Operation Manual for Steel Valves
Outline

Safe and efficient operation of industrial installations requires not only complete knowledge of the engineering and functioning of all machinery and equipment but their continuous proper maintenance as well. Improper operation or maintenance of even a single valve, for example, can affect the whole installation. To help you achieve trouble-free valve performance, general information is given here for optimum operation and maintenance of your KITZ gate, globe and check valves.

This manual is prepared for:

Type of valves: Gate, globe and swing check valves
Shell Material: Cast carbon, alloy or stainless steel
Valve Design: Bolted bonnet or cover
              Outside screw and yoke
              Rising stem
              Rising handwheel (for globe valves)
              Non-rising handwheel (for gate valves)
              RF-flanged, butt-welding ends or socket welding ends

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1. Storage of valves

1-1 For storage of valves, select a dust-free and well ventilated place with low humidity. Under no circumstances should valves be stored outdoors.

1-2 Be careful not to damage the valve stems during handling. In case the valves are rack-mounted for storage, their packing chambers should not come directly in contact with the racks. Placing valves directly on the ground or on a concrete floor is not recommended.

1-3 During storage, all valves should be left fully closed (unlikely to the ball valves which should remain in the fully opened position).

1-4 Prior to shipment, blind covers are placed on the inlet and outlet of each KITZ valve for protection from mechanical damage as well as for prevention of the intrusion of dust and other foreign objects into the valve bore during transit. Do not remove end protectors before the valves are installed. If they are found missing during transit, apply an adequate type of end protector immediately.

1-5 Valve surface paint may come off during transit. Adequate painting should be applied to such valve surface according to Table 1.

1-6 Lubricant may be lost or reduced during transit from stem threads or grease nipples. Adequate lubricant should be applied according to Table 1.

1-7 Adequate rust-preventative is recommended to be applied to valve interior and end flange face according to Table 1.

<table>
<thead>
<tr>
<th>Process</th>
<th>Material</th>
<th>Made by</th>
<th>Method</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon &amp; low alloy steel</td>
<td>Interior rust prevention</td>
<td>METAL GUARD 814</td>
<td>Mobil Oil</td>
<td>Spray*</td>
</tr>
<tr>
<td></td>
<td>End flange face rust prevention</td>
<td>RUST VETO 342</td>
<td>E.F.Houghton</td>
<td>Brush*</td>
</tr>
<tr>
<td></td>
<td>Valve surface coating</td>
<td>Heat resistant paint SILVER-L</td>
<td>Kansai Paint</td>
<td>Brush**</td>
</tr>
<tr>
<td>All steel</td>
<td>Exposed stem thread area</td>
<td>Anti-Seize lubricant</td>
<td>Nihon Lock-Tight</td>
<td>Brush</td>
</tr>
<tr>
<td></td>
<td>Grease nipple</td>
<td>Daphne Corronex II</td>
<td>Idemitsu Kosan</td>
<td>Grease pump</td>
</tr>
</tbody>
</table>

* Remove the end protectors before application. Be sure to put the end protectors back after application.
** Remove any existing dust before application.
2. Valve mounting

2-1
First of all, make sure that the correct KITZ steel valves shown in your piping arrangement plans have been prepared, by checking nameplates, identification tags or any other identification marking on the valves.

2-2
As construction sites are usually very dusty, be sure not to remove the valve end protectors before your valves are ready for installation.

2-3
After removal of the end protectors and other valve protective materials, clean the inlets and outlets of both pipes and valves completely so that the gasket faces of end flanges are free from dust, scratches or other irregularities that will affect sealing performance of the valves. In case of welded end valves, butt-welding surfaces and socket weld ends should be free from dust, rust or other irregularities that will affect subsequent welding.

2-4
In the case of globe or check valves, arrows on the valve bodies indicate the direction of fluid flow. Valves should be mounted according to these flow marks.

2-5 Installing flanged end valves:
(1) First align the bolt holes of valve flanges with those of the pipe flanges, then insert the gaskets and tighten the bolts. Inaccurate alignment causes unbalanced tightening of the bolts and consequently excessive stress on the bolts.
(2) Tighten the bolts evenly and alternately on the tangential line. The ends of the tightened bolts should protrude equally beyond the nuts.
(3) After installing the valves, be sure to re-check all bolts and nuts of the coupled flanges and retighten them if found loose.

