

KEYSTONE

Resilient seated butterfly valves AR1 (wafer) (2" to 36"), 2" to 12", to 175 psi AR2 (lug) (2" to 24"), 14" to 36", to 150 psi

Features and Benefits

- Triple function resilient seat helps provide bi-directional drop-tight shut-off, designed to totally isolate the valve body and stem from the line media.
- Molded-in O-ring seat design serves as flange seals, eliminating the need for gaskets between the flanges and the valve.
- Unique dovetail seat retention design allows for convenient and economical field replacement.
- Superior one-piece through shaft design provides high strength and positive disc control.
- Internal shaft seal is designed to prevent external media from entering valve and it also adjusts for pressure and shaft rotation.
- Heavy-duty, corrosion resistant top bushing delivers upper stem support, absorbs actuator side-loading and extends valve cycle life.
- Polished disc edge helps ensure optimal performance and maximum seat life.
- Stainless steel torque plug (2" to 12"), disc screws (14" to 20") and taper pins (24" to 36") provide positive leak-proof connections while allowing for quick and easy disassembly.
- One-piece body with extended neck allows clearance for flanges and insulation.
- Each valve is factory-tested to 110 percent of the manufacturer's pressure rating.



General Application

Ideally suited for many high performance applications, such as fire protection, water treatment, cooling systems, food and beverage and bulk product handling. Consult your sales representative for appropriate materials and specific services.

Technical Data

Size Range:

Figure AR1 (wafer style) 2" to 36"
Figure AR2 (lugged style) 2" to 24"

Flange Standard:

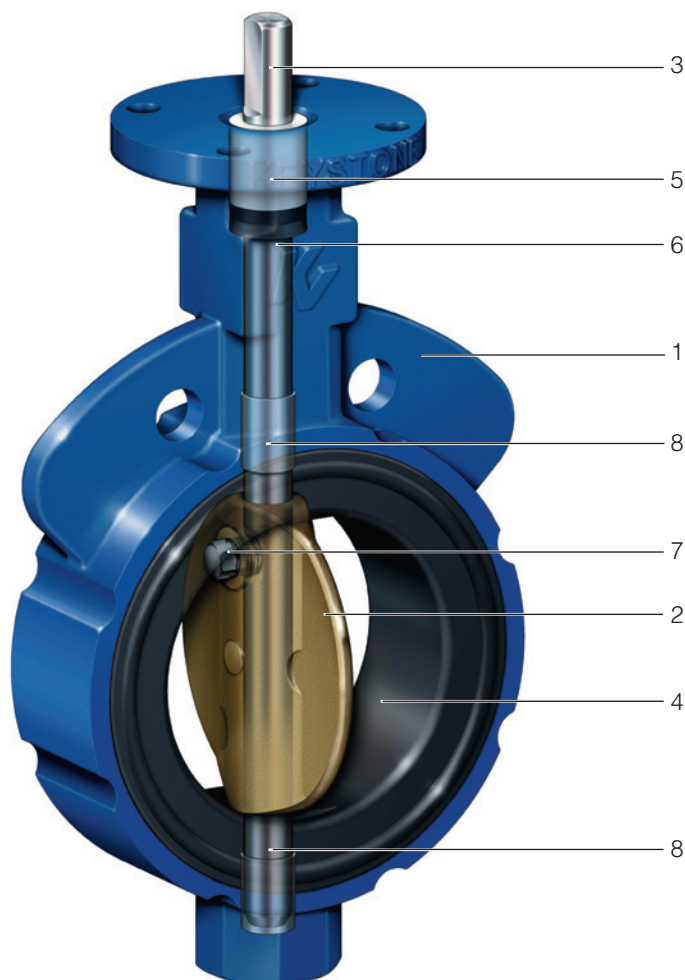
ANSI Class 125/150

(Consult your sales representative for additional drilling standards.)

