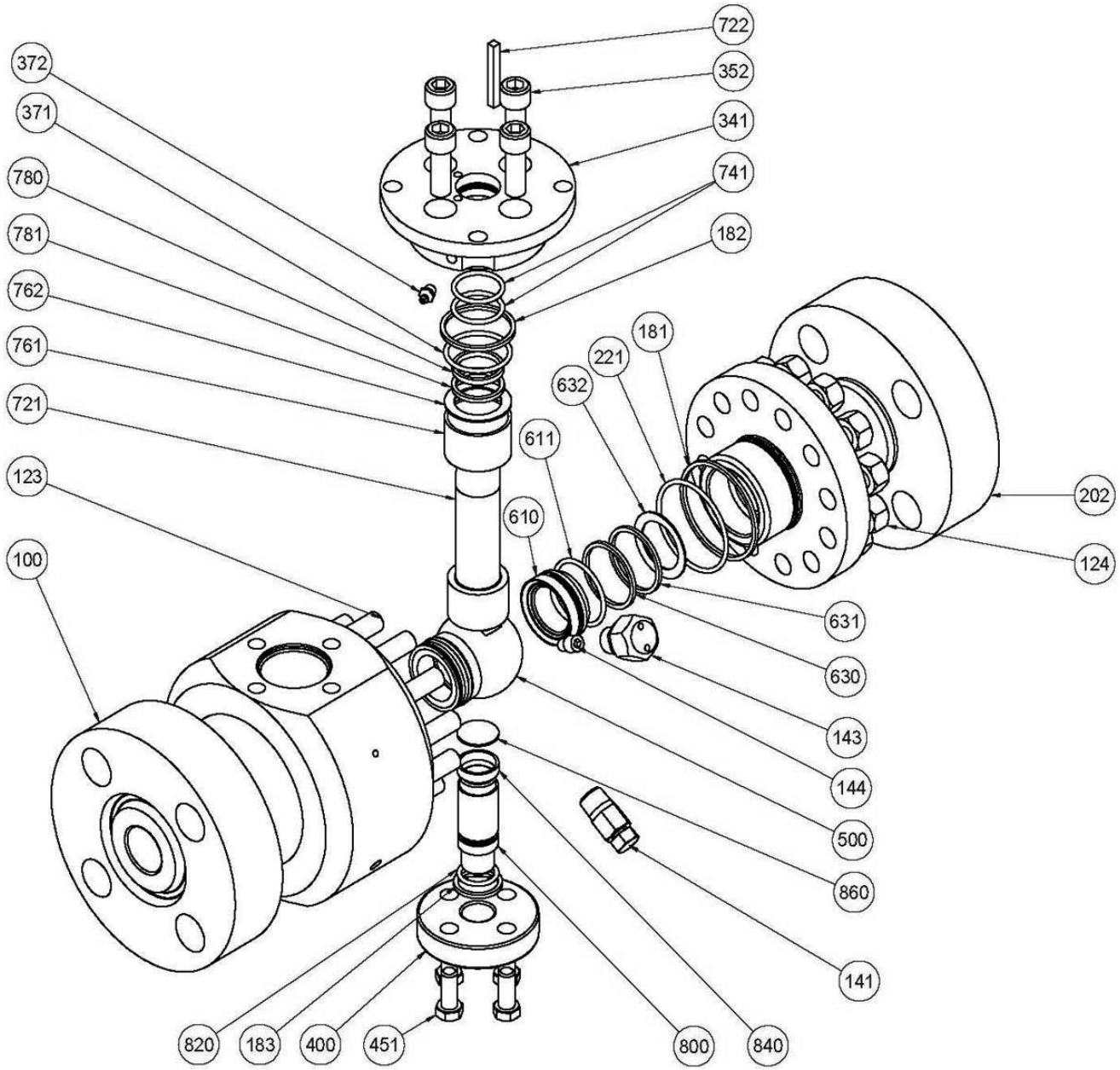
Notes:

1. Are only used on the Studded Outlet Design.
2. Are only used on Flanged-End Design.
3. Seat Inserts are only available for soft seated valves. Metal seated valves are coated with Tungsten Carbide.
4. Are only used on gear operated valves. Lever operated valves do not require a key.
5. Only used on trunnion mounted ball valves. See figure 2 for details.

* Quantity may change depending on valve size.

BILL OF MATERIALS

Figure 2 – TK Valve – Two piece Trunnion Mounted Ball Valve



Sizes

Flanged End – Trunnion Mounted Ball

2" x 2" class 600, 900, 1500 & 2500
3" x 2" class 600, 900, 1500 & 2500
3" x 3" class 300, 600, 900, & 1500
4" x 3" class 150, 300, 600, 900, & 1500
4" x 4" class 300, 600, & 900
6" x 4" class 150 (long), 300, 600, & 900

