High Pressure Valve Series for Hydrogen Stations

KITZ Clean Energy Supply Technology for Future Generation

KITZ CLESTEC®-Series
High Pressure Valve Series for Hydrogen Stations

KITZ started the development of low cost highly durable 70 MPa class high pressure ball valves for hydrogen from 2008. Substantiating the performance through various demonstration tests, KITZ finally completed a “103 MPa trunnion mounted type metal/soft seat ball valve with excellent sealing performance and durability less subjected to the influence of fluid temperature.” In addition, manual needle valves and in-line check valves with a Cv-value of 1.1 were added to form a line-up known as the KITZ CLESTEC®-Series (High Pressure Valve Series for Hydrogen Stations)!

“KITZ CLESTEC®-PROJECT”
As a joint enterprise of the group, development has been conducted by KITZ, manufacturing by KITZ SCT and Perrin GmbH, and sales promoted by the whole group.
Features of Ball Valves

1. DLC coated metal seat structure
   An excellent durability has been achieved by incorporating DLC coating which sufficiently endures the high loads (surface pressure) generated by fluid pressure of 103 MPa and does not degrade the super precision machining on stem/ball and seat portions.
   * DLC: Diamond-Like Carbon

2. Metal seat structure less susceptible to variation of hydrogen temperature
   Selection of ball-seat types available in accordance with the intended use.
   (i) Metal Seat:
       High durability (Open/Close operation durability: 40,000 cycles) has been achieved. Allowable leakage: 10 cc/min.
   (ii) Soft Seat:
       High sealing performance has been achieved. Allowable leakage: 0 cc/min. (at shipment), 0.3 cc/min. (after 20,000 cycles of operation)

3. No restriction on flow directions provided by the symmetric structure (Metal seat only)
   Improved freedom of pipework layout based on no restriction on flow directions.

4. Cv-value almost 10 times as high as needle valve (in-house comparison)
   Cv-value 2.1 (for 9/16” 40,000 psi)

KITS Product Code
Metal Seated Ball Valve : KH19-M
Soft Seated Ball Valve : KH19-S

Specifications of Ball Valves

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum Allowable Pressure</td>
<td>103 MPa: 85 °C</td>
</tr>
<tr>
<td>Fluid Temperature Range</td>
<td>-50 to +85 °C</td>
</tr>
<tr>
<td>Cv-Value</td>
<td>2.1 (for 9/16” 40,000 psi)</td>
</tr>
<tr>
<td>Body Material</td>
<td>F316/F316L-1.4401/04</td>
</tr>
<tr>
<td>Fitting</td>
<td>Coned &amp; Thread</td>
</tr>
<tr>
<td>Actuator</td>
<td>Manual/Automatic (Pneumatic Spring Return)</td>
</tr>
</tbody>
</table>

Actuator Specifications

<table>
<thead>
<tr>
<th>Specification</th>
<th>Setting</th>
</tr>
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<tbody>
<tr>
<td>Operating Fluid</td>
<td>Instrumentation Air</td>
</tr>
<tr>
<td>Operation Pressure Range</td>
<td>0.4 to 0.6 MPa</td>
</tr>
<tr>
<td>Pressure Resistance of Cylinder</td>
<td>0.98 MPa</td>
</tr>
<tr>
<td>Volume of Cylinder (L)</td>
<td>0.14 L</td>
</tr>
<tr>
<td>Operation Temperature Range</td>
<td>-20 °C to +60 °C</td>
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</tbody>
</table>

Component List

<table>
<thead>
<tr>
<th>P/N</th>
<th>Parts Name</th>
<th>Material</th>
</tr>
</thead>
<tbody>
<tr>
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<td>Operation Temperature Range</td>
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</tr>
</tbody>
</table>
2. Metal seat structure less susceptible to corrosion.

(i) Metal Seat
(ii) Soft Seat

Features of Ball Valves

KITZ Product Code
Metal Seated Ball Valve: KH19-M

* DLC: Diamond-Like Carbon

(i) Soft Seat

- Improved freedom of pipework layout based on no restriction on flow directions.
- Increased possibility of upstream installation (after 20,000 cycles of operation), leakage: 10 cc/min.

