Thank you for choosing KITZ products. For safe and trouble-free function and performance of the product, make sure to read and understand all items included in this manual before valve mounting and operation. Keep this manual in a convenient place and accessible to all valve operating personnel.
This manual applies to the manual operation of the KITZ flanged ends, metal seated, trunnion mounted ball valves. For electric or pneumatic valve operation, refer to the operation manual prepared by the manufacturers of the relevant valve actuators.

SAFETY PRECAUTIONS

For the safe use of the product, please read all items in this manual before handling the product. The safety precautions in this manual are determined to ensure safe and proper use of the product and to prevent personal injury and property damage. This manual classifies the safety precautions into [Warning] and [Caution], according to the hazard level, to clearly indicate the extent and severity of the risk.

Both [Warning] and [Caution] indicate important safety instructions. Please be sure to follow them.

![WARNING]

Indicates an imminently hazardous situation that, if not avoided, will result in serious injury or death.

![CAUTION]

Indicates a potentially hazardous situation that, if not avoided, could result in minor or moderated injury and product damage.

![Hallmark]

Indicates prohibited actions that must not be carried out.

![Mandatory]

Indicates mandatory action that must be carried out.

NOTES TO USERS

- This manual is designed to show an appropriate usage of the products for transportation, storage, installation, operation, and maintenance. Be sure to read through this manual before handling the product.

- This manual does not cover the whole scope of conceivable usage of the products for transportation, storage, installation, operation, and maintenance. If technical assistance beyond the scope of this manual is required, contact KITZ Corporation or its distributors.

- The specifications for transportation, storage, installation, operation, and maintenance described in this manual have been determined with valve maintenance taken into consideration. Do not use products beyond the specifications.

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

*Any information provided in this operation manual is subject to change without prior notice.*
Contents

T. Construction and Design Features

U. Valve Operating Devices

V. Transportation and Storage

W. Valve Installation

X. Valve Operation

Y. Periodic Inspection

Z. Disassembly and Reassembly
1. Construction and Design Features

1.1 The construction of the KITZ Trunnion mounted metal seat ball valves and its part names are as illustrated below.

1.2 Rotation of the stem by 90° will open or close the valve.

1.3 The KITZ Trunnion mounted metal seat ball valves are designed for use in the fully open, fully closed or intermediate position. Please choose the gear operator type in cases where the valve is used in the intermediate position.

1.4 Coil springs are provided to the back of the ball seats to press the ball seats to the ball. Each stem, at the top and the bottom, keeps the ball in the center of the valve to ensure a stable valve operation.

1.5 Fluid can flow through the valve port in both directions.

This illustration shows a typical construction of the valve.

[Diagram of the valve with labeled parts]
2. Design Features

2.1 Excellent sealing performance

High sphericity of the ball and ball seat surfaces provides the valve with excellent sealing performance.

2.2 High durability

The ball and ball seat surfaces are fused with nickel alloy to improve durability against high temperature and high pressure fluids.

2.3 Fire safe design

The valve component parts are made of nonflammable materials to enhance the fire safety of the valve.
II. Valve Operating Devices

1. Lever Handle Type Operator

1.1 A lever handle is mounted on the valve stem.

1.2 Rotate the lever handle clockwise by 90° to close the valve and counterclockwise by 90° to open the valve.
II. Valve Operating Devices

2. Gear Operator

2.1 A gear operator is mounted on the valve.

2.2 According to the arrow or letter on the gear handwheel, rotate the handwheel counterclockwise for opening or clockwise for closing the valve.

2.3 The operating torque of the handwheel differs depending on the valve opening/closing position and valve size.

2.4 Gear operator is a device to transmit a large torque to the valve stem by converting the torque from the drive shaft by means of the reduction gearing unit.
V. Transportation and Storage

1. Transportation

1.1 Precautions for transportation

- Keep off the valve lifting area to prevent injuries caused by unsecured valves. Unstable stacking may also result in personal injuries.
- Extra care is required not to damage the painted valve surfaces during transportation. Any damaged surfaces shall be properly repaired to prevent corrosion.
- Extra care is required when handling and storing carton packed products. High humidity may damage the cartons as well as the products.