NOTES	ITEM	QTY	DESCRIPTION
	100	1	Body
	123	*	Body Studs
	124	*	Body Stud Nuts
	141	1	Body Bleed Valve
	143	1	Body Sealant Fitting
	144	1	Body Ball Check Valve
	181	1	Body Adapter Bore Fire Seal
	182	1	Body Bonnet Bore Fire Seal
	183	1	Body Trunnion Bore Fire Seal
	202	1	Adapter (Closure)
	221	1	Adapter O-ring
	341	1	Gear Bonnet
	352	*	Gear Bonnet Socket Head Cap Screws
	371	1	Gear Bonnet O-ring
	372	1	Gear Bonnet Zerk Fitting
	400	1	Trunnion Flange
	451	*	Trunnion Flange Hex Head Cap Screws
	500	1	Ball
1	610	2	Seat Holder
	611	2	Seat Holder O-ring
3	622	*	Seat Holder Coil Spring
	630	2	Seat Holder Fire Seal
	631	2	Seat Holder Fire Seal Compression Ring
4	632	2	Seat Holder Fire Seal Wave Spring/Belleville Spring
	721	1	Gear Stem
2	722	1	Gear Stem Key
	741	2	Stem O-ring
	761	1	Stem Bushing
	762	1	Stem Thrust Washer
	780	1	Stem Fire Seal
	781	1	Stem Fire Seal Compression Ring
	800	1	Trunnion
	820	1	Trunnion O-ring
	840	1	Trunnion Bushing
	860	1	Trunnion Thrust Disc

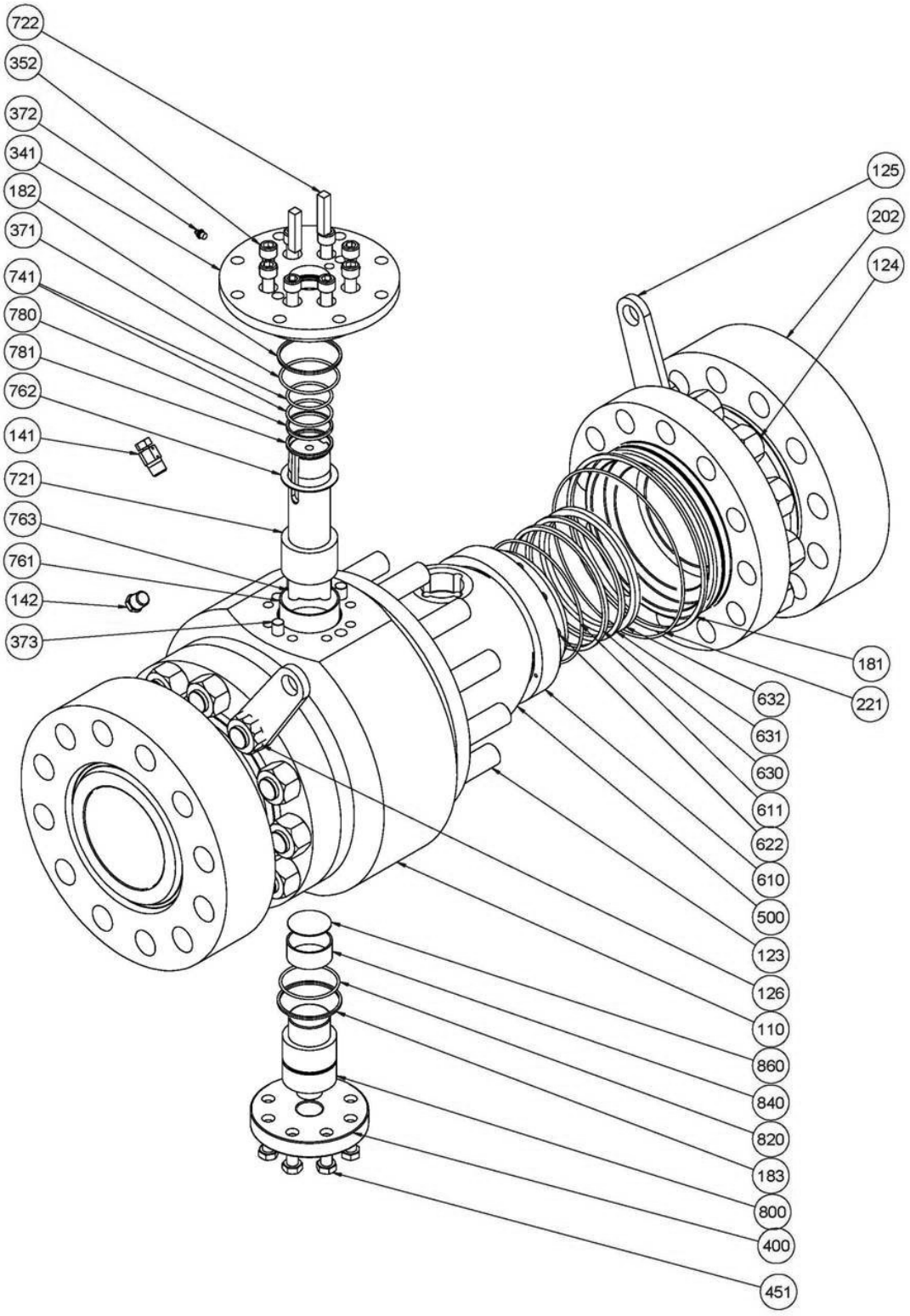
Notes

1. Seat Inserts are only available for soft seat valves. Metal seated valve seats are coated with Tungsten Carbide.
2. Are only used on gear operated valves. Lever operated valves do not require a key.
3. On smaller two-piece trunnion and non-trunnion mounted valves coil springs are not used.
4. When coil springs are not used, the wave spring is then replaced with a Belleville spring.

* Quantity may change depending on valve size.

