

## WKKM 3OF

Flanged floating ball valves

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## Features and Benefits

The handle can be correctly installed only in alignment with the ball port. The valve is open when the handle is aligned with piping and is closed when the handle is perpendicular to piping.

## ASME Classes 150 through 600 <br> $1 / 2$-in full port through 8 -in reduced port NACE MR0175/ISO 15156



WKM 320F* flanged floating ball valves satisfy a wide range of applications. Available in a variety of standard and optional materials, the valves are engineered for heavy-duty, maintenance-free performance and serve a variety of applications in virtually any industry.

## Chemical and petrochemical plants

There is a wide range of chemical and petrochemical applications for WKM 320F ball valves. They serve in plastic plants, handling such slurries as $40 \%$ vinyl chloride in high-pressure catalyst lines, and in processes, handling dry lading such as polyethylene and polystyrene powders.

## Refining

The WKM 320F ball valve is ideal for the refining industry. The many seats, seals, and trims available offer the versatility to handle the wide variety of products used in the refining process.

## Low-temperature service

Standard trims accommodate temperatures to $-20 \operatorname{degF}[-29 \operatorname{deg} \mathrm{C}]$, and temperature trims are available to $-50 \mathrm{deg} \mathrm{F}[-46 \mathrm{deg} \mathrm{C}]$.

## Maintenance-free performance

Under most conditions, the WKM 320F ball valve will provide years of trouble-free service with no maintenance required. In some severe applications, such as handling extremely abrasive slurries at high temperature, it may be necessary to replace the seats occasionally. Seat and seal kits are available, and replacement can be done easily with ordinary tools.

## Sour oil and gas service

WKM* valves have served for years in gathering lines, manifolds, and field processing units in sour oil and gas fields. All trim combinations conform with NACE MR0175/ISO 15156.

## Self-relieving seats

A patent-pending seat design provides automatic cavity relief without requiring a vented ball or external relief valve. API Spec 6D monogram is available upon request.

## Actuation friendly

A variety of actuator types, including pneumatic, hydraulic, diaphragm, vane, electromechanical, and electrohydraulic, can be easily installed.

## Fire tested for safety

All WKM 320F ball valves are qualified under API Standard 607 7th Ed. The seat and locked-in stem design contributes to its fire-tested characteristics. Should the soft seats be destroyed by fire, the ball floats downstream, providing a tight metal-to-metal seal against the lip of the seat pocket. If the tailpiece seals are destroyed, the metal-to-metal tailpiece-to-body connection retards external leakage.

Adjustable, replaceable packing
The inline valve stem packing options consist of PTFE and graphite.
The packing is field adjustable and virtually never requires lubrication.

## Fugitive emissions

WKM 320F ball valves can be supplied and certified to meet the requirements of fugitive emissions (FE) as regulated by ISO and API.

## Positively retained stem

The stem is positively retained and cannot be removed with the valve in service.

Tight-sealing floating ball design
The ground, polished ball is free to float and mates perfectly with the conical seats for a positive, leak-proof seal. Self-cleaning and selfadjusting, the ball also is pressure activated-the higher the line pressure, the tighter the seal.


Seat that relieves excess cavity pressure to the upstream side of the valve.


Fugitive-emissions packing arrangement.

## Specifications

## ASME Classes 150 through 600

## Operating temperatures

- From -50 to $500 \operatorname{degF}$ [-46 to $260 \operatorname{deg} C$ ]


## Standard material

- Body
- Carbon steel and stainless steel
- Ball and stem
- Carbon steel and stainless steel
- Optional materials available upon request


## Industry compliance

- American Society of Mechanical Engineers (ASME) Standards B16.5 and B16.34
- Manufacturers Standardization Society Specifications MSS SP-25, 55, and 72
- API Spec 607 7th Ed. fire-test specification
- Canadian Registration Number (CRN)
- API Spec 608
- NACE MR0175
- ANSI Standard B16.34
- API Spec 6D upon request
- ISO or API fugitive emissions upon request
- European Pressure Equipment Directive (PED/CE) available upon request



## Materials List

| Body Group Trim Number |  |  |  |  |
| :--- | :--- | :--- | :--- | :--- |
| Part | Carbon Steel <br> (NACE) 24 | Carbon Steel for Low <br> Temperature (NACE) 37 | Stainless Steel <br> (NACE) 23 | Carbon Steel with Coating <br> (NACE) 26 |
| Body | A216 Grade wrought carbon <br> (WCC) | A352 Grade low-temperature <br> wrought carbon (LCC) | A351 Grade CF8M | A216 Grade WCC, ZPEX® coating |
| Tailpiece | A216 Grade WCC | A352 Grade LCC | A351 Grade CF8M | A216 Grade WCC, ZPEX coating |
| Bonnet cap | Low alloy carbon steel (CS) zinc <br> plated | Low alloy CS zinc plated | Low alloy CS zinc plated | Low alloy CS zinc plated |
| Studs | A320 Grade L7M zinc plated | A320 Grade L7M zinc plated | A320 Grade L7M zinc plated | A320 Grade L7M zinc plated ${ }^{+}$ |
| Nuts | A194 Grade 7M zinc plated | A194 Grade 7M zinc plated | A194 Grade 7M zinc plated | A194 Grade 7M zinc plated ${ }^{+}$ |
| Packing studs | A320 Grade L7M zinc plated | A320 Grade L7M zinc plated | A320 Grade L7M zinc plated | A320 Grade L7M zinc plated |
| Packing nuts | A194 Grade 7M zinc plated | A194 Grade 7M zinc plated | A194 Grade 7M zinc plated | A194 Grade 7M zinc plated |

NACE indicates compliance with NACE MR0175/ISO 15156
${ }^{\dagger}$ ZPEX coating on studs and nuts available on request.

| Internal Group Trim Number |  |  |  |  |
| :--- | :--- | :--- | :--- | :--- |
| Ball | A105 CS ENP | $-^{\dagger}$ | A351 CF8M or 316 SS | A105 CS ENP |
| Stem | A105 CS ENP | $-^{\dagger}$ | 316 stainless steel (SS) | A105 CS ENP |
| Ground spring | INCONEL ${ }^{\oplus}$ material | $-^{\dagger}$ | INCONEL | INCONEL |
| Compression ring | 316 SS | $-^{\dagger}$ | 316 SS | 316 SS |
| Thrust washer | CS and TFE | $-^{\dagger}$ | SS and TFE | CS and TFE |

${ }^{\dagger}$ Low-temperature model requires 23 stainless internal group.

| Seal Group Trim Code |  |  |  |  |
| :--- | :--- | :--- | :--- | :--- |
| Part | LTF | TTF | CGF | PGF |
| Temperature limits | -20 to 220 degF | -50 to 300 degF | -50 to 500 degF | -50 to 500 degF |
|  | $[-29$ to 104 degC $]$ | $[-46$ to 149 degC $]$ | $[-46$ to 260 degC $]$ | $[-46$ to 260 degC $]$ |
| Seat | Delrin ${ }^{\ominus}$ material | Filled PTFE | High-performance PTFE | PEEK |
| Packing | PTFE | PTFE | Graphite | Graphite |
| Body seal | Spiral-wound gasket | Spiral-wound gasket | Spiral-wound gasket | Spiral-wound gasket |

## Actuator Trim Codes

| Actuator Codes |  |
| :--- | :--- |
| Part (Body) | Worm Gear-For All Body Material Codes |
| Mounting bracket | Carbon steel |
| Bolting | Carbon steel |
| Set screw | Carbon steel |
| Stem adapter | Carbon steel |
| Actuator | As selected |
| Handwheel | Carbon steel |


| Actuator Codes (Wrenches) |  |
| :--- | :--- |
| Part (Body) | Wrench-For All Body Material Codes |
| Wrench head | Steel |
| Wrench handle | Carbon steel |
| Wrench handle pin | Carbon steel |
| Capscrew | Alloy steel |
| Stop plate | Carbon steel |

## How to Order

Flanged (two-piece cast)


## Trim Codes

## Example



## Dimensional Data-1/2-in Full Port Through 8-in $\times 6$-in Reduced Port

## $1 / 2$-in full port through 8 -in reduced port <br> ASME Classes 150, 300, and 600



2-in 600 valve with bracket.


