
KITZ

Operation Manual

For

API 6D, 3 piece, Trunnion Mounted Ball Valve
Soft and Metal seated

T60S/SF, UF3TCS Series

T60M/SF, UF3TC6H Series

Thank you for having chosen KITZ products.

For safe and trouble-free function and performance of the product, ensure to read and understand all items of this manual before valve mounting and operation.

Keep this manual in a convenient place for your valve operators' easy access.

This manual applies to manual operation of KITZ flanged ends manual operated soft and metal seated API 6D, 3 piece, trunnion mounted ball valve series.

CAUTION AND WARNING

To ensure safe and trouble-free function and performance, please read all the contents of this manual before handling, transportation, mounting and operation of the valves. Keep this manual to the place accessible to the operator.

The signal words "WARNING" and "CAUTION" are defined as follows:



WARNING

Indicating potentially hazardous conditions, which may result in serious injury to personnel, if such warnings shall be ignored.



CAUTION

Indicating potentially hazardous conditions, which may result in injury to personnel or only property damage, if such cautions shall be ignored.



Indicates prohibition of an action.



Indicates mandatory implementation of an action.

NOTES TO USERS

This manual covers normal usage of our products. The technical data for operation, maintenance and inspection of the products are prepared in consideration of safety. However, they are good only to cover typical applications as a general guideline to users. If technical assistance beyond this manual is required, contact KITZ Corporation or its distributors.

The illustrations given in this manual do not introduce all details. If more detailed data are needed, refer to our relevant valve assembly drawings.

Any information provided in this operation manual is subject to revision at any time without notice. This edition cancels all previous issues.

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. Construction and Design feature

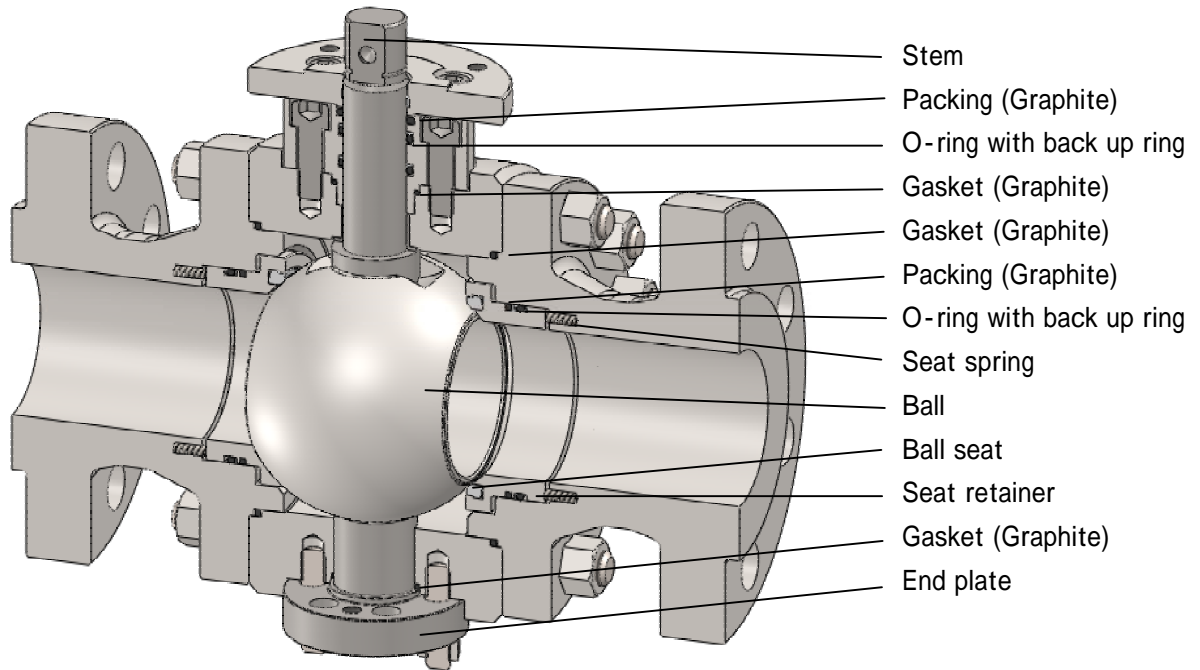
. Construction and Design features

1. Construction and Design features

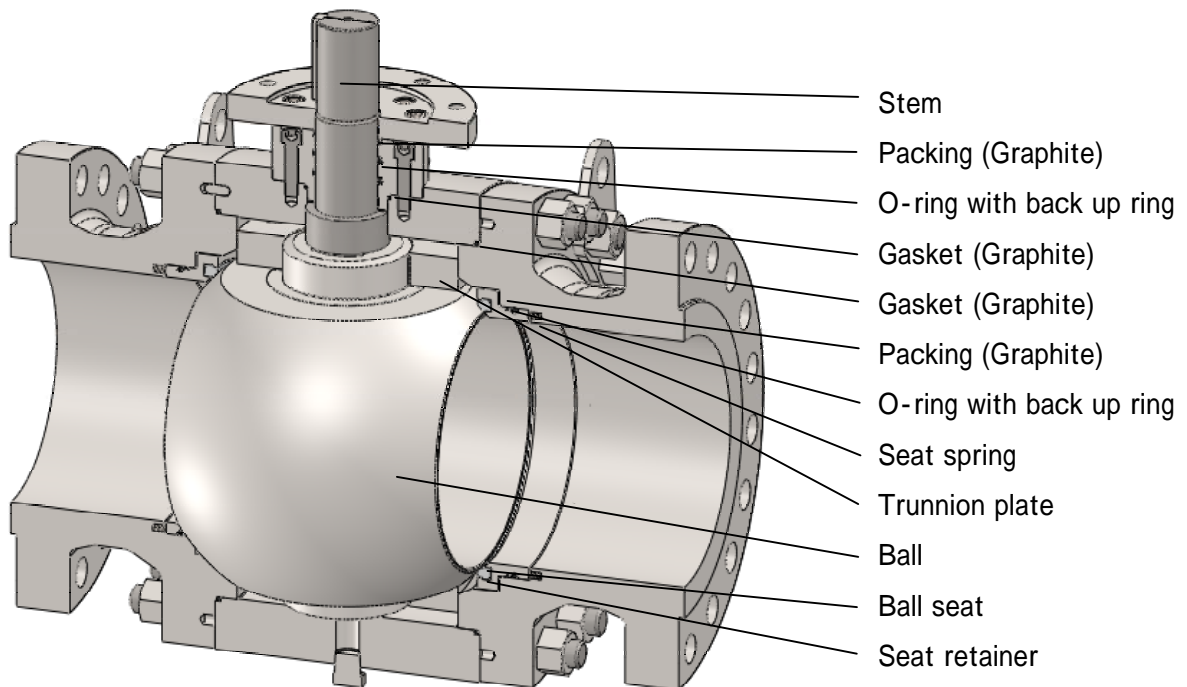
- 1.1 Construction and parts names are as illustrated next page.
- 1.2 The valve can be operated by rotating the stem by 90 degrees to open or shut.
- 1.3 The valve is designed for use in the full open or full closed position only.
- 1.4 The valve for size up to NPS4 for full bore and up to NPS6 for reduced bore have two stems, at the top and bottom, supporting the ball, the design of which gives the valve less impact on operation torque.
- 1.5 The valve for size NPS6 and larger for full bore and size NPS8 and larger for reduced bore have two trunnion plates, at the top and bottom of the ball, supporting the ball, the design of which gives the valve less impact on operation torque.
- 1.6 The valve is a bi-directional valve.

Construction and Design features

1.7 Typical construction for Soft seated valve.



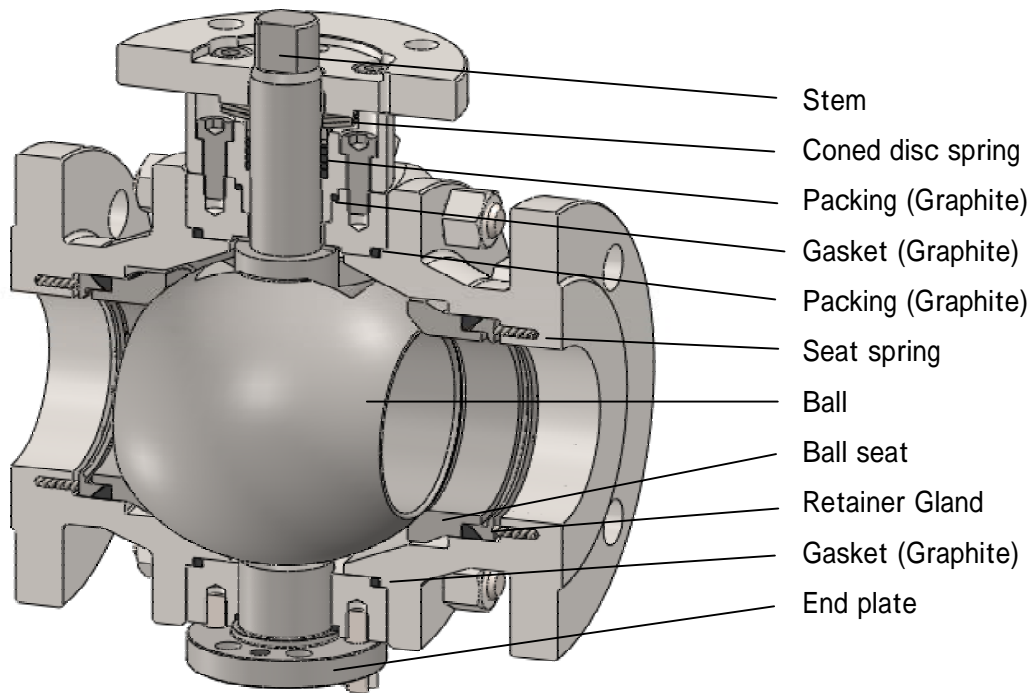
This illustration shows typical construction for size up to NPS4.



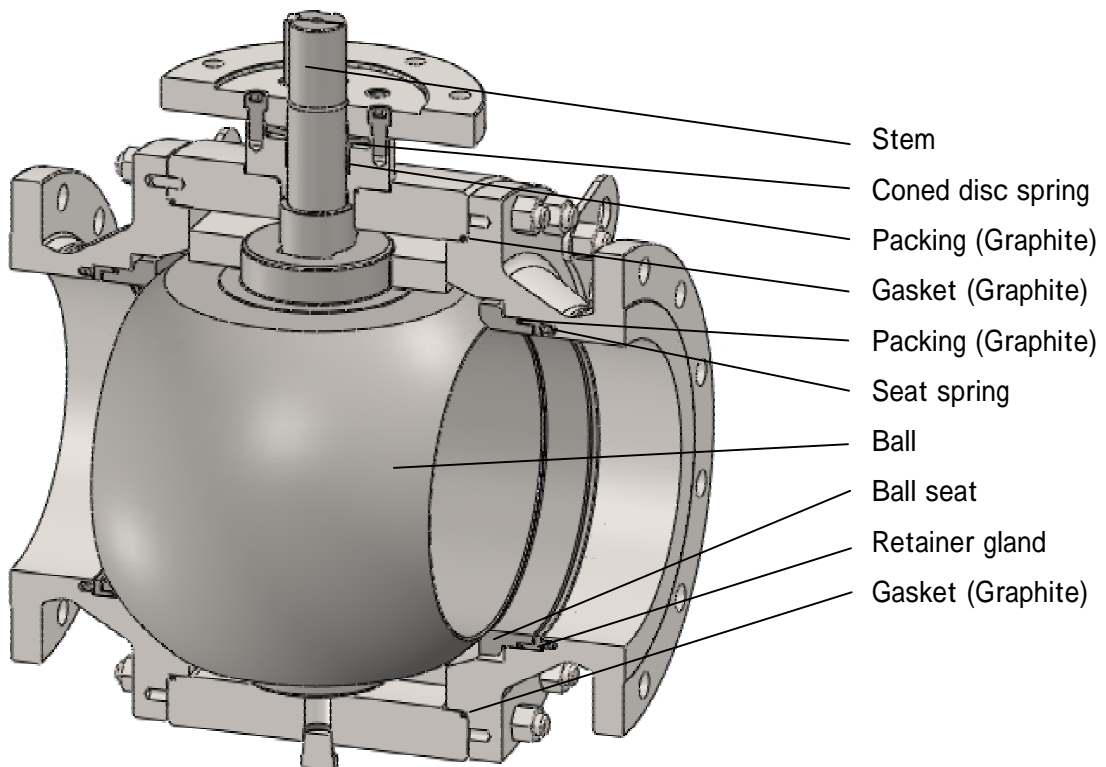
This illustration shows typical construction for size NPS6 and larger.

Construction and Design features

1.8 Typical construction for Metal seated valve.



This illustration shows typical construction for size up to NPS4.



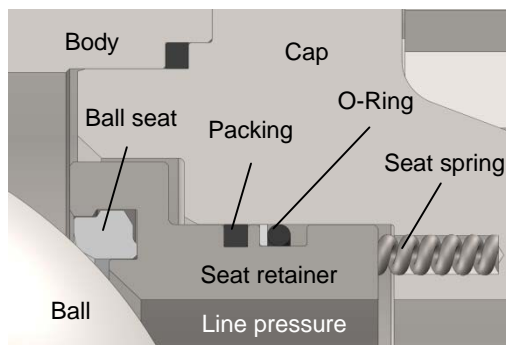
This illustration shows typical construction for size NPS6 and larger.

Construction and Design features

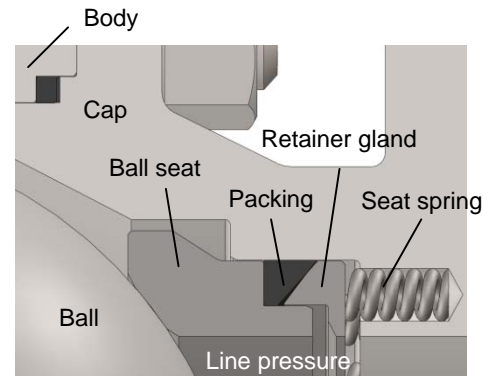
2. Design features

2.1 Double block and bleed function.

The ball seat is provided on the upstream and downstream, which independently function to seal the media. Consequently the valve bore and the body cavity are isolated from each other when the valve is fully opened or shut so that the residue within the body cavity may be disposed through the drain port.



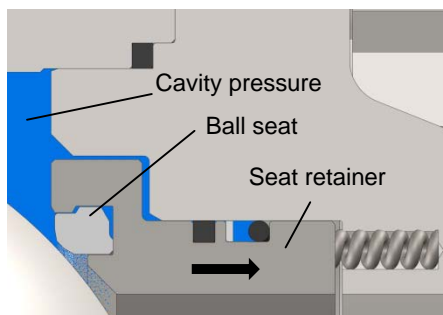
Soft seated design features



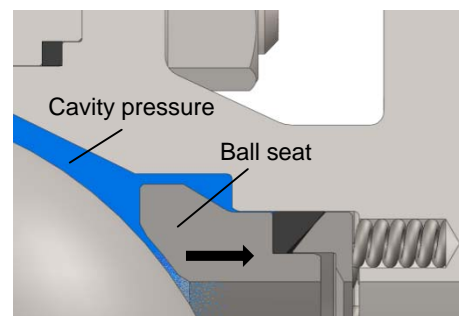
Metal seated design features

2.2 Excessive cavity pressure relief mechanism

Seal is made on the upstream side by the seat retainer whose seat spring pushes the ball seat against the ball at fully shut position. In case the line fluid trapped in the body cavity evaporates and causes excessive rise in the cavity pressure for some reasons, especially when the cavity pressure exceeds the line pressure, the ball seat will move slightly away from the ball surface to relieve the excessive cavity pressure into the valve bore.



Soft seated



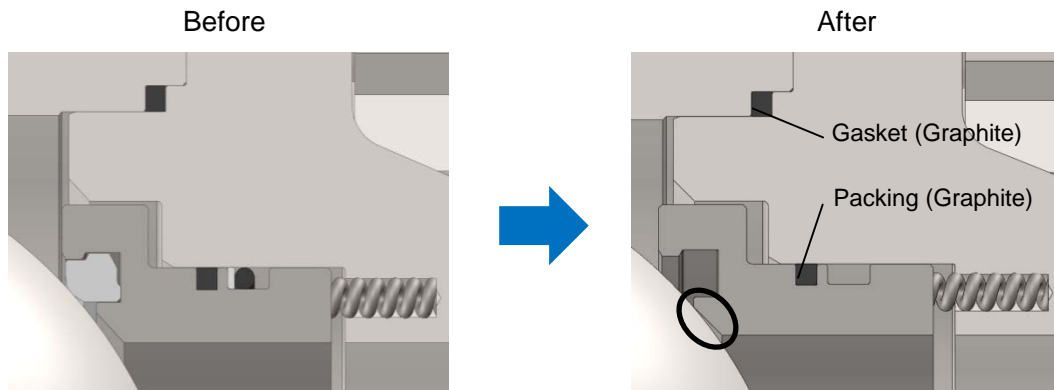
Metal seated

Construction and Design features

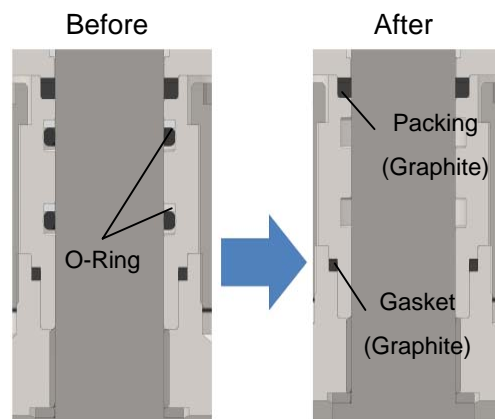
2.3 Fire safe design

When the ball seats are decomposed or deteriorated by a fire, the edge of the metal seat retainer preloaded by the seat spring comes into contact with the ball to shut off the fluid to minimize internal leakage through the valve bore.