Keystone Butterfly Valves Figure AR1/AR2

General Purpose Valve

Parts and Materials



Materials

| Part | Standard Material | Material Specification | Optional Material |
|--|---|---|------------------------------------|
| 1 Body | Cast iron Ductile iron | ASTM A-126, Class B ASTM A-395 GR 60/40/18 | Carbon steel Stainless steel |
| 2 Disc | Ductile iron Aluminum bronze 316 Stainless steel | ASTM A-536 GR 65/45/12 ASTM B-148, UNS C95200 Grade A ASTM A-743, CF8M | |
| 3 Stem | 316 Stainless steel (2" to 12") 18-8 Stainless steel (14" to 20") 17-4 PH Stainless steel (24" to 36") (2" to 20") | ASTM A-276 UNS S31600 ASTM A-276 UNS S30400 ASTM A-564 UNS S17400 ASTM A-108 UNS G10450 | Phosphate treated steel |
| 4 Seat | NBR food grade (0°F to 212°F) EPDM food grade (-40°F to 250°F) | | Fluoroelastomer (FKM) White NBR |
| 5 Upper stem bushing | Polyester (2" to 20") Bronze (24" to 36") | | |
| 6 Stem packing | NBR | | |
| 7 Torque plug (2" to 12") Disc screws (14" to 20") Taper pins (24" to 36") | 316 Stainless steel 316 Stainless steel 17-4 PH Stainless steel | ASTM A-276 UNS S31600 condition A ASTM F-593 Group 2 condition CW1 ASTM A564 UNS S17400 H1075 | |
| 8 Bearings (2" to 12") | Sintered metal | | |

Keystone Butterfly Valves Figure AR1/AR2

General Purpose Valve

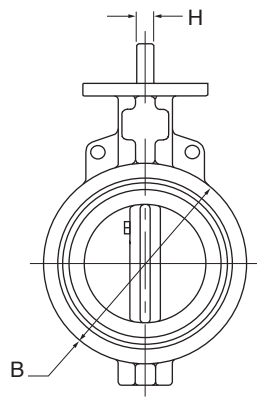


Figure AR1 Wafer

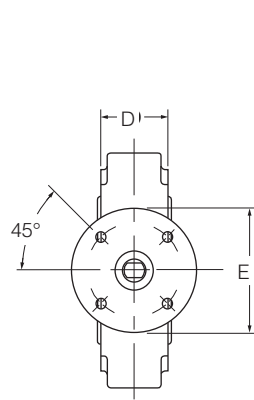
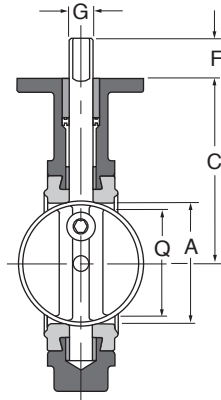


Figure AR2 Lugged

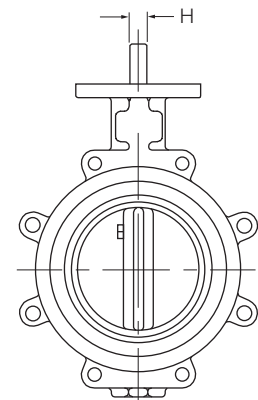


Figure AR1 – Dimensions (inches)

