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Trunnion Mounted

Ball Valves

Storage, Installation, Operation and Maintenance Instructions

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Safety information

Take the following precautions before doing any job on the valves, particularly for valves under pipeline pressure:

1. Know which fluid is in the pipeline. Take appropriate safety measures in case of toxic, flammable or dangerous fluids: confirm that emergency breathing equipment is available, inform other workers in the immediate area about your job and the possibility of releasing fluids to the atmosphere, determine if there is a spark hazard from other activities, etc.
2. Get all the permissions and authority required to perform your job safely for yourself, other workers, and plant operation. Confirm if you can open valves that are normally closed, or close valves that are normally open.
3. Wear all protective clothing and equipment required for the intended tasks. Wear safety glasses, hearing protection and gloves when working with high-pressure equipment.
4. Hold a safety meeting with all the people involved in your job. Discuss the objectives, risks and emergency response activities.
5. Check the valve tag, read the body rating and confirm design pressure and temperature of the valve. Do not exceed these values.
6. Use extreme caution when venting the body cavity of a pressurized valve.

1 General

1.1 Scope

This manual provides instructions for storage, installation, operation and maintenance of Vector trunnion mounted ball valves. Regular maintenance, detailed application of these instructions and the use of Vector spare parts guarantee proper operation and reduce maintenance costs.

The following instructions must be thoroughly reviewed and understood prior to installing, operating or performing maintenance on this equipment. Throughout the text, safety notes and caution notes will appear; strict adherence is required to prevent serious injury or equipment malfunction.

This is a Caution note.
It shows remarkable points about the process or the characteristics of the valve.

This is a Safety note.
It shows remarkable points about issues related to safety, to prevent injury to yourself or damage to the equipment.

Vector will not accept any liability for damage to people, things or installations caused by wrong use of the valves, unqualified operator or maintenance personnel, or non-observance of safety rules.

1.2 General warnings

1. Before starting any maintenance action, confirm which fluid is in the valve, and take precautions in case of toxic, flammable or dangerous components.
2. Internal parts (ball, shaft, seats, seals, etc.) must be handled with care to avoid scratches or other damages to their surface.
3. Graphite is brittle, and any twisting or bending must be avoided.
4. All tools and equipment for handling and supporting the internal parts must be covered by a soft material.

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5. Before undertaking any work in the valve, check the position number(s) in the list of parts of the general assembly drawing.

1.3 After sales service & Spare parts

Vector trains customer-service personnel in the operation and maintenance of ball valves regularly. Arrangements for these services can be made through Vector or your local representative.

When performing maintenance, use Vector replacement parts only. Parts are obtained through Vector or your local representative. Always include model and serial number of the unit being repaired when ordering spare parts. **Reference to the serial number will speed up any request regarding your valve**. The model number, serial number and rating of the valve, among other things, are shown in the Identification Plate located on the body of the valve.

The recommended spare parts are clearly indicated in the assembly drawing of the valve included with Vector supply.

2 Storage

2.1 Valve receipt

All valves must be visually inspected upon receipt, to find any external sign of damage that may have happened during transportation.

> **If any evidence of damage is found upon receipt, please contact Vector immediately.**

2.2 Storage location

The valves should be stored indoors, in their original shipping box, in a dry, ventilated area. If indoor storage is not possible, the boxes must be kept covered and dry. Valves must not be unpacked and exposed to weather before they have been installed permanently in the pipeline.

The dessicant bags must be replaced every three months approximately.

2.3 Protection

All valves are supplied with end protectors, made of wood or plastic. While in storage, do not remove the end protectors for a long time. In case that the end protectors are removed for inspection or maintenance, they must be put back in place when finished.

When a valve is going to be stored for an extended period, remove the end protectors and spray a light coating of rust preventive compound or machine oil on the internal parts once a year. Make sure that the rust-preventive compound is compatible with the fluid to be passed through the valve. Put back the end protectors to prevent any foreign matter from entering the valve body. When the use of a rust preventive compound is not allowed, the valve should be enclosed in an air-tight envelope, evacuated of all air and sealed.