And also, metal seated design is composed of noninflammable materials, which is suitable for fire safe design.



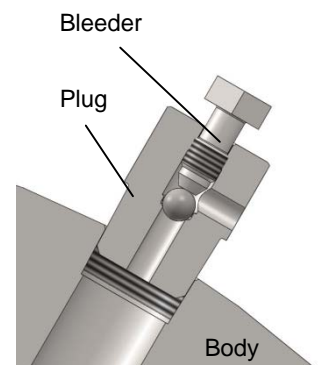
Internal leakage prevention



External leakage prevention

2.4 Drain or vent port

The valve has the block and bleed structure that allows a valve or other types of connection to be installed at the drain or vent port through which the fluid in the cavity can be discharged.







. Shipping, Handling and Storage

. Shipping, Handling and Storage

1. Shipping and Handling Valves

1.1 Care for Shipping and Handling Valves.

 WARNING	
	Keep off the valve lifting area to prevent injuries caused by the unsecured valves. Unstable stacking may also result in personal injuries.

 CAUTION	
	<p>Pay attention not to damage painted surfaces during transportation, which may subsequently cause corrosion to the valve. Repair is required if the surface is damaged.</p> <p>Pay attention to handling and storage of carton packed products. The high humidity may damage the cartons.</p>




1.2 Shipment

- 1.2.1 Maintain original packing condition during shipment. Provide appropriate protection covers if they are found damaged during transportation.
- 1.2.2 Handle valves carefully so that they may not fall or drop on the ground. Any extraordinary mechanical impact should be avoided for the valve protection.
- 1.2.3 When hang the products using the eyebolts, please use it within the load capacity range of the eyebolts. The hanging angle has to be 45 degrees or less and hang with two slings.
- 1.2.4 When hold the products using the support legs, please ground it so as not to shock the products while keeping it level on the hard plane.

. Shipping, Handling and Storage

2. Storage

2.1 Care for Valve storage

 CAUTION	
	<p>DO NOT store valves in the corrosive environment, which may cause corrosion from the valve threaded areas.</p> <p>DO NOT remove protection covers until installation. They prevent any foreign objects from intruding valves.</p> <p>DO NOT place any objects on valves, and DO NOT step on them. Overloading may cause damage to valves.</p> <p>DO NOT pile up products carelessly to avoid damage to the products and personal injury caused by unstable piling.</p>
	<p>Keep the valves in the opened position during storage. Storing the valves in halfway position may deform the ball seats, leading to cause of the seat leakage. And storing the valves in fully shut position may damage seal surface of the ball by foreign objects intrusion affect, when the flange protectors or covers are torn or removed.</p>

2.2 Storage

2.2.1 Indoor storage of valves in a dust-free, low humidity and well ventilated place is recommended.




2.2.2 Storage of valves directly on the ground or concrete floor is not recommended. Place packed valves on the pallets or the racks for storage.



2.2.3 Take some appropriate measures to protect valves into the directly exposure to dust, rain or sunlight if valves are temporarily stored outdoors.

. Valve installation

. Valve installation

1. Care for Valve installation.



 WARNING	
	Check the valve specifications with the identification plate or tag and the relevant Catalogue, to ensure that the exact valves specified in your piping arrangement plan was provided. The service fluid, pressure and temperature determine the compatibility of sealing materials and ball seat materials. Incorrect application of valves could be hazardous.
	DO NOT install for pipe end service, which may cause the external leakage. In such a case, use the blank flange to prevent the leakage.

 CAUTION	
	<p>Keep a secure footing for valve installation and operation.</p> <p>Sufficient lighting should be prepared for valve operation.</p> <p>Piping should be properly supported, if needed.</p>

- 1.1 Allow sufficient room for operation, installation, removal and subsequent maintenance of valves, considering the valve height and the stem direction.
- 1.2 Take appropriate measures for smooth operation, inspection and maintenance of valves if they are forced to be installed in small spaces.
- 1.3 Try not to install valves in the places where valve functions may be hampered by outer forces such as vibrations.
- 1.4 It is recommended to install valves to horizontal pipes in upright positions.
- 1.5 When hang the products using the eyebolts, please use it within the load capacity range of the eyebolts. The hanging angle has to be 45 degrees or less and hang with two slings.

. Valve installation

2. Care for Piping.

 CAUTION	
	<p>Keep off the valve lifting area to prevent injuries caused by the unsecured valves.</p> <p>Care should be taken to keep hands clear of valves while placing them between pipe flanges.</p> <p>Pay attention not to damage flange surfaces and gaskets.</p> <p>Piping should be properly supported to align pipes on both sides.</p> <p>For valves with the gland packing structure, retighten gland packing before operation. Pressure applied to the gland packing may be lowered due to the stress relaxation taking place during transportation or storage, which may cause leakage.</p> <p>Use new gaskets when installing valves into pipelines.</p>

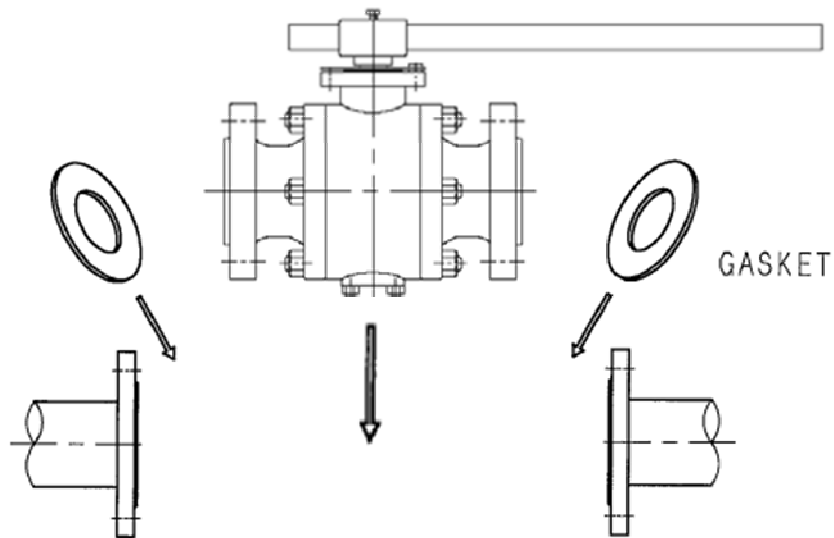
. Valve installation

- 2.1 Check the following items before installation of the valves.
 - 2.1.1 The service conditions should be within the range of the relevant valve specification.
 - 2.1.2 Valve flanges should correspond with pipe flanges.
 - 2.1.3 Gasket contact surfaces of pipe and valve flanges must be free from scratches or any other damages.
 - 2.1.4 The appropriate length should be kept between pipe flanges for the valve face-to-face dimensions including the gasket thickness.
 - 2.1.5 Pipes and valves should be accurately aligned.
 - 2.1.6 Pipe flanges should face parallel to each other. The bolt holes of flanges should be symmetrically lined up against the center line of flanges.
- 2.2 Before installation of the valves, the connecting pipes should be cleaned to remove any foreign objects such as sand, dust and welding spatters.
- 2.3 Do not give extraordinary shock to valves by throwing, dropping, dragging or toppling them down.
- 2.4 Remove flange covers from valves just before installation.
- 2.5 Check all threaded areas after installation and retighten them, if needed.
- 2.6 Flush the inside of the valves and pipes, after installation to remove foreign objects. During be flushed, the valves should open. Do not operate the valves during flushing.

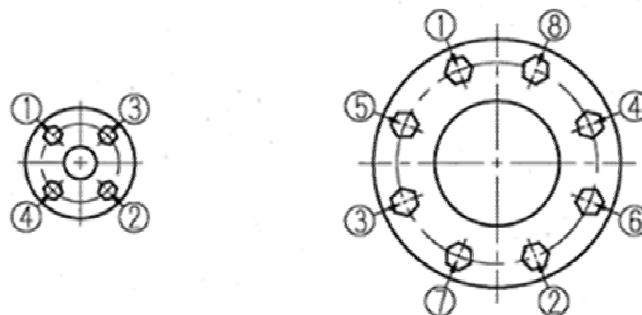
. Valve installation

3. Valve installation procedure

- 3.1 Pipes and valves should be accurately aligned.
- 3.2 The appropriate length should be kept between pipe flanges for the valve face-to-face dimensions including the gasket thickness.
- 3.3 Place the valve between the pipe flanges. Insert bolts through the bottom bolt holes and tighten them lightly. Support the valve during the remaining steps of installation.
- 3.4 Insert gaskets between the valve and pipe flanges.
It is recommended to apply lubricant (gasket paste) to gasket faces.



- 3.5 Make sure the correct alignment of gaskets, which are held in place with the bottom bolts.
- 3.6 Thread bolts through the other holes of flanges and lightly tighten them.
- 3.7 Evenly tighten the bolts alternately in a star pattern as shown below. Once the bolting is properly tightened, both ends of each bolt should evenly protrude beyond the nuts.



- 3.8 Gradually raise the line temperature and pressure during the test run. Retighten valve bolting, if needed.

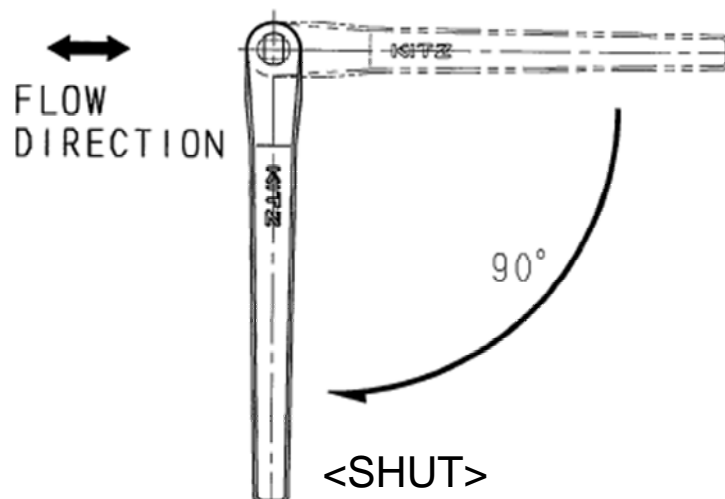
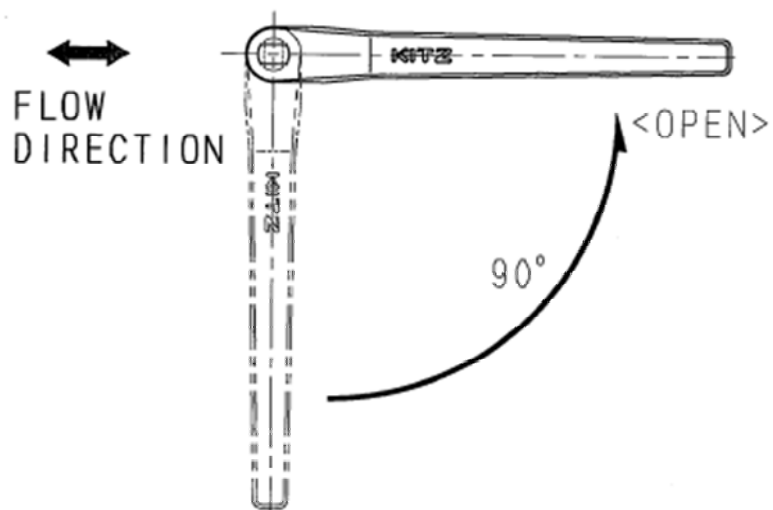
. Valve operation

Valve operation

1. Lever type operator

1.1 The lever handle is directly mounted on the valve stem.

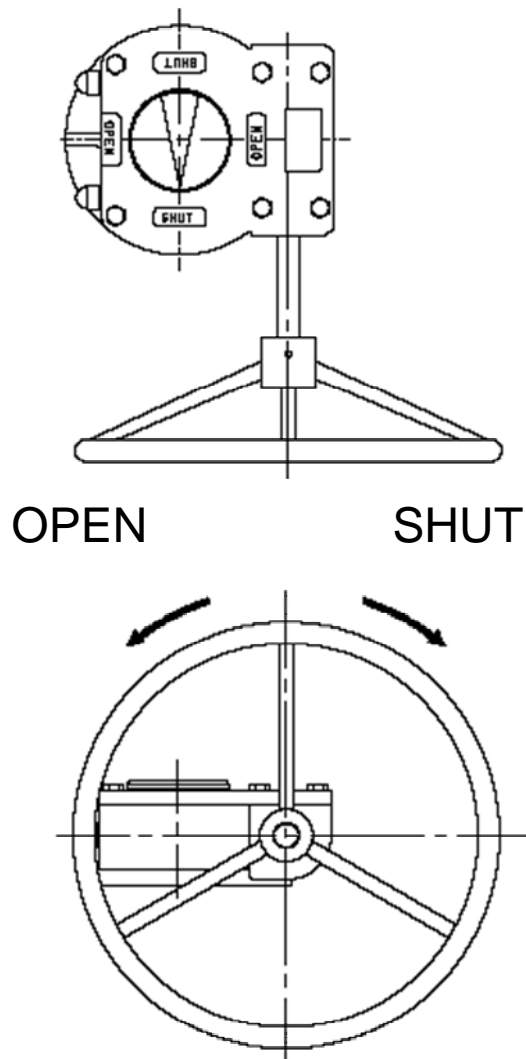
1.2 Rotate the lever handle clockwise by 90° to shut the valve and counterclockwise by 90° to open the valve.



Valve operation




2. Gear operator

- 2.1 The gear operator shall be mounted on the valve.
- 2.2 There should be an arrow or letter to the gearbox surface for indicate the wheel rotation direction to open or shut the valves.
- 2.3 Hand wheel operation forces differ in the valve opening position, fluid pressure value and /or fluid temperature value.
- 2.4 Gear operator is the device to convey force from the operator to the valve stem through reduction gear.



Valve operation

3. Care for valve operation

 CAUTION	
	<p>DO NOT apply too excessive force to operate the valves by using a pipe or hand wheel rotating tools.</p> <p>Never loosen bolts or nuts used in the gland, gland plate, bonnet, cap flanges and end flanges of pressurized valves.</p> <p>DO NOT use valves in an intermediate position. Such use may damage ball seats and cause internal through-bore leakage.</p>
	<p>For valves with the gland packing structure, retighten gland bolts and nuts before operation of valves. Check an operation torque while retightening the bolts and nuts so that the operation won't become too difficult due to over tightening. Gland bolts should be alternately tightened with even force.</p> <p>Valves should be kept fully open during the line test or pressure test. Fully shut valves during the test may deform the ball seats, leading to the occurrence of internal through-bore leakage.</p> <p>In case of the service temperature fluctuates, tighten all bolts and nuts after the temperature is stabilized in order to prevent occurrence of stress relaxation of the gland packing and/or gasket.</p> <p>Gradually open the valves to prevent damage of pipe, when high temperature fluids such as steam are handled.</p> <p>Take some appropriate measures to prevent freezing, as needed.</p>

Valve operation

4. Daily valve inspection during operation



In order to operate valves safely and satisfactorily, it is very important to inspect daily.

Here are the items essential to your daily inspection.

Inspection items	Areas to be inspected	Inspection method	Remedial measure
External leakage	Gland area	Visual check, Soapy water	Replace the packing rings. Replace the O rings.
	Flanged areas	Visual check, Soapy water	Retighten the flange bolts. Replace the relevant components.
	Threaded areas	Visual check, Soapy water	Retighten each threaded area. Replace the relevant components.
	Body	Visual check, Soapy water	Replace the valves.
Abnormal noises	Valve body	Auditory check	Consult a piping engineer.
	Loosened bolting	Auditory check	Retighten bolting.
	Pipe Vibration	Auditory check	Consult a piping engineer.
Loosened bolting	Bolts and nuts	Visual and tactile check	Retighten the bolts and nuts.
Internal thru-bore leakage	-	-	Remove foreign objects. Disassemble and inspect the valves, (Replace ball seats), Replace valves.
Valve operation	Valve operating position	Visual check	Ensure that the valve in the predetermined operating position.
	Disturbed operation	Tactile check, auditory check	Disassemble and inspect the valve components.

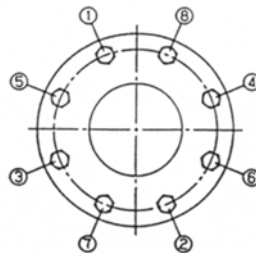
Valve operation

5. Troubleshooting and corrective measures

 CAUTION	
	<p>Operators should take protective measures at all times to prevent direct exposure to the media including wearing protective goggles, gloves and safety shoes a minimum.</p> <p>More stringent protective measures may be necessary when handling toxic, inflammable or corrosive media.</p> <p>Ensure to reduce the media pressure to the atmospheric level, before retightening gland or flange bolting, and loosening or replacing packing rings and gaskets.</p> <p>When retightening the flange bolts, care should be taken for a possible gasket blow out. Operation should be carried out at the position where operators do not get a direct exposure of the media, even if such a blow out occurs.</p> <p>Ensure to reduce the line pressure to the atmospheric level, before replacing packing rings, gaskets and O rings or loosening bolts and nuts. Operation should be carried out at the position where operators do not get a direct exposure of the media.</p>

5.1 Leakage from the flanged areas

Evenly tighten the bolting alternately and gradually in a star pattern as shown below.