| Size | A | B | C | D | E | F | G | H | Q | Key | Top Plate Drilling | | | Weight (lbs) | Adapt. Code |
|-------------------------------|--------------------------------|----------------------------------|----------------------------------|---------------------------------|---|-------------------------------|--------------------------------|--------------------------------|----------------------------------|---|-------------------------------|-----------|--------------------------------|--------------|-------------|
| | | | | | | | | | | | Bolt Circle | No. Holes | Hole Dia. | | |
| 2 | 2 | 4 ¹ / ₈ | 5 ¹ / ₂ | 1 ⁵ / ₈ | 4 | 1 ¹ / ₄ | 9 ¹ / ₁₆ | 3 ³ / ₈ | 1 ³ / ₈ | N/A | 3 ¹ / ₄ | 4 | 7 ¹ / ₁₆ | 6.3 | BAB |
| 2 ¹ / ₂ | 2 ¹ / ₂ | 4 ⁵ / ₈ | 6 | 1 ³ / ₄ | 4 | 1 ¹ / ₄ | 9 ¹ / ₁₆ | 3 ³ / ₈ | 2 ¹ / ₁₆ | N/A | 3 ¹ / ₄ | 4 | 7 ¹ / ₁₆ | 8.5 | BAB |
| 3 | 3 | 5 ¹ / ₈ | 6 ¹ / ₄ | 1 ³ / ₄ | 4 | 1 ¹ / ₄ | 9 ¹ / ₁₆ | 3 ³ / ₈ | 2 ⁹ / ₁₆ | N/A | 3 ¹ / ₄ | 4 | 7 ¹ / ₁₆ | 10.0 | BAB |
| 4 | 4 | 6 ³ / ₈ | 7 | 2 | 4 | 1 ¹ / ₄ | 5 ⁵ / ₈ | 7 ¹ / ₁₆ | 3 ⁵ / ₈ | N/A | 3 ¹ / ₄ | 4 | 7 ¹ / ₁₆ | 14.0 | BAC |
| 5 | 5 | 7 ³ / ₈ | 7 ¹ / ₂ | 2 ¹ / ₈ | 4 | 1 ¹ / ₄ | 3 ³ / ₄ | 1 ¹ / ₂ | 4 ³ / ₄ | N/A | 3 ¹ / ₄ | 4 | 7 ¹ / ₁₆ | 18.0 | BAD |
| 6 | 5 ³ / ₄ | 8 ¹ / ₂ | 8 | 2 ¹ / ₈ | 4 | 1 ¹ / ₄ | 3 ³ / ₄ | 1 ¹ / ₂ | 5 ¹ / ₂ | N/A | 3 ¹ / ₄ | 4 | 7 ¹ / ₁₆ | 22.0 | BAD |
| 8 | 7 ³ / ₄ | 10 ¹¹ / ₁₆ | 9 ¹ / ₂ | 2 ¹ / ₂ | 6 | 1 ¹ / ₄ | 7 ⁷ / ₈ | 5 ⁵ / ₈ | 7 ¹ / ₂ | N/A | 5 | 4 | 9 ¹ / ₁₆ | 38.0 | CAE |
| 10 | 9 ³ / ₄ | 13 | 10 ³ / ₄ | 2 ¹ / ₂ | 6 | 2 | 1 ¹ / ₈ | N/A | 9 ¹⁹ / ₃₂ | 1 ¹ / ₄ x 1 ¹ / ₄ | 5 | 4 | 9 ¹ / ₁₆ | 51.0 | CAF |
| 12 | 11 ³ / ₄ | 14 ¹³ / ₁₆ | 12 ¹ / ₄ | 3 | 6 | 2 | 1 ¹ / ₈ | N/A | 11 ⁹ / ₁₆ | 1 ¹ / ₄ x 1 ¹ / ₄ | 5 | 4 | 9 ¹ / ₁₆ | 71.0 | CAF |
| 14 | 13 ¹ / ₄ | 16 ³ / ₄ | 12 | 3 | 6 | 3 | 1 ³ / ₈ | N/A | 13 ¹ / ₈ | 5 ⁵ / ₁₆ x 5 ⁵ / ₁₆ | 5 | 4 | 9 ¹ / ₁₆ | 114.0 | CAG |
| 16 | 15 ¹ / ₄ | 19 ¹ / ₄ | 12 ⁶¹ / ₆₄ | 4 | 6 | 3 | 1 ⁵ / ₈ | N/A | 15 | 3 ³ / ₈ x 3 ³ / ₈ | 5 | 4 | 9 ¹ / ₁₆ | 193.0 | CAH |
| 18 | 17 ¹ / ₄ | 21 ¹ / ₂ | 14 ¹ / ₂ | 4 ¹ / ₄ | 8 | 4 ¹ / ₄ | 1 ⁷ / ₈ | N/A | 16 ⁷ / ₈ | 1 ¹ / ₂ x 3 ³ / ₈ | 6 ¹ / ₂ | 4 | 1 ³ / ₁₆ | 222.0 | DAJ |
| 20 | 19 ¹ / ₄ | 23 ³ / ₄ | 15 ⁷ / ₈ | 5 | 8 | 4 ¹ / ₄ | 1 ⁷ / ₈ | N/A | 18 ³ / ₄ | 1 ¹ / ₂ x 3 ³ / ₈ | 6 ¹ / ₂ | 4 | 1 ³ / ₁₆ | 315.0 | DAJ |
| 24 | 23 ¹ / ₄ | 28 ¹ / ₄ | 19 ¹ / ₂ | 5 ¹⁵ / ₁₆ | 8 | 4 ¹ / ₄ | 1 ⁷ / ₈ | N/A | 22 ⁵ / ₈ | 1 ¹ / ₂ x 3 ³ / ₈ | 6 ¹ / ₂ | 4 | 1 ³ / ₁₆ | 506.0 | DAJ |
| 30 | 29 ¹ / ₄ | 34 ⁵ / ₈ | 23 | 6 ⁹ / ₁₆ | 8 | 4 ¹ / ₄ | 2 ¹ / ₄ | N/A | 28 ¹¹ / ₁₆ | 1 ¹ / ₂ x 3 ³ / ₈ | 6 ¹ / ₂ | 4 | 1 ³ / ₁₆ | 610.0 | DAK |
| 36 | 35 ¹ / ₄ | 41 ¹ / ₄ | 27 ³ / ₄ | 7 ⁷ / ₈ | 8 | 5 ¹ / ₄ | 2 ⁷ / ₈ | N/A | 34 ¹ / ₂ | 3 ³ / ₄ x 1 ¹ / ₂ | 6 ¹ / ₂ | 4 | 1 ³ / ₁₆ | 1,185.0 | DAV |