2-6 Installing welded end valves:
(1) All welding for mounting valves to the pipelines should be made by duly qualified welders or welding operators in accordance with the qualified welding procedures.
(2) Valves should be welded with the disc slightly opened, using weld material (rod or wire) with an appropriate diameter to meet the dimension and shape of the area to be welded, for prevention of overheating valves.
(3) Do socket welding as explained in Figure 1 and Table 2:

Table 2: Minimum Leg of Fillet Weld, Cx

<table>
<thead>
<tr>
<th>Sch. No.</th>
<th>1/2&quot;</th>
<th>3/4&quot;</th>
<th>1&quot;</th>
<th>1-1/2&quot;</th>
<th>2&quot;</th>
</tr>
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<tbody>
<tr>
<td>5S/10S</td>
<td>0.125 (3.2)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>40</td>
<td>0.145 (3.2)</td>
<td>0.159 (4.1)</td>
<td>0.168 (4.3)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>80</td>
<td>0.161 (4.1)</td>
<td>0.168 (4.3)</td>
<td>0.196 (5.0)</td>
<td>0.218 (5.6)</td>
<td>0.238 (6.1)</td>
</tr>
<tr>
<td>160</td>
<td>0.205 (5.3)</td>
<td>0.239 (6.1)</td>
<td>0.273 (7.0)</td>
<td>0.307 (7.8)</td>
<td>0.375 (9.6)</td>
</tr>
</tbody>
</table>

* Unit: inches (mm)

Fig. 1

(4) Conduct butt-welding as illustrated in Figures 2 and 3. In case of Figure 3, tack welding a few places is recommended to avoid misalignment of valves and pipes.
3. Valve operation

3-1
Turn the handwheel clockwise according to the letter, symbol or mark indicating the direction to close gate or globe valves. Turn it counter-clockwise to open them.

3-2
In new valves or if gland packing of old valves is replaced, the handwheel torque may be found relatively high, due to the pile of new packing rings. This, however, will be reduced to a reasonable level after the valves have been operated several times.

3-3
Handwheel operating torque also depends on the type and size of each valve, and its opening position as well. Note that the operating torque is extremely high when a fully closed valve is opened, or when the disc comes close to the extreme of its travel to the fully closed position.

3-4
Be sure to turn the handwheel of gate valve back to the reverse direction by about 90° at the moment when the disc reaches the extreme of its fully closed position. This is particularly important in high temperature service to remove the thermal stress and make valve reopening easier and smoother.

3-5
Gate valves are to be used only in fully opened or closed position, since they are designed only as shut-off valves, but in no way for throttling service as globe valves. Partial opening will vibrate the valve disc and may cause damage to the valve.

3-6
Sometimes foreign objects are found stuck around disc seating areas disturbing full closing of the valve. In such a case, open the valve again to allow fluid flow and try to

[6] Valves should be protected from overheating by means of covering them with wet clothes.

2.7
Finally the valves and pipe interiors should be flushed to remove foreign objects, as they may later cause fluid leakage through the valve seats.

2.8
Consult with a piping engineer to assure that general stress of the pipeline is not concentrated on the valves.

2.9
For the valves mounted on the end of pipelines, installation of drain discharge devices is recommended.
remove all disturbing objects through the valve bore. Check the valve interior if it still does not solve the problem.

3.7
Usage of special tools such as levers or wrenches provided with pipe extensions should be minimized to turn handwheels, as it may damage yokes and discs of valves. Manual gears or valve actuators are recommended to be provided for easier operation of larger size valves.

3.8 Detection of leakage during valve operation:
(1) Leakage may occur through the gland area of a new valve. Gland packing should be tightened according to Section 3.8-(2) of this manual. If a large amount of leakage is detected, or the fluid itself is considered toxic, the valve should be fully opened so that the backseat may be in contact with the gland area to interrupt the leakage temporarily.

(2) Tightening gland bolts is the usual method to stop stem leakage. Care should be taken to tighten them alternately and evenly to avoid one-sided tightening. The torque should be minimized just to stop leakage, since overtightening may cause reduced packing elasticity for lower sealing performance. New packing should be provided if the problem still cannot be solved.

(3) If leakage is detected through flange gaskets, all related bolts and nuts should be retightened according to Section 3.8-(2) of this manual. Replace gaskets if leakage still cannot be stopped.

4. Daily valve inspection

4.1
For safe, undisturbed operation of your valves, daily inspection is very important. The following are the main items of your daily inspection:

(1) Fluid leakage:
  a) from the gland area
  b) from the flange connection
  c) from the threaded area
  d) through the valve body surface
  e) through the welded area

(1) Generation of abnormal noise:
  a) from the valve itself
  b) from the loosened bolting
  c) from the vibrated pipelines

(3) Visual confirmation:
  a) of correct valve operating position
  b) of securely tightened bolting
  c) of adequately fed lubricant around the valve stem

4.2
If any of these problems is detected, remedial measures are to be taken immediately as follows:

(1) Fluid leakage:
  Refer to Section 3.8 of this manual to remedy the leakage from the gland area, flanged connection or threaded area. For the leakage through the valve body surface, a valve repair specialist should be called.