. Periodic inspection

. Periodic inspection

1. Periodic inspection



- 1.1 A periodic inspection with valves mounted to pipelines is recommended at least once a year.
- 1.2 Ensure the smooth operation and safety of valves during inspection.
- 1.3 Inspection items and methods are same as daily inspection.
See Chapter for the items and methods suggested.
- 1.4 Where valves and adjoining piping are not daily inspected or not operated for a long time, a periodic inspection is recommended. (A periodic inspection should be carried out on all valves.)
- 1.5 It is particularly important to thoroughly check the valves used for the following service :
 - (1) Where performance failure of valves could result in a major shutdown of an entire plant unit.
 - (2) Where the media contain high viscosity and may get stuck to and built up inside the valves.
 - (3) Where corrosion and/or wear by the media is expected.
 - (4) Remove the valves from the pipelines for inspection, if needed.
 - (5) In case the disassembly of the valves is required, it is recommended to call the valve manufacturer for inspection and repairs.



. Periodic inspection

2. Inspection and maintenance

In case pipelines or facilities where valves are installed are shut down for the pipeline inspection, provide the valves with the body and seat pressure test and operation test, if needed. If any defect is detected, disassemble the valves for further inspection. The valves must pass required inspections before being sent back to the pipelines or facilities for reinstallation.

2.1 Care for removal of the valves from pipelines or installation of the valves on pipelines.

 CAUTION	
	<p>Discharge the fluid from pipes and reduce line pressure to the atmospheric level when dismantling valves from pipelines.</p> <p>Discharge the fluid and pressure trapped within the valve body with the valve intermediate position before disassembling.</p> <p>In case fluid is toxic, inflammable or corrosive, remove the fluid completely from pipes and internal valves.</p> <p>Take protective measures to prevent direct exposure to the fluid and catching fire.</p> <p>Keep off the working area to prevent personal injury if valves are installed at high places.</p>

 CAUTION	
	<p>Wear protective items such as goggles, gloves and working boots.</p> <p>Keep a secure footing at dismantling and mounting valves.</p> <p>Pipes and valves should be properly supported to avoid misalignment, when the valves are removed or installed.</p> <p>Mark both pipes and valve flanges, before valves are removed from pipelines. Valves should be reinstalled with these marks mated.</p> <p>Ensure to use new gaskets, when valves are reinstalled in pipelines.</p>

. Periodic inspection

2.2 Disassembly

Refer to Chapter and VII for disassembly procedure.

2.3 Inspection items for disassembly inspection

Refer to the table below for the items, methods, judgment and remedial measures of disassembly inspection.

Inspection components	Inspection items	Detection	Method	Judgment	Remedial measures
Body, Cap	Flange	Corrosion, Damage, Crack	Visual check, Measuring flange thickness	No appearance of corrosion, damage or crack	Welding repair or scrap
	Fluids contact surface	Corrosion, Scratch, Crack	Visual check, Measuring wall thickness, N.D.E	No appearance of corrosion. Propriety of wall thickness	Welding repair or scrap
Ball seat, Seat retainer Ball	Seat surface	Corrosion, Scratch, Crack	Visual check	No appearance of wear or damage	Replacement of ball seat
	Seat retainer Ball	Corrosion, Scratch, Crack	Visual check	No appearance of wear, corrosion or damage	Replacement of seat retainer and ball
Stem		Corrosion, Scratch, Distortion	Visual check Dimensional check	No appearance of corrosion, damage or distortion	Correction of defects or replacement
Bonnet End plate Trunnion plate		Corrosion, Scratch, Crack	Visual check	No appearance of corrosion or damage	Replacement of bonnet, end plate or trunnion plate
O ring Packing Gasket				Replace these parts at disassembly	Replacement
Bearing		Wear Corrosion, Scratch		No appearance of corrosion or damage	Replacement of bearing

. Periodic inspection

2.4 Reassembly

Refer to Chapter and VII for reassembly procedure.

2.5 Valve test and inspection



Confirm the following items for test and inspection before and after maintenance operation.

2.5.1 Operation test

- (1) Check smooth operation of valves without galling or sticking of internal valve components.
- (2) Check that the stem is firmly assembled with the ball.
- (3) Ensure that there should be no offset of the ball ports and ball seats at the fully open position. The ball should not be protruded into the valve port other than the rounded surface of the ball port edges.

2.5.2 Shell test and seat leakage test

- (1) Care for shell test and seat leakage test.

 CAUTION	
	<p>Wear protective items such as goggles, gloves and working boots.</p> <p>Before shell test and seat leakage test, take some precautions for operators safety.</p>

- (2) Shell test and seat leakage test



All valves should be subjected to a hydrostatic or pneumatic shell test and seat leakage test at the required test pressures after reassembly. Refer to ISO 14313 or API 6D for test methods and procedures.



. Disassembly and Reassembly
Soft seat

. Disassembly and Reassembly (Soft seat)

1. Disassembly procedures for soft seal

1.1 Care for disassembly.

 WARNING	
	Operator should take an appropriate caution for not being exposed to the fluid or catching fire.

 CAUTION	
	<p>Wear protective items such as goggles, gloves and working boots.</p> <p>Pay attention not to catch fingers during disassembly.</p> <p>When disassembling valves of big mass one, use an appropriate lifting machine for safety operation.</p>

1.2 Before disassembly

1.2.1 Place the valve in a dust-free area.

1.2.2 Take care not to damage the flange surfaces, ball and stem.

1.2.3 Give identification marks on edges of the coupled flanges for adequate and easy coupling of the body and the body cap on subsequent reassembly.

1.2.4 If bolting are found seized or stuck each other because of rust, apply some lubricant and leave it for a while for easier unthreading.

. Disassembly and Reassembly (Soft seat)

1.3 Disassembly sequence for size up to NPS4 for full bore valve and up to NPS6 for reduced bore.

1.3.1 Depressurizing the valve interior.

1.3.2 Disassembly of the any operator

1.3.3 Disassembly of the gland plate

1.3.4 Disassembly of the bonnet

1.3.5 Disassembly of the cap

1.3.6 Disassembly of the end plate

1.3.7 Disassembly of the ball

1.3.8 Disassembly of the stem

1.3.9 Disassembly of the seat retainer assembly

. Disassembly and Reassembly (Soft seat)

- 1.4 Disassembly sequence for size up to NPS4 for full bore valve and up to NPS6 for reduced bore. (Refer to Cross-sectional assembly drawing of page 45.)
- 1.4.1 Before disassembly, partially open the valve and enough to reduce the internal pressure trapped inside of the valve to a safe level enough. After having confirmed reduction of the internal pressure to a safe level, remove the plug (85A) and drain the line fluid and other internal residue remaining inside the valve.
- 1.4.2 Hold the valve in fully opened position.
- 1.4.3 Remove the operator.
- 1.4.4 Remove Gland bolts (36) and Gland plate (144), and then remove Bonnet bolts (35C) and Bonnet (202) together with other adjacent components(O-ring(45D)) except Stem (3). (Refer to the Figure "A" below.). If it is difficult to remove the Set pin (14), make use of the threaded tap on top of the Set pin (14). Set the eyebolt or some devices, and pull up the Set pin (14).

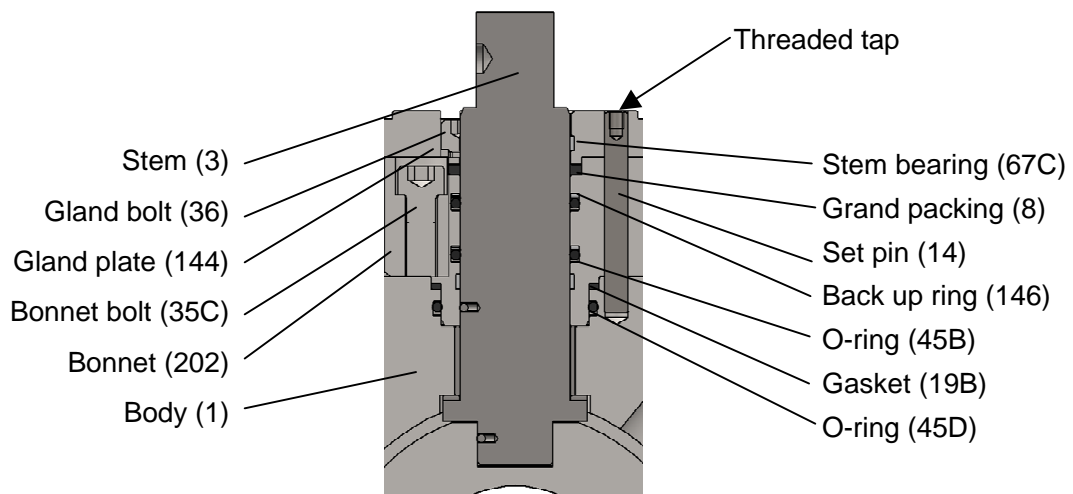


Figure "A"

. Disassembly and Reassembly (Soft seat)

1.4.5 Place the valve on the floor with the one side of cap flange facing to the floor.

1. Mark the Body (1) and the Cap (2) position for proper position. Then loosen the Cap nuts (33A) of the upper Cap (2) evenly and alternately in a star pattern until the Seat springs (143) lose their loading force.
2. Remove the Cap nuts (33A) of the upside cap after the Seat springs (143A) lose their loading force.
3. Lift out the upper Cap (2) slowly, confirming that the Seat retainer (150) and its assembly, which has been housed with the Cap (2). When the Seat retainer (150) and the Ball seat (30) are separated from the Ball (4), hold the Seat retainer (150) by tapes to prevent detachment from the Cap (2). The Cap (2) is lifted out carefully with the Seat retainer assembly, not to drop the Seat retainer assembly .
Place the Cap (2) on the floor with the Seat retainer (150) facing upside.
4. Reverse the valve as face the opposite Cap (2) towards upside. Take care not to be damage the Ball (4) when reverse the valve. Disassemble the other Cap (2) with following the same processes in 1 to 3.

. Disassembly and Reassembly (Soft seat)

- 1.4.6 Remove Cover nuts (33B), and remove End plate (147) together with other adjacent components (O-ring(45E)). (Refer to the Figure "B" below.) If it is difficult to remove the End plate (147), make use of the threaded taps on the End plate (147). Set bolts or screws on taps, fasten to pull up the End plate (147).

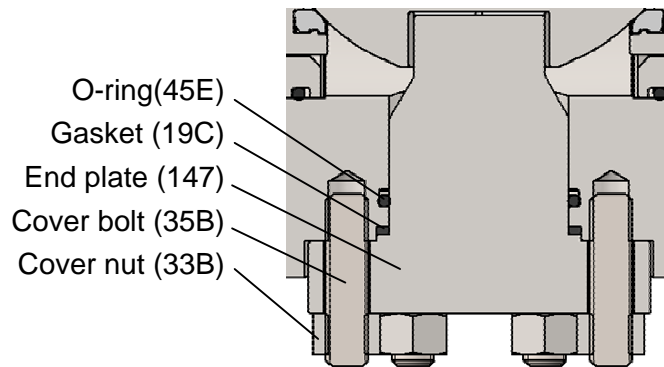


Figure "B"

- 1.4.7 Here the ball port is opened. Detach the Ball (4) from the Stem (3), and remove the Ball (4) as following direction. Take care not to the Ball (4) contacts with the Body (1) internal. Then remove the Thrust washer (47A) and the Curl bearing (67A) from the Ball (4). (Refer to the Figure "C" below.)

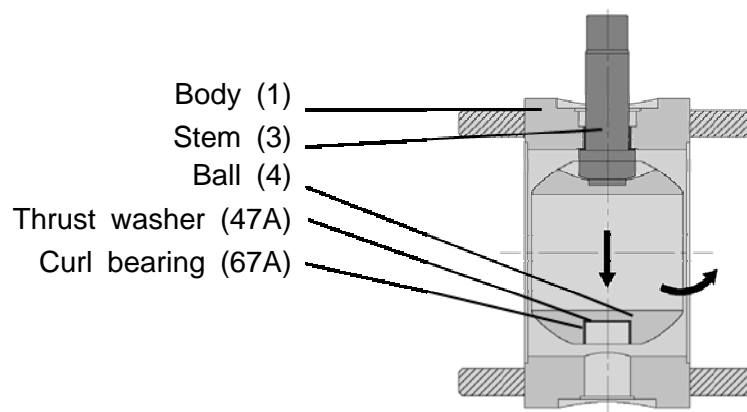


Figure "C"

. Disassembly and Reassembly (Soft seat)

- 1.4.8 Remove the Stem (3) together with Thrust washer (47B) through the inside of the Body (1). Some of the ball valves, depending on their size and nominal pressure, are provided with Stem washer (31). Remove also the Stem washer (31) together with Stem (3), if provided.

For side entry stem type, remove the Stem (3) through body port as the Figure "D" below.

For end entry stem type, remove the Stem (3) through body end hole as the Figure "E" below, and remove the Thrust washer (47B) when through the body inside. Then remove the Stem bearing (67B) from the Body (1).

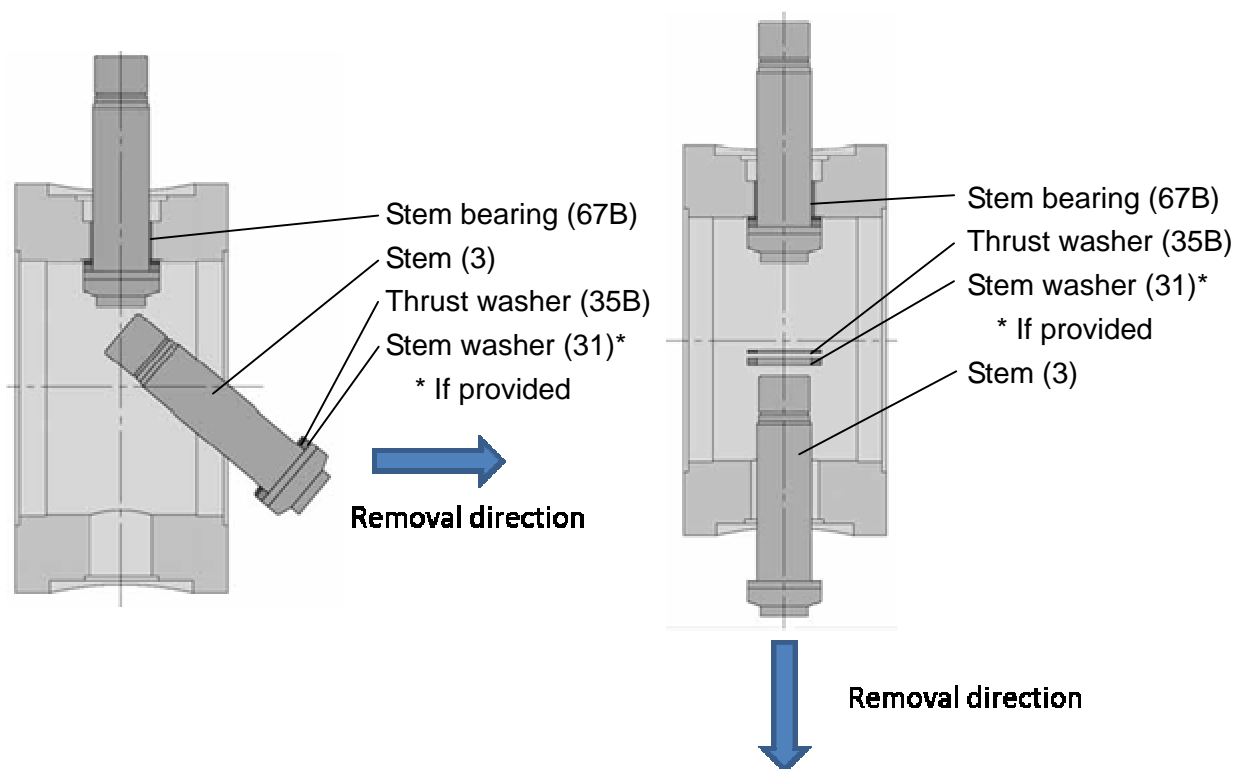


Figure "D" : Side entry stem type

Figure "E" : End entry stem type

- 1.4.9 Remove the Seat retainer (150) assembly from the Cap (2). Mark the removed Seat retainers (150) for proper identification with both caps.
- 1.4.10 Remove the Gasket (19A) from the Body (1), and remove Seat springs (143) from Cap (2).
- 1.4.11 Remove the O-ring (45A) and Retainer packing (176) from Seat retainer (150).
- 1.4.12 Turn the Ball seat (30) counterclockwise until remove from the Seat retainer (150). Take care not to damage the Seat retainer (150), if using any tools.