Valve with wrench hand.


Valve with gear.


## Dimensions

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Size， in［mm］ | $\frac{\mathrm{A}}{\mathrm{RF}}$ | $\varnothing$ B | BB | D | E | J J | JJ | K | $\varnothing$ L |  | MM |  | NN | P | $\varnothing 0$ | $\varnothing 00$ | $\varnothing$ R | $\varnothing$ RR | S | T | U | V | W | X | Y | Z |
| $1 / 2$ <br> ［13］ | $\begin{aligned} & \hline 4.25 \\ & {[108]} \end{aligned}$ | $\begin{aligned} & \hline 0.51 \\ & {[13]} \end{aligned}$ | $\begin{aligned} & 0.51 \\ & {[13]} \end{aligned}$ | $\begin{aligned} & 1.12 \\ & {[28.5]} \end{aligned}$ | $\begin{aligned} & 2.35 \\ & {[60]} \\ & \hline \end{aligned}$ | $\begin{aligned} & 1.51 \\ & {[38.4]} \end{aligned}$ |  | $\begin{aligned} & \hline 2.66 \\ & {[67.6]} \end{aligned}$ | $\begin{aligned} & \hline 0.47 \\ & {[11.9]} \end{aligned}$ |  |  | $\begin{aligned} & \hline 0.69 \\ & {[17.5]} \end{aligned}$ |  | $\begin{aligned} & \hline 0.35 \\ & {[8.9]} \end{aligned}$ | $\begin{aligned} & 10-24 \mathrm{unc} \\ & \text { (4) } 0.38 \mathrm{dp} \end{aligned}$ | － | $\begin{aligned} & \hline 0.13-(2) \\ & 0.19 \mathrm{dp} \end{aligned}$ | － | － | － | － | － | － | － | $\begin{aligned} & \hline 6 \\ & {[152]} \end{aligned}$ | $\begin{aligned} & \hline 3.37 \\ & {[85.6]} \end{aligned}$ |
| $\begin{aligned} & 3 / 4 \times 1 / 2 \\ & {[19 \times 13]} \\ & \hline \end{aligned}$ | $\begin{aligned} & 4.625 \\ & {[117.5]} \end{aligned}$ | $\begin{aligned} & 0.51 \\ & {[13]} \\ & \end{aligned}$ | $\begin{aligned} & 0.76 \\ & {[19.3]} \end{aligned}$ | $\begin{aligned} & 1.12 \\ & {[28.5]} \end{aligned}$ | $\begin{aligned} & 2.35 \\ & {[60]} \end{aligned}$ | $\begin{aligned} & 1.513 \\ & {[38.4]} \\ & \hline \end{aligned}$ |  | $\begin{aligned} & \hline 2.66 \\ & {[67.6]} \end{aligned}$ | $\begin{aligned} & 0.47 \\ & {[11.9]} \end{aligned}$ | $\begin{aligned} & 1.88 \\ & {[47.6]} \end{aligned}$ |  | $\begin{aligned} & 0.69 \\ & {[17.5]} \end{aligned}$ |  | $\begin{aligned} & 0.35 \\ & {[8.9]} \end{aligned}$ | 10－24 unc （4） 0.38 dp | － | $\begin{aligned} & 0.13-(2) \\ & 0.19 \mathrm{dp} \end{aligned}$ | － | － | － | － | － | － | － | $\begin{aligned} & \hline 6 \\ & {[152]} \end{aligned}$ | $\begin{aligned} & 3.37 \\ & \\ & \hline 85.62 \\ & \hline \end{aligned}$ |
| $\begin{aligned} & 3 / 4 \times 3 / 4 \\ & {[19 \times 19]} \\ & \hline \end{aligned}$ | $\begin{aligned} & 4.625 \\ & {[117.5]} \end{aligned}$ | $\begin{aligned} & \hline 0.76 \\ & {[19.3]} \\ & \hline \end{aligned}$ | $\begin{aligned} & 0.76 \\ & {\left[\begin{array}{l} \text { [19.3] } \\ \hline \end{array}\right.} \\ & \hline \end{aligned}$ | $\begin{aligned} & 1.12 \\ & {[28.5]} \\ & \hline \end{aligned}$ | $\begin{aligned} & 2.35 \\ & {[60]} \\ & \hline \end{aligned}$ | $\begin{aligned} & 1.73 \\ & {[43.9]} \\ & \hline \end{aligned}$ |  | $\begin{aligned} & 2.88 \\ & {[73]} \\ & \hline \end{aligned}$ | $\begin{aligned} & 0.47 \\ & {[11.9]} \end{aligned}$ | $\begin{aligned} & \hline 1.88 \\ & {[47.6]} \\ & \hline \end{aligned}$ |  | $\begin{aligned} & 0.69 \\ & {[17.5]} \end{aligned}$ |  | $\begin{aligned} & 0.35 \\ & {[8.9]} \end{aligned}$ | $\begin{aligned} & 10-24 \mathrm{unc} \\ & \text { (4) } 0.38 \mathrm{dp} \end{aligned}$ | － | $\begin{aligned} & 0.13-(2) \\ & 0.25 \mathrm{dp} \\ & \hline \end{aligned}$ | － | － | － | － | － | － | － | $\begin{aligned} & 6 \\ & {[152]} \end{aligned}$ | $\begin{aligned} & 3.59 \\ & \text { [91] } \end{aligned}$ |
| $\begin{aligned} & 1 \times 3 / 4 \\ & {[25 \times 19]} \end{aligned}$ | $\begin{aligned} & 5 \\ & {[127]} \end{aligned}$ | $\begin{gathered} 0.76 \\ {[19.3]} \end{gathered}$ | $\begin{gathered} 1.01 \\ \hline \text { [25.7] } \end{gathered}$ | $\begin{aligned} & 1.12 \\ & {[28.5]} \end{aligned}$ | $\begin{aligned} & 2.35 \\ & {[60]} \end{aligned}$ | $\begin{aligned} & 1.73 \\ & {[43.9]} \end{aligned}$ |  | $\begin{aligned} & 2.88 \\ & {[73]} \end{aligned}$ | $\begin{aligned} & \hline 0.47 \\ & {[11.9]} \end{aligned}$ |  |  | $\begin{aligned} & \hline 0.69 \\ & {[17.5]} \end{aligned}$ |  | $\begin{aligned} & 0.35 \\ & {[8.9]} \end{aligned}$ | $10-24$ unc <br> （4） .025 dp | － | $\begin{aligned} & 0.13-(2) \\ & 0.25 \mathrm{dp} \end{aligned}$ | － | － | － | － | － | － | － | $\begin{aligned} & 6 \\ & \text { [152] } \end{aligned}$ | $\begin{aligned} & 3.59 \\ & \text { [91] } \end{aligned}$ |