1.2 Transportation

1.2.1 Maintain the original packing condition during shipment and until the valve is installed at the worksite. Provide appropriate protection covers if they are found missing during transportation.

1.2.2 Do not give any extraordinary shock to valves by throwing, dropping, dragging, or toppling them down.
2. Storage

2.1 Precautions for storage

- DO NOT store valves in the corrosive environment. The threaded portions may rust leading to a valve malfunction.
- DO NOT remove the flange protection covers until installation. They prevent foreign objects from intruding into the valve.
- DO NOT place any objects on valves, and do not step on them. Overloading may damage valves.
- DO NOT pile up valves for storage. Unstable piling may damage the valves or cause personal injury.
- KEEP valves in the fully open position during storage. Storing valves in the fully closed position may cause breakage of the protection cover, which leads to ball damage.

2.2 Storage

2.2.1 Store valves in a dust-free, low humidity and well ventilated place.

2.2.2 Place packed valves on pallets or racks for storage. Storing valves directly on the ground or concrete floor shall be avoided.

2.2.3 Take some appropriate measures to protect valves from direct exposure to dust, rain or sunlight if they are temporarily stored outdoors.
1. Precautions for Installation

- Check the valve specifications with the nameplate or the relevant catalogue. Service pressure, fluid and temperature of the valve are determined by the ball seat materials and so forth. Use of the valve beyond the specifications will lead to a failure such as internal and external leakage.

- Keep a secure footing for valve installation and operation.

- Provide required lighting for valve operation.

- Pipes shall be supported adequately.

1.1 Allow sufficient room for safe and easy valve operation, installation, disassembly and subsequent maintenance work with consideration given to the valve size and the stem direction.

1.2 Take appropriate measures in cases where valves are installed in confined areas.

1.3 Try not to install valves in the places where valve functions may be hampered by outer forces such as vibrations.

1.4 Install valves in an upright position to horizontal pipelines.
### CAUTION

- Keep off the valve lifting area to prevent injuries caused by unsecured valves.
- Take care not to catch your fingers or hands during piping work.
- Take care not to damage the flange and seat surfaces.
- Use support stands for the correct alignment of the downstream and upstream pipes.
- Retighten the gland packing to prevent leakage before operation. The tightening pressure applied to the gland packing may have been lowered due to the stress relaxation of the packing during transportation or storage.
- Use new gaskets when installing valves into the pipelines.
2.1 Check the following before installation.

2.1.1 The service conditions are within the range of the valve specifications.

2.1.2 The valve flanges match their corresponding pipe flanges.

2.1.3 The flange surfaces of the valve and pipes are free from scratches or any other damages.

2.1.4 Appropriate space is kept between the pipe flanges for the valve face-to-face dimensions including the gasket thickness.

2.1.5 The pipes on the upstream and downstream sides of the valve are aligned.

2.1.6 The pipe flanges are in parallel to each other. The bolt holes of the flanges are symmetrically lined up against the centerline of the flanges.

2.2 Before installation, clean the connecting pipes and remove any foreign objects such as sand, dust and welding spatters.

2.3 Do not give any extraordinary shock to valves by throwing, dropping, dragging or toppling them down.

2.4 Remove the flange covers from the valve just before installation.

2.5 Check all threaded portions after installation and retighten them, if needed.

2.6 After installation, fully open all valves on the pipeline and flush the pipe interior to remove foreign objects. Do not operate the valves while flushing.
3. Valve Installation Procedures

3.1 Align the upstream and downstream pipes of the valve.

3.2 Check that there is an appropriate space between the pipe flanges for the valve face-to-face dimensions including the gasket thickness.

3.3 Place the valve between the pipe flanges. Insert the bottom bolts through the bolt holes and tighten them lightly.

3.4 Insert the gaskets between the valve and pipe flanges. It is recommended to apply lubricant (gasket paste) to the gasket surfaces.

3.5 Make sure that the gaskets have been inserted in the correct position.

3.6 Attach the remaining bolts and nuts to the flanges and temporarily tighten them.

3.7 Evenly and alternately tighten the bolts in a star pattern as shown below. After bolting has been properly performed, both ends of each bolt will evenly protrude beyond the nuts.

