1 STORAGE AND HANDLING

1.1 Storage
When valves are to be stored for some time (2 months or more) before being fitted, storage should be in the original delivery crates or cases.

1.1.1 Storage conditions
The valves should be stored off the ground in a clean, dry indoor area. Protect the valve from temperature and humidity extremes, and exposure to excessive dust, moisture, vibration, deformations, sunlight and ozone.

Recommendations
1. Temperature: storage temperature below 25°C (77°F), above 0°C (32°F) preferable below 15°C (59°F).
2. Humidity: storage conditions should be such that condensation does not occur, store in a dry environment. Maximum 50% relative humidity.
3. Light: valve elastomers should be protected from light, in particular direct sunlight or strong artificial light with high ultra violet.
4. Ozone: storage rooms should not contain any equipment generating ozone. E.g. lamps, electric motors.

1.2 Handling
To prevent damage during handling, the valves should be lifted by hand or using appropriate lifting equipment. Do not fasten lifting devices around the valve operating shaft, actuator or through the valve waterway. The valve should be lifted with chains or slings which are fastened to rods or bolts which go through the bolt holes in the body flanges. The valves should be protected from external events e.g. (bumps, hitting and vibration) during transport. Any flange protection caps need to be removed before the valve is mounted in the pipeline. Lift the valve with great care from the transport package (crate, pallet). While handling or installing the valve, ensure that no damage occurs to the valve, the pneumatic/electrical/hydraulic actuator or other instrumentation.

2 SPARE PARTS
Only original Keystone spare parts are allowed to be used. Safe operation cannot be guaranteed if third party spare parts are used.
3 INSTALLATION

WARNING!
For safety reasons, it is important to take the following precautions before you start work on the valve:

1. Personnel making any adjustments to the valves should utilize suitable equipment. All required personal protection means should be worn.
2. The line must be depressurized before installing the valve.
3. Installation and handling of valves should be done only by personnel who are trained in all aspects of manual and mechanical handling techniques.
4. Misuse of the valve is not allowed. For example: the valve, handles, actuators or other parts may not be used as ‘climbing tools’.
5. Ensure that valve pressure/temperature limitations marked on the identification tag are within the service conditions. The trim number on the valve’s nameplate identifies the valve materials. See Product Manual for valve specific P/T diagram and trim number definition.
6. Ensure that valve materials are compatible with the pipeline fluid.

3.1 Visual valve inspection

1. Confirm that the materials of construction listed on the valve nameplate are appropriate for the service intended and are as specified.
2. Tag/name plate identification
   - Manufacturer: Keystone
   - Model: Series GRW or GRL
   - Nominal size: DN or NPS
   - M.P.W.P.: Maximum permissible working pressure
   - Flange compatibility: e.g. ANSI 125/150 PN 10/16
   - Temperature: e.g. -40/120°C (-40/250°F)
   - Trim: Materials of construction

3.2 Flange and pipe compatibility

Check matching of flange drilling pattern of valve and pipe before assembly. Flanges have to meet the following requirements [see Figure 1]:

- If the flange (or pipe) is provided with a raised face, the diameter of this shall be at least 8 mm larger than the YY-dimension of the valve.
- The use of the flange-gaskets is not allowed since it might damage the valve.
- The Keystone seat-face design eliminates the need for the gaskets.
- Use flange bolting in accordance with appropriate standard.

Do not use flange gaskets, as this could lead to valve damage!

3.3 Valve installation

The valves are bi-directional and may be installed in either direction relative to the flow. The valve will control flow equally in either direction. The recommended installation position is shaft horizontal and the lower disc edge opening down-stream. (Especially for slurry service and media with a tendency for sedimentation). For optimum valve control and smooth performance, it is recommended to have a 10 to 20 pipe diameters of straight run inlet piping and 3 to 5 pipe diameters straight outlet piping.

A valve is not a crow-bar. Do not use the valve to spread the flanges. Seat damage might result.
NOTES
• The valve can be installed in the pipe-line either with or without the actuator mounted on top of the valve. Make sure to turn the disc slowly in the event there is a mismatch causing the disc to touch the adjacent piping.
• It is the responsibility of the valve user and not the valve manufacturer to ensure that the pipeline system has been built professionally and the valve has been properly installed.
• Adjacent piping must be positioned so that minimal piping stresses are transmitted to the valve flanges during or after installation.
• Handling and lifting of the valves during installation MUST be performed following the same instructions described in previous section ‘1.2 Handling’.