| $\begin{aligned} & 1 \\ & {[25]} \end{aligned}$ | $\begin{aligned} & 5 \\ & {[127]} \end{aligned}$ | $\begin{aligned} & 1.01 \\ & {[26]} \end{aligned}$ | $\begin{aligned} & 1.01 \\ & {[26]} \end{aligned}$ | $\begin{array}{ll} \hline 1.25 \\ {[31.8]} \end{array}$ | $\begin{aligned} & 2.66 \\ & {[67.6]} \end{aligned}$ | $\begin{aligned} & 1.99 \\ & {[51]} \end{aligned}$ | － | $\begin{aligned} & 3.54 \\ & {[90]} \end{aligned}$ | $\begin{aligned} & 0.55 \\ & {[14]} \end{aligned}$ | $\begin{aligned} & \hline 2.13 \\ & {[54]} \\ & \hline \end{aligned}$ |  | $\begin{aligned} & 0.81 \\ & {[21]} \end{aligned}$ | － | $\begin{gathered} 0.43 \\ {[11]} \end{gathered}$ | $\begin{aligned} & 0.25-20(4) \\ & 0.38 \mathrm{dp} \end{aligned}$ | － | $\begin{aligned} & 0.19-(2) \\ & 0.31 \mathrm{dp} \end{aligned}$ | － | － | － | － | － | － | － | 8 <br> ［203］ | $\begin{aligned} & 4.65 \\ & {[118]} \end{aligned}$ |
| $\begin{aligned} & 11 / 2 \\ & {[38]} \\ & \hline \end{aligned}$ | $\begin{aligned} & 6.50 \\ & {[165]} \\ & \end{aligned}$ | $\begin{aligned} & 1.51 \\ & {[38]} \end{aligned}$ | $\begin{aligned} & 1.51 \\ & {[38]} \end{aligned}$ | $\begin{aligned} & 1.76 \\ & {[44.7]} \end{aligned}$ | $\begin{aligned} & 3.37 \\ & {[85.6]} \end{aligned}$ | $\begin{aligned} & 2.76 \\ & {[70]} \\ & \hline \end{aligned}$ | － | $\begin{aligned} & 4.50 \\ & {[114]} \end{aligned}$ | $\begin{aligned} & 0.71 \\ & {[18]} \end{aligned}$ | $\begin{aligned} & 2.76 \\ & {[70]} \\ & \hline \end{aligned}$ |  | $\begin{aligned} & 1.21 \\ & {[31]} \end{aligned}$ | － | $\begin{aligned} & 0.55 \\ & {[14]} \end{aligned}$ | $\begin{aligned} & 0.25-20(4) \\ & 0.44 \mathrm{dp} \end{aligned}$ | － | $\begin{aligned} & 0.19-(2) \\ & 0.31 \mathrm{dp} \end{aligned}$ | － | － | － | － | － | － | － | $\begin{aligned} & 10 \\ & {[254]} \\ & \hline \end{aligned}$ | $\begin{aligned} & 5.85 \\ & {[149]} \end{aligned}$ |
| $\begin{aligned} & 2 \times 1 / 1 / 2 \\ & {[50 \times 38]} \end{aligned}$ | $\begin{aligned} & \hline 7 \\ & {[178]} \end{aligned}$ | $\begin{aligned} & 1.51 \\ & {[38]} \end{aligned}$ | $\begin{aligned} & 2.03 \\ & {[52]} \end{aligned}$ | $\begin{aligned} & 1.76 \\ & \text { [44.7] } \end{aligned}$ | $\begin{aligned} & 3.37 \\ & {[85.6]} \end{aligned}$ | $\begin{aligned} & 2.76 \\ & {[70]} \end{aligned}$ | － | $\begin{aligned} & 4.50 \\ & \text { [114] } \end{aligned}$ | $\begin{aligned} & 0.71 \\ & {[18]} \end{aligned}$ |  |  | $\begin{aligned} & 1.21 \\ & {[31]} \end{aligned}$ | － | $\begin{aligned} & 0.55 \\ & {[14]} \end{aligned}$ | $\begin{aligned} & 0.25-20(4) \\ & 0.44 \mathrm{dp} \end{aligned}$ | － | $\begin{aligned} & 0.19-(2) \\ & 0.31 \mathrm{dp} \end{aligned}$ | － | － | － | － | － | － | － | $\begin{aligned} & \hline 10 \\ & \text { [254] } \end{aligned}$ | $\begin{aligned} & 5.85 \\ & {[149]} \end{aligned}$ |
| $\begin{aligned} & 2 \\ & {[50]} \\ & \hline \end{aligned}$ | $\begin{aligned} & 7 \\ & {[178]} \\ & \hline \end{aligned}$ | $\begin{aligned} & 2.03 \\ & {[52]} \end{aligned}$ | $\begin{aligned} & 2.03 \\ & {[52]} \end{aligned}$ | $\begin{aligned} & \hline 2.24 \\ & {[57]} \\ & \hline \end{aligned}$ | $\begin{aligned} & 3.88 \\ & {[98.6]} \end{aligned}$ | $\begin{aligned} & 3.46 \\ & {[88]} \end{aligned}$ | － | $\begin{aligned} & 5.65 \\ & {[143]} \end{aligned}$ | $\begin{aligned} & 0.86 \\ & {[22]} \end{aligned}$ | $\begin{aligned} & 3.38 \\ & {[86]} \\ & \hline \end{aligned}$ |  | $\begin{aligned} & 1.38 \\ & {[35]} \end{aligned}$ | － | $\begin{aligned} & 0.67 \\ & {[17]} \end{aligned}$ | $\begin{aligned} & 0.38-16(4) \\ & 0.41 \mathrm{dp} \end{aligned}$ | － | $\begin{aligned} & 0.25-(2) \\ & 0.38 \mathrm{dp} \end{aligned}$ | － | － | － | － | － | － | － | $\begin{aligned} & 12 \\ & {[305]} \end{aligned}$ | $\begin{aligned} & \hline 7.27 \\ & {[185]} \\ & \hline \end{aligned}$ |
| $\begin{aligned} & 3 \times 2 \\ & {[80 \times 50]} \end{aligned}$ | $\begin{aligned} & 8 \\ & \text { [203] } \end{aligned}$ | $\begin{aligned} & 2.03 \\ & {[52]} \end{aligned}$ | $\begin{aligned} & 3.03 \\ & {[77]} \end{aligned}$ | $\begin{aligned} & 2.24 \\ & {[57]} \end{aligned}$ | $\begin{aligned} & \hline 3.88 \\ & {[98.6]} \\ & \hline \end{aligned}$ | $\begin{aligned} & 3.46 \\ & \text { [88] } \\ & \hline \end{aligned}$ | － | $\begin{aligned} & 5.65 \\ & {[143]} \\ & \hline \end{aligned}$ | $\begin{aligned} & 0.86 \\ & {[22]} \end{aligned}$ | $\begin{aligned} & 3.38 \\ & {[86]} \\ & \hline \end{aligned}$ |  | $\begin{aligned} & 1.38 \\ & {[35]} \\ & \hline \end{aligned}$ | － | $\begin{aligned} & 0.67 \\ & {[17]} \\ & \hline \end{aligned}$ | $\begin{aligned} & 0.38-16(4) \\ & 0.41 \mathrm{dp} \end{aligned}$ | － | $\begin{aligned} & \hline 0.25-(2) \\ & 0.38 \mathrm{dp} \\ & \hline \end{aligned}$ | － | － | － | － | － | － | － | $\begin{aligned} & 12 \\ & {[305]} \end{aligned}$ | $\begin{aligned} & \hline 7.27 \\ & {[185]} \\ & \hline \end{aligned}$ |