2.4 Periodic maintenance while in storage

During the storage period, the valve must be inspected and maintained regularly. The recommended maintenance programme is as follows:

1. Replace the dessicant material every three months, ensuring a proper and secure location in the equipment.
2. Inspect visually the outer surfaces every six months, for any alteration of the protective coating. In case of presence of rust or damaged painting, the area must be wire brushed and degreased using an appropriate chemical solvent. Vector will be glad to provide instructions to restore the protective coating, in accordance with the painting cycle used in our factory.
3. Inspect visually the accessible inner surfaces of the valve once a year. The extent of inspection should be limited to the exposed surfaces after removing the end protectors and shipping caps. Disassembly of the valve is not required nor intended during inspection.

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4. Clean and lubricate the internal parts once a year, following the procedure outlined earlier (see 2.3). After cleaning and lubrication, rotate the valve completely by closing and opening it. Keep the ball in the open position to protect sealing surfaces.
5. Attach firmly all end protectors, shipping caps and plugs to prevent the entrance of foreign matter inside the valve.
6. Water, dirt, oil, grease or any foreign matter must not be present. If they were found, remove them immediately, determine the source of these contaminants, and take corrective actions to prevent further recurrences.
7. If the valve has been stored for more than five years, we advise to hire a Vector Service Engineer to inspect the valve before installation.

All valves, except fail closed, are shipped and must be stored in the open position, to protect sealing surfaces.

3 Installation

3.1 Valve preparation and cleaning

1. Unpack the valve carefully to prevent damage to the accessories and component parts. Should any problems arise, contact Vector or your local representative.
2. Remove the end protectors and check the conditions of the valve.
3. Clean the readily accessible internal parts with a cloth and an adequate solvent.
4. Spray some lubricant over the internal parts.
5. Close and open the valve completely.

During the installation, keep the ball in the fully open position.

3.2 Hoisting

When hoisting the valve, make sure that the ropes or cables are strong enough, and are positioned so that any tubing or accessories, if present, are not damaged.

A minimum of two lifting lugs are provided to balance the valve weight.

Do not lift the valve using only one lifting lug.
Do not lift the complete valve assembly using the lever, actuator or gearbox lifting lugs.

3.3 Fitting the valve to the piping

Vector ball valves are bi-directional and may be installed for flow in either direction, unless otherwise specified.

Remove the protective end caps just before installation. Do not keep an unprotected end open to the atmosphere for more than 12 hours.

The valve must be properly aligned and the connecting piping adequately supported. No pipe strain must be imposed on the valve body. Do not locate the valve at a point were large end loads may take place.

After installation, we suggest to lock the valve in the open position before flushing the pipeline.

Do not operate the valve during flushing.

Flushing will take out of the pipeline foreign matter, which could damage the valve seats. See 6.2 for recommendations during flushing.

After flushing and system hydro-testing, the valve must be drained to remove test fluid.

3.3.1 Flanged end valves

The flanges of the connecting pipe must be square with the valve mating flanges, which should be of the same size and pressure rating.

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Install flanged valves installed using the appropriate gasket (not supplied). Clean thoroughly the gasket mating surfaces to ensure leak-proof joints. Torque bolting of the flange in accordance with an approved procedure or a suitable standard; for example, ASME PCC-1 or equivalent.

During installation, the ball must be in the open position.

3.3.2 Weld end valves

On butt-welded ends, there shall be no offset between the pipe and valve end before welding.

Welding shall be done by qualified welders, following welding procedures suitable for the valve and pipe materials.

Take adequate measures to prevent that the valve internal parts reach excessive temperatures. Particularly, do not exceed maximum allowable temperature of soft seals and seats. Vector recommends to monitor body temperature at all stages of welding process.