. Disassembly and Reassembly (Soft seat)

1.5 Disassembly sequence for size NPS6 and larger for full bore valve and for size NPS8 and larger for reduced bore.

1.5.1 Depressurizing the valve interior.

1.5.2 Disassembly of the operator

1.5.3 Disassembly of the gland plate

1.5.4 Disassembly of the bonnet

1.5.5 Disassembly of the stem

1.5.6 Disassembly of the cap

1.5.7 Disassembly of the ball

1.5.8 Disassembly of the other cap

1.5.9 Disassembly of the seat retainer assembly

. Disassembly and Reassembly (Soft seat)

- 1.6 Disassembly sequence for size NPS6 and larger for full bore valve and for size NPS8 and larger for reduced bore. (Refer to Cross-sectional assembly drawing of page 47.)
- 1.6.1 Before disassembly, partially open the valve and reduce the internal pressure trapped inside of the valve to a safe level enough. And also, the cavity pressure can be discharged by Vent valve(85B).
After having confirmed reduction of the internal pressure to a safe level, remove the Plug (85A) and drain the line fluid and other internal residue remaining inside the valve.
- 1.6.2 Hold the valve in fully opened position.
- 1.6.3 Remove the operator.
- 1.6.4 Remove Gland bolts (36) and Gland plate (144), and then remove Bonnet bolts (35B) and Bonnet (202) together with other adjacent components (O-ring(45D)). (Refer to the Figure "F" below.) Then remove the Stem (3) with the Thrust washer (47B). If it is difficult to remove the Set pin (14), make use of the threaded tap on top of the Set pin (14). Set the eyebolt or some devices, and pull up the Set pin (3).The Stem (3) can be removed together with Bonnet (202) when disassemble the Bonnet (202). If it is difficult to remove the Stem (3), make use of the threaded tap on top of the Stem (3). Set the eyebolt, and pull up the Stem (3).

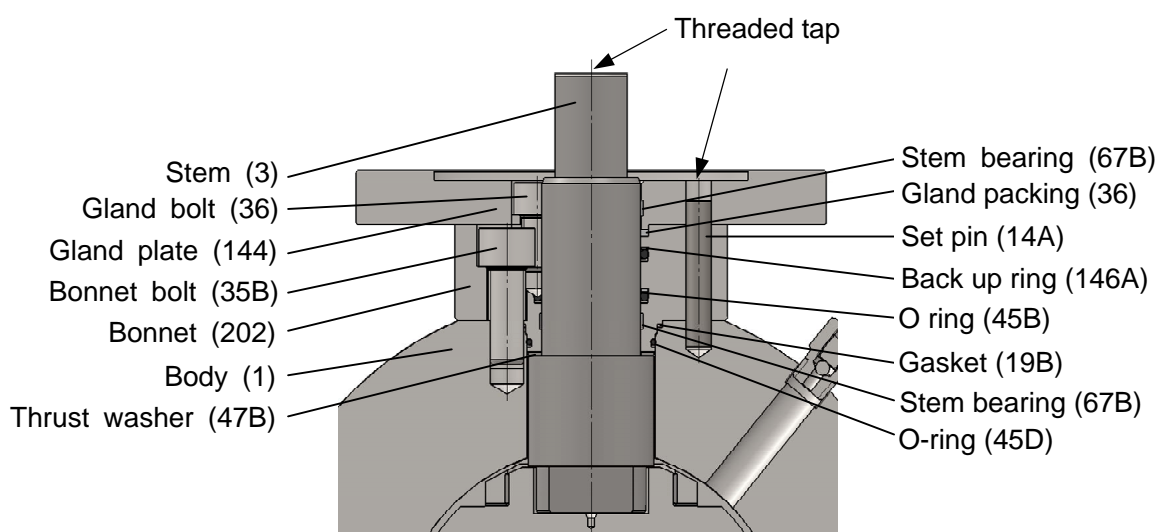


Figure "F"

. Disassembly and Reassembly (Soft seat)

- 1.6.5 Place the valve on the floor with the one side of cap flange facing to the floor.
1. Mark the Body (1) and the Cap (2) position for proper position. Then loosen the Cap nuts (33) of the upper cap evenly and alternately in a star pattern until the Seat springs (143) lose their loading force.
 2. Remove the Cap nuts (33) of the upside Cap (2) after the Seat springs (143) lose their loading force.
 3. Some of the ball valves, depending on their size and nominal pressure, are provided with Lifting lugs (822) mounted with flange bolting. As Lifting lugs (822) are factory-mounted at the most convenient locations, be sure to mark locations of Lifting lugs (822) during disassembly for easier subsequent reassembly.
 4. Lift out the upper Cap (2) slowly, confirming that the Seat retainer (150) and its assembly, which has been housed with the Cap (2). Take care not to drop Set pins (14B) which are set the between Body (1) and Cap (2) (one side), Cap (2) and Trunnion plate (104). When the Seat retainer assembly and the Ball seat (30) are separated from the Ball (4), hold the Seat retainer assembly by hand or tapes to prevent detachment from the Cap (2). Lift up the Cap (2) carefully with the Seat retainer assembly, not to drop off the Seat retainer assembly. Place the Cap (2) on the floor with the Seat retainer assembly facing upside.
- 1.6.6 Put a cloth belt into the port and lift the Ball (4) slowly together with Trunnion plates (104), Curl bearings (67A) and Thrust washers (47A). The Ball (4) is lifted out carefully with Trunnion plates (104) with taking care to prevent the Ball (4) surface from the damage or scratch during disassembly. When the Ball (4) is lifted out from the Body (1), hold Trunnion plates (104) by hand or bands to prevent detachment from the Ball (4), and take care not to drop Trunnion plates (104) from the Ball (4) and Set pins (14B) from Trunnion plate (104). Storage the Ball (4) and other components, and subsequent reassembly.

. Disassembly and Reassembly (Soft seat)

1.6.7 Remove the Body.

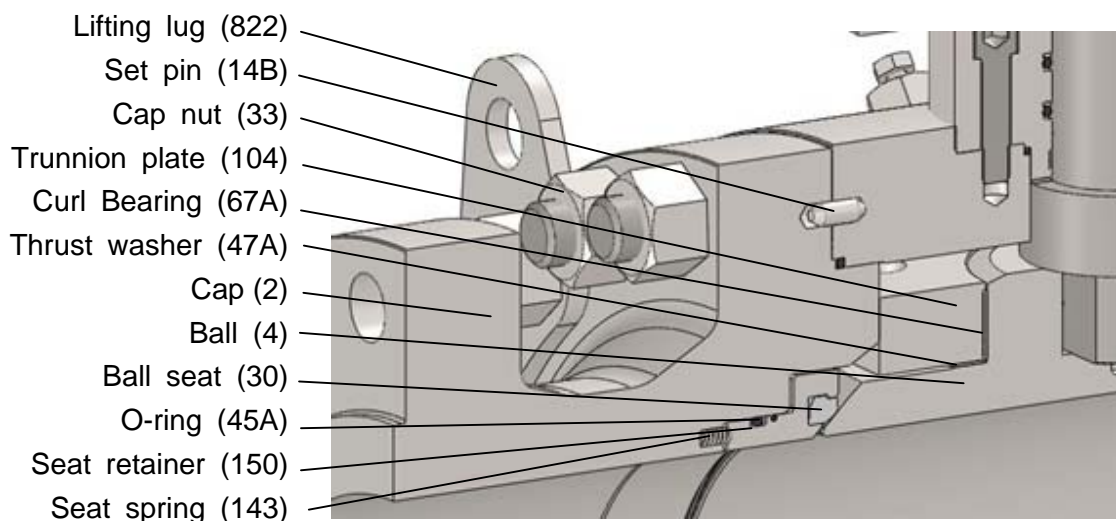
1. Mark the Body (1) and the Cap (2) position for proper position. Then loosen the Cap nuts (33) of the lower cap evenly.
2. Remove the Cap nuts (33) of the lower cap (2).
3. Some of the ball valves, depending on their size and nominal pressure, are provided with Lifting Lugs (822) mounted with flange bolting. As Lifting lugs (822) are factory-mounted at the most convenient locations, be sure to mark locations of Lifting lugs (822) during disassembly for easier subsequent reassembly.
4. Set eyebolts at threaded taps on the Body (1), and lift out the Body (1) with a crane using eyebolts.

1.6.8 Remove the Seat retainer (150) assembly from the Cap (2). Mark the removed Seat retainer (150) for proper identification with both Caps (2).

1.6.9 Remove the Gasket (19A) from the Body (1), and remove Seat springs (143) from Cap (2).




1.6.10 Remove the O-ring (45A), Backup ring (146A) Retainer packing (176) from Seat retainer (150).

1.6.11 Turn the Ball seat (30) counterclockwise until remove from the Seat retainer (150). Take care not to damage the Seat retainer (150), if using any tools.



. Disassembly and Reassembly (Soft seat)

2. Reassembly procedures
 - 2.1 Care for reassembly

 CAUTION	
	<p>Wear protective items such as goggles, gloves and working boots.</p> <p>No open flame or smoking should be allowed in the work area.</p> <p>Pay attention not to catch fingers during reassembly.</p> <p>Ensure to replace consumable parts for new ones, such as the gland packing, gaskets, ball seats, O-rings, thrust washers, stem bearings, curl bearings and retainer packings. Reuse of these parts may cause leakage.</p> <p>When reassembling valves of big mass one, use an appropriate lifting machine for safety operation.</p>
	<p>In case the valves are to be used for oxygen service, do not apply lubricant to all valve interior and valve internal parts which will directly contact the media. Use fluorine base lubricant for moving parts and packings.</p>

2.2 Before reassembly

- 2.2.1 New parts for replacement should be prepared beforehand.
- 2.2.2 The consumables (gland packing, gaskets, ball seats, O-rings, backup rings, ball seats, thrust washers, stem bearings, curl bearings, retainer packings) should be replaced for new ones. Reuse of these parts may cause leakage.
- 2.2.3 Be sure to clean the parts to remove dust, oil and other foreign objects, in case the parts are reused. Ensure to remove rusts and other soils out of the seat retaining area of the body and the body cap to have satisfactory sealing performance.
- 2.2.4 For carbon steel and low alloy steel valves apply METALGARD 814 or an equivalent rust preventative to the inner surface of the body and body cap, including stem holes. To O-rings and adjacent areas, apply SHELL ALVANIA EP GREASE No.2 or an equivalent lithium soap grease lubricant unless otherwise specified.

. Disassembly and Reassembly (Soft seat)

- 2.2.5 Assemble the valve in a dust-free area.
- 2.2.6 Take care not to damage flange surfaces, ball, ball seat, stem and all internal machined parts.
- 2.2.7 Ensure mating the marks given before disassembly.
- 2.2.8 Keep in mind that all threads should be securely tightened.

. Disassembly and Reassembly (Soft seat)

2.3 Reassembly sequence for size up to NPS4 for full bore valve and up to NPS6 for reduced bore.

2.3.1 Reassembly of the cap bolts

2.3.2 Reassembly of the stem

2.3.3 Reassembly of the ball

2.3.4 Reassembly of cover bolts and the end plate

2.3.5 Reassembly of the seat retainer assembly

2.3.6 Reassembly of the seat retainer on the caps

2.3.7 Reassembly of caps

2.3.8 Reassembly of the bonnet, gland plate and small components around the stem

2.3.9 Reassembly of the operator

. Disassembly and Reassembly (Soft seat)

- 2.4 Reassembly procedure for size up to NPS4 for full bore valve and up to NPS6 for reduced bore.
- 2.4.1 Place the Cap bolts (35A) to both side of the Body (1), tightening them securely.
- 2.4.2 Place the Stem bearing (67B) to the Body (1) and place the Stem (3) together with Thrust washer (47B) and Stem washer (31), if provided.
- 2.4.3 Place the Curl bearing (67A) and the Thrust washer (47A) to the Ball (4). Then place the Ball (4) into the Body (1) slowly with care to protect it from damage or scratch, and connect to the Stem (3).
- 2.4.4 Place Cover bolts (35B), the Gasket (19C) and O-ring (45C) to the Body (1). Then place the End plate (147) assembly to the Body (1), and connect it to the bottom of the Ball (4). (Refer to the Figure "B".)
- 2.4.5 Place Cover nuts (33B) and tighten them. Evenly tighten the Cover bolt nuts (35B) alternately and gradually in a star pattern.
- 2.4.6 Turn the Ball seats (30) clockwise until set the Seat retainers (150). Refer to Figure "G" regarding the direction of the ball seat (30). Take care not to damage the Ball seats (30).
- 2.4.7 According to Figure "G" below, assemble the Backup rings (146A), O-rings (45A) and the Retainer packings (176) on the Seat retainer (150).

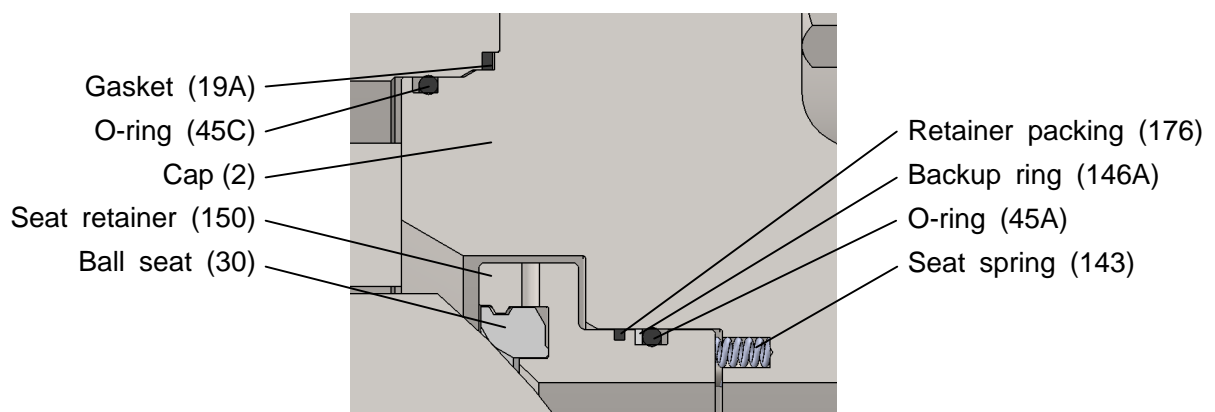


Figure "G"

- 2.4.8 Assemble Seat springs (143) on the Caps (2), and insert the Seat retainer assemblies into the both Caps (2). Insert the seat retainer assembly completely using the press ring or other tools to be inserted and compressed the O-ring (45A) in the Cap (2) housing.

. Disassembly and Reassembly (Soft seat)

- 2.4.9 Place the body assembly on the floor with the one side of Cap bolts (33) facing to the floor.
1. Turn the Stem (3) and adjust ball ports to the fully close position.
 2. Set the Gasket (19A) on the Body (1).
 3. Lift the Cap (2) with a crane and lower it slowly on the Body (1). When lift the Cap (2) hold the Seat retainer assembly by hand or tapes to prevent detachment from the Cap (2). The Cap (2) is lifted out carefully with the Seat retainer assembly, take care not to drop Seat retainer assembly. Take care of the markings for proper position.
 4. Place Cap nuts (33A) and tighten them. Evenly tighten the Cap nuts (33A) alternately and gradually in a star pattern.
 5. Reverse the valve as face the opposite Cap (2) towards upside. Take care not to be damage the Ball (4) when reverse the valve. Reassemble the other Cap (2) with following the same processes in 2 to 4.
- 2.4.10 Assemble the Bonnet (202), the Gland plate (144) and all small components around the Stem (3) according to Figure "A".
- 2.4.11 Place the operator.
- 2.4.12 Place vent valve (85B) and drain Plug (85A) with sealing material.
- 2.4.13 Ensure all threaded components are securely tightened. Retighten them, if any loosened components are found.