(ii) Metal Seat

- Symmetric structure (Metal seat only)
- Endures the high loads (surface pressure)
- An excellent durability has been achieved by variations of hydrogen temperature

Ball Valve

- Material: F316/F316L-1.4401/04
- Stem: 1.4308

Actuator Specifications

- Manual Valve
- Actuator: Manual/Automatic (Pneumatic Spring Return)
- Fitting: Coned & Thread
- Body Material: F316/F316L-1.4401/04
- Fluid Volume of Cylinder: 0.14 L
- Pressure Resistance of Cylinder: 0.98 MPa
- Operation Pressure Range: 0.4 to 0.6 MPa
- Operating Fluid: Instrumentation Air

Table of Specifications

- Nominal Size: 9/16, 3/8, 1/4
- Tubing End: Inch, Metric
- Specification: 20,000 psi, 60,000 psi
- Material: F316/F316L-1.4401/04
- Actuator Specifications: Manual/Automatic
- Weight: 2.8 kg

Component List

- P/N: Parts Name | Material
  1. Body | F316/F316L-1.4401/04
  2. Body Cap | F316/F316L-1.4401/04
  3. Retainer Ring | F316/F316L-1.4401/04
  4. Ball | 2.4856 + DLC
  5. Spacer Ring | 2.0936
  6. Bottom Cover | F316/F316L-1.4401/04
  7. Bearing | 2.0936
  8. Disk Spring | A187 TYPE316
  9. O-Ring | EPDM
  10. Back-Up Ring | PTFE-25% GLAS
  11. Seat Retainer | 2.1247 + DLC
  12. Gasket | 2.0090
  13. Stem Sealing | KITZ Standard
  14. Lever | 1.4308
  15. Hex. Screw M6x25 | A2.70
  16. Hex. Nut M6 | A4
  17. Gland | A479 TYPE316
  18. Collar | A479 TYPE316

Table of Component List

- P/N: Parts Name | Material
  1. Body | F316/F316L-1.4401/04
  2. Body Cap | F316/F316L-1.4401/04
  3. Retainer Ring | F316/F316L-1.4401/04
  4. Ball | 2.4856 + DLC
  5. Spacer Ring | 2.0936
  6. Bottom Cover | F316/F316L-1.4401/04
  7. Bearing | 2.0936
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  14. Lever | 1.4308
  15. Hex. Screw M6x25 | A2.70
  16. Hex. Nut M6 | A4
  17. Gland | A479 TYPE316
  18. Collar | A479 TYPE316

Table of Dimension

- Nominal Size: 9/16, 3/8, 1/4
- Tubing End: Inch, Metric
- Specification: 20,000 psi, 60,000 psi
- Material: F316/F316L-1.4401/04
- Actuator Specifications: Manual/Automatic
- Weight: 4.5 kg

Table of Component List

- P/N: Parts Name | Material
  1. Body | F316/F316L-1.4401/04
  2. Body Cap | F316/F316L-1.4401/04
  3. Retainer Ring | F316/F316L-1.4401/04
  4. Ball | 2.4856 + DLC
  5. Spacer Ring | 2.0936
  6. Bottom Cover | F316/F316L-1.4401/04
  7. Bearing | 2.0936
  8. Disk Spring | A187 TYPE316
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  16. Hex. Nut M6 | A4
  17. Gland | A479 TYPE316
  18. Collar | A479 TYPE316

Table of Dimension

- Nominal Size: 9/16, 3/8, 1/4
- Tubing End: Inch, Metric
- Specification: 20,000 psi, 60,000 psi
- Material: F316/F316L-1.4401/04
- Actuator Specifications: Manual/Automatic
- Weight: 4.5 kg

Table of Component List

- P/N: Parts Name | Material
  1. Body | F316/F316L-1.4401/04
  2. Body Cap | F316/F316L-1.4401/04
  3. Retainer Ring | F316/F316L-1.4401/04
  4. Ball | 2.4856 + DLC
  5. Spacer Ring | 2.0936
  6. Bottom Cover | F316/F316L-1.4401/04
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  8. Disk Spring | A187 TYPE316
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  16. Hex. Nut M6 | A4
  17. Gland | A479 TYPE316
  18. Collar | A479 TYPE316

Table of Dimension

- Nominal Size: 9/16, 3/8, 1/4
- Tubing End: Inch, Metric
- Specification: 20,000 psi, 60,000 psi
- Material: F316/F316L-1.4401/04
- Actuator Specifications: Manual/Automatic
- Weight: 4.5 kg

Table of Component List

- P/N: Parts Name | Material
  1. Body | F316/F316L-1.4401/04
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  16. Hex. Nut M6 | A4
  17. Gland | A479 TYPE316
  18. Collar | A479 TYPE316
Needle Valves

Features of Needle Valves

1. Needle valve incorporates non-rotational structure
The adopted non-rotational structure secures an excellent sealing performance by preventing galling or scratching due to the up/down sealing motion of a valve body while rotating.