| $\begin{aligned} & 3 \\ & {[80]} \\ & \hline \end{aligned}$ | $\begin{aligned} & 8 \\ & {[203]} \end{aligned}$ | $\begin{aligned} & 3.03 \\ & {[77]} \end{aligned}$ | $\begin{aligned} & 3.03 \\ & {[77]} \end{aligned}$ | $\begin{aligned} & 2.5 \\ & {[63.5]} \end{aligned}$ | $\begin{aligned} & 4.38 \\ & {[111]} \\ & \hline \end{aligned}$ | $\begin{aligned} & 4.51 \\ & {[115]} \end{aligned}$ | 8 <br> ［203］ | $\begin{aligned} & \hline 7 \\ & {[178]} \end{aligned}$ | $\begin{aligned} & 1.10 \\ & {[28]} \\ & \hline \end{aligned}$ | $\begin{aligned} & 4.02 \\ & {[102]} \end{aligned}$ | $\begin{aligned} & 4.02 \\ & {[102]} \end{aligned}$ | $\begin{aligned} & 1.63 \\ & {[41]} \end{aligned}$ | $\begin{aligned} & 1.63 \\ & {[41]} \end{aligned}$ | $\begin{aligned} & 0.86 \\ & {[22]} \\ & {[2]} \end{aligned}$ | $\begin{aligned} & 0.38-16(4) \\ & 0.63 \mathrm{dp} \end{aligned}$ | $\begin{aligned} & \text { 0.44-(4) } \\ & \text { thru } \end{aligned}$ | $\begin{aligned} & 0.31-(2) \\ & 0.38 \mathrm{dp} \\ & \hline \end{aligned}$ | $\begin{aligned} & 0.31-(2) \\ & 0.53 \mathrm{dp} \end{aligned}$ | $\begin{aligned} & 7.91 \\ & {[201]} \\ & \hline \end{aligned}$ | $\begin{aligned} & 9.12 \\ & {[232]} \end{aligned}$ | $\begin{aligned} & 10.68 \\ & {[271]} \end{aligned}$ | $\begin{aligned} & 81.75 \\ & \hline[44] \\ & \hline \end{aligned}$ | $\begin{aligned} & 9.08 \\ & {[231]} \end{aligned}$ | $\begin{aligned} & 6 \\ & {[152]} \end{aligned}$ | $\begin{aligned} & 16 \\ & {[406]} \end{aligned}$ | $\begin{aligned} & 8.42 \\ & {[214]} \end{aligned}$ |
| $\begin{aligned} & 4 \times 3 \\ & {[100 \times 80]} \end{aligned}$ | $\begin{aligned} & 929] \\ & {[229]} \end{aligned}$ | $\begin{aligned} & 3.03 \\ & {[77]} \end{aligned}$ | $\begin{aligned} & 4.03 \\ & {[102]} \end{aligned}$ | $\begin{aligned} & 2.5 \\ & {[63.5]} \end{aligned}$ | $\begin{aligned} & 4.38 \\ & {[111]} \end{aligned}$ | $\begin{aligned} & 4.51 \\ & {[115]} \end{aligned}$ | 8 <br> ［203］ | $\begin{aligned} & \hline 7 \\ & {[178]} \end{aligned}$ | $\begin{aligned} & 1.10 \\ & {[28]} \end{aligned}$ | $\begin{aligned} & 4.002] \\ & {[102]} \end{aligned}$ | $\begin{aligned} & 4.02 \\ & {[102]} \end{aligned}$ | $\begin{aligned} & 1.63 \\ & 141] \end{aligned}$ | $\begin{aligned} & 1.63 \\ & {[41]} \end{aligned}$ | $\begin{aligned} & 0.86 \\ & {[22]} \\ & {[26} \end{aligned}$ | $\begin{aligned} & 0.38-16(4) \\ & 0.63 \mathrm{dp} \end{aligned}$ | $\begin{aligned} & \text { 0.44-(4) } \\ & \text { thru } \\ & \hline \end{aligned}$ | $\begin{aligned} & 0.31-(2) \\ & 0.38 \mathrm{dp} \end{aligned}$ | $\begin{aligned} & 0.31-(2) \\ & 0.53 \mathrm{dp} \end{aligned}$ | $\begin{aligned} & 7.91 \\ & {[201]} \\ & \hline \end{aligned}$ | $\begin{aligned} & 9.12 \\ & {[232]} \end{aligned}$ | $\begin{aligned} & 10.68 \\ & {[271]} \end{aligned}$ | $\begin{aligned} & \hline 1.75 \\ & \text { [44] } \end{aligned}$ | $\begin{aligned} & 9.08 \\ & {[231]} \end{aligned}$ | $\begin{aligned} & 6 \\ & {[152]} \end{aligned}$ | $\begin{aligned} & 16 \\ & {[406]} \end{aligned}$ | $\begin{aligned} & 8.42 \\ & {[214]} \end{aligned}$ |
| $\begin{aligned} & 4 \\ & {[100]} \end{aligned}$ | $\begin{aligned} & 9 \\ & \text { [229] } \end{aligned}$ | $\begin{aligned} & 4.03 \\ & {[102]} \end{aligned}$ | $\begin{aligned} & 4.03 \\ & {[102]} \end{aligned}$ | $\begin{aligned} & 3 \\ & {[76]} \end{aligned}$ | $\begin{aligned} & 5.38 \\ & {[137]} \end{aligned}$ | $\begin{aligned} & \hline 5.89 \\ & {[150]} \\ & \hline \end{aligned}$ | $\begin{aligned} & 10.51 \\ & {[267]} \end{aligned}$ | $\begin{aligned} & 9.32 \\ & {[237]} \end{aligned}$ | $\begin{aligned} & 1.41 \\ & {[36]} \end{aligned}$ | $\begin{aligned} & 4.92 \\ & {[125]} \end{aligned}$ | $\begin{aligned} & 4.92 \\ & {[125]} \end{aligned}$ | $\begin{aligned} & 1.94 \\ & {[49]} \end{aligned}$ | $\begin{aligned} & 1.94 \\ & {[49]} \end{aligned}$ | $\begin{aligned} & 1.06 \\ & {[27]} \\ & \hline \end{aligned}$ | $\begin{aligned} & 0.50-13(4) \\ & 0.75 \mathrm{dp} \end{aligned}$ | $\begin{aligned} & 0.56-(4) \\ & \text { thru } \end{aligned}$ | $\begin{aligned} & 0.44-(2) \\ & 0.63 \mathrm{dp} \end{aligned}$ | $\begin{aligned} & 0.44-(2) \\ & 0.63 \mathrm{dp} \end{aligned}$ | $\begin{aligned} & 10.31 \\ & {[217]} \end{aligned}$ | $\begin{aligned} & 11.88 \\ & {[302]} \end{aligned}$ | $\begin{aligned} & 13.49 \\ & {[343]} \end{aligned}$ | $\begin{aligned} & 9.51 \\ & \hline 64] \\ & \hline 64 \end{aligned}$ | $\begin{aligned} & 9.22 \\ & {[2341]} \end{aligned}$ | $\begin{gathered} 10 \\ ][254] \end{gathered}$ | $\begin{aligned} & 24 \\ & {[610]} \end{aligned}$ | $\begin{aligned} & 111.50 \\ & {[292]} \end{aligned}$ |