Figure AR2 – Dimensions (inches)

| Size | A | B | C | D | E | F | G | H | Q | Key | Top Plate Drilling | | | Tapped Lug Data | | | Weight (lbs) | Adapt. Code |
|-------------------------------|--------------------------------|----------------------------------|----------------------------------|---------------------------------|---|-------------------------------|--------------------------------|--------------------------------|---------------------------------|---|-------------------------------|-----------|--------------------------------|--------------------------------|------------|--|--------------|-------------|
| | | | | | | | | | | | Bolt Circle | No. Holes | Hole Dia. | Hole Circle | Bolt Holes | No. Tap | | |
| 2 | 2 | 4 ¹ / ₈ | 5 ¹ / ₂ | 1 ⁵ / ₈ | 4 | 1 ¹ / ₄ | 9 ¹ / ₁₆ | 3 ³ / ₈ | 1 ³ / ₈ | N/A | 3 ¹ / ₄ | 4 | 7 ¹ / ₁₆ | 4 ³ / ₄ | 4 | 5 ⁵ / ₈ - 11 UNC | 7.0 | BAB |
| 2 ¹ / ₂ | 2 ¹ / ₂ | 4 ⁵ / ₈ | 6 | 1 ³ / ₄ | 4 | 1 ¹ / ₄ | 9 ¹ / ₁₆ | 3 ³ / ₈ | 2 ¹ / ₁₆ | N/A | 3 ¹ / ₄ | 4 | 7 ¹ / ₁₆ | 5 ¹ / ₂ | 4 | 5 ⁵ / ₈ - 11 UNC | 10.0 | BAB |
| 3 | 3 | 5 ³ / ₁₆ | 6 ¹ / ₄ | 1 ³ / ₄ | 4 | 1 ¹ / ₄ | 9 ¹ / ₁₆ | 3 ³ / ₈ | 2 ⁹ / ₁₆ | N/A | 3 ¹ / ₄ | 4 | 7 ¹ / ₁₆ | 6 | 4 | 5 ⁵ / ₈ - 11 UNC | 11.5 | BAB |
| 4 | 4 | 6 ³ / ₈ | 7 | 2 | 4 | 1 ¹ / ₄ | 5 ⁵ / ₈ | 7 ¹ / ₁₆ | 3 ⁵ / ₈ | N/A | 3 ¹ / ₄ | 4 | 7 ¹ / ₁₆ | 7 ¹ / ₂ | 8 | 5 ⁵ / ₈ - 11 UNC | 18.0 | BAC |
| 5 | 5 | 7 ³ / ₈ | 7 ¹ / ₂ | 2 ¹ / ₈ | 4 | 1 ¹ / ₄ | 3 ³ / ₄ | 1 ¹ / ₂ | 4 ³ / ₄ | N/A | 3 ¹ / ₄ | 4 | 7 ¹ / ₁₆ | 8 ¹ / ₂ | 8 | 3 ³ / ₄ - 10 UNC | 22.5 | BAD |
| 6 | 5 ³ / ₄ | 8 ¹ / ₂ | 8 | 2 ¹ / ₈ | 4 | 1 ¹ / ₄ | 3 ³ / ₄ | 1 ¹ / ₂ | 5 ¹ / ₂ | N/A | 3 ¹ / ₄ | 4 | 7 ¹ / ₁₆ | 9 ¹ / ₂ | 8 | 3 ³ / ₄ - 10 UNC | 28.5 | BAD |