3.8 Gradually raise the line temperature and pressure during the test. Retighten the bolts if needed.
1. Precautions for Operation

- Never loosen the bolts or nuts used in the gland, cap and pipe flange areas of the pressurized valve.
- Do not use the valve in the slightly open position for a long period of time. Such use may cause vibration or erosion of the ball and ball seats.
- Manually operate the lever handle and gear operator. Stop the fully opening/closing operation at the position where a mechanical stopper activates. Excessive force on the lever handle and gear operator, by use of a pipe or handwheel rotating tool, may damage the mechanical stopper or gear operator, leading to seat leakage.
- Retighten the gland bolts and nuts before starting the valve operation. Check the handle torque to avoid overtightening while retightening the bolts and nuts. The gland bolts shall be alternately and evenly tightened.
- Fluctuations of the service temperature may cause stress relaxation of the packing. Retighten each bolt and nut after the temperature has been stabilized.
- Operate valves slowly to prevent pipe damage when high temperature fluids such as steam are handled.
- Take appropriate measures to prevent freezing, as needed.

2. Valve Operation

2.1 Lever handle operation

Rotating the lever handle clockwise by 90° will close the valve and counterclockwise by 90° will open the valve.

2.2 Gear operation

Rotating the handwheel clockwise according to the letter and arrow on the handwheel will close the valve. Counterclockwise rotation will open the valve.
### X. Valve Operation

#### 3. Daily Inspection

Daily maintenance work and inspection shall be carried out on the valves in use.

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<tr>
<th>Problems</th>
<th>Areas to be inspected</th>
<th>Inspection methods</th>
<th>Remedies</th>
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</thead>
<tbody>
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<td>Visual check</td>
<td>Soap water</td>
<td>Retighten the gland bolts and nuts. Replace the gland packing.</td>
</tr>
<tr>
<td>Flanged areas</td>
<td>Visual check</td>
<td>Soap water</td>
<td>Retighten the flange bolts. Replace the gaskets.</td>
</tr>
<tr>
<td>Threaded portions</td>
<td>Visual check</td>
<td>Soap water</td>
<td>Retighten each threaded portion. Replace the leakage-related parts.</td>
</tr>
<tr>
<td>External leakage</td>
<td>Valve surfaces</td>
<td>Visual check</td>
<td>Soap water</td>
</tr>
<tr>
<td>Valve body</td>
<td>Auditory check</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Loosened bolts</td>
<td>Auditory check</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Abnormal noise</td>
<td>Pipe vibrations</td>
<td>Auditory check</td>
<td></td>
</tr>
<tr>
<td>Loosened bolts and nuts</td>
<td></td>
<td>Visual check</td>
<td>Tactile check</td>
</tr>
<tr>
<td>Excessive seat leakage</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Valve opening/closing position</td>
<td></td>
<td>Visual check</td>
<td></td>
</tr>
<tr>
<td>Operational failure</td>
<td>Lever handle or gear operator</td>
<td>Tactile check</td>
<td>Auditory check</td>
</tr>
</tbody>
</table>
V. Valve Operation

4. Precautions for Troubleshooting

- Wear protective items such as goggles, gloves and working boots.
- Take adequate safety measures against toxic, inflammable or corrosive fluid.
- Reduce the line pressure to the atmospheric level before retightening the bolts.
- When retightening the flange bolts, care shall be taken for a possible blowout of the gaskets. Operation shall be carried out at the position where the operator does not get direct exposure to the fluid, even if such a blowout occurs.
- Reduce the line pressure to the atmospheric level before replacing the packing and gaskets or loosening the bolts and nuts. Operation shall be carried out at the position where the operator does not get direct exposure to the fluid.

4.1 Leakage from the gland area

Retighten the gland bolts if leakage from the gland area is detected. Evenly and alternately tighten the bolts as shown below. Adequate torque shall be applied so that the valve operation will not get heavy. If it does not stop the leakage, replace the packing.