. Disassembly and Reassembly (Soft seat)

- 2.5 Reassembly sequence for size NPS6 and larger for full bore valve and NPS8 and larger for reduced bore.
 - 2.5.1 Reassembly of the cap bolts
 - 2.5.2 Reassembly of the seat retainer assembly
 - 2.5.3 Reassembly of the seat retainer assembly on the caps
 - 2.5.4 Reassembly of the body
 - 2.5.5 Reassembly of the ball
 - 2.5.6 Reassembly of the cap
 - 2.5.7 Reassembly of the stem
 - 2.5.8 Reassembly of the bonnet, gland plate and small components around the stem
 - 2.5.9 Reassembly of the operator

. Disassembly and Reassembly (Soft seat)

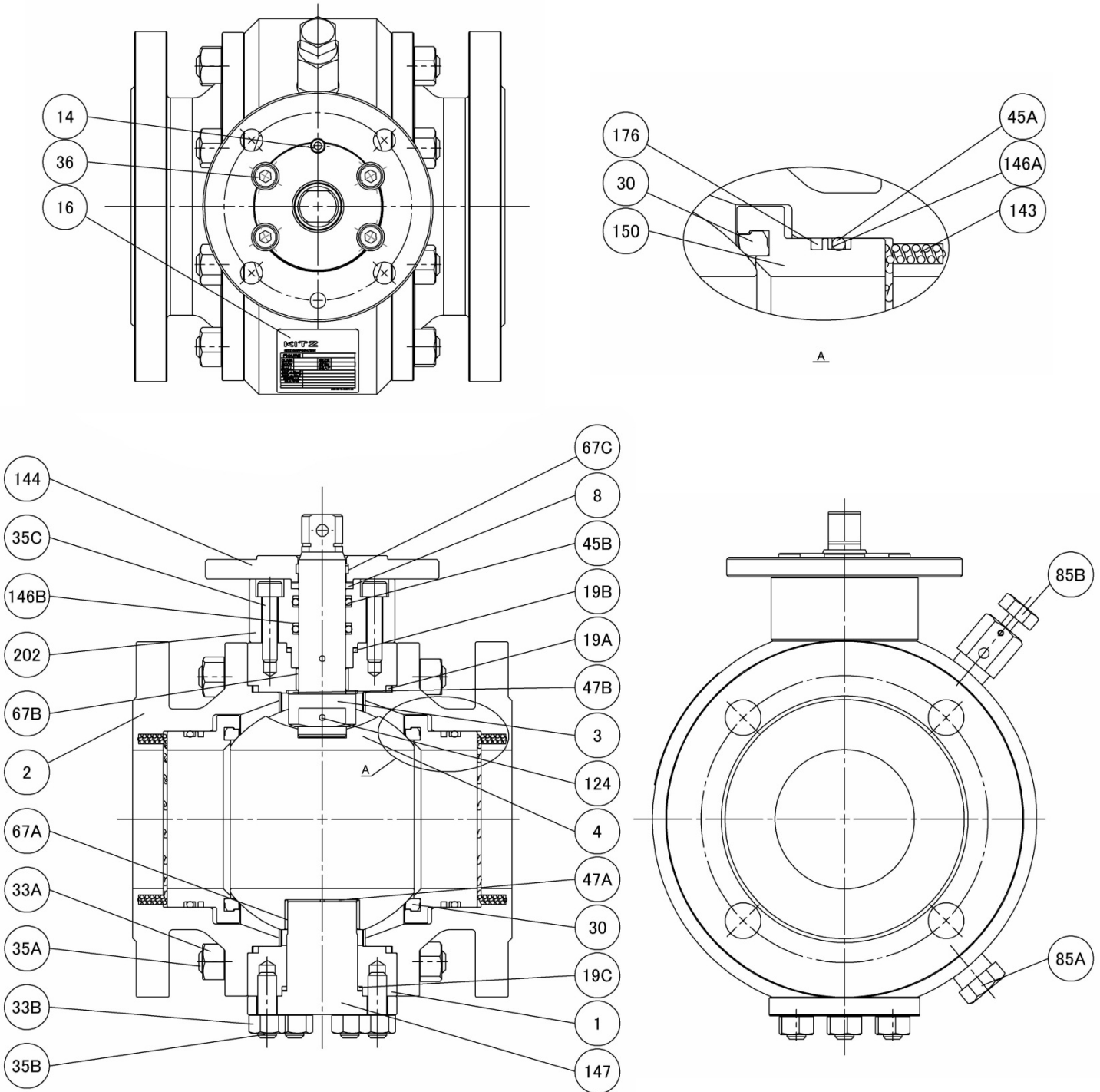
- 2.6 Reassembly procedure for size NPS6 and larger for full bore valve and NPS8 and larger for reduced bore.
- 2.6.1 Place the Cap bolts (35A) to both side of the Body (1), tightening them securely.
- 2.6.2 Turn the Ball seat (30) clockwise until set the Seat retainer (150). Refer to Figure "G" regarding the direction of the ball seat (30). Take care not to damage the Ball seat (30).
- 2.6.3 According to Figure "G", assemble the Backup ring (146A), O-ring (45A) and Retainer packing (176) on the Seat retainer (150) assembled some components.
- 2.6.4 Place the Cap (2) on the floor with the end flange facing to the floor. Assemble Seat springs (143) on the Cap (2), and insert the Seat retainer assembly into the both Caps (2). Insert the Seat retainer assembly completely using the press ring or other tools to be inserted and compressed the O-ring in the Cap (2) housing.
- 2.6.5 Set the Gasket (19A) and Set pin (14B) on the Body (1).
- 2.6.6 Lift the Body (1) with a crane using eyebolts set on the Body (1) threaded taps, and lower it slowly on the Cap (2) with taking care not to drop the Gasket (19A) and Set pin (14B) from the Body (1).
- 2.6.7 Place Thrust washers (47A) to the Ball (4), then place Trunnion plates (104) assembled the Curl bearings (67A) and Set pins (14B) to the Ball (4).
- 2.6.8 Put a cloth belt into the port and lift the Ball (4) slowly together with Trunnion plates (104), and place into the Body (1). The Body (1) is lifted out carefully with taking care to prevent the Ball (4) surface from the damage or scratch during disassembly. Hold Trunnion plates (104), by hand or bands to prevent detachment from the Ball (4), and take care not to drop Trunnion plates (104) from the Ball (4) and Set pins (14B) from the Trunnion plates (104) when lift out the Ball (4). Then adjust the Ball (4) to set the close position.
- 2.6.9 Set the Gasket (19A) on the Body (1).

. Disassembly and Reassembly (Soft seat)

- 2.6.10 Lift the other Cap (2) with a crane and lower it slowly on the Body (1). When lift the Cap (2), hold the seat retainer by hand or tapes to prevent detachment from the cap. The cap shall be lifted out carefully with the Seat retainer assembly take care not to drop the seat retainer assembly.
- 2.6.11 Place Cap nuts (33) and tighten them. Evenly tighten the Cap nuts (33) alternately and gradually in a star pattern. Some of the ball valves, depending on their size and nominal pressure, are provided with Lifting Lugs (822). Place them at proper position, if provided.
- 2.6.12 Place the Stem (3), Bonnet (202) and Gland plate (144) together with all small components according to Figure "F".
- 2.6.13 Place the operator.
- 2.6.14 Place vent valve (85B) and drain Plug (85A) with sealing material.
- 2.6.15 Ensure all threaded components are securely tightened. Retighten them, if any loosened components are found.

. Disassembly and Reassembly (Soft seat)

3. Cross-sectional assembly drawing



This drawing represents only a typical construction of the valve for size up to NPS4.
Please refer to the approved drawing for assembly and disassembly.

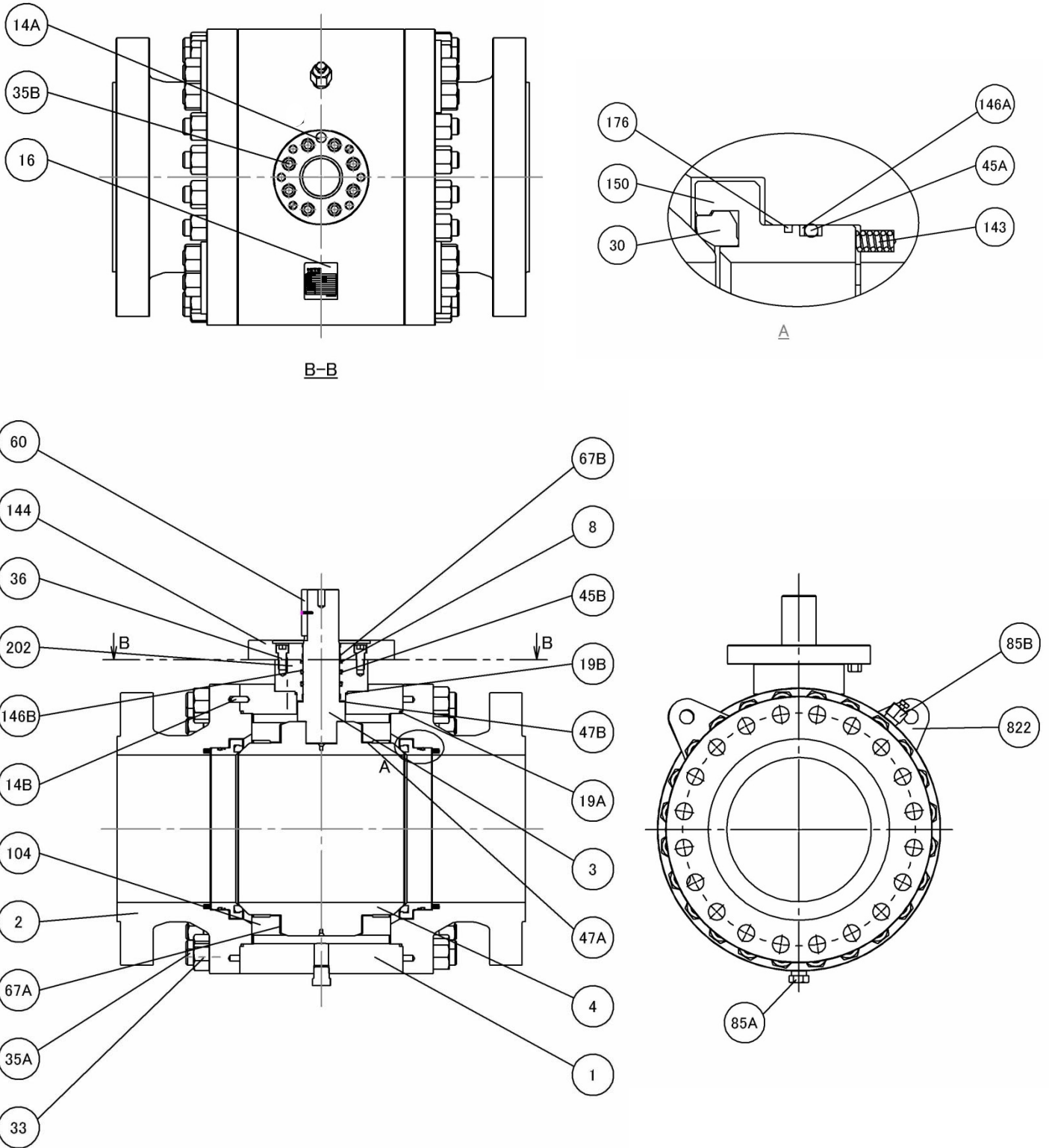
. Disassembly and Reassembly (Soft seat)

NO.	PARTS NAME	QTY
1	Body	1
2	Cap	2
3	Stem	1
4	Ball	1
8	Gland packing	1
14	Set pin	1
16	Name plate	1
19A	Gasket	2
19B	Gasket	1
19C	Gasket	1
30	Ball seat	2
33A	Cap nut	2S
33B	Cover nut	1S
35A	Cap bolt	2S
35B	Cover bolt	1S
35C	Bonnet bolt	1S
36	Gland bolt	1S
45A	O ring	2
45B	O ring	2
47A	Thrust washer	1
47B	Thrust washer	1
67A	Curl bearing (Ball)	1
67B	Stem bearing	1
67C	Stem bearing	1
85A	Plug	1
85B	Vent valve	1
143	Seat spring	2S
144	Gland plate	1
146A	Back up ring	1S
146B	Back up ring	1S
147	End plate	1
150	Seat retainer	2
176	Retainer packing	2
202	Bonnet	1

This table represents typical parts of size up to NPS4 for full bore and size up to NPS6 for reduced bore.

Please refer to the approved drawing.

. Disassembly and Reassembly (Soft seat)



This drawing represents only a typical construction of the valve for size NPS6 and larger.
Please refer to the approved drawing for assembly and disassembly.

. Disassembly and Reassembly (Soft seat)

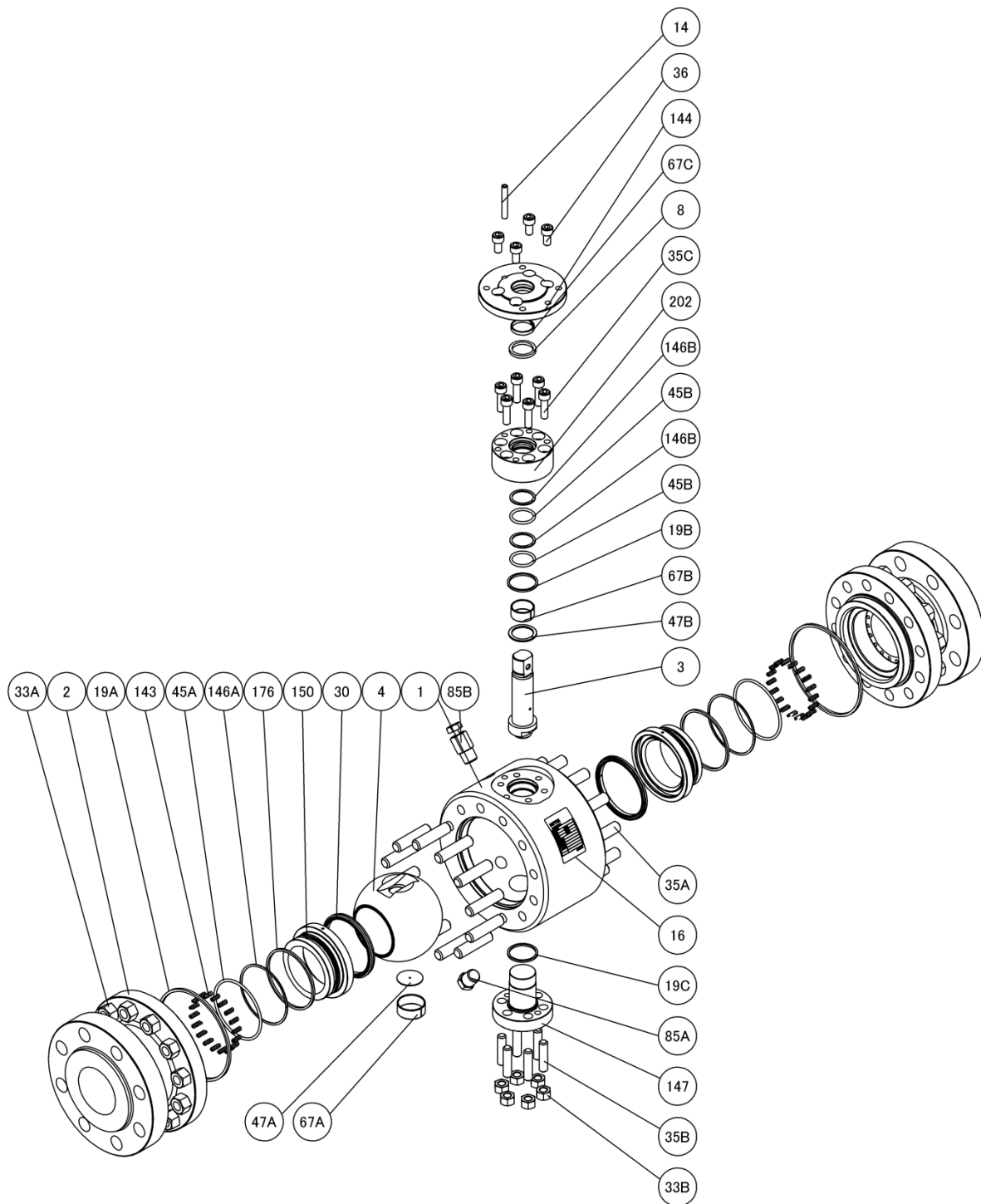
NO	PARTS NAME	QTY
1	Body	1
2	Cap	2
3	Stem	1
4	Ball	1
8	Gland packing	1
14A	Set pin	1
14B	Set pin	1
16	Name plate	1
19A	Gasket	2
19B	Gasket	1
30	Ball seat	2
33	Cap nut	2S
35A	Cap bolt	2S
35B	Bonnet bolt	1S
36	Gland bolt	1S
45A	O ring	2
45B	O ring	2
47A	Thrust washer	2
47B	Thrust washer	1
060	Key	1
67A	Curl bearing (Ball)	2
67B	Stem bearing	2
85A	Plug	1
85B	Vent valve	1
104	Trunnion plate	2
143	Seat spring	2S
144	Gland plate	1
146A	Back up ring	1S
146B	Back up ring	1S
150	Seat retainer	2
176	Retainer packing	2
202	Bonnet	1
822	Lifting lug	1S

This table represents typical parts of the valve for size NPS6 and larger for full bore valve and for size NPS8 and larger for reduced bore.

Please refer to the approved drawing.