During preheating, welding and stress relieving, the ball must be in the open position.

4 Operation

4.1 Normal operation

The valve is taken from the fully-open to the fully-closed position with a 90º turn of the stem in the clockwise direction. Conversely, the valve is opened by turning the stem 90º counterclockwise.

4.2 Partial operation

Vector recommends to move the ball regularly, in order to prevent any sticking problem between ball and seat. A partial operation (say, 15% of the total stroke) every month is usually enough to ensure good seat and ball life. When the valve is normally opened, a partial operation should be a little or no disturbance to normal plant operation. When the valve is normally closed, however, a partial operation discharges fluid downstream, and could be a great problem to normal plant operation.

> **Always get authorization to partially operate an in-service valve.**

Ball valves in natural gas service may need a more extensive partial-operation and seat-lubrication programme. See our recommendations in section 6.

4.3 Double block-and-bleed

The pressure trapped in the body cavity can be vented to the atmosphere while pressure is maintained in the pipeline, both in the fully open and fully closed positions.

This characteristic is used to:

1. Ensure that the seats are providing an effective seal.
2. Drain or flush the body cavity of an in-service ball valve.

4.3.1 Venting procedure

1. Operate the valve to the fully open or fully closed position, whichever is more convenient for you.
2. Turn loose the head of the *vent fitting* [39] located at the top of the body, to release cavity pressure.

> **Use extreme caution when venting the body cavity of a pressurized valve.**

Continue venting until body cavity pressure is atmospheric. It will take some time to depressurize the body cavity. It depends on size of the fitting, body cavity pressure and fluid compressibility.

> **If the body cavity keeps venting fluid at a constant flowrate for a very long time, it is a signal of bad sealing of the valve seats.**

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4.3.2 Draining procedure

The purpose of draining the body cavity is to bleed out all the liquid collected in the body cavity. Even in gas service, some condensate, compressor oil and other residues may get trapped in the body cavity after a while. We recommend to drain the body cavity once a year.

Drain the liquids into a suitable bucket to avoid releasing them to the environment. Keep clean your working area.

To drain the body cavity, proceed as follows:

1. Operate the valve to the fully open or fully closed position, whichever is more convenient for you.
2. Turn loose the head of the *drain fitting* [39.1] located at the bottom of the body, to bleed liquids trapped in the body cavity.

It will take some time to bleed the body cavity. It depends on the size of the fitting, pressure in the body cavity and compressibility of the fluid.

If there are hydrates in gas service, the drain fitting may freeze during high-pressure draining. Work slowly and ensure that the pressure trapped in the body cavity has been completely released, by opening and closing the drain fitting several times.

4.3.3 Flushing procedure

The purpose of flushing the body cavity is to clean away any residual or dirt collected inside, using a suitable solvent. To flush the body cavity:

1. Vent body cavity (see 4.3.1).
2. Drain body cavity (see 4.3.2).
3. Remove the *vent fitting* [39] and introduce adequate flushing media into the body. Release the flushing media through the *drain fitting* [39.1] at your convenience.

4.3.4 Release of cavity overpressure

Vector trunnion mounted ball valves are designed to release cavity overpressure into the pipeline automatically.

Since body cavity and pipeline are isolated in the fully open and fully closed position, pressure trapped in the body cavity may be different than pressure in the line. Examples of this situation are during pipeline de-pressurization, or heating of body cavity causing a sudden pressure build-up.

An overpressure in the body cavity will pop the seats off the ball surface, and excess pressure will be relieved into the pipeline. After the pop-off action, the seats will return to their normal position, in contact with the ball.

The pop-off action is triggered by differential pressure between body cavity and pipeline. The body cavity pressure can not exceed in 1.33 times the valve pressure rating at the specified maximum operating temperature; however, pop-off action usually happens long before, with just a few bars of differential pressure.