4.2 Leakage from the flanged areas

Evenly, alternately and gradually tighten the bolts in a star pattern as shown below.
## Valve Operation

### Troubleshooting Problems Possible cause Remedies

<table>
<thead>
<tr>
<th>Opening/Closing failure</th>
<th>Foreign objects have got stuck in the valve body cavity and around the ball seats.</th>
<th>Disassemble and inspect the valve.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Foreign objects have jammed around the stem.</td>
<td>Remove the foreign objects and check that there are no further problems around the stem.</td>
</tr>
<tr>
<td>Excessive valve operating torque</td>
<td>Foreign objects have got stuck in the valve body cavity and around the ball seats.</td>
<td>Slightly open the valve and flush out the built-up foreign objects, or disassemble and inspect the valve.</td>
</tr>
<tr>
<td></td>
<td>The gland packing has been loosened.</td>
<td>Retighten the gland bolts and nuts.</td>
</tr>
<tr>
<td></td>
<td>The gland packing has been unevenly tightened.</td>
<td>Tighten the gland bolts evenly.</td>
</tr>
<tr>
<td>Leakage from gland packing area</td>
<td>The gland packing has been damaged.</td>
<td>Replace the gland packing.</td>
</tr>
<tr>
<td>Excessive seat leakage when in the fully closed position.</td>
<td>The ball seats and ball have been damaged.</td>
<td>Disassemble and inspect the valve. (Replace the ball seats and ball.)</td>
</tr>
<tr>
<td></td>
<td>Bolts and nuts have been loosened.</td>
<td>Retighten the bolts and nuts.</td>
</tr>
<tr>
<td>Abnormal noise or vibrations</td>
<td>Cavitation has occurred while the valve is in the partially open position.</td>
<td>Change the valve opening position.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Problems Possible cause Remedies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Opening/Closing failure</td>
</tr>
<tr>
<td>Excessive valve operating torque</td>
</tr>
<tr>
<td>Leakage from gland packing area</td>
</tr>
<tr>
<td>Excessive seat leakage when in the fully closed position.</td>
</tr>
<tr>
<td>Abnormal noise or vibrations</td>
</tr>
</tbody>
</table>
1. Periodic Inspection

1.1 Perform a periodic inspection with the valve mounted to the pipeline at least once a year.

1.2 Check that the valve operates adequately and safely.

1.3 Inspection items and methods are the same as those for daily inspection. See Chapter V for the items and methods.

1.4 Perform a periodic inspection on the valves that are not inspected or not operated on a daily basis. (Periodic inspection shall be carried out on all valves.)

1.5 Thorough checks are required for the valves in cases where:
   a) performance failure of the valve could result in a major shutdown of the entire plant.
   b) fluid contains high viscosity and may get stuck and built up inside the valve.
   c) corrosion and/or wear due to fluid are expected. Remove the valve from the pipeline for inspection, if needed.

   When disassembly of the valve is required, it is recommended to call the valve manufacturer for inspection and repair.

1.6 It is recommended to replace gland packing at the time of the periodic inspection.
2. Inspection and Maintenance
When inspections of the pipeline facilities are conducted, perform leakage test on the valve seats and operation test on the valve, as required. If any defect is detected, disassemble the valve for further inspection. The valve shall pass the required inspections before being sent back to the pipeline.

2.1 Precautions for valve removal and installation
- Before removing a valve from the pipeline, discharge the fluid from the pipeline and reduce the line pressure to the atmospheric level.
- Under fully closed conditions, some fluid and pressure may have been trapped within the valve body. Before removing the valve, partially open the valve and discharge the remaining fluid and pressure.
- When a toxic, inflammable or corrosive fluid has been handled, remove the fluid completely from the pipeline and valve interior.
- Take protective measures to prevent direct exposure to the fluid and catching fire.
- Keep off the valve lifting area to prevent injuries caused by unsecured valves.
- Wear protective items such as goggles, gloves and working boots.
- Keep a secure footing when removing and installing valves.
- Use support stands for the correct alignment of the downstream and upstream pipes.
- Put matchmarks on the pipe flanges and valve flanges before removing the valve from the pipeline. The valve shall be reinstalled with the matchmarks aligned.
- Make sure to use new gaskets when valves are reinstalled to the pipeline.
### 2.2 Disassembly

Refer to Chapter VII for disassembly procedures.