| 8 | 7 ³ / ₄ | 10 ¹¹ / ₁₆ | 9 ¹ / ₂ | 2 ¹ / ₂ | 6 | 1 ¹ / ₄ | 7 ⁷ / ₈ | 5 ⁵ / ₈ | 7 ¹ / ₂ | N/A | 5 | 4 | 9 ¹ / ₁₆ | 11 ³ / ₄ | 8 | 3 ³ / ₄ - 10 UNC | 49.0 | CAE |
| 10 | 9 ³ / ₄ | 13 | 10 ³ / ₄ | 2 ¹ / ₂ | 6 | 2 | 1 ¹ / ₈ | N/A | 9 ¹⁹ / ₃₂ | 1 ¹ / ₄ x 1 ¹ / ₄ | 5 | 4 | 9 ¹ / ₁₆ | 14 ¹ / ₄ | 12 | 7 ⁷ / ₈ - 9 UNC | 69.0 | CAF |
| 12 | 11 ³ / ₄ | 14 ¹³ / ₁₆ | 12 ¹ / ₄ | 3 | 6 | 2 | 1 ¹ / ₈ | N/A | 11 ⁹ / ₁₆ | 1 ¹ / ₄ x 1 ¹ / ₄ | 5 | 4 | 9 ¹ / ₁₆ | 17 | 12 | 7 ⁷ / ₈ - 9 UNC | 107.0 | CAF |
| 14 | 13 ¹ / ₄ | 16 ³ / ₄ | 12 | 3 | 6 | 3 | 1 ³ / ₈ | N/A | 13 ¹ / ₈ | 5 ⁵ / ₁₆ x 5 ⁵ / ₁₆ | 5 | 4 | 9 ¹ / ₁₆ | 18 ³ / ₄ | 12 | 1 - 8 NC | 143.0 | CAG |
| 16 | 15 ¹ / ₄ | 19 | 12 ⁶¹ / ₆₄ | 4 | 6 | 3 | 1 ⁵ / ₈ | N/A | 15 | 3 ³ / ₈ x 3 ³ / ₈ | 5 | 4 | 9 ¹ / ₁₆ | 21 ¹ / ₄ | 16 | 1 - 8 NC | 238.0 | CAH |
| 18 | 17 ¹ / ₄ | 21 ³ / ₈ | 14 ¹ / ₂ | 4 ¹ / ₄ | 8 | 4 ¹ / ₄ | 1 ⁷ / ₈ | N/A | 16 ⁷ / ₈ | 1 ¹ / ₂ x 3 ³ / ₈ | 6 ¹ / ₂ | 4 | 1 ³ / ₁₆ | 22 ³ / ₄ | 16 | 1 ¹ / ₈ - 7 NC | 261.0 | DAJ |
| 20 | 19 ¹ / ₄ | 23 ¹ / ₂ | 15 ⁷ / ₈ | 5 | 8 | 4 ¹ / ₄ | 1 ⁷ / ₈ | N/A | 18 ³ / ₄ | 1 ¹ / ₂ x 3 ³ / ₈ | 6 ¹ / ₂ | 4 | 1 ³ / ₁₆ | 25 | 20 | 1 ¹ / ₈ - 7 NC | 366.0 | DAJ |
| 24 | 23 ¹ / ₄ | 28 ¹ / ₄ | 19 ¹ / ₂ | 5 ¹⁵ / ₁₆ | 8 | 4 ¹ / ₄ | 1 ⁷ / ₈ | N/A | 22 ⁵ / ₈ | 1 ¹ / ₂ x 3 ³ / ₈ | 6 ¹ / ₂ | 4 | 1 ³ / ₁₆ | 29 ¹ / ₂ | 20 | 1 ¹ / ₄ - 7 NC | 576.0 | DAJ |

Notes:

1. "H" Dimension refers to flat on stem.
2. "Q" dimension is the minimum allowable pipe or flange inside diameter at the centered body face to protect the disc sealing edge against damage when opening the valve.