BILL OF MATERIALS

Figure 3 – TK Valve – Three piece Trunnion Mounted Ball Valve



Sizes
Flanged End - Trunnion Mounted Ball
All other sizes

NOTES	ITEM	QTY	DESCRIPTION
	110	1	Body
	123	*	Body Studs
	124	*	Body Stud Nuts
3	125	2 or 4*	Body Lifting Lugs
3	126	2 or 4*	Body Stud Jam Nuts
	141	1	Body Bleed Valve
	142	1	Body Drain Plug
	181	2	Body Adapter Bore Fire Seal
	182	1	Body Bonnet Bore Fire Seal
	183	1	Body Trunnion Bore Fire Seal
	202	2	Adapter (Closure)
	221	2	Adapter O-ring
	261	4	Adapter Sealant Fitting (Used on Soft Seated Valve Only)
	262	4	Adapter Ball Check Valve (Used on Soft Seated Valve Only)
	341	1	Gear Bonnet
	352	*	Gear Bonnet Socket Head Cap Screws
	371	1	Gear Bonnet O-ring
	372	1	Gear Bonnet Zerk Fitting
	373	2 or 4*	Gear Bonnet Dowel Pin
	400	1	Trunnion Flange
	451	4*	Trunnion Flange Hex Head Cap Screws
	500	1	Ball
1	610	2	Seat Holder with Seat Insert
	611	2	Seat Holder O-ring
	622	*	Seat Holder Coil Spring
3	630	2	Seat Holder Fire Seal
3	631	2	Seat Holder Fire Seal Compression Ring
3	632	2	Seat Holder Fire Seal Wave Spring
	721	1	Gear Stem
2	722	1 or 2*	Gear Stem Key
	741	2	Stem O-ring
	761	1	Stem Bushing
	762	1	Stem Thrust Washer
	763	4	Stem Dowel Pins
	780	1	Stem Fire Seal
	781	1	Stem Fire Seal Compression Ring
	800	1	Trunnion
	820	1	Trunnion O-ring
	840	1	Trunnion Bushing
	860	1	Trunnion Thrust Disc

Notes
1. Seat Inserts are only available for soft seat valves. Metal seated valve seats are coated with Tungsten Carbide.
2. Gear Stems and Gear Stem Keys are only used on gear operated valves. Lever operated valves do not require a key.
3. Not included on all valve designs. Lifting lugs are used on 6" class 1500 & 2500 and 8" class 600 and up.

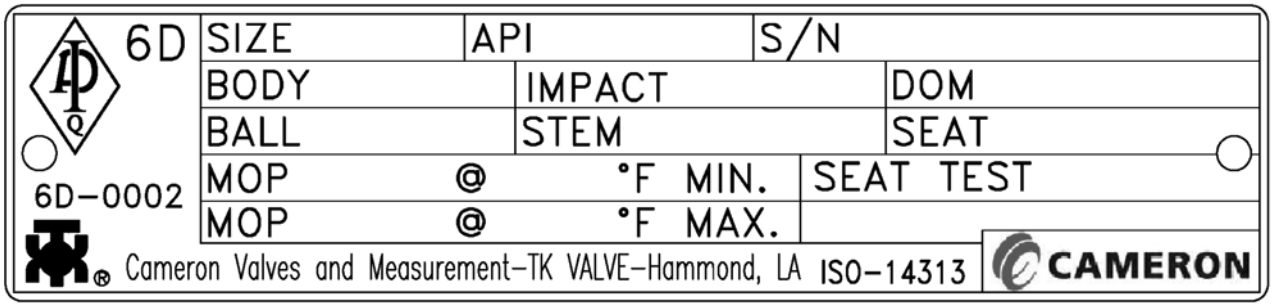
* Quantity may change depending on valve size and class.

NAMEPLATE INFORMATION

TK can provide either a non-monogram or monogram API-6D, API-6A, and/or a CE tag. All tags are securely placed onto the valve and will have the information below stamped in each section.

Caution:
Name plates should never be painted or removed.

Figure 4 -TK
API-6D Nameplate



Item	Description	Stamp Description
1.	Size:	Full port valves will be stamped as "flange end x flange end" • Ex: 12" x 12" Reduced port valves will be stamped as "flange end x ball bore x flange end" • Ex: 12" x 10" x 12"
2.	API	API 6D or API 6A
3.	S/N	Valve's unique serial number.
4.	Body	Body material.
5.	Impact	Impact requirements.
6.	DOM	Date of manufacture.
7.	Ball	Ball material.
8.	Stem	Stem material.
9.	Seat	Seat insert material for soft seats or TCC for metal seats.
10.	MOP	Minimum Operation Pressure at Temperature.
11.	Seat Test	Seat test pressure.
12.	MOP	Maximum Operation Pressure at Temperature.

STORAGE

These recommendations are to protect the valve/s from damage caused by direct exposure to severe environments, indirect exposure to the surrounding environments, and general degradation due to long term storage. Preparation for long term storage for both outside and inside enclosed areas will be as follows.

If compatible with elastomeric materials, valves should be tested with 5 wt. oil to ensure the complete lubrication of all internal machined surfaces. Additionally, lubrication of the valve end connection and any other unpainted surface should be coated with rust preventive to prevent corrosion. Flange covers and/or end caps must be in place in order to prevent any ingress of foreign materials. Lost, cracked, or otherwise damaged covers should be replaced immediately.

Valves 4" and smaller have only one giant buttonhead fitting located in the valve body with an additional zerk type fitting located on the bonnet. Valves 6" and larger feature four giant buttonhead fittings located on the end pieces of the valve (also referred to as "adapters") plus a zerk type fitting on the bonnet. The quantity and type of fittings on gearboxes vary with make and model. Each fitting should be injected with appropriate type and amounts of grease prior to storage. Lubrication fitting covers should be replaced and remain in place during storage.