### 2.3 Inspection items

Refer to the table below for inspection items, methods, judgment and remedies.

<table>
<thead>
<tr>
<th>Parts to be inspected</th>
<th>Inspection Methods</th>
<th>Acceptance criteria</th>
<th>Remedies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flange</td>
<td>Corrosion</td>
<td>Visual check</td>
<td>Welding repair or Scrapping</td>
</tr>
<tr>
<td></td>
<td>Damage</td>
<td>Measuring of the wall thickness</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Crack</td>
<td>Nondestructive test</td>
<td></td>
</tr>
<tr>
<td>Body</td>
<td>Body cap</td>
<td>Visual check</td>
<td>Welding repair or Scrapping</td>
</tr>
<tr>
<td></td>
<td>Fluid contact area</td>
<td>Measuring of the wall thickness</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Corrosion</td>
<td>Nondestructive test</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Scratch</td>
<td>Conformity with the criteria</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Crack</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Seat surfaces</td>
<td>Corrosion</td>
<td>Visual check</td>
<td>Re-lapping of the ball seats or Replacement.</td>
</tr>
<tr>
<td></td>
<td>Scratch</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Crack</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Valve seat</td>
<td>Corrosion</td>
<td>Visual check</td>
<td>Re-lapping of the ball or Replacement.</td>
</tr>
<tr>
<td></td>
<td>Scratch</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Crack</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Valve disc</td>
<td>Corrosion</td>
<td>Visual check</td>
<td>Re-lapping of the ball or Replacement.</td>
</tr>
<tr>
<td></td>
<td>Scratch</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Crack</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stem</td>
<td>Corrosion</td>
<td>Visual check</td>
<td>Correction of distortion or Replacement.</td>
</tr>
<tr>
<td></td>
<td>Erosion</td>
<td>Dimensional check</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Scratch</td>
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<td></td>
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<tr>
<td></td>
<td>Distortion</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Packing</td>
<td>Gasket</td>
<td></td>
<td>Replace the parts at disassembly.</td>
</tr>
</tbody>
</table>

### 2.4 Reassembly

Refer to Chapter VII for reassembly procedures.
2.5 Tests and inspection

Perform the required tests and check the following after maintenance work.

2.5.1 Operation check

1. Check that the valve operates smoothly without galling or sticking to the internal valve components.
2. Check that the stem is securely assembled with the ball.
3. Check that there is no offset of the ball ports and ball seats in the fully open position. The ball shall not protrude into the valve port other than the rounded surface of the ball port edge.

2.5.2 Shell test and seat leakage test

1. Precautions for tests
   - Wear protective items such as goggles, gloves, and working boots.
   - Pay attention to safety when performing shell test and seat leakage test.

2. Shell test and seat leakage test
   - All reassembled valves shall be subjected to a specified hydrostatic or pneumatic shell test at the designated test pressures.
   - Refer to JIS B2003, JPI-7S-39 and API-598 for the test methods and procedures and check that the valve satisfies the requirements.
   - Seat leakage test shall be in accordance with ANSI/FCI 70-2 Class V.
   - Check that the valve satisfies the allowable leakage rate shown below.

   Test fluid: water
   Test pressure: 0.7 MPa
   Allowable leakage rate: 0.05 cc/inch/minute
Disassembly and Reassembly
1. Disassembly

1.1 Precautions for disassembly

- Take protective measures to prevent direct exposure to the fluid and catching fire.
- Under fully closed conditions, some fluid and pressure may have been trapped within the valve body. Before removing the valve, partially open the valve and discharge the remaining fluid and pressure.
- Wear protective items such as goggles, gloves and working boots.
- Take care not to catch your fingers or hands during disassembly work.
- Use an appropriate lifting machine for safety when handling a large size valve.

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, ball seats and stems.
1.2.3 Put matchmarks on the corresponding flanges of the body and the body cap for correct and easy alignment in the subsequent reassembly.