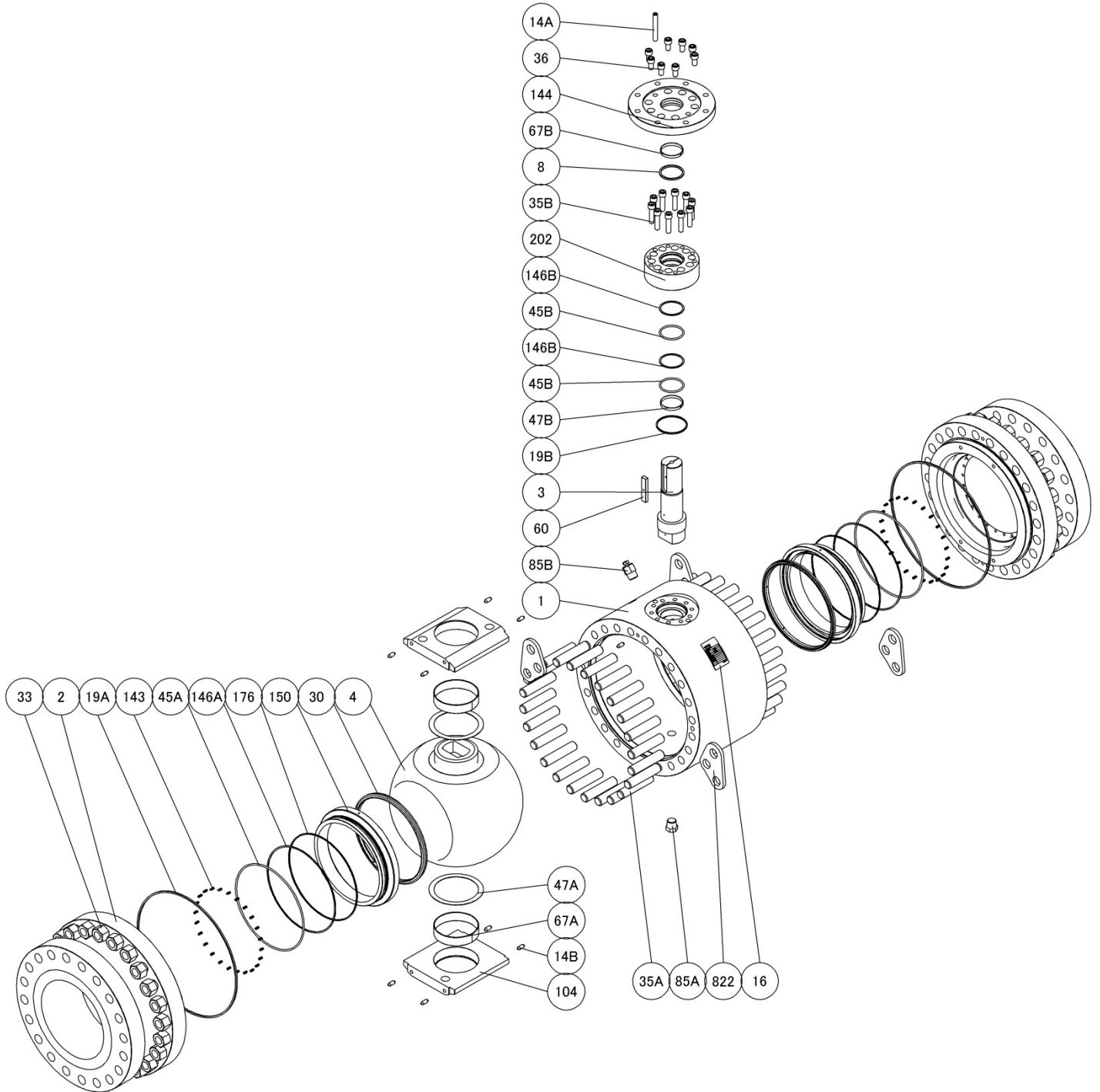
. Disassembly and Reassembly (Soft seat)

4. Exploded view drawing



This drawing represents only a typical construction of the valve for size up to NPS4.
Please refer to the approved drawing for assembly and disassembly.

. Disassembly and Reassembly (Soft seat)




This drawing represents only a typical construction of the valve for size NPS6 and larger.
Please refer to the approved drawing for assembly and disassembly.



. Disassembly and Reassembly
Metal seat

. Disassembly and Reassembly (Metal seat)

1. Disassembly procedures for Metal seal

1.1 Care for disassembly.

 WARNING	
	Operator should take an appropriate caution for not being exposed to the fluid or catching fire.

 CAUTION	
	<p>Wear protective items such as goggles, gloves and working boots.</p> <p>Pay attention not to catch fingers during disassembly.</p> <p>When disassembling valves of big mass one, use an appropriate lifting machine for safety operation.</p>

1.2 Before disassembly

1.2.1 Place the valve in a dust-free area.

1.2.2 Take care not to damage the flange surfaces, ball and stem.

1.2.3 Give identification marks on edges of the coupled flanges for adequate and easy coupling of the body and the body cap on subsequent reassembly.

1.2.4 If bolting are found seized or stuck each other because of rust, apply some lubricant and leave it for a while for easier unthreading.

. Disassembly and Reassembly (Metal seat)

- 1.3 Disassembly sequence for size up to NPS4 for full bore valve and up to NPS6 for reduced bore..
 - 1.3.1 Depressurizing the valve interior.
 - 1.3.2 Disassembly of the any operator.
 - 1.3.3 Disassembly of the gland plate
 - 1.3.4 Disassembly of the bonnet
 - 1.3.5 Disassembly of the cap
 - 1.3.6 Disassembly of the end plate.
 - 1.3.7 Disassembly of the ball
 - 1.3.8 Disassembly of the stem.
 - 1.3.9 Disassembly of the ball seat assembly.

. Disassembly and Reassembly (Metal seat)

1.4 Disassembly sequence for size up to NPS4 for full bore valve and up to NPS6 for reduced bore. (Refer to Cross-sectional assembly drawing of page 69.)

1.4.1 Before disassembly, partially open the valve and enough to reduce the internal pressure trapped inside of the valve to a safe level enough. And also, the cavity pressure can be discharged by Vent valve(85B). After having confirmed reduction of the internal pressure to a safe level, remove the Plug (85A) and drain the line fluid and other internal residue remaining inside the valve.

1.4.2 Hold the ball in fully opened position.

1.4.3 Remove the operator.

1.4.4 Remove Gland bolts (36) and Gland plate (144), and then remove Bonnet bolts (35C) and Bonnet (202) together with other adjacent components except stem (3). (Refer to the figure "A" below.) If it is difficult to remove the Set pin (14), make use of the threaded tap on top of the Set pin (14). Set the eyebolt or some devices, and pull up the Set pin (3).

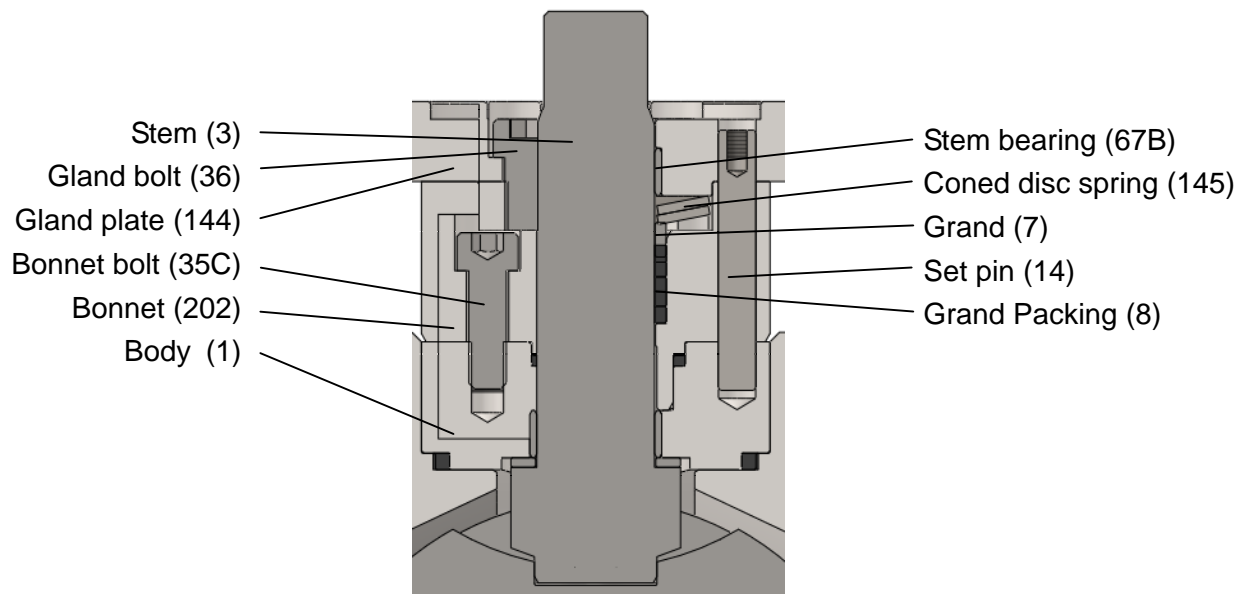


Figure "A"

1.4.5 Place the valve on the floor with the one side of cap flange facing to the floor.

1. Mark the Body (1) and the Cap (2) position for proper position. Then loosen the Cap nuts (33A) of the upper Cap (2) evenly and alternately in a star pattern until the Seat springs (143) lose their loading force.
2. Remove the nuts (33A) of the upside Cap (2) after the Seat springs (143) lose their loading force.

. Disassembly and Reassembly (Metal seat)

3. Lift out the upper Cap (2) slowly, confirming that the Ball seat (30) and its assembly, which has been housed with the Cap (2). When the ball seat assembly is separated from the ball, hold the ball seat assembly by tapes to prevent detachment from the cap. The cap is lifted out carefully with the ball seat assembly, not to drop the ball seat assembly. Place the Cap (2) on the floor with the Ball seat (30) facing upside.
4. Reverse the valve as face the opposite Cap (2) towards upside. Take care not to be damage the Ball (4) when reverse the valve. Disassemble the other cap with following the same processes in 1 to 3.

- 1.4.6 Remove Cover nuts (33B), and remove End plate (147) together with other adjacent components. (Refer to the figure "B" below.) If it is difficult to remove the end plate, make use of the threaded taps on the end plate. Set bolts or screws on taps, fasten to pull up the End plate (147).

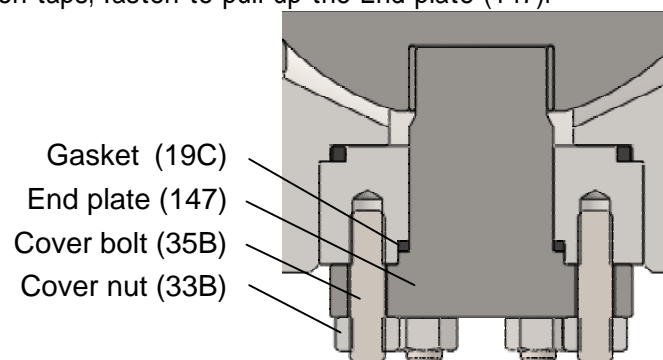


Figure "B"

- 1.4.7 Here the ball port is opened. Detach the Ball (4) from the Stem (3), and remove the Ball (4) as following direction. Take care not to the Ball (4) contacts with the Body (1) internal. Then remove the Curl bearing (67A) from the Ball (4). (Refer to the Figure "C" below.)

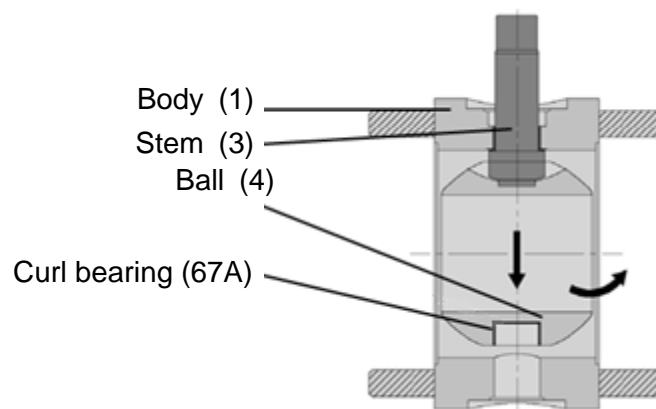


Figure "C"

. Disassembly and Reassembly (Metal seat)

1.4.8 Remove the Stem (3) together with Thrust washer (47B) through the inside of the Body (1).

For side entry stem type, remove the stem through body port as the figure "D" below.

For end entry stem type, remove the Stem (3) through body end hole as the figure "E" below, and remove the Thrust washer (47B) when through the body inside. Then remove the Stem bearing (67B) from the Body (1).

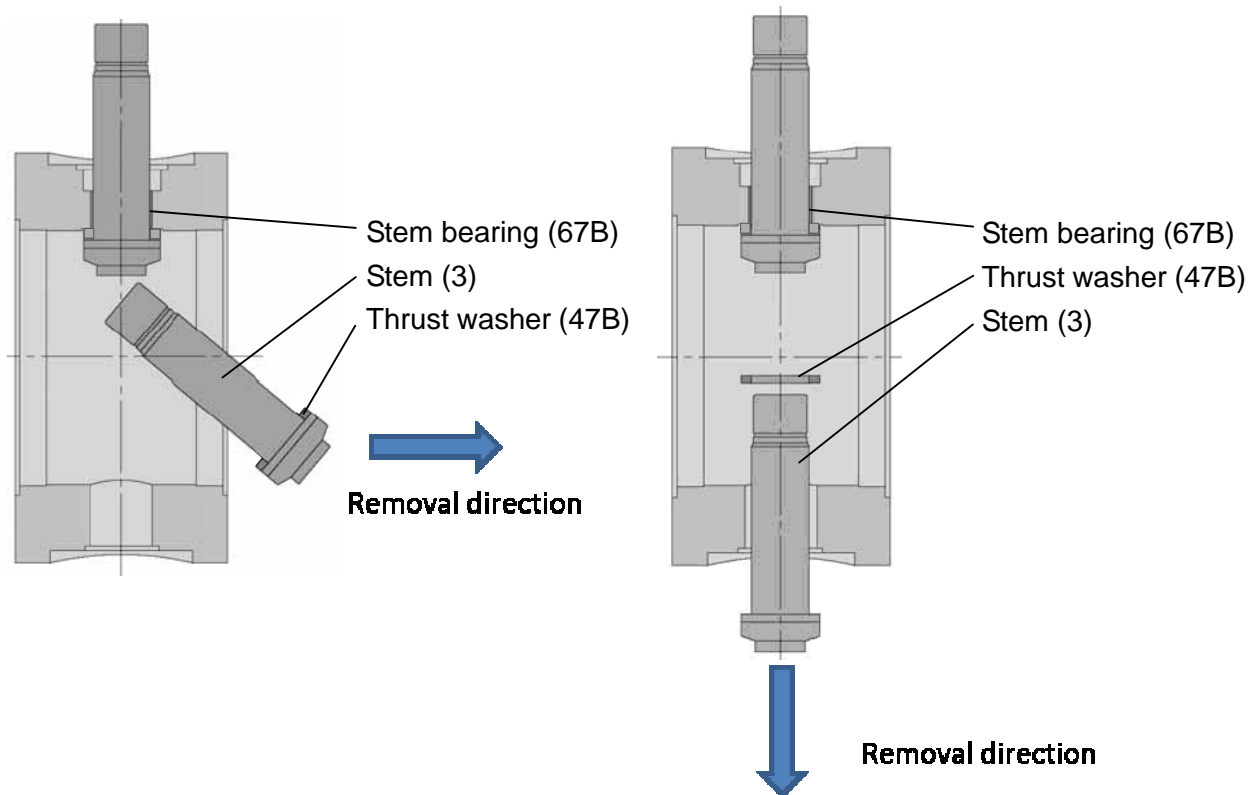


Figure "D" : End entry stem type

Figure "E" : End entry stem type

1.4.9 Remove the ball seat assembly from the Cap (2). Mark the removed ball seat assembly for proper identification with both Caps (2).

1.4.10 Remove the Gasket (19A) from the Body (1), and remove the Retainer glands (175) and Seat springs (143) from Caps (2).

1.4.11 Remove the Seat packings (176) from Ball seats (30).

. Disassembly and Reassembly (Metal seat)

- 1.5 Disassembly sequence for size NPS6 and larger for full bore valve and for size NPS8 and larger for reduced bore.
 - 1.5.1 Depressurizing the valve interior.
 - 1.5.2 Disassembly of the operator.
 - 1.5.3 Disassembly of the gland plate
 - 1.5.4 Disassembly of the bonnet
 - 1.5.5 Disassembly of the stem.
 - 1.5.6 Disassembly of the cap
 - 1.5.7 Disassembly of the ball
 - 1.5.8 Disassembly of the other cap.
 - 1.5.9 Disassembly of the ball seat assembly.

. Disassembly and Reassembly (Metal seat)

1.6 Disassembly sequence for size NPS6 and larger for full bore valve and for size NPS8 and larger for reduced bore. (Refer to Cross-sectional assembly drawing of page 71.)

1.6.1 Before disassembly, partially open the valve and reduce the internal pressure trapped inside of the valve to a safe level enough. And also, the cavity pressure can be discharged by Vent valve(85B). After having confirmed reduction of the internal pressure to a safe level, remove the Plug (85A) and drain the line fluid and other internal residue remaining inside the valve.

1.6.2 Hold the ball in fully closed position.

1.6.3 Remove the operator.

1.6.4 Remove Gland bolts (36) and Gland plate (144), and then remove Bonnet bolts (35B) and Bonnet (202) together with other adjacent components. (Refer to the Figure "F" below.) If it is difficult to remove the Set pin (14), make use of the threaded tap on top of the Set pin (14). Set the eyebolt or some devices, and pull up the Set pin (3).

Then remove the Stem (3) with the Thrust washer (47B). The Stem (3) can be removed together with Bonnet (202) when disassemble the Bonnet (202). If it is difficult to remove the Stem (3), make use of the threaded tap on top of the Stem (3). Set the eyebolt, and pull up the Stem (3).