Valves should be skidded and covered with a plastic film bag to prevent dust accumulation and any ingress of sand, dirt, or moisture from entering into the valve. A Vapor Corrosion Inhibitor (VCI) should be inserted into the envelope of the valve to assist in removing moisture from the valve.

Records of valve maintenance should be kept.

Long-term Outside Storage

If valves are stored outdoors we recommend the following.

On a quarterly basis each stored valve should receive a 1-ounce shot of approved lubricant in each of the valves fittings, including the gearbox and stem fittings. Fitting covers should be inspected and replaced if necessary at this time.

On the same schedule as above and immediately following lubrication, each stored valve should be cycled once from the fully open position to the fully closed position, and then returned to the fully open position. Leaving the valve in some intermediate position for any period of time may result in permanent damage to the soft valve seat. End covers should not be removed to inspect the valve bore at this time unless there is reason to suspect other damage to the valve.

Long-term Enclosed Storage

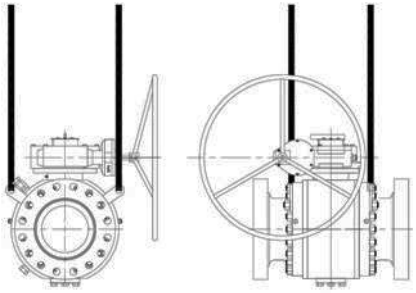
Valves must be stored in a totally enclosed storage facility.

Valves left in storage for periods greater that three (3) years should be hydrostatically tested prior to installation. Valves left in storage for periods greater than six (6) years should be disassembled, cleaned and inspected for damage. All elastomeric seals should be replaced at that time.

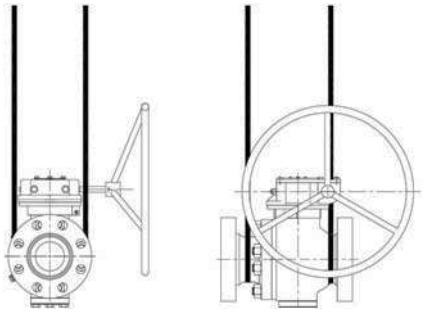
INSTALLATION

Certified lifting devices that are rated for the valve weight should be used when lifting any TK Valves. For valve sizes 1.5" up to 4", 6" class 150 thru 900, and 8" class 150 thru 300 the lifting points should be around the valve neck on either side. For all other valve sizes, lifting lugs will be provided to assist in lifting the valve.

Lifting Valve by Lifting Lugs



Lifting Valve by Valve Neck



TK Valves are bidirectional and are tested at the factory to provide a tight shut-off from either direction.

Special instructions will apply if the valve is required to be installed with the stem in the down position.

Actuator and Gearbox stops are preset at the factory and should require no further adjustments. With the exception of 'fail-safe closed' valves, all other valves are shipped in the open position. Valves should not be closed until the bore of the valve has been cleaned of all debris.

Take caution with the 'fail-safe closed' valves. The ball surface is exposed and particularly vulnerable to weld slag. This surface must be protected when welding nearby.

Sand blasting and painting of valves not in-line should only be done with protective covers on the end flanges and/or weld bevels (to avoid the ingress of sand into the ball and seat area).

Care should be taken not to blast the RTJ groove or the raised face gasket sealing surface.

Weld-end valves also require care to avoid over heating. Industry work procedure should be followed when welding valves into surface.

HYDROSTATIC TESTING

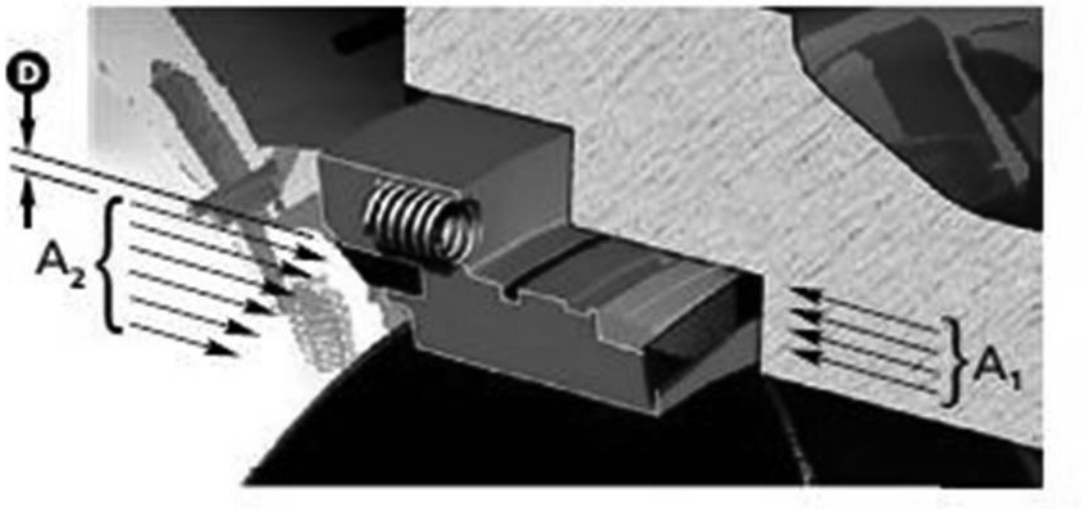
All TK Valves are tested per API-6D or API-6A test requirements. Each valve is tested to a factory closure test at 100% of maximum operating pressure. Valves should not be used as closures for systems where the operating pressure exceeds these figures. The valve should be left open and blind flanges should be used as the closures. Contact our facility for full details.