(2) Generation of abnormal noise:
  Abnormal noise can be distinguished easily from the normal noise, if your maintenance engineer gets used to it during daily inspection. For the abnormal noise generated from the valve itself or the pipeline, your piping engineer should be called. Loosened bolts should be immediately retightened.

(3) Valve operating position:
  Make sure to confirm that gate valves are operated in fully open or closed position. No intermediate position is recommended as advised in Section 3.5 of this manual.
5. Periodic valve inspection

5-1
Inspection should be made periodically to detect wear of the body seats, disc seats or stems, corrosion of the valve body or bonnet interior and wear of the threads. Usually, packing and gaskets are replaced after periodic inspections as a part of basic maintenance operation.

5-2 Valve disassembly:
(1) KITZ gate, globe and swing check valves can be disassembled properly according to the illustrations given in Section 8, 9 and 10 of this manual. If bolting is found too tight to be loosened, apply lubricant and leave it for a while for easier unthreading.

(2) Before disassembly, be sure to follow the preliminary procedures below:
   a) Before dismantling valves from the pipeline, mark them adequately with their original locations and positions of valve mounting to avoid confusion or mistake on subsequent valve remounting.
   b) Before disassembly, remove and collect residual objects from the valves, if any, and note their location. Subsequent examination of these records and materials may be found useful for better valve maintenance.
   c) Give adequate identification marks on edges of the coupled flanges for easy recoupling on subsequent valve reassembly. Wedges of gate valves are also recommended to be marked properly so that they may be reassembled in the right direction.

5-3 Examination of valve components:
(1) Soiled valve interior should be cleaned by means of water, steam, acid or solvent before examination.

(2) Examine the invisible internal area with a tube inspector or a small mirror and a flashlight. Seating areas should be carefully examined to detect any failure for possible repair by lapping.

(3) Worn or corroded areas or parts shall be carefully examined visually or, if necessary, with a magnifying glass. The wear or corrosion taking place in the limited area of valve body interior is extremely dangerous, as it may develop concern of leakage. Cracks should also be carefully detected by liquid penetrant examination.

(4) Wall thickness should be periodically measured for recording undesired variation with the passage of time. Use an ultrasonic thickness gauge or dial caliper to measure the wall thickness.

5-4 Valve reassembly:
(1) Clean all the component parts of the disassembled valves and prepare new spare parts such as gland packing and gaskets before reassembly. Be sure to remove rust and other soil from the seat retaining area of the valve body to have satisfactory sealing performance.

(2) Reassemble the valves in reversal of the procedures taken for disassembly of valves.

5-5 Tests and inspections:
(1) Check the valve operating conditions by fully opening and closing several times. The first operation will probably have relatively higher torque, which shall be reduced after several times of operation.

(2) All valves, after reassembly, should be subjected to hydrostatic shell test and, if necessary, pneumatic seat test as well to insure the valve performance for final acceptance.
6. Maintenance of valve component parts

6-1 Replacement of gland packing:

(1) Even when valves have no failure such as leakage, the gland packing should be replaced preferably every 2 to 3 years to reduce valve operating torque and to prevent stem wear. It is recommended to replace gland packing on every periodic inspection of your valves as suggested in Section 5 of this manual.

(2) Make sure, first of all, that gland packing is suitable for the maximum working pressure and temperature of the process, and the kind of the fluid being handled. Refer to KITZ valve drawings and technical data of your plant process for correct selection of packing materials.

(3) Select a proper tool to remove packing so as not to damage the valve stem and valve packing chamber (or stuffing box).

(4) Clean the valve stem and valve packing chamber carefully.

(5) Normally, packing should be as thick as half the difference between the inside diameter of the packing chamber and the valve stem diameter. If no such packing is available, slightly thicker packing will do, but thinner packing is not recommended under any circumstances.

(6) Cut the packing with a 30° incline preferably, with a sharp cutting device. (Figure 4) Each piece of packing must be sized properly so that both ends may meet one another with correct dimension.

(7) Load packing to half the depth of the packing chamber, and press them down once. Then load the remaining packing and tighten them securely. Loading all packing at a time is not recommended. All gland packing should be located so that the seams are 120° apart from each other. This will place the seam of the fourth packing ring in the same vertical position as the first one. (Figure 5)

(8) Gland packing is usually tightened to a position 3 to 4 mm below the top end of the packing chamber. If leakage occurs, tighten the packing further down until leakage stops.