5 Maintenance

5.1 In-line maintenance

If the ball valve complies with API 6D, it will feature positive retention of the shaft, and fittings for grease injection. Thus, with the valve in-line, you can replace shaft O-rings and inject sealant grease in case of emergency.

5.1.1 Shaft seals

Ensure always that the valve has the feature of shaft retention before in-service replacement of shaft seals.

If the ball valve complies with API 6D, it will feature shaft retention: i.e., the shaft does not eject under any internal

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pressure condition or if the packing gland components and/or valve operator mounting components are removed. Shaft retention is provided by a part called *retaining ring* [21].

If shaft retention is featured, the *support flange gasket* [43], *the shaft packing set* [29], the *lantern ring-shaft O-ring* [30] and the *lantern ring-body O-ring* [32] can be replaced. To do so, proceed as follows:

1. Vent body cavity as described in 4.3.1.
2. Remove the *actuator* [53], taking care not to damage the *shaft [06]* or *key* [25].
3. Remove the *support flange bolts* [18] and the *support flange* [10].
4. Extract the *lantern ring* [20].
5. Replace the *support flange gasket* [43], the *shaft packing set* [29], the *lantern ring-shaft O-ring* [30] and the *lantern ring-body O-ring* [32].
6. To assemble, repeat the sequence in reverse order.

5.1.2 Emergency sealant injection

A sealant is a grease-like subtance used to stop small leakages through sealing surfaces. A slightly damaged or scratched sealing surface can still close if some sealant is injected. Sealant injection is intended for emergency situations, where a major valve overhaul to replace the seats is not possible.

Sealant is injected through the *grease fittings* [40] located in the valve body, near the seat area.

In most cases, sealant injection in the upstream seat will be enough to stop a small leakage. However, it would probably be necessary to inject sealant each time the valve is operated to keep leakage under control.

The procedure for injection of sealant in the seats is as follows:

1. Before injection of sealant, ensure that the ball stops are not out of alignment. A small misalignment of 2 or 3 degrees may open the bore hole to the line pressure, causing continuous leakage.
2. Use an appropriate **high pressure sealant-injection pump**, capable of overcoming the pipe pressure and the high pressure build-up caused by the sealant itself, during its injection in the sealant passages.
3. Confirm that the ball is in the closed position. Otherwise, the grease will go down the pipeline and the whole procedure will not be effective.
4. Remove the safety cap of the grease fitting.

> **When removing the safety cap of the grease fitting, be careful not to unscrew the complete grease fitting out of the body, because it is under pipe pressure. Use a back-up wrench.**

5. Start injecting a light grade sealant. If you do not succeed, gradually work up to heavier sealants.
6. Recommended quantity is 1 oz (29 cc) of sealant per inch of valve size per seat ring, without considering the quantity required to fill pump and hoses.
7. Inject only enough sealant to stop the leakage. An excess of sealant is wasteful, and contaminates the installation downstream.

Vector ball valves feature another sealant injection point in the shaft area, to help stop leakage through the O-rings located there. The quantity of sealant required is proportional to the diameter of the shaft and, in any case, much smaller than the amount required in the seats.

5.2 Major overhaul / disassembly

To disassemble the valve, it is necessary to remove it from the line. Before diassembly, make sure that a new set of soft parts (gaskets, packing and O-rings) is available, because soft parts can not be reused.

Soft seals made of elastomers such as Viton, Buna, FPM, FKM, FFKM, etc. lose elasticity with time. We recommend to take advantage of the scheduled plant stops to replace them. As a general rule, elastomers must be replaced every two years; however, high working temperature or pressure, or chemical composition of the fluid, can shorten their

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lifetime. In case of doubt, Vector will be glad to answer any question about your specific needs.

5.2.1 Removal of valve from the line (flanged)

If the valve must be removed from the line, the following actions must be completed by a skilled operator.