Piston-Action Seats

As line pressure increases, the seat reacts to the force of the pressure to form an effective seal. Line pressure against the seat area A1 (see below illustration) is not equalized by pressure against seat area A2. The difference in areas 'piston-action' which forces the seat unit against the ball surface. The net result of this 'piston-action' is the formation of a tight, effective seal. In the absence of line pressure, coil springs around the seat unit provide a tight seat by keeping the seat in contact with the ball surface.

Self-Relieving Seats

TK valve seats are self-relieving unless otherwise specified. This means the pressure on the ball side of the seat will cause it to back away from the ball, thus relieving any excess pressure in the body cavity. For this reason, it is unnecessary to install any devices to relieve excess body cavity pressure.



MOUNTING A GEAR BOX/ACTUATOR

Scope

To establish work instructions for the mounting and setting the stop sequence for the gear operators, thereby assuring that the proper installation practices are followed on all valves.

Mounting and Setting Stops

With the operator positioned with the cover down, install the mounting studs. Measure the bonnet and operator nut thickness to gage the proper amount of stud to leave protruding from the gearbox.

Spray the face of the valve bonnet with spray grease. If the valve is sub-sea use flange sealant in place of the spray grease.

Before sliding the operator completely against the bonnet, check the position of the handwheel shaft, which should point to the side away from the bleed valve on three piece OF valves. On two piece OF valves, the shaft will be to the bottom right. The shaft will always be at 90 degrees from the centerline of the valve and never at an angle. The operator can be rotated around the stem into the proper position, without removing it from the stem.

After correctly positioning the handwheel shaft, slide the operator toward the bonnet placing the studs through the bonnet flange until approximately 1/4" of the stud is exposed on the back of the flange. Start all nuts onto the studs (flat side down) and tighten them with the proper open end wrench.

Remove the indicator plate from the top of the operator. Using the handwheel, turn the operator so that the keyslot of the stem and operator are aligned with each other. On small gearboxes, it is possible to install the key on the stem prior to sliding the operator onto the valve shaft.

Install the square key into keyslot until it is below the surface of the operator hub. Do not use excessive force to drive the key! If the key does not fit properly, recheck the alignment of the slots. (Another key or pin punch should be used to drive against the key to prevent damage to the operator key or key slot).

To set the closed stop, turn the handwheel clockwise until the key slot in the valve stem is at a 90 degree angle to the valve flow bore. Loosen the jam nut on the stop farthest from the handwheel shaft (see illustration). Then turn the stop bolt clockwise until it stops. Retighten the jam nut. It may be necessary to turn the stop screw counter clockwise in order to get additional travel and move the operator farther closed. The handwheel should always be turning in the closed direction to set the closed stop so that all slack will be taken out of the gearing. This ensures a more accurate stop setting.

After setting the closed stop, a check should be made to ensure that it has been correctly set. This is accomplished by turning the handwheel shaft several turns towards the open position, and then returning it until the closed stop is contacted. The keyway will be at a 90 degree angle to the flowbore.

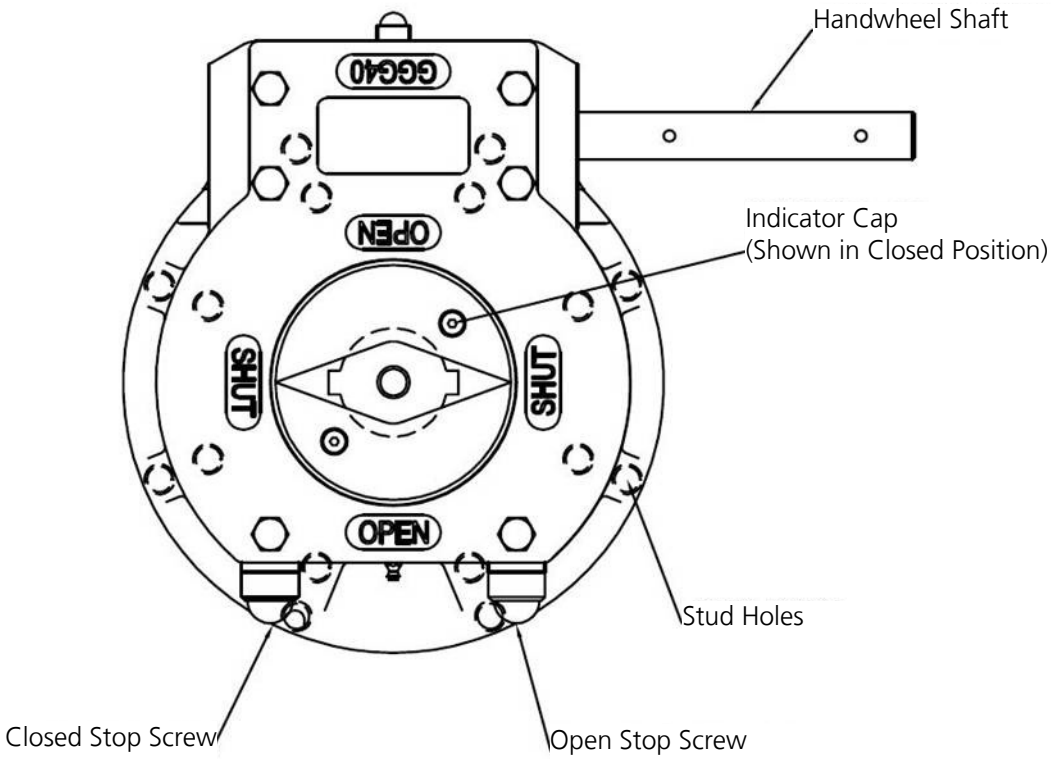
To set the open stop, turn the handwheel shaft counter clockwise until the key slot in the valve stem is aligned with the valve flow bore. Look into the bore of the valve, and continue opening until the flow bore of the ball is in alignment with the flow bore of the seatholders. There should not be more than 1/16" of the ball radius exposed into the flow bore once the final setting has been made.