IMPORTANT
Mating flange faces should be in good condition and free of dirt and/or inclusions and pipe insides should be well cleaned.

3.3.1 Existing system (see Figure 2)
1. Check whether the flange distance meets the valve face-to-face dimensions. Spread the flanges with adequate tooling for easy insertion of the valve.
2. In case of a wafer valve, insert some flange bolts in the pipe flanges, to help you hold the valve after insertion.
3. Close the valve so that the disc edge is at least 10 mm (⅜”) within the body.
4. Insert the valve between the flanges, center the valve body and insert all flange bolts. Tighten the flange-bolts hand tight.
5. Slowly open the valve completely. (The disc is in line with parallel flats or keyway in shaft head. Keyway points towards disc edge.)
6. Maintain the valve flange alignment while gradually removing the flange-spreaders and tighten the flange-bolts hand tight.
7. Slowly close and open the valve to check for adequate disc clearance.
8. Cross-tighten all bolting to the proper torque. Do not over tighten.

3.3.2 New system (see Figure 2)
1. With the disc in the near-closed position, center each mating flange with the valve body. Fix the body with some flange-bolts and tighten the bolts.
2. Use the flange-valve-flange assembly for fit-up and centering to the pipe.
3. Tack-weld the flanges to the pipe.
4. Remove the bolting and remove the valve from between the flanges.

IMPORTANT
Do not finish-weld the flanges to the pipe with the valve bolted between the flanges as this will result in serious heat-damage to the seat.

5. Finish-weld the flanges to the pipe and allow the flanges to cool completely.
6. Install the valve now according to the procedure for installing in existing systems.

3.4 Valve verification
Check the operation of the valve by operating it to ‘full open’ and ‘full close’. To verify the valve operation, the disc position indicator on the actuator or the handle should rotate between the ‘full open’ and ‘full close’ indicators on the actuator or throttle plate. For normal installation the valve disc travels clockwise to close.
3.5 Sources of possible danger

This section contains some examples of possible foreseen danger sources.

3.5.1 Mechanical
A. When manual operators are used, available space should be checked in order to avoid hands being clamped.
B. Mechanical sparks caused on impact of valve and e.g. tooling, are a potential source of ignition of surrounding atmosphere.

3.5.2 Electrical
If static charges or stray electrical currents can initiate explosions, the valve should be grounded to earth.

3.5.3 Thermal
A. Isolation should be used on valves with application temperatures > +40°C (+104°F) and < -20°C (-4°F) to prevent them from being touched (to avoid burning).
B. If the valve is used in hot gas/liquid applications that might give exothermic reactions, precautions must be taken so that the valve surface cannot lead to danger for people or the direct environment. In dust and possible explosion zones, the operation temperatures and ignition temperatures for dust should be reviewed.

3.5.4 Operational
Closing a valve too fast may result in water hammer in the upstream part of the pipeline. Water hammer results in excessive stresses in the valve and will cause severe damage. Water hammer should be avoided in all circumstances.

Due to differential pressure across the valve disc, butterfly valves have the tendency to be closed by the flow. Take care when unlatching the valve operating mechanism.

**FIGURE 2**

**EXISTING SYSTEM**

1. Spread the flanges with the adequate tooling. Insert some flange bolts to hold the valve.
2. Open the valve and remove the flange spreads.
3. Close the valve clockwise, return to open position and cross-tighten all bolting.

**NEW SYSTEM**

1. Center a flange-valve-flange assembly between the pipes.
2. Tack weld the flanges to the pipes.
3. Remove the valve and finish weld. Install the valve according to the procedure in the left column.
3.6 TROUBLESHOOTING GUIDE

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Possible case</th>
<th>Resolution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Valve would not rotate</td>
<td>1. Actuator has failed</td>
<td>1. Replace or repair</td>
</tr>
<tr>
<td></td>
<td>2. Valve packed with debris</td>
<td>2. Flush or clean valve to remove debris</td>
</tr>
<tr>
<td>Valve leaking</td>
<td>1. Valve not fully closed</td>
<td>1. Close valve, check actuator stop settings</td>
</tr>
<tr>
<td></td>
<td>2. Debris trapped in valve</td>
<td>2. Cycle and flush (with valve open) to remove debris</td>
</tr>
<tr>
<td></td>
<td>3. Seat is damaged</td>
<td>3. Replace seat</td>
</tr>
<tr>
<td>Jerky operation</td>
<td>1. Extreme dry application</td>
<td>1. Put some silicone oil on seat or increase size of actuator</td>
</tr>
<tr>
<td></td>
<td>2. Air supply actuator inadequate</td>
<td>2. Increase air supply pressure and/or volume</td>
</tr>
</tbody>
</table>