1. Check carefully that the line is depressurized and drained.
2. Operate the valve to half-travel, to release any cavity pressure; if necessary, drain the valve too.
3. Turn the valve to the open position.
4. Support the valve properly if its size and weight exceed the handling capacity. Use suitable facilities to support the valve by its lifting lugs.
5. Unscrew the bolting connecting valve and pipe at both sides of the valve.

5.2.2 Actuator removal

To remove the actuator proceed as follows:

1. After removing the valve from the line, ensure that the valve is in the open position. Mark the position of the actuator, to help to assemble it in the right position later (i.e. mark the orientation of the gearbox or handwheel).
2. Remove the *actuator* [53].
3. Remove the *actuator keys* [25].

5.2.3 Support flange removal

To remove the support flange proceed as follows:

1. Remove the *support flange bolts* [18].
2. Mark the position of the *support flange* [10] and remove it.
3. In this situation, you can replace the *support flange gasket* [43] and the *shaft packing set* [29].

5.2.4 Lantern ring removal

To remove the lantern ring proceed as follows:

1. Pull out the *lantern ring* [20].
2. In this situation, you can replace the *lantern ring-shaft O-ring* [30] and the *lantern ring-body O-ring* [32].

5.2.5 Retaining ring removal

The *retaining ring* [21] is screwed in the body, and has "teeth" in its upper face to unscrew it easily. Its mission is to prevent that the shaft is thrown out of the valve by body pressure during in-line replacement of *lantern ring O-rings* [30][32].

> **Never remove the retaining ring of a pressurized valve.**

1. Turn the ball half-open and open the vent fittings to relieve any pressure trapped in the body cavity.
2. Unscrew the *retaining ring* [21], using a pipe with teeth in one end.
3. In this situation, you can replace *retention ring – shaft O-ring* [31] and *retention ring – body O-ring* [33].

Now you have replaced all the seals that stop leakage through the shaft.

5.2.6 Body-bonnet seals

There are also soft seals between *bonnet* [09] and *body* [01] that may need replacement. You can reach them unscrewing the *body-bonnet bolts* [19]. Do not forget to mark the position of the bonnet before proceeding (i.e. mark the position of the *grease fitting* [40.1]).

5.2.7 Seat carrier extraction

To extract the seat carrier proceed as follows:

1. Turn the ball half-open and open the vent fittings to relieve any pressure trapped in the body cavity.
2. Turn the valve to the open position.
3. Turn the valve on end, over a soft, level surface that can not damage the faces of the valve; for example, over a wooden board.

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In the following steps, you will extract the uppermost seat carrier for inspection and/or replacement:

4. Remove the *body adaptor nuts* [15].
5. Lift *adaptor* [03], being very careful that the *seat carrier* [07] remains with the adaptor.

Seat carrier must remain with adaptor during extraction. Do not let the seat carrier fall and damage the ball. Joining seat carrier and adaptor with some adhesive tape can do the job for small sizes.

6. Turn *adaptor* [03] on end, over a soft, level surface that can not damage the face.
7. Pull the *seat carrier* [07] off the adaptor.
   The *seat carrier* [07] and the *seat* [08] can not be separated. If the seat is damaged, the complete seat carrier and seat assembly must be replaced as a single unit.
8. In this situation, you can replace the *seat carrier packing* [28], the *seat carrier O-ring* [27], and the *body-adaptor gaskets* [12][13].

To prevent that the *seat carrier springs* [26] fall off the seat carrier during handling, keep them in place with a glob of grease. For safety, ensure that the grease is compatible with the working fluid.

Replace the seat carriers one by one. Re-assemble the first adaptor following the steps in reverse order; when finished, turn the valve over the opposite end and proceed with the second seat carrier.

We do not recommend to extract the *shaft* [06], *ball* [05] and *spacers* [11] [11.1] to get access to the lowermost seat carrier, because the surface of the ball can get damaged during handling.