When the ball and ball seats are reused, be careful not to change the installation orientation of the ball and the ball seats at reassembly.

1.2.4 When the bolts and nuts are found seized or stuck to each other due to rust, apply some lubricant and leave it for a while.
1.3 Disassembly sequence

1.3.1 Depressurization of the valve interior
1.3.2 Removal of the lever handle or gear operator
1.3.3 Removal of the gland area parts
1.3.4 Removal of the stem
1.3.5 Removal of the bottom stem
1.3.6 Removal of the body cap
1.3.7 Removal of the ball
1.3.8 Removal of the ball seats

1.4 Disassembly procedures

1.4.1 Before disassembly, partially open the valve and decrease the pressure in the valve interior to the atmospheric level. Then, gradually loosen the plug (85) to discharge the internal fluid. Confirm that the remaining fluid has been discharged to the safe level, and then remove the plug (85) and drain the internal fluid and residue from the valve.

1.4.2 Fully close the valve.

1.4.3 Remove the bolts (138 and 140), and then remove the gear unit (102) and the connector (92).

1.4.4 After removing the gland nuts (34), gland bolts (36B) and flange (46), remove the gland (7) from the gland plate (144).

1.4.5 Remove the gland plate (144) and then remove the stem (3) together with the stem bearing (67A) and other adjacent parts. (Refer to Figure B below.)

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**Figure B**

[Diagram showing the components: Valve Stem (3), Set Pin (14), Gland Packing (8), Gland Bolt (36A), Gasket (19B), Gland Plate (144), Stem Bearing (67A)]

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In cases where it is difficult to remove the stem, make use of the internally threaded portion provided on the top of the stem and follow the procedures shown below. (Also see the figure below.)

1. Firmly thread the bolt into the internally threaded portion on the top of the stem and secure it with the nut (a).
2. Assemble the wooden board, pipe, steel plate, washer and nut (b) as illustrated below.
3. Tighten the nut (b) clockwise to pull out the stem.

1.4.6 Remove the end plate (147). Remove the adjacent parts of the bottom stem, and then pull out the bottom stem (103).

Internal thread is also provided to the bottom stem. Please refer to the above procedures for the removal of the bottom stem. Figure C shown below illustrates the construction of the bottom stem area.

**Figure C**

- STEAM BEARING (67B)
- BOTTOM STEM (103)
- COVER BOLT (35B)
- GASKET (19C)
- COVER NUT (33B)
- END PLATE (147)
1.4.7 Place the valve on the floor with the body end flange facing to the floor.

1. Loosen the cap nuts (33A) evenly and alternately in a star pattern until the seat springs (143) lose their repulsive force. Especially loosen the last two nuts slowly with special care.

2. Remove the cap nuts (33A) after the seat springs (143) have lost their repulsive force.

3. Some of the ball valves, depending on their size and pressure class, are provided with a lifting lug. As the lifting lug is factory-mounted at the most convenient location, be sure to mark its location during disassembly for the subsequent reassembly.

4. Lift out the body cap (2) slowly, confirming that the ball seat (30) and its adjacent parts are now exposed and left on the ball. If the ball seat and its adjacent parts are still left within the body cap, lightly hammer the body cap, with the ball seat slightly off the ball, to detach the ball seat and its adjacent parts.

Never leave the ball seat adjacent parts within the body cap. Be careful not to lose the removed parts.

1.4.8 The ball port can be viewed from the horizontal direction. Pass a cloth belt through the ball port and slowly lift the ball (4) out of the valve body. Take care not to damage or scratch the ball surface during disassembly, storage and reassembly.

1.4.9 When removing the ball seats (30) from the body and body cap, put an indication mark on each ball seat to make a distinction between the ball seats for the body side and the body cap side.

1.4.10 Remove the retainer gland (175), retainer packing (176) and seat springs (143) from each ball seat (30).
2. Reassembly

2.1 Precautions for reassembly
- Wear protective items such as goggles, gloves and working boots.
- No open flame or smoking shall be allowed in the work area.
- Take care not to catch your fingers or hands during reassembly work.
- Replace the consumable parts, such as gland packing, gaskets and retainer packing for new ones. Reuse of these parts may cause leakage.
- Use an appropriate lifting machine for safety when handling a large size valve.