Once the alignment is accomplished, loosen the jam nut on the open stop bolt and turn the stop bolt clockwise until it stops. Retighten the jam nut.

It may be necessary to turn the stop screw counter clockwise in order to get additional travel. Move the operator farther open, in order to align the ball flow bore with the flow bore of the seatholder. **The handwheel should always be turning in the open direction to set the open stop, so that all slack will be taken out of the gearing. This ensures a more accurate stop setting.**

After setting the open stop a quick check should be made to ensure that it has been set correctly. This is accomplished by turning the handwheel shaft several turns towards closed then returning it until it hits the open stop. There should be no more than 1/16" of the ball radius exposed into the flow bore after the stop is properly set. If further alignment is necessary screw the open stop screw in or out to readjust the ball travel.

Replace indicator cap and tighten all fasteners.



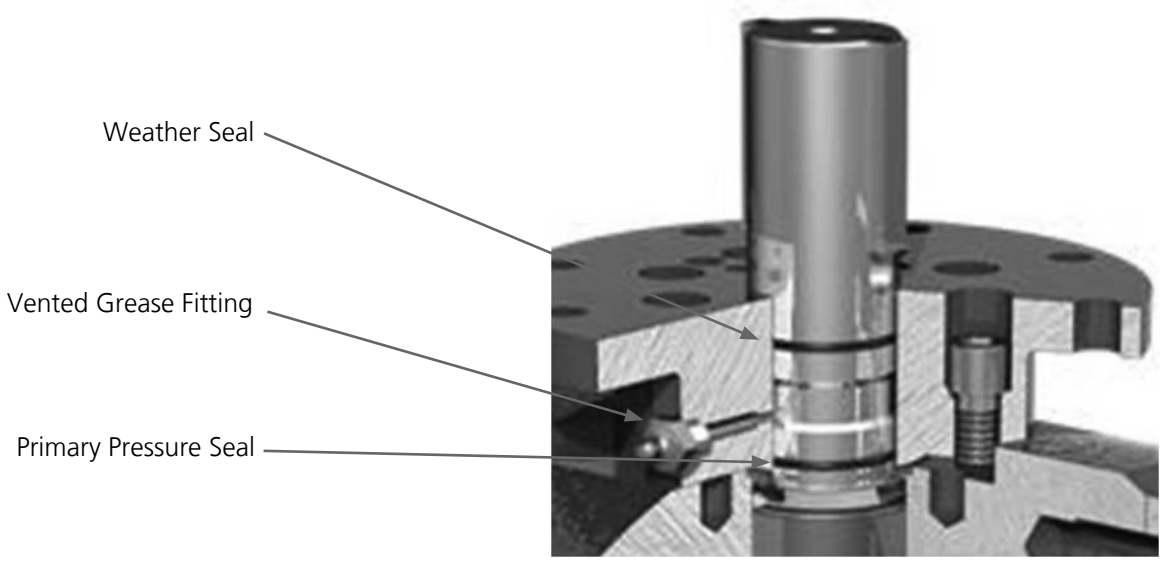
ROUTINE MAINTENANCE

Lubrication of TK Valves is not necessary for all applications, and is not a requirement for the valve to seal pressure. In certain applications however, as in dry gas for example, lubrication twice yearly is recommended. This lubrication reduces the stem torque, making the valve easier to operate, and reduces wear of the stem, seat and ball. Biannual greasing of the stem gland also reduces torque and extends stem, bonnet, and stem O-ring life.

Medium weight grease is recommended and has been field tested and proven to be very effective in reducing torque.

Stem Lubrication

Access for lubricating the stem seals is through a vented grease fitting that is located on the stem bonnet. There are two O-rings on the stem. The bottom O-ring is the primary pressure seal and the top O-ring is a weather seal. All TK Valve sizes and models will incorporate this bonnet/stem grease fitting.



CAUTION

Caution:
In the unlikely event of a primary stem seal failure, leaks will occur through the grease fitting. To temporarily fix the leak, the vented grease fitting can be replaced with a 1/8" NPT pipe plug. This will cause the weather seal to become the primary pressure seal. At this time both of the stem seals should be replaced at the earliest opportunity. DO NOT remove the bonnet while the valve is under pressure!

WARNING

Warning:
Under no circumstances must the slotted vented grease fitting be replaced with a non-slotted grease fitting.

Checking for Seat Leakage

All trunnion mounted TK Valves are incorporated with a Bleed Valve. To check for a tight closure or seat seal, open the needle (bleed) valve slightly. After initial blow-down, there should be no additional flow.

TK Valves in buried services are equipped with watertight extensions. Sealant and bleed fittings are carried to the top of the extension when required.