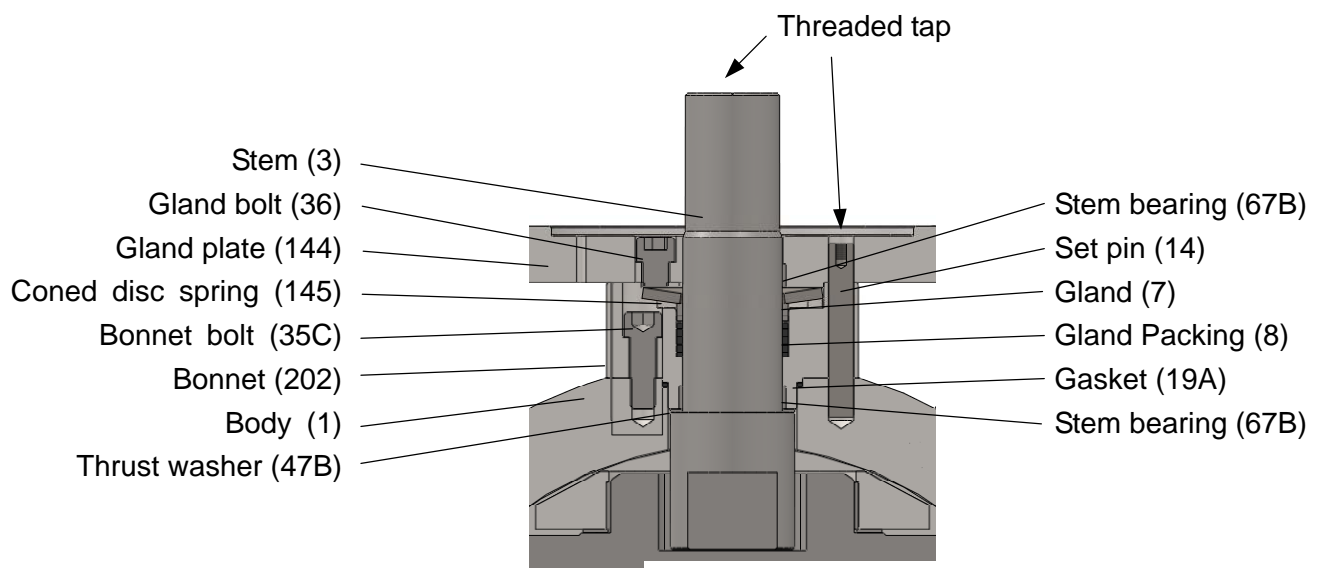


Figure "F"

. Disassembly and Reassembly (Metal seat)

- 1.6.5 Place the valve on the floor with the one side of cap flange facing to the floor.
1. Mark the Body (1) and the Cap (2) position for proper position. Then loosen the Cap nuts (33) of the upper cap evenly and alternately in a star pattern until the Seat springs (143) lose their loading force.
 2. Remove the Cap nuts (33) of the upside Cap (2) after the Seat springs (143) lose their loading force.
 3. Some of the ball valves, depending on their size and nominal pressure, are provided with Lifting lugs (822) mounted with flange bolting. As Lifting lugs (822) are factory-mounted at the most convenient locations, be sure to mark locations of Lifting lugs (822) during disassembly for easier subsequent reassembly.
 4. Lift out the upper Cap (2) slowly, confirming that the Ball seat (30) and its assembly, which has been housed with the Cap (2). When the ball seat assembly is separated from the ball, hold the ball seat assembly by tapes to prevent detachment from the Cap (2). Lift up the Cap (2) carefully with the ball seat assembly, not to drop off the ball seat assembly. Place the Cap (2) on the floor with the ball seat assembly facing upside.
- 1.6.6 Put a cloth belt into the port and lift the Ball (4) slowly together with Trunnion plates (104), Curl bearings (67A) and Thrust washers (47A). The Ball (4) is lifted out carefully with Trunnion plates (104) with taking care to prevent the Ball (4) surface from the damage or scratch during disassembly. When the Ball (4) is lifted out from the Body (1), hold Trunnion plates (104) by hand or bands to prevent detachment from the Ball (4), and take care not to drop Trunnion plates (104) from the Ball (4) and Set pins (14B) from Trunnion plates (104). Storage the Ball (4) and other components, and subsequent reassembly.

. Disassembly and Reassembly (Metal seat)

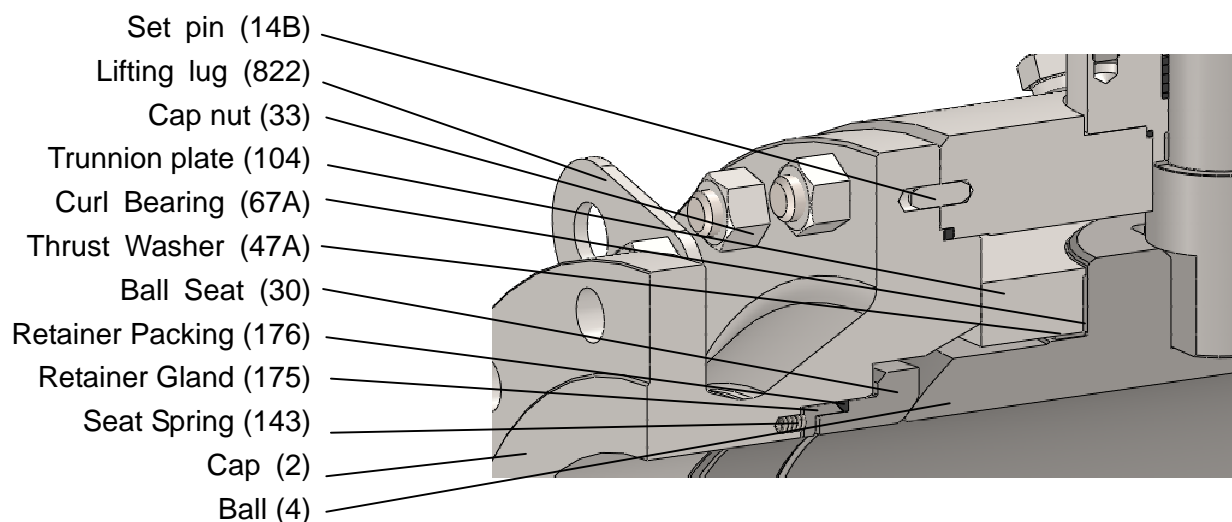
1.6.7 Remove the Body .

1. Mark the Body (1) and the Cap (2) position for proper position. Then loosen the Cap nuts (33) of the lower cap evenly.
2. Remove the Cap nuts (33) of the lower cap (2).
3. Some of the ball valves, depending on their size and nominal pressure, are provided with Lifting lugs (822) mounted with flange bolting. As Lifting Lugs (822) are factory-mounted at the most convenient locations, be sure to mark locations of Lifting Lugs (822) during disassembly for easier subsequent reassembly.
4. Set eyebolts at threaded taps on the Body (1), and lift out the Body (1) with a crane using eyebolts.

1.6.8 Remove the ball seat assembly from the Cap (2). Mark the removed ball seat assembly for proper identification with both Caps (2).

1.6.9 Remove the Gasket (19A) from the Body (1), and remove the Retainer glands (175) and Seat springs (143) from Caps (2).




1.6.10 Remove the Seat packings (176) from Ball seats (30).



. Disassembly and Reassembly (Metal seat)

2. Reassembly procedures

2.1 Care for reassembly

 CAUTION	
	<p>Wear protective items such as goggles, gloves and working boots.</p> <p>No open flame or smoking should be allowed in the work area.</p> <p>Pay attention not to catch fingers during reassembly.</p> <p>Ensure to replace consumable parts for new ones, such as the gland packing, gaskets, thrust washers, stem bearings, bearings and seat packings. Reuse of these parts may cause leakage.</p> <p>When reassembling valves of big mass one, use an appropriate lifting machine for safety operation.</p>
	<p>In case the valves are to be used for oxygen service, do not apply lubricant to all valve interior and valve internal parts which will directly contact the media.</p>

2.2 Before reassembly

- 2.2.1 New parts for replacement should be prepared beforehand.
- 2.2.2 The consumables (gland packing, gaskets, thrust washers, stem bearings, bearings and seat packings) should be replaced for new ones. Reuse of these parts may cause leakage.
- 2.2.3 Be sure to clean the parts to remove dust, oil and other foreign objects, in case the parts are reused. Ensure to remove rusts and other soils out of the seat retaining area of the body and the body cap to have satisfactory sealing performance.
- 2.2.4 For carbon steel and low alloy steel valves apply METALGARD 814 or an equivalent rust preventative to the inner surface of the body and body cap, including stem holes. To packing and adjacent areas, apply CLIMAX 750S or an equivalent lithium soap grease lubricant unless otherwise specified.

. Disassembly and Reassembly (Metal seat)

- 2.2.5 Assemble the valve in a dust-free area.
- 2.2.6 Take care not to damage flange surfaces, ball, ball seat, stem and all internal machined parts.
- 2.2.7 Ensure mating the marks given before disassembly
- 2.2.8 Keep in mind that all threads should be securely tightened.

. Disassembly and Reassembly (Metal seat)

2.3 Reassembly sequence for size up to NPS4 for full bore valve and up to NPS6 for reduced bore.

2.3.1 Reassembly of the cap bolts.

2.3.2 Reassembly of the stem.

2.3.3 Reassembly of the ball

2.3.4 Reassembly of cover bolts and the end plate.

2.3.5 Reassembly of the ball seat on the caps.

2.3.6 Reassembly of caps.

2.3.7 Reassembly of the bonnet, gland plate and small components around the stem.

2.3.8 Reassembly of the operator.

. Disassembly and Reassembly (Metal seat)

- 2.4 Reassembly procedure for size up to NPS4 for full bore valve and up to NPS6 for reduced bore.
- 2.4.1 Place the Cap bolts (35A) to both side of the Body (1), tightening them securely.
- 2.4.2 Place the Stem bearing (67B) to the Body (1) and place the Stem (3) together with Thrust washer (47B).
- 2.4.3 Place the Curl bearing (67A) to the Ball (4). Then place the Ball (4) into the Body (1) slowly with care to protect it from damage or scratch, and connect to the Stem (3).
- 2.4.4 Place Cover bolts (35B) and the Gasket (19C) to the Body (1). Then place the End plate (147) to the Body (1), and connect it to the bottom of the Ball (4). (Refer to the figure "B")
- 2.4.5 Place Cover nuts (33B) and tighten them. Evenly tighten the Cover bolt nuts (35B) alternately and gradually in a star pattern.
- 2.4.6 Set the Seat packings (176) to the Ball seats (30). Refer to Figure "G" regarding the direction of the Retainer packing (176).
- 2.4.7 According to Figure "G" below, assemble the springs (143) on the Caps (2). Then insert the Retainer glands (175) and ball seat assemblies into the both Caps (2).

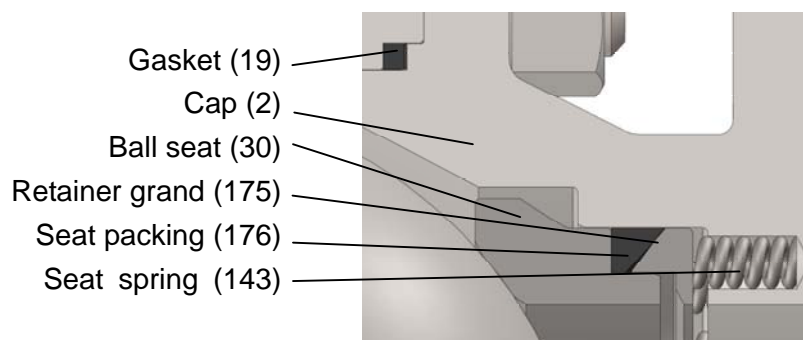


Figure "G"

. Disassembly and Reassembly (Metal seat)

- 2.4.8 Place the body assembly on the floor with the one side of Cap bolts (35A) facing to the floor.
1. Turn the Stem (3) and adjust ball ports to the fully closed position.
 2. Set the Gasket (19A) on the body.
 3. Lift the Cap (2) with a crane and lower it slowly on the Body (1). When lift the Cap (2) hold the Ball seat assembly by tapes to prevent detachment from the Cap (2). The Cap (2) is lifted out carefully with the Ball seat assembly, take care not to drop Ball seat assembly. Take care of the markings for proper position.
 4. Place Cap nuts (33A) and tighten them. Evenly tighten the Cap nuts (33A) alternately and gradually in a star pattern.
 5. Reverse the valve as face the opposite Cap (2) towards upside. Take care not to be damage the Ball (4) when reverse the valve. Reassemble the other Cap (2) with following the same processes in 2 to 4.
- 2.4.9 Assemble the Bonnet (202), the Gland plate (144) and all small components around the stem according to figure "A".
- 2.4.10 Place the operator.
- 2.4.11 Place vent valve (85B) and drain Plug (85A) with sealing material.
(Graphite tape is suitable.)
- 2.4.12 Ensure all threaded components are securely tightened. Retighten them, if any loosened components are found.

. Disassembly and Reassembly (Metal seat)

- 2.5 Reassembly sequence for size NPS6 and larger for full bore valve and for size NPS8 and larger for reduced bore.
 - 2.5.1 Reassembly of the cap bolts
 - 2.5.2 Reassembly of some parts on cap and ball seat
 - 2.5.3 Reassembly of the seat retainer assembly on the caps
 - 2.5.4 Reassembly of the body
 - 2.5.5 Reassembly of the ball
 - 2.5.6 Reassembly of the cap
 - 2.5.7 Reassembly of the stem
 - 2.5.8 Reassembly of the bonnet, gland plate and small components around the stem
 - 2.5.9 Reassembly of the operator

. Disassembly and Reassembly (Metal seat)

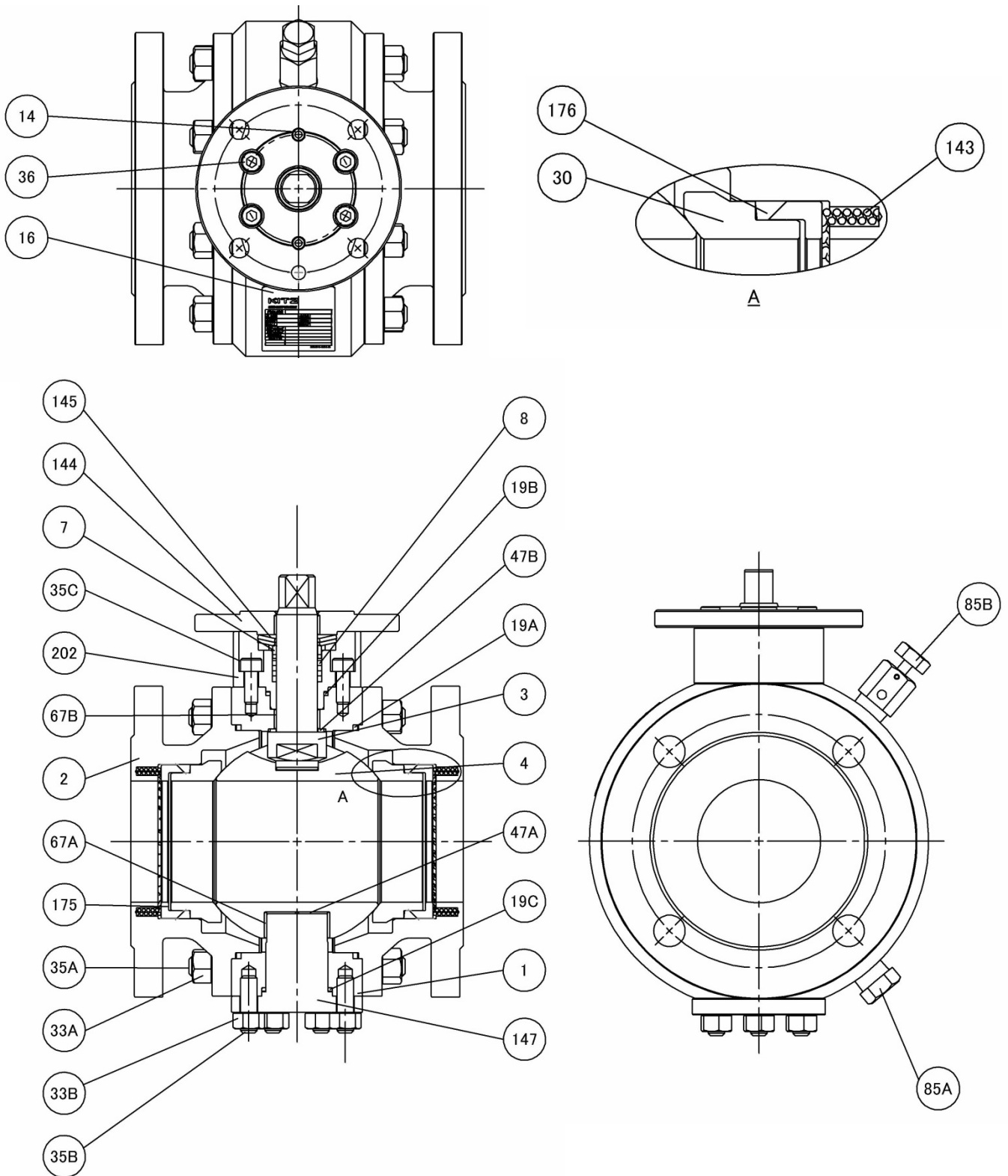
- 2.6 Reassembly procedure for size NPS6 and larger for full bore valve and for size NPS8 and larger for reduced bore.
- 2.6.1 Place the Cap bolts (35A) to both side of the Body (1), tightening them securely.
- 2.6.2 Set the Seat packings (176) to the Ball seats (30). Refer to Figure "G" regarding the direction of the Seat packing (176).
- 2.6.3 According to Figure "G" below, assemble the Seat springs (143) on the Caps (2). Then insert the Retainer gland (175) and ball seat assemblies into the both Caps (2).
- 2.6.4 Set the Gasket (19A) and Set pin (14B) on the body.
- 2.6.5 Lift the Body (1) with a crane using eyebolts set on the body threaded taps, and lower it slowly on the Cap (2) with taking care not to drop the Gasket (19A) from the Body (1).
- 2.6.6 Place Thrust washers (47A) to the Ball (4), then place Trunnion plates (104) assembled the Curl bearing (67A) and Set pins (14B) to the Ball (4).
- 2.6.7 Put a cloth belt into the port and lift the Ball (4) slowly together with Trunnion plates (104), and place into the Body (1). The Body (1) is lifted out carefully with taking care to prevent the Ball (4) surface from the damage or scratch during disassembly. Hold Trunnion plates (104), by hand or bands to prevent detachment from the Ball (4), and take care not to drop Trunnion plates (104) from the Ball (4) and Set pins (14B) from the Trunnion plates (104) when lift out the Ball (4). Then adjust the Ball (4) to set the close position.
- 2.6.8 Set the Gasket (19A) on the Body (1).
- 2.6.9 Lift the other Cap (2) with a crane and lower it slowly on the Body (1). When lift the Cap (2), hold the Ball seat (30) by tapes to prevent detachment from the Cap (2). The Cap (2) is lifted out carefully with the Ball seat (30) take care not to drop the Ball seat (30).