2.2 Before reassembly

2.2.1 Prepare the new parts for replacement in advance.
- The consumables (gland packing, gaskets, and retainer packing) shall be replaced with the new parts. Replace the ball seats if worn. Lapping of the ball and ball seats shall be performed before reassembly if needed.
- Clean the reuse parts to remove dust, oil and other foreign objects. Remove rusts and dirt from the ball seats and the retainer packing area to ensure the sealing performance.
- Apply METAL GUARD 814 or an equivalent rust preventative to the inner surfaces of the body and body cap, including the stem holes.
- Assemble the valve in a dust-free area.
- Take care not to damage the flange surfaces, ball, ball seats, and stem.
- When performing reassembly, align the matchmarks given before disassembled.
- Securely tighten each bolt and nut.

---

**CAUTION**

- Wear protective items such as goggles, gloves and working boots.
- No open flame or smoking shall be allowed in the work area.
- Take care not to catch your fingers or hands during reassembly work.
- Replace the consumable parts, such as gland packing, gaskets and retainer packing for new ones. Reuse of these parts may cause leakage.
- Use an appropriate lifting machine for safety when handling a large size valve.
- Prepare the new parts for replacement in advance.
- The consumables (gland packing, gaskets, and retainer packing) shall be replaced with the new parts. Replace the ball seats if worn. Lapping of the ball and ball seats shall be performed before reassembly if needed.
- Clean the reuse parts to remove dust, oil and other foreign objects. Remove rusts and dirt from the ball seats and the retainer packing area to ensure the sealing performance.
- Apply METAL GUARD 814 or an equivalent rust preventative to the inner surfaces of the body and body cap, including the stem holes.
- Assemble the valve in a dust-free area.
- Take care not to damage the flange surfaces, ball, ball seats, and stem.
- When performing reassembly, align the matchmarks given before disassembled.
- Securely tighten each bolt and nut.
2.3 Reassembly sequence

2.3.1 Attachment of the body cap bolts

2.3.2 Attachment of the ball seat on the body side

2.3.3 Installation of the ball

2.3.4 Installation of the stem and the bottom stem

2.3.5 Attachment of the ball seat on the body cap side

2.3.6 Attachment of the body cap

2.3.7 Attachment of the adjacent parts of each stem
2.4 Reassembly procedures

2.4.1 Attach the cap bolts (35A) to the valve body (1) and tighten them securely.

2.4.2 According to the figure below, attach the retainer gland (175), seat springs (143), retainer packing (176) and ball seat (30) to the valve body (1).

2.4.3 Lift the ball (4) with a cloth belt and slowly lower it into the valve body (1) with care not to damage or scratch the ball.

2.4.4 Using a hydraulic press, align the stem hole of the ball with the stem hole of the valve body for the correct centering. Provide protection such as a soft pad on the ball to prevent the ball surface from being scratched by the hydraulic press. Attach the stem bearings (67A and 67B) and other adjacent parts to the stem (3) and the bottom stem (103). Then, install the stem (3) and the bottom stem (103) into the body.

2.4.5 Place the ball seat (30), retainer packing (176), retainer gland (175) and the seat springs (143) on the ball (4) carefully. Adjust the center position of the ball seat (30) and the body cap (2) for the correct alignment.

2.4.6 Attach the gasket (19A) to the flange of the body and body cap. Lift the body cap (2) with a crane and place it slowly on the ball seat (30) while centering it with the ball seat. Evenly and alternately tighten the cap nuts (33A) in a star pattern to secure the body cap (2).

2.4.7 Attach the remaining parts around the stems according to Fig. B and Fig. C. Replace the gaskets (19B, 19C and 44) and the packing (8) with new ones.

2.4.8 Make sure that all threaded portions are securely tightened. Retighten them if any loosened parts are found.
### Cross-Sectional Assembly Drawing

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

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<th>No.</th>
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<tr>
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**Detail A**