5.3 Assembly

To assemble the valve proceed as follows:

1. Prior to re-assembly, replace all soft seals (O-rings and gaskets).
2. Inspect metallic parts for damage, paying attention to bearing and sealing surfaces, and replace all defective parts. Clean all parts with solvent, and lubricate lightly all contact surfaces and sealing surfaces of the parts.
3. Follow the steps for disassembly in reverse order.
4. All parts must fit snugly. Do not force them unnecessarily.
5. Install actuator and check smooth operation of the valve. Adjust open /closed position stops.

6 Recommendations for Natural Gas Service

6.1 Introduction

Ball valves in natural gas service deserve a complete section. It is well known that natural gas has some particular characteristics and associated potential problems that must be addressed. Fortunately, the points you must consider are few and very clear, and the preventive measures are simple. They can be summarized as follows:

Natural gas is flammable. All activities performed in the area must be safe, as well as the equipment used.

Hydrogen sulfide (H_2S) is usually present. Hydrogen sulfide is a very toxic gas that requires additional measures and equipment, such as detectors, emergency evacuation plans and breathing apparatus.

Natural gas is very drying. Natural gas washes away the lubricants, so the torque required to turn the valve increases. Eventually, the seats of the valve get stuck to the ball surface, and the actuator can not turn the valve anymore. It can be prevented with simple maintenance, consisting of cycling the valves often and injecting small amounts of grease in the seats and seals regularly. The grease must be adequate for natural gas service as well.

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Natural gas is not usually clean. Natural gas may carry condensates and dirt that gets trapped in the valves, and may damage the internal parts. Operation of the valves becomes more difficult, too. It is true that plant sites do install filters in their systems, but experience has proven that no system is perfect. In any case, the internal parts of the valve can be protected using a judicious amount of grease to fill the cavities.

6.2 Flushing the pipeline

Flushing washes away all welding slag, dirt, sand, solids and debris collected in the pipelines during construction. Flushing is the most dangerous activity for the valves, and it happens before they are even put to service. We recommend the following:

1. **Find a good grease for natural gas service.** The grease must be insoluble. It must be resistant to breakdown or shearing of the gel structure under high pressure injection and under the pressure between seating surfaces. It must be stable over a wide range of temperatures, and not freeze. It must not react chemically with the fluid and become solid, or rubber like (i.e. *polymerize*).
   In our experience, the best greases are ***fully synthetic***; if you have any doubt or concern,Vector will be happy to assist you in this matter.

> **Beware of greases made of a sinthetic oil with a mineral thickener. The natural gas washes away the oil, leaving the thickener behind. The thickener is like a powder that caulks or bake hard in the seats, gluing them "solid" to the ball.**

2. Use an appropriate **high pressure grease-injection pump**, capable of overcoming the pipe pressure and the high pressure build-up caused by the grease itself, during its injection in the grease passages.
3. **Inject a generous amount of grease in the seats before flushing.** The object is to cover them and to fill the groove between seat carrier and ball with grease. The dirt will get stuck to the grease during flushing, *but it will not come inside*. And before turning the valve for the first time, inject again a small amount of grease into the seats. A little is enough (¼ of the normal quantity per seat, see 5.1.2). The dirty grease will be pushed into the pipe by the fresh grease, and the turning action of the ball will drag fresh grease towards the seats, not dirty grease.
4. **Do not turn the valve during flushing**.

6.3 Commissioning

The first year of operation is crucial, because when the pipe is put into service, all debris is pushed downstream, and contaminates the valves along its travel. With time, the pipe gets cleaner and initial problems disappear.

> **Remember: ball valves in natural gas service are like the human body: they need "exercise". Keep moving them and lubricating them, and you will have no problems. Do not let them have a sedentary life.**

The same recommendations regarding grease injection for flushing (see 6.2) apply for commissioning. The key is to re-fill the grease channels regularly, and gradually push the dirt out of the seats. Provided that the grease is properly chosen (see 6.2), it will not damage the valve, and will shield seats from contamination. Regular cycling is also important, for two reasons: to prevent that the seats get stuck, and to distribute fresh lubricant over the seating surfaces of the ball and seats.