2. Secure shaft sealing structure

KITZ Product Code
HNV6

Specifications of Needle Valves

- Maximum Allowable Pressure: 103 MPa: 85°C
- Fluid Temperature Range: -40 to +85°C
- Cv-Value: 0.23 (for 3/8 60,000 psi)
- Body Material: ASTM A276 TYPE316
- Fitting: Coned & Thread
- Actuator: Manual

Component List

- P/N
- Parts Name
- Material
  1. Body
  2. Needle
  3. Gland Ring
  4. Gland Packing A
  5. Cap
  6. Washer
  7. Hexagon Nut
  8. Sleeve
  9. Bar Handle
  10. Gland Packing B
  11. Gland
  12. Hexagon Nut
  13. Hexagon Socket Head Set Screw
  14. Gland
  15. Collar

Dimensions Table

<table>
<thead>
<tr>
<th>Nominal Size</th>
<th>Inch Tubing End</th>
<th>d</th>
<th>d1</th>
<th>d2</th>
<th>d3</th>
<th>d4</th>
<th>R</th>
<th>H</th>
<th>H1</th>
<th>H2</th>
<th>D1</th>
<th>L</th>
<th>L1</th>
<th>S2</th>
<th>Weight</th>
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</thead>
<tbody>
<tr>
<td>3/8</td>
<td>3/8” 60,000 psi</td>
<td>3.2</td>
<td>6.6</td>
<td>3.4” 16UNF</td>
<td>13.5</td>
<td>15.7</td>
<td>60</td>
<td>104 (Full Open)</td>
<td>19</td>
<td>25</td>
<td>76</td>
<td>70</td>
<td>38</td>
<td>35</td>
<td>1.5 kg</td>
</tr>
<tr>
<td>1/4</td>
<td>1/4” 20,000 psi</td>
<td>2.8</td>
<td>4.8</td>
<td>1/4” 20UNF</td>
<td>7.1</td>
<td>12.7</td>
<td>60</td>
<td>104 (Full Open)</td>
<td>19</td>
<td>25</td>
<td>76</td>
<td>70</td>
<td>38</td>
<td>35</td>
<td></td>
</tr>
<tr>
<td>1/4</td>
<td>1/4” 60,000 psi</td>
<td>2.4</td>
<td>4.3</td>
<td>1/4” 18UNF</td>
<td>9.7</td>
<td>11.2</td>
<td>60</td>
<td>104 (Full Open)</td>
<td>19</td>
<td>25</td>
<td>76</td>
<td>70</td>
<td>38</td>
<td>35</td>
<td></td>
</tr>
<tr>
<td>3/8</td>
<td>3/8” 20,000 psi</td>
<td>3.2</td>
<td>7.9</td>
<td>3/8” 18UNF</td>
<td>9.7</td>
<td>15.7</td>
<td>60</td>
<td>104 (Full Open)</td>
<td>19</td>
<td>25</td>
<td>76</td>
<td>70</td>
<td>38</td>
<td>35</td>
<td></td>
</tr>
</tbody>
</table>
Check Valves

Features of Needle Valves

1. Needle valve incorporates non-rotational structure
   - The adopted non-rotational structure secures an excellent sealing performance by preventing galling or scratching due to the up/down sealing motion of a valve body while rotating.