| $\begin{aligned} & 6 \times 4 \\ & {[150 \times 100]} \end{aligned}$ | $\begin{aligned} & 10.50 \\ & {[267]} \end{aligned}$ | $\begin{aligned} & 4.03 \\ & {[102]} \end{aligned}$ | $\begin{aligned} & {[152]} \\ & {[8} \end{aligned}$ | $\begin{aligned} & 3 \\ & {[76]} \end{aligned}$ | $\begin{aligned} & 5.38 \\ & {[137]} \end{aligned}$ | $\begin{aligned} & 5.89 \\ & {[150]} \end{aligned}$ | $\begin{aligned} & 10.51 \\ & {[267]} \end{aligned}$ | $\begin{aligned} & 9.32 \\ & {[237]} \end{aligned}$ | $\begin{aligned} & 1.41 \\ & {[36]} \end{aligned}$ | $\begin{aligned} & 4.92 \\ & {[125]} \\ & \hline \end{aligned}$ | $\begin{aligned} & 4.92 \\ & {[125]} \\ & \hline \end{aligned}$ | $\begin{aligned} & 1.94 \\ & {[49]} \\ & {[4]} \end{aligned}$ | $\begin{aligned} & 1.94 \\ & {[49]} \end{aligned}$ | $\begin{aligned} & 1.06 \\ & {[27]} \end{aligned}$ | $\begin{aligned} & 0.50-13(4) \\ & 0.75 \mathrm{dp} \end{aligned}$ | $\begin{aligned} & 0.56-(4) \\ & \text { thru } \end{aligned}$ | $\begin{aligned} & \hline 0.44-(2) \\ & 0.63 \mathrm{dp} \\ & \hline \end{aligned}$ | $\begin{aligned} & 0.44-(2) \\ & 0.63 \mathrm{dp} \end{aligned}$ | $\begin{aligned} & 10.31 \\ & {[217]} \end{aligned}$ | $\begin{aligned} & 11.88 \\ & {[302]} \end{aligned}$ | $\begin{aligned} & 13.58 \\ & {[345]} \end{aligned}$ | $\begin{aligned} & 8.51 \\ & \hline[6] \end{aligned}$ | $\begin{aligned} & 12.08 \\ & {[307]} \end{aligned}$ | $\begin{aligned} & 10 \\ & {[254]} \\ & \end{aligned}$ | $\begin{aligned} & 24 \\ & {[610]} \end{aligned}$ | $\begin{aligned} & 11.50 \\ & {[292]} \end{aligned}$ |
| $\begin{aligned} & 6 \\ & {[150]} \end{aligned}$ | $\begin{aligned} & 15.50 \\ & {[394]} \end{aligned}$ | $\begin{aligned} & \hline 6 \\ & {[152]} \end{aligned}$ | $\begin{aligned} & 6 \\ & {[152]} \end{aligned}$ | $\begin{aligned} & 3.5 \\ & {[89]} \end{aligned}$ | $\begin{aligned} & 6.25 \\ & {[159]} \end{aligned}$ | $\begin{aligned} & \hline 7.72 \\ & {[196]} \end{aligned}$ | $\begin{aligned} & 13.72 \\ & {[349]} \end{aligned}$ | $\begin{aligned} & 12.31 \\ & {[313]} \end{aligned}$ | $\begin{aligned} & 1.89 \\ & {[48]} \end{aligned}$ | $\begin{aligned} & 5.51 \\ & {[140]} \end{aligned}$ | $\begin{aligned} & 6.47 \\ & {[165]} \end{aligned}$ | $\begin{aligned} & 2.38 \\ & {[60]} \end{aligned}$ | $\begin{aligned} & 2.38 \\ & {[60]} \end{aligned}$ | $\begin{aligned} & 1.41 \\ & {[36]} \end{aligned}$ | $\begin{aligned} & 0.63-11(4) \\ & 1.00 \mathrm{dp} \end{aligned}$ | $\begin{aligned} & \text { 0.81-(4) } \\ & \text { thru } \end{aligned}$ | $\begin{aligned} & 0.63-(2) \\ & 0.75 \mathrm{dp} \end{aligned}$ | $\begin{aligned} & 0.63-(2) \\ & 0.81 \mathrm{dp} \end{aligned}$ | － | $\begin{aligned} & 15.17 \\ & {[385]} \end{aligned}$ | $\begin{aligned} & 16.97 \\ & {[431]} \end{aligned}$ | $\begin{aligned} & \hline 3 \\ & {[76]} \end{aligned}$ | $\begin{aligned} & 11.56 \\ & \text { [294] } \end{aligned}$ | $\begin{aligned} & 14 \\ & {[356]} \end{aligned}$ | － | － |
| $\begin{aligned} & 8 \times 6 \\ & {[200 \times 150]} \end{aligned}$ | $\begin{aligned} & 18 \\ & {[457]} \end{aligned}$ | $\begin{aligned} & 6 \\ & {[152]} \end{aligned}$ | $\begin{aligned} & 8 \\ & \text { [203] } \end{aligned}$ | $\begin{aligned} & 3.5 \\ & \text { [89] } \end{aligned}$ | $\begin{aligned} & 6.25 \\ & {[159]} \end{aligned}$ | $\begin{aligned} & 7.72 \\ & {[196]} \end{aligned}$ | $\begin{aligned} & 13.72 \\ & {[349]} \end{aligned}$ | $\begin{aligned} & 12.31 \\ & {[313]} \end{aligned}$ | $\begin{aligned} & 1.89 \\ & {[48]} \end{aligned}$ | $\begin{aligned} & 5.51 \\ & {[140]} \end{aligned}$ | $\begin{aligned} & 6.47 \\ & {[165]} \end{aligned}$ | $\begin{aligned} & 2.38 \\ & {[60]} \end{aligned}$ | $\begin{aligned} & 2.38 \\ & {[60]} \end{aligned}$ | $\begin{aligned} & 1.41 \\ & {[36]} \end{aligned}$ | $\begin{aligned} & 0.63-11(4) \\ & 1.00 \mathrm{dp} \end{aligned}$ | $\begin{aligned} & \text { 0.81-(4) } \\ & \text { thru } \end{aligned}$ | $\begin{aligned} & 0.63-(2) \\ & 0.5 \mathrm{dp} \end{aligned}$ | $\begin{aligned} & 0.63-(2) \\ & 0.81 \mathrm{dp} \end{aligned}$ | － | $\begin{aligned} & 15.22 \\ & {[387]} \end{aligned}$ | $\begin{aligned} & 16.98 \\ & {[431]} \end{aligned}$ | $\begin{aligned} & 83 \\ & {[76]} \\ & \hline \end{aligned}$ | $\begin{aligned} & 11.56 \\ & {[294]} \end{aligned}$ | $\begin{aligned} & 14 \\ & {[356]} \\ & \hline \end{aligned}$ | － | － |