Vector recommends the following programme for start-up:

1. For the first year, inject a small amount of grease into the seats *before* turning the valve, every time.
2. Cycle the valves periodically as follows:
   - For the first month, every week.
   - For the second month, every two weeks.

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- For the third month onwards, every month, for at least 6 months.
- Then every six months. Along with the maintenance cycles, inject a little of fresh grease to keep seats and shaft lubricated.

7 Final remarks

7.1 Find the assembly drawing that we sent with your valve

Vector manufactures valves specifically suited to the requirements of your purchase order. Therefore, the valve that you actually have may differ from the one shown in the drawing in this manual.

We send an assembly drawing with every valve we manufacture, and that assembly drawing does match the valve that goes with. Thus, we strongly suggest that you get the particular assembly drawing of your valve, before doing any job in it. It would be much better than using the drawing in this manual as a rough approximation.

If you can not find the documents of the valve, please contact us and we will be glad to send you a copy. *The serial number in the nameplate will speed up any enquiry about your valve.*

7.2 If in doubt, call Vector

If you have any doubt, please call us. We are glad to give assistance to our customers and in return, get their comments about our products. Any feedback is always welcome.

7.3 About this manual

We want this manual accurate, complete and, above all, helpful to you.

Please tell us if you do not understand something, or feel that some information is missing, or just want to know more about our valves. We are always thankful to receive anything that may help us to make things better.

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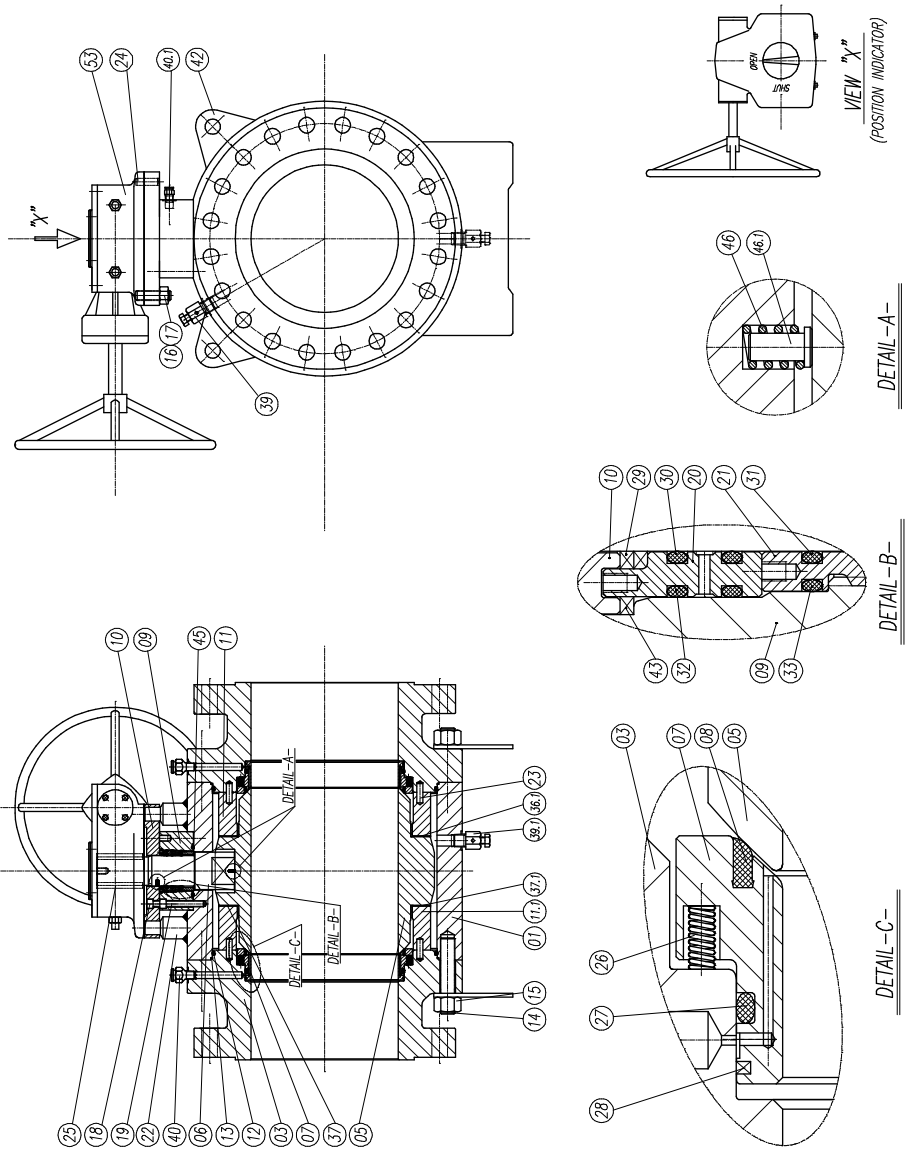
LIST OF MATERIALS