2. Secure shaft sealing structure
   - H1

Specifications of Needle Valves

- KITZ CLESTEC®
- Features of Needle Valves
- KITZ Product Code
- H1
- HNV6
- Inch Tubing End
- 3/8" 20,000 psi
- 1/4" 60,000 psi
- 9/16"-18UNF
- 9/16"-18UNF
- 3/4"-16UNF
- 9/16"-18UNF
- 9/16"-18UNF
- 7/16"-20UNF
- 3/4"-16UNF
- 103 MPa: 85°C
- Fluid Temperature Range
- Maximum Allowable Pressure
- Maximum Cracking Pressure
- 0.01 MPa
- Body Material
- ASTM A276 TYPE316
- Minimum Sealing Pressure
- 10.0 MPa
- Fitting
- Coned & Thread
- Cv-Value
- 1.1 (for 9/16 40,000 psi)
- Cv-value
- 1.1 has been achieved.
- Specifications of Check Valves
- Fluid Temperature Range
- -40 to +85°C
- Minimum Sealing Pressure
- 10.0 MPa
- Fitting
- Coned & Thread
- Cracking Pressure
- 0.01 MPa
- Maximum Allowable Pressure
- 103 MPa: 85°C
- Cv-Value
- 1.1
- Fitting
- Coned & Thread

Features of Check Valves

1. High flow type in-line check valve never seen before
   - The diameter identical with the pipe bore of φ 6.4, 9/16" 40,000 psi specification is adopted as flow channel.
   - Cv-value = 1.1 has been achieved.

2. Excellent valve seat sealing performance

KITZ Product Code

HIC9

Specifications of Check Valves

- Material
- Body: A276 TYPE316
- Sleeve: A276 TYPE316
- Poppet: PEEK
- Cap: A276 TYPE316
- Gasket: B187 C10200
- Spring: A313 TYPE316
- Gland: A479 TYPE316
- Collar: A479 TYPE316

Component List

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<tr>
<th>P/N</th>
<th>Parts Name</th>
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<tbody>
<tr>
<td>1</td>
<td>Body</td>
<td>A276 TYPE316</td>
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<tr>
<td>2</td>
<td>Sleeve</td>
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<td>3</td>
<td>Poppet</td>
<td>PEEK</td>
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<td>5</td>
<td>Cap</td>
<td>A276 TYPE316</td>
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<td>6</td>
<td>Spring</td>
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<tr>
<td>7</td>
<td>Gland</td>
<td>A479 TYPE316</td>
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<td>8</td>
<td>Collar</td>
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</tr>
<tr>
<td>9</td>
<td>Sleeve</td>
<td>A276 TYPE316</td>
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Dimension Table

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<th>Nominal Size</th>
<th>Inch Tubing End</th>
<th>d</th>
<th>d1</th>
<th>d2</th>
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<th>d4</th>
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<th>D</th>
<th>L</th>
<th>L1</th>
<th>S1</th>
<th>Weight</th>
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<tbody>
<tr>
<td>9/16</td>
<td>9/16* 40,000 psi</td>
<td>6.4</td>
<td>11.4</td>
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<td>15.7</td>
<td>19.1</td>
<td>60</td>
<td>60</td>
<td>128.2</td>
<td>58</td>
<td>41</td>
<td>2.5 kg</td>
</tr>
<tr>
<td>1/4</td>
<td>1/4* 20,000 psi</td>
<td>2.8</td>
<td>4.8</td>
<td>7/16&quot;-20UNF</td>
<td>7.1</td>
<td>12.7</td>
<td>60</td>
<td>60</td>
<td>128.2</td>
<td>58</td>
<td>41</td>
<td></td>
</tr>
<tr>
<td>1/4</td>
<td>1/4* 60,000 psi</td>
<td>2.4</td>
<td>4.3</td>
<td>9/16&quot;-18UNF</td>
<td>9.7</td>
<td>11.2</td>
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<td>9/16* 60,000 psi</td>
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<td>9.7</td>
<td>1-1/8&quot;-12UNF</td>
<td>15.7</td>
<td>19.1</td>
<td>60</td>
<td>60</td>
<td>128.2</td>
<td>58</td>
<td>41</td>
<td></td>
</tr>
</tbody>
</table>
1 Transportation

1-1 Cautions for Transportation

**Caution**
- Pay special attention to cardboard packing, if used. The package may suffer a loss of integrity from moisture etc. and damage the product.

1-2 Transportation

- Please maintain the package/packing style at delivery as it is when moving or transporting the valves to pipework site.
- Do not throw, drop, drag, or roll etc. as this will apply shock to the valve.

2 Storage

2-1 Cautions for Storage

**Caution**
- Do not store in the corrosive gas atmosphere. The corrosion will occur from the thread and damage the function.
- Do not drop, upset, vibrate, or apply heavy loads during storage. The valve function may be affected.
- Do not pile up for storing. Load collapse may occur to cause human injury and product damage.