6-2 Lapping valve component parts:

(1) Repair of valve component parts such as discs and seats seldom required for valve operation under normal working conditions. Follow the instructions below if it is required:

(2) Materials and tools:
   a) Lapping powder:
      - Carborundum 400 to 600 mesh for rough finish.
      - Carborundum 800 to 1200 mesh for fine finish.
   b) Inspection paste:
      - Mixture of vegetable oil and red lead.
   c) Lapping plate:
      - Tools are to be made of high quality cast iron with 240 Brinell hardness with no casting blowholes.
      - Diameter of the lapping plate is 5 to 10 mm larger than the surface of the part to lap.

(3) Lapping procedures:
   a) Though valves may be lapped either in or out of the pipelines, we recommend valves be dismantled out of line so lapping is easier and gives better service.
   b) Be sure to clean the part to be lapped carefully before lapping.
   c) Apply an adequate amount of the mixture of lapping powder and vegetable oil.
d) While lapping, apply a pressure of 1 kgf/cm² to the lapping plate. Excessive surface pressure will make lapping too fast and cause galling.

e) Lapping should be carried out until the whole surface becomes flat for even and tight contact. Do not keep lapping the same place too long, as it may affect the flatness of the lapping plate.

f) After lapping, wipe the lapped area with a piece of cloth and carefully check the surface finish. Apply the inspection paste to a precision surface plate or a new lapping plate, press and gently move it left and right a few times against the lapped surface by 10° or 15°, and check the result of your lapping work.

g) Figures 6 to 10 show how the lapping plate should contact the valve parts for proper lapping.

7. Adjustment of fitting position of manual gear operator

To move the mounting position of manual gear box, open the valve half way, remove mounting bolts, turn the gear box to the desired position, which can be moved every 90°, and tighten the bolts again. (Figure 11)
8. Exploded view of gate valve

Fig. 12

1. Body
2. Bonnet
3. Stem
4. Disc
5. Gland
6. Gland Packing
7. Handwheel
8. Wheel Nut
9. Name Plate
10. Body Gasket
11. Body Seat Ring
12. Bonnet Nut
13. Gland Nut
14. Bonnet Bolt
15. Gland Bolt
16. Bonnet Bush
17. Set Screw
18. Gland Bolt Pin
19. Yoke Sleeve
20. Gland Flange
21. Sleeve Nut
22. Grease Nipple
9. Exploded view of globe valve

Fig. 13

- Body
- Bonnet
- Stem
- Disc
- Lock Nut
- Gland
- Gland Packing
- Handwheel
- Wheel Nut
- Name Plate
- Gasket
- Body Seat Ring
- Stem Washer
- Bonnet Nut
- Gland Nut
- Bonnet Bolt
- Gland Bolt
- Yoke Bush
- Bonnet Bush
- Gland Bolt pin
- Gland Flange
10. Exploded view of swing check valve

Fig. 14

1. Body  
2. Cover  
3. Disc  
4. Disc Nut  
5. Split Pin  
6. Name Plate  
7. Hinge Pin  
8. Plug  
9. Gasket  
10. Body Seat Ring  
11. Cover Nut  
12. Cover Bolt  
13. Gasket  
14. Arm  
15. Washer
11. Handling motor operated valves

11-1 Operation of electric actuators:
For operation and maintenance of any electric actuator mounted on KITZ steel valves, only the operation manual provided by relevant actuator manufacturer should be referred to as its reliable guide. In case any electric actuator is factory-mounted on KITZ steel valves at KITZ’s own option, such actuator operation manual shall be supplied by KITZ Corporation.

11-2 Handling motor operated valves:
For safe transportation, move the whole assembly by means of passing belts or ropes around the valve bodies. Neither belts nor ropes should be applied around the actuator for this purpose. Before mounting to the pipelines, actuators should be carefully examined to detect damages of bodies, loosened bolts and any other mechanical failure.

11-3 Electric wiring:
(1) Prior to shipment, blind plugs are placed on all electric inlets and outlets of actuators for mechanical protection and dust prevention. Do not remove these blind plugs until the valves are mounted to the pipeline.

(2) Make sure that the power supply conforms with your design requirement and electric connection is done correctly according to your wiring diagram.

(3) Care should be taken to avoid mishandling that may cause short circuit. Electricity should be turned off when the switch covers are opened.

(4) Operate the valves manually to their fully open and closed position before electric actuators are operated, to assure safe and undisturbed operation of the assembly in advance.

(5) Limit switches and torque switches of the actuators have been adequately adjusted before shipment by the manufacturer. For readjustment of these switches, the actuator manufacturer or his agent should be contacted for appropriate advice in advance.

11-4 Maintenance of electric actuator:
(1) All boltings should be checked periodically and retightened when necessary.

(2) Clean the valve stem periodically and apply the lubricant for smooth operation of the assembly.