|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Size， in［mm］ |  | $\varnothing$ B | BB | D | E | J | JJ | K | $\varnothing \mathbf{L}$ | $\varnothing$ M | MM |  | NN | P | $\varnothing 0$ | $\varnothing 00$ | $\varnothing$ R | $\varnothing$ RR | S | T | U | V | W | X | Y | Z |
| $\begin{aligned} & 1 / 2 \\ & {[13]} \\ & \hline \end{aligned}$ | $\begin{aligned} & \hline 5.50 \\ & {[139.7]} \end{aligned}$ | $\begin{aligned} & \hline 0.51 \\ & {[13]} \\ & \hline \end{aligned}$ | $\begin{aligned} & \hline 0.51 \\ & {[13]} \end{aligned}$ | $\begin{aligned} & 1.12 \\ & {[28]} \\ & \hline \end{aligned}$ | $\begin{aligned} & \hline 2.35 \\ & {[59.7]} \\ & \hline \end{aligned}$ | $\begin{gathered} 1.51 \\ 7 \text { [ [38.4] } \\ \hline \end{gathered}$ |  | $\begin{aligned} & \hline 2.66 \\ & {[67.6]} \end{aligned}$ | $\begin{aligned} & 0.47 \\ & {[12]} \end{aligned}$ | $\begin{aligned} & 1.88 \\ & {[47.6]} \end{aligned}$ |  | $\begin{aligned} & \hline 0.69 \\ & {[17.5]} \\ & \hline \end{aligned}$ |  | $\begin{aligned} & 0.35 \\ & {[8.9]} \end{aligned}$ | $\begin{aligned} & 10-24 \mathrm{unc} \\ & \text { (4) } 0.38 \mathrm{dp} \end{aligned}$ | － | $\begin{aligned} & 0.13-(2) \\ & 0.19 \mathrm{dp} \end{aligned}$ | － | － | － | － | － | － | － | $\begin{aligned} & \hline 6 \\ & {[152]} \end{aligned}$ | $\begin{aligned} & \hline 3.37 \\ & 185.6] \\ & \hline \end{aligned}$ |
| $\begin{aligned} & 3 / 4 \times 1 / 2 \\ & {[193 \times 13]} \\ & \hline \end{aligned}$ | $\begin{aligned} & \hline 6.00 \\ & {[152.4]} \\ & \hline \end{aligned}$ | $\begin{aligned} & \hline 0.51 \\ & {[13]} \end{aligned}$ | $\begin{aligned} & \hline 0.76 \\ & {[19.3]} \end{aligned}$ | $\begin{aligned} & 1.12 \\ & {[28]} \\ & \hline \end{aligned}$ | $\begin{aligned} & \hline 2.35 \\ & {[59.7]} \end{aligned}$ | $\begin{gathered} 1.51 \\ 7][38.4] \end{gathered}$ |  | $\begin{aligned} & \hline 2.66 \\ & {[67.6]} \end{aligned}$ | $\begin{aligned} & 0.47 \\ & \hline[12] \\ & \hline \end{aligned}$ | $\begin{aligned} & 1.88 \\ & {[47.6]} \end{aligned}$ |  | $\begin{aligned} & 0.69 \\ & {[17.5]} \end{aligned}$ |  | $\begin{aligned} & 0.35 \\ & {[8.9]} \end{aligned}$ | $\begin{aligned} & 10-24 \mathrm{unc} \\ & \text { (4) } 0.38 \mathrm{dp} \end{aligned}$ | － | $\begin{aligned} & \hline 0.13-(2) \\ & 0.19 \mathrm{dp} \end{aligned}$ | － | － | － | － | － |  |  | $\begin{aligned} & 6 \\ & {[152]} \end{aligned}$ | $\begin{aligned} & 3.37 \\ & {[85.6]} \end{aligned}$ |
| $\begin{aligned} & 3 / 4 \times 3 / 4 \\ & {[193 \times 19.3]} \\ & \hline \end{aligned}$ | $\begin{aligned} & \hline 6 \\ & \text { [152.4] } \\ & \hline \end{aligned}$ | $\begin{aligned} & \hline 0.76 \\ & {[19.3]} \\ & \hline \end{aligned}$ | $\begin{aligned} & \hline 0.76 \\ & {[19.3]} \end{aligned}$ | $\begin{aligned} & 1.25 \\ & {[32]} \end{aligned}$ | $\begin{aligned} & \hline 2.66 \\ & {[67.6]} \end{aligned}$ | $\begin{gathered} 1.80 \\ \text { b] [45.7] } \\ \hline \end{gathered}$ |  | $\begin{aligned} & 3.34 \\ & {[84.9]} \end{aligned}$ | $\begin{gathered} 0.55 \\ {[14]} \end{gathered}$ | $\begin{aligned} & \hline 2.13 \\ & \text { [54] } \end{aligned}$ |  | $\begin{aligned} & 0.81 \\ & {[20.6]} \\ & \hline \end{aligned}$ | － | $\begin{aligned} & \hline 0.43 \\ & {[10.2]} \end{aligned}$ | $\begin{aligned} & \hline 0.250-20 \\ & \text { (4) } 0.44 \mathrm{dp} \end{aligned}$ | － |  | － | － | － | － | － | － | － | $\begin{aligned} & 8 \\ & {[203]} \end{aligned}$ | $\begin{gathered} 4.18 \\ {[106]} \end{gathered}$ |
| $\begin{aligned} & 1 \times 3 / 4 \\ & {[25 \times 19]} \\ & \hline \end{aligned}$ | $\begin{aligned} & \hline 6.5 \\ & {[165.1]} \\ & \hline \end{aligned}$ | $\begin{aligned} & \hline 0.76 \\ & {[19.3]} \\ & \hline \end{aligned}$ | $\begin{aligned} & \hline 1.01 \\ & {\left[\begin{array}{l} {[25.7]} \end{array}\right.} \end{aligned}$ | $\begin{aligned} & 1.25 \\ & \hline \text { [32] } \end{aligned}$ | $\begin{aligned} & 2.66 \\ & {[67.6]} \end{aligned}$ | $\begin{gathered} 1.80 \\ \text { b] [45.7] } \end{gathered}$ |  | $\begin{aligned} & 3.34 \\ & \text { [84.9] } \end{aligned}$ | $\begin{aligned} & 0.55 \\ & \hline \text { [14] } \end{aligned}$ | $\begin{aligned} & 2.13 \\ & {[54]} \end{aligned}$ |  | $\begin{aligned} & 0.81 \\ & {[20.6]} \\ & \hline \end{aligned}$ | － | $\begin{aligned} & \hline 0.43 \\ & {[10.2]} \\ & \hline \end{aligned}$ | $\begin{aligned} & 0.250-20 \\ & \text { (4) } 0.44 \mathrm{dp} \end{aligned}$ | － | $\begin{aligned} & \hline 0.19-(2) \\ & 0.31 \mathrm{dp} \end{aligned}$ | － | － | － | － | － | － | － | 8 ［203］ | $\begin{gathered} 4.18 \\ {[106]} \end{gathered}$ |
| $\begin{aligned} & 1 \\ & {[25]} \end{aligned}$ | $\begin{aligned} & 6.50 \\ & {[165]} \\ & \hline \end{aligned}$ | $\begin{aligned} & 1.01 \\ & {[26]} \end{aligned}$ | $\begin{aligned} & 1.01 \\ & {[26]} \end{aligned}$ | $\begin{aligned} & 1.76 \\ & {[45]} \\ & \hline \end{aligned}$ | $\begin{aligned} & 3.37 \\ & {[85.6]} \end{aligned}$ | $\text { f] } \begin{array}{r} 2.39 \\ {[61]} \end{array}$ | － | $\begin{gathered} 4.12 \\ {[105]} \end{gathered}$ | $\begin{gathered} 0.71 \\ {[18]} \end{gathered}$ | $\begin{aligned} & 2.76 \\ & {[70]} \end{aligned}$ |  | $\begin{aligned} & 1.21 \\ & {[31]} \end{aligned}$ | － | $\begin{aligned} & 0.55 \\ & {[14]} \\ & \hline \end{aligned}$ | $\begin{aligned} & 0.25-20 \\ & \text { (4) } 0.38 \mathrm{dp} \end{aligned}$ | － |  | － | － | － | － | － | － | － | $\begin{aligned} & 10 \\ & {[254]} \\ & \hline \end{aligned}$ | $\begin{gathered} 5.48 \\ {[139]} \end{gathered}$ |