3 Pipework-1

3-1 Cautions on Pipework

**Warning**
- When working in high places, pay special attention to safety such as preventing a person from going underneath.

**Caution**
- Do not disassemble the valve when fitting to the pipework.
- Never use a pipe wrench on the valve. Please use a proper tool such as a spanner.
- At fitting on the pipework, do not apply torque in the direction of loosening the connecting thread of body and cap. (left turn) It will cause leakage at the connection.
- Apply a lubricant to the thread of gland nut suitable for temperature and environment etc. for use.
- For mounting and removing a valve, be sure to use a spanner on hexagonal collar at the near side to pipework. If a spanner is used on the far side collar, it may cause the leakage from valve main unit. In the case of a needle valve, the midsection may be adjusted for mounting and removing.
- Avoid applying a bending moment from the pipework to the valve at installation. If an excessive bending moment is applied, the valve body may be deformed and cause leakage at the connection.
Cautions for Handling

Please be sure to thoroughly read the handling manual packed with the product before use.

3 Pipework-2

3-2 Please check the following items before mounting a valve to the pipework.

- The fluid pressure and valve specification are matching.
- Proper tube size, material, and thickness are used.
- No damage on the valve and fitting portion. No missing parts.
- Remove dusts and scales etc. in the pipework before connecting a valve.
- Do not throw, drop, drag, or roll etc. to apply shock to a valve.
- Remove the protector for the valve immediately before mounting on the pipework.
- For detailed instructions on thread cutting and end machining, etc., please contact our company.
- Attach the gland nut and collar on the tube. Thoroughly screw in the collar until one or two thread can be seen at the tip of tube. (Ref. Fig.1)

- Insert the tube in the valve body, and fasten the gland nut as tight as possible with your fingers.
- Use a torque wrench and re-tighten to the specified torque. Please refer to the table below for standard torques.

<table>
<thead>
<tr>
<th>Fitting Tube Size</th>
<th>Fastening Torque (N-m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/4” 20,000 psi</td>
<td>27</td>
</tr>
<tr>
<td>3/8” 20,000 psi</td>
<td>41</td>
</tr>
<tr>
<td>9/16” 20,000 psi</td>
<td>75</td>
</tr>
<tr>
<td>1/4” 50,000 psi</td>
<td>34</td>
</tr>
<tr>
<td>3/8” 40,000 psi</td>
<td>68</td>
</tr>
<tr>
<td>9/16” 60,000 psi</td>
<td>136</td>
</tr>
</tbody>
</table>

- After mounting on the pipework, be sure to check every fastening portion, and re-tighten if loose.
- After mounting on the pipework, be sure to fully open all the valves in the pipe line, and remove the foreign matters by flushing. Never operate a valve for open/close during flushing.
- If you want to disassemble the joint after having connected the pipe once and re-connect to the pipework again, paint a pair of match marks using a marking pen (Ref. thick lines in Fig. 2) to indicate the position of gland nut before loosening. Check the secure re-tightening to the match marks at re-assembly.

4 Regular Checks

4-1 Maintenance Inspections

- If a piping installation with mounted valves is opened for a maintenance inspection, the check on valve seats and external leakage and on operation shall be conducted as necessity. If any sign of malfunctioning on valve seats, external leakage etc. is found, conduct an overhaul inspection, and the valve has to pass this inspection.

4-2 Cautions at removing from and mounting to pipework

**Warning**

- When removing a valve from pipework, be sure to drain the liquid and return to the atmospheric pressure.
- A ball valve may have some sealed pressure or fluid under fully closed status. Be sure to half open the valve to release pressure and fluid before removing a valve.
- If the fluid inside the pipework is toxic, inflammable or corrosive, please completely remove such fluid from inside the pipework and valves.
- Be careful enough during work to prevent the fluid from contacting your body, or catching fire.
- When working in high places, pay special attention to safety such as preventing a person from going underneath, etc.

**Caution**

- Wear protective goods such as safety glasses, safety gloves, safety shoes, etc.
- Secure a necessary foothold for working for removing and mounting a valve.
- For mounting and removing a valve, be sure to use a spanner on the hexagonal collar at the near side to pipework. If a far side collar or body barrel is used, it may cause the leakage from main unit.
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