. Disassembly and Reassembly (Metal seat)

- 2.6.10 Place Cap nuts (33) and tighten them. Evenly tighten the Cap nuts (33) alternately and gradually in a star pattern.
Some of the ball valves, depending on their size and nominal pressure, are provided with lifting lugs (822). Place them at proper position, if provided.
- 2.6.11 Place the stem (3), bonnet (202) and gland plate (144) together with all small components according to figure "F".
- 2.6.12 Place the operator.
- 2.6.13 Place Vent valve (85B) and drain Plug (85A) with sealing material.
(Graphite tape is suitable.)
- 2.6.14 Ensure all threaded components are securely tightened. Retighten them, if any loosened components are found.

. Disassembly and Reassembly (Metal seat)

3. Cross-sectional assembly drawing



This drawing represents only a typical construction of size up to NPS4 for full bore.
Please refer to the approved drawing for assembly and disassembly.

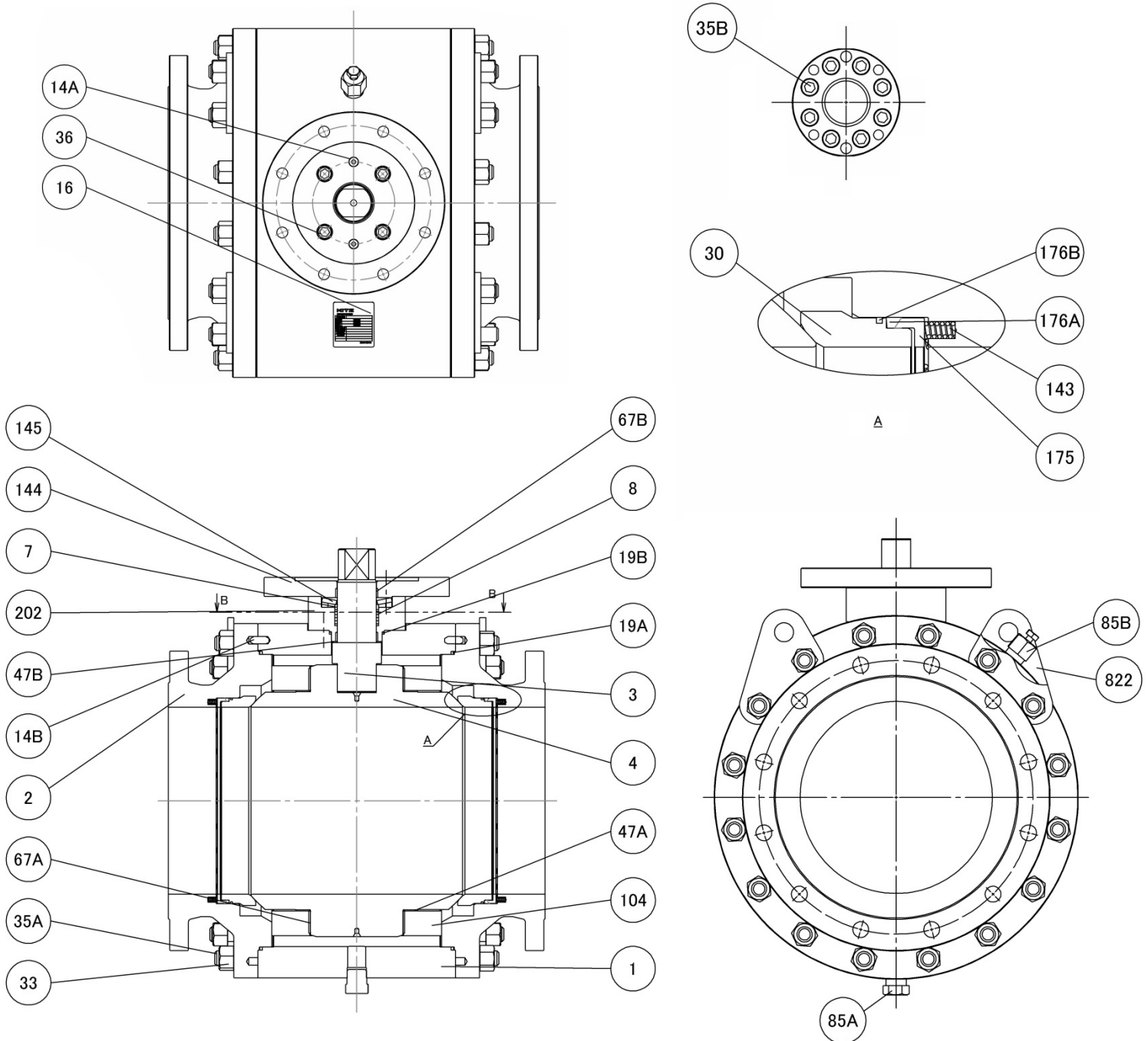
. Disassembly and Reassembly (Metal seat)

NO	PARTS NAME	QTY
1	Body	1
2	Cap	2
3	Stem	1
4	Ball	1
7	Gland	1
8	Gland packing	1S
14	Set pin	2
16	Name plate	1
19A	Gasket	2
19B	Gasket	1
19C	Gasket	1
30	Ball seat	2
33A	Cap nut	2S
33B	Cover nut	1S
35A	Cap bolt	2S
35B	Cover bolt	1S
35C	Bonnet bolt	1S
36	Gland bolt	1S
47A	Thrust washer	1
47B	Thrust washer	1
67A	Curl bearing (Ball)	1
67B	Stem bearing	2
85A	Plug	1
85B	Vent valve	1
143	Seat spring	2S
144	Gland plate	1
145	Coned disc spring	1S
147	End plate	1
175	Retainer gland	2
176	Seat packing	2
202	Bonnet	1

This table represents typical parts of size up to NPS4 for full bore and size up to NPS6 for reduced bore.

Please refer to the approved drawing.

. Disassembly and Reassembly (Metal seat)



This drawing represents only a typical construction of the valve for size NPS6 and larger.
Please refer to the approved drawing for assembly and disassembly.

. Disassembly and Reassembly (Metal seat)

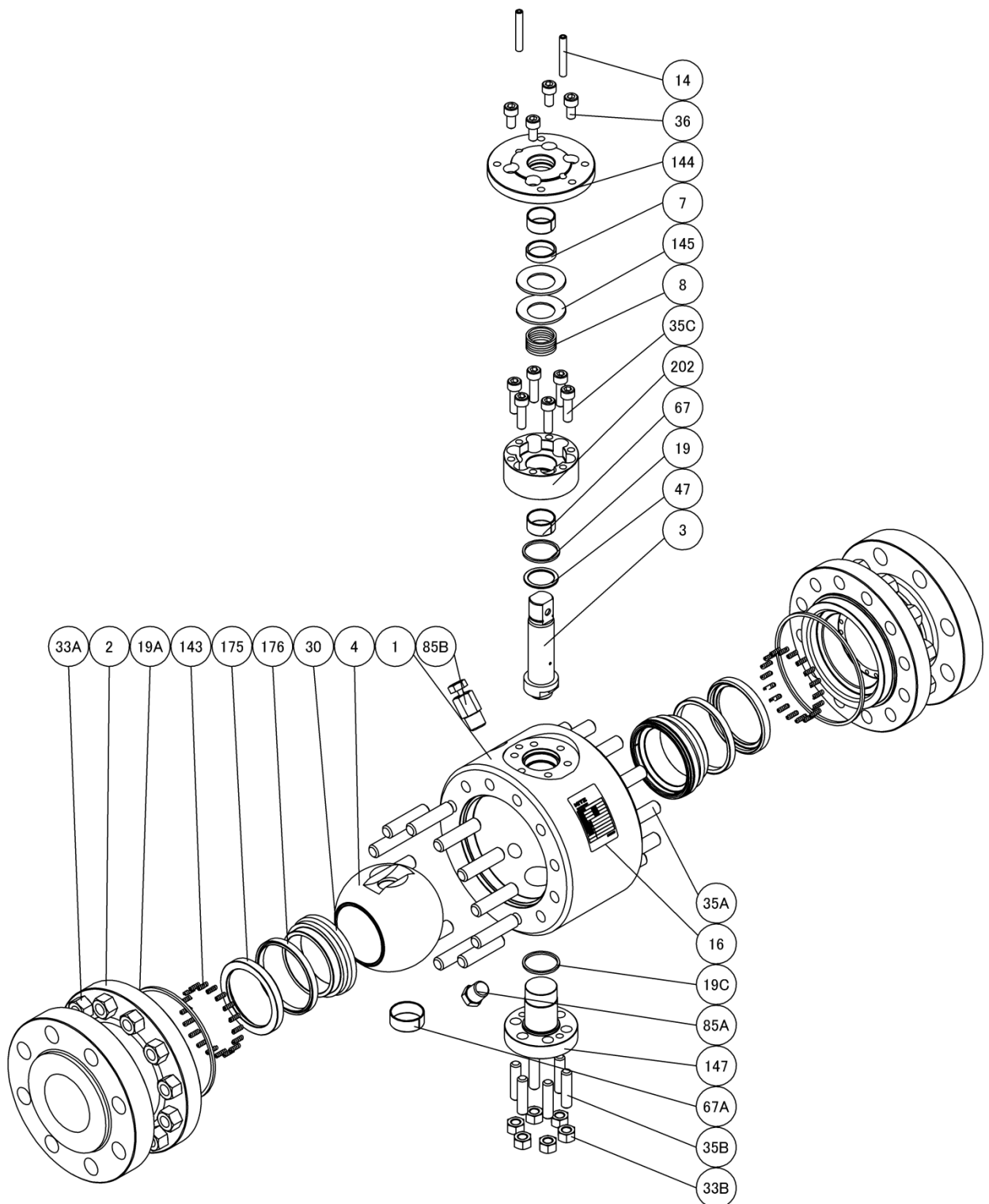
NO	PARTS NAME	QTY
1	Body	1
2	Cap	2
3	Stem	1
4	Ball	1
7	Gland	1
8	Gland packing	1S
14A	Set pin	2
14B	Set pin	1S
16	Name plate	1
19A	Gasket	2
19B	Gasket	1
30	Ball seat	2
33	Cap nut	2S
35A	Cap bolt	2S
35B	Bonnet bolt	1S
36	Gland bolt	1S
47A	Thrust washer	2
47B	Thrust washer	1
67A	Cur bearing (Ball)	2
67B	Stem bearing	2
85A	Plug	1
85B	Vent valve	1
104	Trunnion plate	2
143	Seat spring	2S
144	Gland plate	1
145	Coned disc spring	1S
175	Retainer gland	2
176	Seat packing	2
202	Bonnet	1
822	Lifting lug	1S

This table represents typical parts of the valve for size NPS6 and larger for full bore valve and for size NPS8 and larger for reduced bore.

Please refer to the approved drawing.

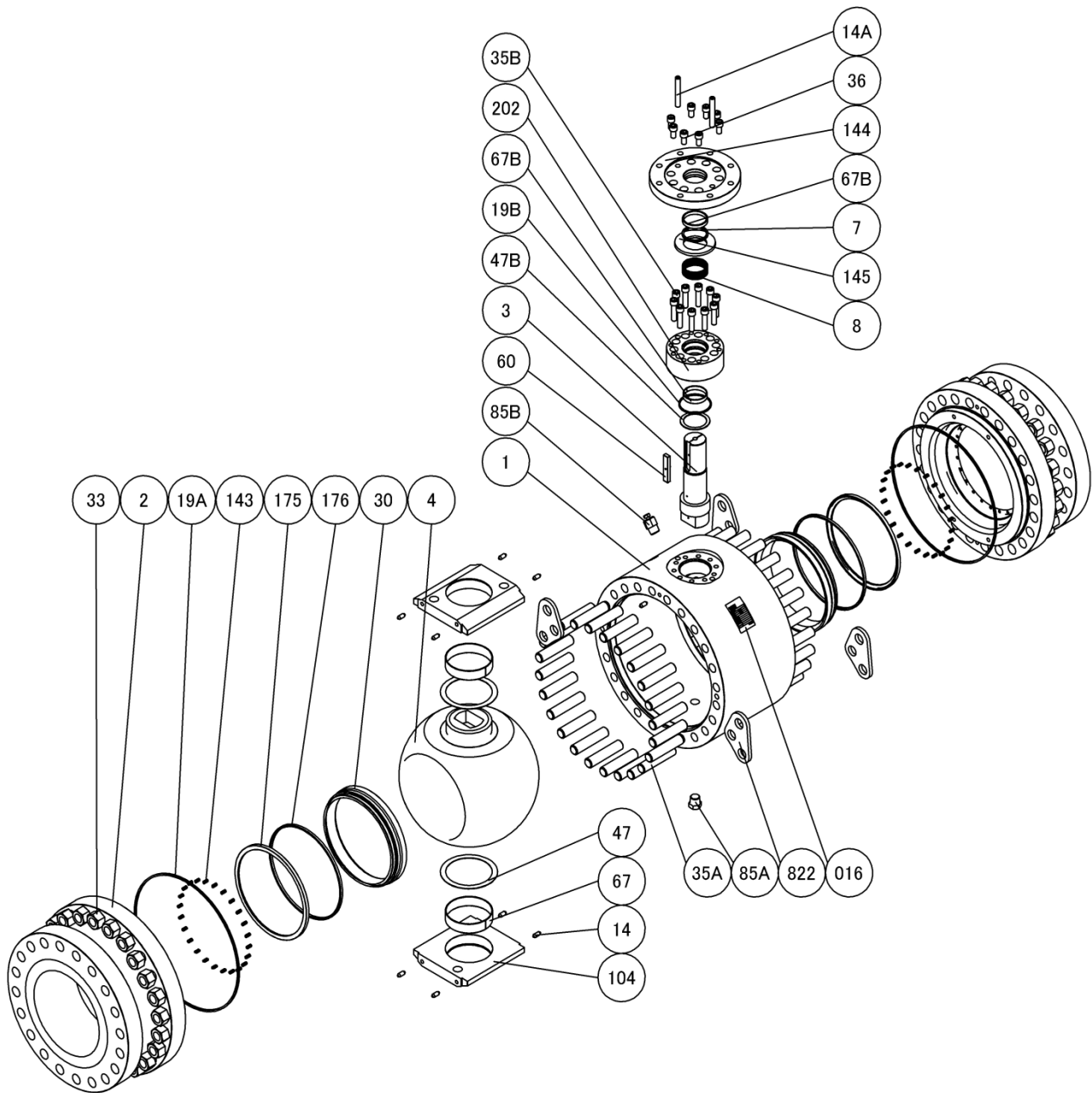
. Disassembly and Reassembly (Metal seat)

4. Exploded view drawing



This drawing represents only a typical construction of the valve for size up to NPS4.
Please refer to the approved drawing for assembly and disassembly.

. Disassembly and Reassembly (Metal seat)



This drawing represents only a typical construction of the valve for size NPS6 and larger.
Please refer to the approved drawing for assembly and disassembly.

. Trouble shooting

. Trouble shooting

Defect	Possible cause	Remedial measure
Disturbed valve operation	Foreign objects may have choked up the valve body cavity and stock around the ball seats.	Disassemble and inspect the valve components.
Excessive valve torque	Foreign objects may have stuck to the stem.	Remove the foreign objects and ensure no further problems on the area.
	Foreign objects may have choked up the valve body cavity and stock around the ball seats.	Flush the built-up objects by the media with the ball slightly open. Disassemble and inspect the valve.
	The gland bolts may have been over-tightened. (In case of valves with the gland packing structure)	Loosen the gland bolts once and adequately retighten them so that the leakage through the gland does not occur.
Leakage from the gland area	Damaged O-rings.	Replacement of O-rings
	Loosed gland or gland plate.	Retighten the gland or gland bolts
	Uneven tightening of gland bolts (In case of valves with the gland packing structure)	Loose the bolts once and evenly retighten them.
	Damaged gland packing. (In case of valves with the gland packing structure)	Replace the gland packing.
Internal through-bore leakage	Damaged ball seats.	Disassemble and inspect the valve. Replace ball seats.
Abnormal noise or vibration	Loosed bolts and nuts.	Retighten the bolts and nuts.