| $\begin{aligned} & 11 / 2 \\ & {[38]} \\ & \hline \end{aligned}$ | $\begin{aligned} & 7.50 \\ & {[191]} \end{aligned}$ | $\begin{aligned} & 1.51 \\ & {[38]} \\ & \hline \end{aligned}$ | $\begin{aligned} & 1.51 \\ & {[38]} \end{aligned}$ | $\begin{aligned} & 2.24 \\ & {[57]} \end{aligned}$ | $\begin{aligned} & 3.88 \\ & {[98.6]} \end{aligned}$ | $\begin{aligned} & 3.08 \\ & \text { i] }[78] \end{aligned}$ | － | $\begin{aligned} & 5.27 \\ & {[134]} \end{aligned}$ | $\begin{aligned} & \hline 0.86 \\ & {[22]} \end{aligned}$ | $\begin{aligned} & 3.38 \\ & {[86]} \end{aligned}$ | － | $\begin{aligned} & 1.38 \\ & {[35]} \end{aligned}$ | － | $\begin{aligned} & 0.67 \\ & {[17]} \end{aligned}$ | $\begin{aligned} & 0.38-16 \\ & \text { (4) } 0.63 \mathrm{dp} \end{aligned}$ | － | $\begin{aligned} & 0.25-(2) \\ & 0.38 \mathrm{dp} \end{aligned}$ | － | － | － | － | － | － | － | $\begin{aligned} & 12 \\ & {[305]} \end{aligned}$ | $\begin{aligned} & 6.89 \\ & {[175]} \end{aligned}$ |
| $\begin{aligned} & 2 \times 11 / 2 \\ & {[50 \times 38]} \\ & \hline \end{aligned}$ | $\begin{aligned} & \hline 8.50 \\ & {[216]} \\ & \hline \end{aligned}$ | $\begin{aligned} & 1.51 \\ & {[38]} \end{aligned}$ | $\begin{aligned} & 2.03 \\ & {[52]} \end{aligned}$ | $\begin{aligned} & 2.24 \\ & \text { [57] } \end{aligned}$ | $\begin{aligned} & 3.88 \\ & {[98.6]} \end{aligned}$ | $\begin{gathered} 3.08 \\ \hline \text { 3] }[78] \end{gathered}$ | － | $\begin{aligned} & 5.27 \\ & {[134]} \\ & \hline \end{aligned}$ | $\begin{aligned} & \hline 0.86 \\ & {[22]} \end{aligned}$ | $\begin{aligned} & \hline 3.38 \\ & {[86]} \end{aligned}$ |  | $\begin{aligned} & 1.38 \\ & {[35]} \\ & \hline \end{aligned}$ | － | $\begin{aligned} & 0.67 \\ & {[17]} \end{aligned}$ | $\begin{aligned} & 0.38-16 \\ & \text { (4) } 0.63 \mathrm{dp} \end{aligned}$ | － | $\begin{aligned} & \hline 0.25-(2) \\ & 0.38 \mathrm{dp} \end{aligned}$ | － | － | － | － | － | － | － | $\begin{aligned} & \hline 12 \\ & {[305]} \end{aligned}$ | $\begin{aligned} & 6.89 \\ & {[175]} \end{aligned}$ |
| $\begin{aligned} & 2 \\ & \text { [50] } \\ & \hline \end{aligned}$ | $\begin{aligned} & \hline 8.50 \\ & {[216]} \\ & \hline \end{aligned}$ | $\begin{aligned} & 2.03 \\ & {[52]} \\ & \hline \end{aligned}$ | $\begin{aligned} & 2.03 \\ & {[52]} \\ & \hline \end{aligned}$ | $\begin{aligned} & \hline 2.5 \\ & {[63.5]} \\ & \hline \end{aligned}$ | $\begin{aligned} & \hline 4.38 \\ & {[111]} \\ & \hline \end{aligned}$ | $\begin{aligned} & 3.70 \\ & {[94]} \\ & \hline \end{aligned}$ | － | $\begin{aligned} & \hline 6.16 \\ & {[156]} \\ & \hline \end{aligned}$ | $\begin{aligned} & 1.10 \\ & {[28]} \end{aligned}$ | $\begin{aligned} & 4.02 \\ & {[102]} \end{aligned}$ |  | $\begin{aligned} & 1.63 \\ & {[41]} \end{aligned}$ | － | $\begin{aligned} & \hline 0.86 \\ & {[22]} \end{aligned}$ | $\begin{aligned} & 0.38-16(4) \\ & 0.63 \mathrm{dp} \end{aligned}$ | － |  | － | － | － | － | － | － | － | $\begin{aligned} & 16 \\ & {[406]} \end{aligned}$ | $\begin{gathered} 7.61 \\ \text { [193] } \\ \hline \end{gathered}$ |
| $\begin{aligned} & \hline 3 \times 2 \\ & {[80 \times 50]} \\ & \hline \end{aligned}$ | $\begin{aligned} & \hline 11.12 \\ & {[282]} \\ & \hline \end{aligned}$ | $\begin{aligned} & \hline 2.03 \\ & \text { [52] } \end{aligned}$ | $\begin{aligned} & 3.03 \\ & {[77]} \end{aligned}$ | $\begin{aligned} & \hline 2.5 \\ & {[63.5]} \\ & \hline \end{aligned}$ | $\begin{gathered} \hline 4.38 \\ {[111]} \\ \hline \end{gathered}$ | $\begin{aligned} & 3.70 \\ & \text { [94] } \\ & \hline \end{aligned}$ | － | $\begin{aligned} & \hline 6.19 \\ & {[157]} \end{aligned}$ | $\begin{aligned} & 1.10 \\ & {[28]} \end{aligned}$ | $\begin{gathered} 4.02 \\ {[102]} \\ \hline \end{gathered}$ |  | $\begin{aligned} & 1.63 \\ & {[41]} \end{aligned}$ | － | $\begin{aligned} & 0.86 \\ & {[22]} \\ & \hline \end{aligned}$ | $\begin{aligned} & \hline 0.38-16 \\ & \text { (4) } 0.63 \mathrm{dp} \\ & \hline \end{aligned}$ | － | $\begin{aligned} & \hline 0.31-(2) \\ & 0.38 \mathrm{dp} \\ & \hline \end{aligned}$ | － | － | － | － | － | － | － | $\begin{aligned} & \hline 16 \\ & {[406]} \end{aligned}$ | $\begin{gathered} 7.61 \\ \text { [193] } \\ \hline \end{gathered}$ |
| $\begin{aligned} & 3 \\ & \text { [80] } \\ & \hline \end{aligned}$ | $\begin{aligned} & 11.13 \\ & {[283]} \\ & \hline \end{aligned}$ | $\begin{aligned} & 3.03 \\ & {[77]} \end{aligned}$ | $\begin{aligned} & 3.03 \\ & {[77]} \end{aligned}$ | $\begin{aligned} & 3 \\ & {[77]} \\ & \hline \end{aligned}$ | $\begin{aligned} & 5.38 \\ & {[137]} \end{aligned}$ | $\begin{aligned} & 5.14 \\ & \text { [131] } \end{aligned}$ | $\begin{aligned} & 9.76 \\ & {[248]} \end{aligned}$ | $\begin{aligned} & \hline 8.57 \\ & {[218]} \\ & \hline \end{aligned}$ | $\begin{aligned} & 1.41 \\ & {[36]} \end{aligned}$ | $\begin{aligned} & 4.92 \\ & {[125]} \end{aligned}$ | $\begin{gathered} \hline 4.92 \\ 1 \\ \hline \end{gathered}$ | $\begin{aligned} & 1.94 \\ & {[49]} \end{aligned}$ | $\begin{aligned} & 1.94 \\ & {[49]} \end{aligned}$ | $\begin{aligned} & 1.06 \\ & {[27]} \end{aligned}$ | $\begin{aligned} & 0.50-13 \\ & \text { (4) } 0.75 \mathrm{dp} \end{aligned}$ | $\begin{aligned} & 0.56-(4) \\ & \text { thru } \end{aligned}$ | $\begin{aligned} & 0.44-(2) \\ & 0.63 \mathrm{dp} \\ & \hline \end{aligned}$ | $\begin{aligned} & 0.44-(2) \\ & 0.63 \mathrm{dp} \end{aligned}$ | $\begin{aligned} & 9.56 \\ & {[243]} \end{aligned}$ | $\begin{aligned} & 11.13 \\ & {[283]} \end{aligned}$ | $\begin{array}{r} 12.83 \\ {[326]} \\ \hline \end{array}$ | $\begin{aligned} & 2.51 \\ & {[64]} \end{aligned}$ | $\begin{aligned} & 12.08 \\ & {[307]} \\ & \hline \end{aligned}$ | $\begin{aligned} & \hline 14 \\ & {[356]} \\ & \hline \end{aligned}$ | $\begin{aligned} & 24 \\ & {[610]} \end{aligned}$ | $\begin{aligned} & 10.75 \\ & {[273]} \end{aligned}$ |