SEAT SEALANT

Lubrication guns may be air operated or manually operated depending on the customer's preference. Either type of lubrication gun should be capable of injecting lubricant or sealant above the maximum line pressure of the valve and should be supplied with a giant button head adapter.

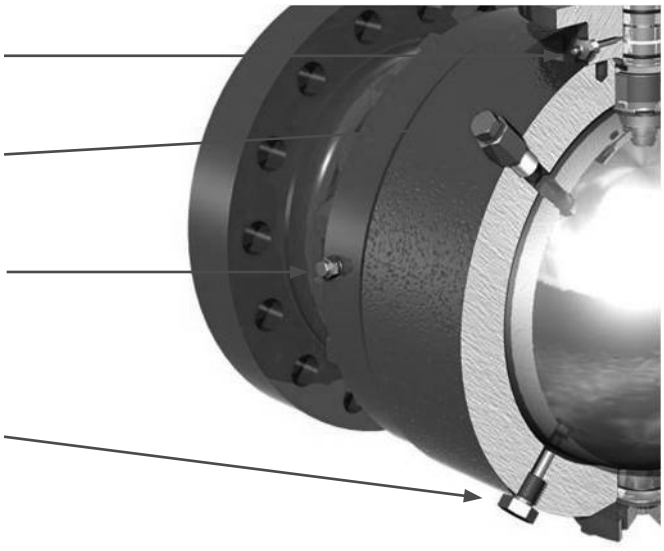
TK Valves are generally designed with auxiliary sealant fittings that are used to inject sealant directly to the ball sealing area. This is sometimes necessary in preventing damage to the seats by flushing debris away from the seats and in the event of a damaged seat caused by debris in the line. Auxiliary sealant fittings should not be removed if there is pressure in the line and should never be coated or painted over.

Metal seated designed valves do not incorporate a sealant injection fitting as standard.

Grease the seats in the following manner:

1. For 4" valves and smaller:
    a. Open the valve to the fully open position
    b. Inject grease through the single giant button-head located on the valve body. As grease is injected the body cavity area around the ball is filled with grease. The amount of grease will vary from 2 ounces for 1 1/2" valves up to 10 ounces for a 4" valve. No damage can result from over greasing.
    c. Stroke the valve several times to distribute the grease to the surface of the ball. Then return the valve to the desired position, either fully open or fully closed.
2. For 6" valves and larger:
    a. Close the valve fully and inject each of the 4 giant button head grease fittings with two ounces (8-10 strokes of a manual grease gun) of lubricant.
    b. Open the valve to the fully open-position and then inject each of the 4 giant button-heads as in step A above.
    c. Cycle the valve to the closed position to further distribute the grease to the surface of the ball. When sealant injecting, repeat steps A-C several times to fully distribute the sealant. Always make your last injection of the sealant in the closed position.
    d. Place the valve in the position desired, either fully open or fully closed. Always avoid leaving the valve in an intermediate position for long periods.

Types of Fittings:



DISASSEMBLY AND REASSEMBLY

Before removing the valve from the line, make sure that the line has been fully depressurized. For valve designs which incorporate a body bleed valve, check prior to removal from line, place the ball in the half-open position and open the body bleed valve to relieve any retained cavity pressure.

Once the valve is removed, appropriate isolation of the pipe ends should be undertaken by the operator/contractor to prevent the creation of a combustible mixture where possible, and to prevent the introduction of dirt and debris into the system.

All parts must be clean and free of dirt and foreign material before assembly. A light grease compatible with line material and service temperature aids greatly in the assembly of close-tolerance components. O-rings should be well-lubricated to avoid pinching between 'mating' parts.

Disassembly

1. Remove the operator from the valve bonnet. In case of lever-operated valves, remove the retaining ring and stop plate from the stem.

2. Scribe alignment marks on the body, adapter(s) and the bonnet to ensure proper reassembly. It is vital that the bolt holes on the pipeline flanges straddle the vertical and horizontal center-lines of the valve.

3. Loosen all bolting.

Two-Piece Seat Supported

4. Place Valve in the closed position.

5. Remove closure from the body of the valve. It may be necessary to pry apart the closure from the body.

6. Remove ball from body cavity. (It is only possible to remove the ball before the stem on non-trunnion mounted valves).

7. Remove bonnet and stem.

8. Remove one seat from the closure and the other from the body. Gently tapping from underneath the seat will allow the seats to become free.

9. Collect and retain seat springs.

Two-Piece Trunnion Supported

4. Remove bonnet and stem from valve.

5. Remove trunnion flange. It is not necessary to separate the trunnion from the flange.

6. Remove adapter.

7. Remove ball from body cavity.

8. Remove one seat from the closure and the other from the body. Gently tapping from underneath the seat will allow the seats to become free.

9. Collect and retain springs.

Three-Piece Trunnion Supported

4. Remove both closures. One seat will come out with each closure.
5. Remove the seats from the adapters by using a jack screw and lifting straight out.
6. Collect and retain springs.
7. Position valve, without closures, such that the stem and trunnion are in the horizontal positions and apply support for ball.

8. Remove bonnet, stem, and trunnion from sub assembly. By lifting the ball to relieve pressure from the stem and trunnion, it is then possible to remove the stem and trunnion.

9. Carefully remove ball from body cavity once the stem and trunnion have been removed.

Continue Disassembly for all Valve Designs

10. The bonnet bore, thru which the stem passes, is a sealing surface. Before removing the stem from the bonnet, dress the exposed portion of the stem by remove all rust, nicks, burrs, ect and spray with penetration oil. Then gently tap the stem out of the bonnet. Do not use a hard-face hammer!