7. Pull the lower shaft out of the body (a threaded hole is provided in the end of the shaft). [See Table 1 for tapped hole dimensions]
8. Remove the disc by pulling or ‘rolling’ out of the seat bore.
9. Remove the seat from the body: pry under both seat edges at one point, collapse the seat into the shape of a round bottom heart configuration and pull the seat out of the body bore.
10. Remove bearings from shaft bores.

4.4 Valve assembly (see Figure 3)
1. Clean all parts. Use silicone grease on the disc to facilitate the assembly.
2. Mount the two shaft bearings close to the bore of the body.
3. If removed before, re-assemble the packing in the body.
4. Collapse the seat in the shape of a round bottom heart and firmly place the ‘bottom’ part of the seat into position in the body. Align the holes in the seat properly with the holes in the body.
5. Fit the circlip to the groove in the upper shaft.
6. Insert the upper shaft with sufficient (silicone) grease so that it protrudes approximately 10 mm (⅜”) into the inside bore of the seat. Insert the lower shaft with sufficient (silicone) grease so that it is flush with the inside bore of the seat. Install the disc, with the hexagonal bore to the top. Insert the disc in the seat with the shaft bore on the topside against the shaft, leaving the bottom part of the disc just outside the seat. Ensure the keyway or parallel flats on shaft are aligned to the disc edge.
7. Insert the shafts completely using a rotating pressure on the shaft, and a rotating motion on the disc. Pay special attention in order that the seat is not damaged due to any misalignment of stem holes.
8. Put some sealant on the plug and screw it into the lower shaft bore.
9. Fit the bushing over the top of the shaft and into the top of the body. Retain it in place with the circlip.
10. Mount the actuation.

4.5 Re-installing the valve
See section 3.3.1
KEYSTONE SERIES GR RESILIENT SEATED BUTTERFLY VALVES GRW/GRL
INSTALLATION AND OPERATION MANUAL

SERIES GRW (WAFFER)
DN 50-300 (NPS 2-12)

PARTS LIST

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Body</td>
</tr>
<tr>
<td>2</td>
<td>Disc</td>
</tr>
<tr>
<td>3</td>
<td>Upper shaft</td>
</tr>
<tr>
<td>4</td>
<td>Lower shaft</td>
</tr>
<tr>
<td>5</td>
<td>Seat</td>
</tr>
<tr>
<td>6</td>
<td>Upper bushing</td>
</tr>
<tr>
<td>7</td>
<td>Shaft seal</td>
</tr>
<tr>
<td>8</td>
<td>Plug</td>
</tr>
<tr>
<td>9</td>
<td>Shaft circlip</td>
</tr>
<tr>
<td>10</td>
<td>Body circlip</td>
</tr>
<tr>
<td>11</td>
<td>Upper and lower bearing</td>
</tr>
</tbody>
</table>

SERIES GRL (LUGGED)
DN 50-300 (NPS 2-12)

FIGURE 3

PARTS LIST

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Body</td>
</tr>
<tr>
<td>2</td>
<td>Disc</td>
</tr>
<tr>
<td>3</td>
<td>Upper shaft</td>
</tr>
<tr>
<td>4</td>
<td>Lower shaft</td>
</tr>
<tr>
<td>5</td>
<td>Seat</td>
</tr>
<tr>
<td>6</td>
<td>Upper bushing</td>
</tr>
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<td>7</td>
<td>Shaft seal</td>
</tr>
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<td>8</td>
<td>Plug</td>
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<td>9</td>
<td>Shaft circlip</td>
</tr>
<tr>
<td>10</td>
<td>Body circlip</td>
</tr>
<tr>
<td>11</td>
<td>Upper and lower bearing</td>
</tr>
</tbody>
</table>
5 MAINTENANCE BUTTERFLY VALVES SERIES
GRW/GRL DN 350-900 (NPS 14-36)

The Keystone Series GRW/GRL butterfly valves are designed to require a minimum of maintenance.

WARNING! See section 4!