REF.	QTY.	SPARE	PART NAME	MATERIAL
01	1		BODY	A105
03	1		ADAPTOR	A105
05	1		BALL	A105 + ENP
06	1		SHAFT	A182 F6
07	2	X	SEAT CARRIER	A105 + ENP
08	2		SEAT	TFM 4215
09	1		BONNET	A105
10	1		SUPPORT FLANGE	CARBON STEEL
11	1		UPPER SPACER	A105
11.1	1		LOWER SPACER	A105
12	1	X	BODY ADAPTOR GASKET	FPM
13	1	X	BODY ADAPTOR GASKET	GRAPHITE
14	–		BODY ADAPTOR STUD	A 193 B7
15	–		BODY ADAPTOR STUD NUT	A 194 2H
16	8		ACTUATOR STUD	CARBON STEEL
17	8		ACTUATOR STUD NUT	CARBON STEEL
18	4		SUPPORT FLANGE BOLT	CARBON STEEL
19	4		BODY BONNET BOLT	CARBON STEEL
20	1		LANTERN RING	A536 GR80–55.06
21	1		RETAINING RING	A536 GR80–55.06
22	2		ANTIROTATION PIN	UNE F155
23	8		BODY SPACER PIN	AISI 1043
24	2		ACTUATOR PIN	AISI–1043
25	2		ACTUATOR KEY	AISI–1043
26	–	X	SEAT CARRIER SPRING	AISI 302
27	2	X	SEAT CARRIER O–RING	FPM
28	2	X	SEAT CARRIER PACKING	GRAPHITE
29	1	X	SHAFT PACKING SET	GRAPHITE
30	2	X	LANTERN RING–SHAFT O–RING	FPM
31	1	X	RETENTION RING–SHAFT O–RING	FPM
32	2	X	LANTERN RING–BODY O–RING	FPM
33	1	X	RETENTION RING–BODY O–RING	FPM
36.1	1		SLIP WASHER	A536 GR80–55.06
37	1		UPPER BUSHING	CS. STEEL/PTFE COATED
37.1	1		LOWER BUSHING	CS. STEEL/PTFE COATED
39	1		VENT PLUG	CARBON STEEL
39.1	1		DRAIN PLUG	CARBON STEEL
40	2		GREASE FITTING	CARBON STEEL
40.1	1		GREASE FITTING	CARBON STEEL
42	2		LIFTING LUG	CARBON STEEL
43	1	X	SUPPORT FLANGE GASKET	GRAPHITE
45	1		THRUST WASHER	A536 GR80–55.06
46	2		ANTISTATIC SPRING	AISI 302
46.1	2		ANTISTATIC BOLT	AISI 316
53	1		ACTUATOR	COMMERCIAL



We suggest you to print this sheet in A3 paper.