Valve Sizing

Rate of flow through a valve depends upon the pressure drop. The most common method of presenting this information is by C_v . The C_v is the valve coefficient of flow and represents the flow of water in gallons per minute (GPM) with a 1 psi pressure drop through the valve. The higher the C_v , the greater the flow and the better the control characteristics. Throttling characteristics are shown in the same manner with C_v 's at the various disc openings. See Table 1 for tabulated C_v 's for the Figure AR1/AR2 Butterfly Valve.

Table 1
 C_v Chart (Water @ 70°F, Specific Gravity = 1.00)

| Valve Size | Disc position (Degrees Open) | | | | | | | |
|------------|------------------------------|------|------|-------|-------|-------|-------|-------|
| | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 |
| 2" | 1.3 | 5 | 14 | 26 | 40 | 52 | 59 | 60 |
| 2.5" | 1.4 | 6 | 21 | 44 | 74 | 107 | 138 | 151 |
| 3" | 1.5 | 8 | 29 | 67 | 115 | 175 | 234 | 262 |
| 4" | 15 | 48 | 107 | 196 | 318 | 463 | 589 | 647 |
| 5" | 32 | 99 | 206 | 362 | 579 | 832 | 1045 | 1141 |
| 6" | 47 | 145 | 295 | 510 | 810 | 1160 | 1450 | 1580 |
| 8" | 84 | 239 | 450 | 751 | 1190 | 1754 | 2385 | 2892 |
| 10" | 133 | 360 | 652 | 1064 | 1683 | 2524 | 3596 | 4593 |
| 12" | 192 | 509 | 899 | 1449 | 2288 | 3470 | 5085 | 6682 |
| 14" | 340 | 770 | 1400 | 2200 | 3400 | 5600 | 7900 | 10000 |
| 16" | 440 | 1000 | 1800 | 2800 | 4500 | 7400 | 10800 | 13000 |
| 18" | 570 | 1300 | 2300 | 3600 | 5800 | 9600 | 15000 | 18000 |
| 20" | 710 | 1600 | 2900 | 4600 | 7200 | 12000 | 18400 | 22000 |
| 24" | 1000 | 2300 | 4000 | 6400 | 10000 | 16500 | 25900 | 30000 |
| 30" | 1500 | 3600 | 6200 | 9900 | 16000 | 26000 | 42500 | 47000 |
| 36" | 2600 | 5200 | 9100 | 15000 | 23000 | 38000 | 65000 | 70000 |

Torque Data

Torque is the rotary effort required to operate a valve. This turning force in a butterfly valve is determined by three factors – the friction of the disc and seat due to interference for sealing, bearing friction, and fluid dynamic torque.

Breakaway torque at 70°F

Breakaway torque is the total of the torques resulting from bearing friction and disc/seat interference friction at a given pressure differential. See Table 2 for torques to open and close the valve at pressures shown in wet services with minimum operating frequency of one per week (normal conditions).

Note: These values are valid for water and lubricating fluids only at 70°F. Since torques are greatly increased for dry and nonlubricating fluids and temperature variations, contact your Keystone representative for accurate values in these applications.

Table 2
Seating and Unseating Torques

| Valve Size | Category 2 (Normal Conditions) | | | |
|------------|--------------------------------|-------|-------|------|
| | 50 | 100 | 150 | 175 |
| 2" | 224 | 229 | 233 | 235 |
| 2.5" | 277 | 284 | 291 | 264 |
| 3" | 330 | 340 | 350 | 355 |
| 4" | 500 | 519 | 539 | 549 |
| 5" | 687 | 724 | 761 | 779 |
| 6" | 953 | 1006 | 1059 | 1086 |
| 8" | 1610 | 1720 | 1830 | 1885 |
| 10" | 2521 | 2751 | 2963 | 3074 |
| 12" | 3418 | 3737 | 4055 | 4214 |
| 14" | 5147 | 5995 | 6842 | – |
| 16" | 6808 | 8116 | 9424 | – |
| 18" | 8810 | 10720 | 12630 | – |
| 20" | 11172 | 13845 | 16517 | – |
| 24" | 13372 | 16994 | 20616 | – |
| 30" | 22074 | 29148 | 36222 | – |
| 36" | 33224 | 45448 | 57672 | – |

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