5.1 Routine maintenance
See section 4.1

5.2 Removing the valve from the pipe system
See section 4.2

5.3 Valve disassembly (see Figure 4)
1. Turn the disc to almost open position.
2. Remove actuator.
3. Remove the disc screw with the O-ring from the disc.
4. Remove the circlip from the top of the body.
5. Pull the shaft out of the body.
6. Remove the bushing, shaft seals and circlip from the top of the shaft.
7. Remove the disc by pulling or ‘rolling’ out of the seat bore.
8. Into the shape of a round bottom heart configuration and pull the seat out of the body bore.
9. Remove circlip from the bottom body plug and pull the plug out of the body.
10. Remove the O-ring from the plug.
11. Remove bearings from shaft bores.

5.4 Valve assembly (see Figure 4)
1. Clean all parts.
2. Fit bearings into shaft bores (2 bearings are to be installed close to the bore of the body and 2 bearings at the outer ends of the shaft bores). Collapse the seat in the shape of a round bottom heart firmly place the ‘bottom’ part of the seat into position in the body. Align the holes in the seat properly with the holes in the body.
3. Fit the shaft circlip to the groove in the shaft.
4. Insert the shaft with sufficient [silicone] grease so that it protrudes approximately 10 mm (⅜”) into the inside bore of the seat. Install the disc, with the disc screw holes toward the valve top-plate, by inserting the disc in the seat with the shaft bore on the topside against the shaft, leaving the bottom part of the disc just outside the seat. Push the bottom part of the disc in place with a twisting motion.
5. Insert the shaft completely using a rotating pressure on the shaft, and a rotating motion on the disc. Pay special attention in order that the seat is not damaged due to any misalignment of stem holes.
6. Align the counter-drilled position of the shaft with the disc screw hole. Place the O-ring on the disc screw. Apply thread locking compound around disc screw thread. Install the disc screw and tighten securely. [see Table 2 for suggested tightening torques]
7. Place the O-ring onto the bottom plug. Place the plug into the body and position it with a circlip.
8. Place the shaft seals on the inside and outside of the bushing then fit it over the top of the shaft and into the top of the body. Retain it in place with the circlip body.
9. Mount the actuator.

5.5 Re-installing the valve
See section 3.3.1

TABLE 2 - Recommended disc screw tightening torques

<table>
<thead>
<tr>
<th>DN</th>
<th>Valve size</th>
<th>NPS</th>
<th>Tightening torque</th>
<th>Nm</th>
<th>ft•lbs</th>
</tr>
</thead>
<tbody>
<tr>
<td>350-400</td>
<td></td>
<td>14-16</td>
<td></td>
<td>140</td>
<td>103</td>
</tr>
<tr>
<td>450-500</td>
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<td>18-20</td>
<td></td>
<td>270</td>
<td>200</td>
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<tr>
<td>600-800</td>
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<td>24-32</td>
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<td>470</td>
<td>347</td>
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<tr>
<td>900</td>
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<td>36</td>
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<td>1270</td>
<td>937</td>
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**PARTS LIST**

<table>
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<tr>
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<tbody>
<tr>
<td>1.</td>
<td>Body</td>
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<tr>
<td>2.</td>
<td>Disc</td>
</tr>
<tr>
<td>3.</td>
<td>Shaft</td>
</tr>
<tr>
<td>4.</td>
<td>Seat</td>
</tr>
<tr>
<td>5.</td>
<td>Disc screw</td>
</tr>
<tr>
<td>6.</td>
<td>Disc screw O-ring</td>
</tr>
<tr>
<td>7.</td>
<td>Plug</td>
</tr>
<tr>
<td>8.</td>
<td>Plug circlip</td>
</tr>
<tr>
<td>9.</td>
<td>Plug O-ring</td>
</tr>
<tr>
<td>10.</td>
<td>Bushing</td>
</tr>
<tr>
<td>11.</td>
<td>Body circlip</td>
</tr>
<tr>
<td>12.</td>
<td>Shaft circlip</td>
</tr>
<tr>
<td>13.</td>
<td>Body O-ring</td>
</tr>
<tr>
<td>14.</td>
<td>Shaft O-ring</td>
</tr>
<tr>
<td>15.</td>
<td>Bearing</td>
</tr>
<tr>
<td>16.</td>
<td>Parallel key</td>
</tr>
</tbody>
</table>

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**FIGURE 4**