11. For all valve designs, inspect the bushing in the body bonnet bore. If damaged or worn, replace before reassembly.

12. Remove all O-rings and replace if necessary. Retain the thrust washer and disc.

Inspection Areas

1. Inspect the surface of the ball for gouges, nicks, pits or other departures on the spherical surface and particularly in the seating area.

   Small isolated imperfections that are less that 1/16" (1.55mm) may be dressed with a light application of a fine emery cloth.

2. Any gouges, nicks, cuts or thermal distress on the seat sealing area indicates a new seat assembly is required. Seat assemblies are not field repairable.

3. Stem and ball bushings, washers, and disc should be replaced if damaged or worn.

4. O-rings should be replaced if broken, nicked, frayed, stretched, or swollen. If O-rings are damaged due to incompatible service conditions, consult with the nearest representative or the factory.

REASSEMBLY

1. Make sure that all components are thoroughly clean prior to installation.

2. Slide thrust washer onto the stem and install O-rings.

3. Install stem bushing into the valve body. Do not use a hard-face hammer. The bonnet hub can be used to recess bushing to proper depth.

4. Install the thrust disc and trunnion bushing into the ball trunnion bore. Do not use a hard-face hammer.

5. Install coil springs (wave springs where fitted) in seat assemblies where appropriate. Hold coil springs in place by weaving rubber bands from spring to spring.

   Note: Some 3" and 4" valves use wave springs in place of coil springs. In this case, install wave springs prior to installing seats.

   Note: 1.5" and 2" valves use belleville springs. In this case, install belleville springs prior to installing seat holders. The outside of the belleville spring bears on the seat holder.

6. Replace each fire safe seal for all fire safe certified valves.

Two-Piece Seat Supported (non-trunnion)

7. Taking care not to damage the seat sealing surface, install one seat in the body and one seat in the closure.

8. Install stem into the bonnet.

9. Install the bonnet and stem assembly onto the body.

10. Rotate the stem to the closed position to accept the ball.

11. Install the ball into the body cavity.

12. Install the closure onto the body.

Two-Piece Trunnion Supported

7. Taking care not to damage the seat sealing surface, install one seat in the body and one seat in the closure.

8. Line up the stem and trunnion bore, place the ball into the body cavity. Insert the trunnion into the ball to hold the ball in place. Do not drive trunnion completely in at this time.

9. Ensure the ball is aligned with the stem bore and insert the stem.

10. At this time the trunnion can be completely installed.

11. Install the bonnet onto the body.

12. Install the closure onto the body.

Three-Piece Trunnion Supported

7. Line up with the stem and trunnion bore, place the ball into the body cavity. Insert the trunnion into the ball to hold the ball in place.

8. Install trunnion taking care not to damage trunnion bushing in the ball.

9. Install stem.

10. Install bonnet and make sure the ball rotates freely.

11. Taking care not to damage any sealing surfaces, install seats into the closures.

12. Install the closures onto the body.

Continue Assembly for all Valve Designs

13. On lever operated valves, make sure of correct location of the stop socket head cap screw.

14. Tighten all bolting on the assembled valve.

15. Reinstall operator onto the valve. See “Mounting Gear Box and Actuator” in installation instructions.

16. If available retest the valve to the appropriate specifications.

TROUBLESHOOTING

Trouble	Probable Cause	Remedy
The valve is hard to operate	Actuator Unit	Refer to actuator maintenance manual or remove actuator cover and check stem adaptation and linkage for damage.
	Infrequent operation - lack of lubrication	Lubricate actuator with suitable industrial grease
	Ice in valve operator	Apply heat or inject antifreeze solution into valve, but consult with authorized dealer prior to using remedy on operators.
Ball is not properly aligned with bores of seats.	There is a build up in the seat area due to line contaminates	Clean the seat area as outlined in Routine Seat Cleaning.
	Restrictions in bore of valve or stop not set properly	Remove bore restrictions or check stop in worm gear actuator and/or actuator limit switches.
Erratic Operation	Damaged actuator unit	Replace broken or damaged parts
	Restriction of pneumatic actuator vent	Remove restriction
	Faulty power supply	Check power supply
Valve is leaking between tailpiece and body	Infrequent operation - lack of lubrication	Lubricate actuator with suitable industrial grease
Leakage around valve stem	Damaged O-ring seal	Disassemble and replace O-rings.
	Damaged O-ring seal	Inject valve sealant into stem fitting (if present) or replace stem O-ring.
Valve will not fully close	Ice in body of valve	Apply heat or inject antifreeze solution into body of valve. Drain periodically to eliminate water accumulation.
	Improper setting of actuator limit switches or stops in worm gear	Reset actuator limit switches or stops for proper closing
	Infrequent operation - lack of lubrication	Lubricate actuator with suitable industrial grease.
Grease fitting leaking	Damaged Fitting	Tighten safety cap or replace safety cap if damaged **WARNING**: Never remove entire grease fitting when valve is under pressure.
	Trash in fitting	Inject a small amount of cleaner into fitting to dislodge trash. Clean the seat area as outlined in Routine Seat Cleaning.
Valve will not seal	Contamination around seat area due to service Damaged seat face or seat O-ring	Inject seat sealant for temporary seal or replace seats
	Valve not fully closed	Check that operator or limit-switches do not stop the rotation of ball prior to reaching the fully closed position.

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