| $\begin{aligned} & 4 \times 3 \\ & {[100 \times 80]} \end{aligned}$ | $\begin{aligned} & 12 \\ & {[305]} \end{aligned}$ | $\begin{aligned} & 3.03 \\ & {[77]} \end{aligned}$ | $\begin{gathered} \hline 4.08 \\ {[104]} \end{gathered}$ | $\begin{aligned} & 3 \\ & {[77]} \\ & \hline \end{aligned}$ | $\begin{aligned} & \hline 5.38 \\ & {[137]} \end{aligned}$ | $\begin{aligned} & \hline 5.14 \\ & \text { [131] } \\ & \hline \end{aligned}$ | $\begin{aligned} & 9.76 \\ & {[288]} \end{aligned}$ | $\begin{aligned} & 8.57 \\ & {[218]} \end{aligned}$ | $\begin{aligned} & 1.41 \\ & {[36]} \end{aligned}$ | $\begin{aligned} & 4.92 \\ & {[125]} \end{aligned}$ | $\begin{aligned} & 4.92 \\ & \text { [125] } \end{aligned}$ | $\begin{aligned} & 1.94 \\ & {[49]} \\ & \hline 49 \end{aligned}$ | $\begin{aligned} & 1.94 \\ & {[49]} \end{aligned}$ | $\begin{aligned} & 1.06 \\ & {[27]} \end{aligned}$ | $\begin{aligned} & 0.50-13 \\ & \text { (4) } 0.75 \mathrm{dp} \end{aligned}$ | $\begin{aligned} & 0.56-(4) \\ & \text { thru } \end{aligned}$ | $\begin{aligned} & 0.44-(2) \\ & 0.63 \mathrm{dp} \end{aligned}$ | $\begin{aligned} & 0.44-(2) \\ & 0.63 \mathrm{dp} \end{aligned}$ | $\begin{aligned} & 9.56 \\ & {[243]} \end{aligned}$ | $\begin{aligned} & 11.26 \\ & {[286]} \end{aligned}$ | $\begin{aligned} & 13.02 \\ & {[331]} \end{aligned}$ | $\begin{aligned} & 23 \\ & \hline \end{aligned}$ | $\begin{aligned} & 11.56 \\ & {[294]} \end{aligned}$ | $\begin{aligned} & 14 \\ & {[356]} \end{aligned}$ | $\begin{aligned} & 24 \\ & {[610]} \\ & \hline \end{aligned}$ | $\begin{aligned} & 10.75 \\ & {[273]} \end{aligned}$ |
| $\begin{aligned} & \hline 4 \\ & {[100]} \\ & \hline \end{aligned}$ | $\begin{aligned} & \hline 12 \\ & {[305]} \\ & \hline \end{aligned}$ | $\begin{aligned} & \hline 4.03 \\ & {[102]} \end{aligned}$ | $\begin{gathered} 4.08 \\ {[104]} \end{gathered}$ | $\begin{aligned} & \hline 3.5 \\ & \text { [89] } \end{aligned}$ | $\begin{gathered} 6.25 \\ {[159]} \end{gathered}$ | $\begin{aligned} & 6.22 \\ & {[158]} \\ & \hline \end{aligned}$ | $\begin{aligned} & \begin{array}{l} 12.22 \\ {[310]} \\ \hline \end{array} ⿳ ⺈ ⿴ 囗 十 一 ⿱ ⿴ 囗 十 丌 \end{aligned}$ | $\begin{aligned} & 10.81 \\ & \text { [275] } \end{aligned}$ | $\begin{aligned} & 1.89 \\ & {[48]} \end{aligned}$ | $\begin{aligned} & 5.51 \\ & {[140]} \end{aligned}$ | $\begin{aligned} & 6.5 \\ & {[165]} \end{aligned}$ | $\begin{aligned} & 2.38 \\ & {[60]} \\ & \hline \end{aligned}$ | $\begin{aligned} & \hline 2.38 \\ & {[60]} \end{aligned}$ | $\begin{aligned} & 1.41 \\ & {[36]} \end{aligned}$ | $\begin{aligned} & 0.63-(4) \\ & 1.00 \mathrm{dp} \end{aligned}$ | $\begin{aligned} & \text { 0.81-(4) } \\ & \text { thru } \end{aligned}$ | $\begin{aligned} & \hline 0.63-(2) \\ & 0.81 \mathrm{dp} \end{aligned}$ | $\begin{aligned} & 0.63-(2) \\ & 0.75 \mathrm{dp} \end{aligned}$ | $\begin{aligned} & \hline 12.06 \\ & {[306]} \end{aligned}$ | $\begin{aligned} & 13.72 \\ & {[349]} \end{aligned}$ | $\begin{array}{r} 15.48 \\ {[393]} \\ \hline \end{array}$ | $\begin{aligned} & \hline 3 \\ & {[76]} \end{aligned}$ | $\begin{aligned} & 13.31 \\ & {[338]} \end{aligned}$ | $\begin{aligned} & 20 \\ & {[508]} \\ & \hline \end{aligned}$ | － | － |
| $\begin{aligned} & 6 \times 4 \\ & {[150 \times 100]} \end{aligned}$ | $\begin{aligned} & 15.88 \\ & {[403]} \\ & \hline \end{aligned}$ | $\begin{gathered} 4.03 \\ {[102]} \end{gathered}$ | 6 <br> $[152]$ | $\begin{aligned} & 3.5 \\ & \text { [89] } \\ & \hline \end{aligned}$ | $\begin{aligned} & 6.25 \\ & {[159]} \\ & \hline \end{aligned}$ | $\begin{gathered} 6.22 \\ 1][158] \\ \hline \end{gathered}$ | $\begin{aligned} & \begin{array}{l} 12.22 \\ {[310]} \\ \hline \end{array} ⿳ ⺈ ⿴ 囗 十 一 2, \end{aligned}$ | $\begin{aligned} & 10.81 \\ & \text { [275] } \end{aligned}$ | $\begin{aligned} & 1.89 \\ & {[48]} \end{aligned}$ | $\begin{aligned} & 5.51 \\ & {[140]} \end{aligned}$ | $\begin{aligned} & 6.5 \\ & {[165]} \end{aligned}$ | $\begin{aligned} & 2.38 \\ & {[60]} \end{aligned}$ | $\begin{aligned} & 2.38 \\ & {[60]} \end{aligned}$ | $\begin{aligned} & 1.41 \\ & {[36]} \end{aligned}$ | $\begin{aligned} & 0.63-(4) \\ & 1.00 \mathrm{dp} \\ & \hline \end{aligned}$ | $\begin{aligned} & \text { 0.81-(4) } \\ & \text { thru } \end{aligned}$ | $\begin{aligned} & 0.63-(2) \\ & 0.81 \mathrm{dp} \end{aligned}$ | $\begin{aligned} & \hline 0.63-(2) \\ & 0.75 \mathrm{dp} \\ & \hline \end{aligned}$ | $\begin{aligned} & 12.06 \\ & {[306]} \\ & \hline \end{aligned}$ | $\begin{aligned} & 13.72 \\ & {[349]} \\ & \hline \end{aligned}$ | $\begin{array}{r} 15.48 \\ {[393]} \\ \hline \end{array}$ | $\begin{aligned} & 3 \\ & {[76]} \end{aligned}$ | $\begin{aligned} & 13.31 \\ & {[338]} \\ & \hline \end{aligned}$ | $\begin{aligned} & 120 \\ & 1 \quad[508] \\ & \hline \end{aligned}$ | － | － |
| $\begin{aligned} & \hline 6 \\ & {[150]} \\ & \hline \end{aligned}$ | $\begin{aligned} & 15.88 \\ & {[403]} \\ & \hline \end{aligned}$ | $\begin{aligned} & 6 \\ & {[152]} \end{aligned}$ | $\begin{aligned} & 6 \\ & {[152]} \end{aligned}$ | $\begin{aligned} & \hline 4.25 \\ & {[108]} \\ & \hline \end{aligned}$ | $\begin{aligned} & \hline 7.75 \\ & {[197]} \\ & \hline \end{aligned}$ | $\begin{aligned} & 8.05 \\ & {[205]} \\ & \hline \end{aligned}$ | $\begin{array}{r} 15.43 \\ {[392]} \\ \hline \end{array}$ | $\begin{array}{r} 314.09 \\ \\ \hline \end{array}$ | $\begin{aligned} & 2.36 \\ & {[60]} \end{aligned}$ | $\begin{aligned} & 6.5 \\ & {[165]} \end{aligned}$ | $\begin{aligned} & 6.5 \\ & {[165]} \\ & \hline \end{aligned}$ | $\begin{aligned} & \hline 3 \\ & {[76]} \end{aligned}$ | $\begin{aligned} & 3 \\ & {[76]} \end{aligned}$ | － | $\begin{aligned} & 0.75-(4) \\ & 0.81 \mathrm{dp} \end{aligned}$ | $\begin{aligned} & \text { 0.81-(4) } \\ & \text { thru } \end{aligned}$ | $\begin{aligned} & 0.75-(2) \\ & 1.06 \mathrm{dp} \end{aligned}$ | $\begin{aligned} & 0.75-(2) \\ & 1.06 \mathrm{dp} \end{aligned}$ | － | $\begin{aligned} & 17.05 \\ & {[433]} \end{aligned}$ | $\begin{array}{r} 18.98 \\ \text { [482] } \\ \hline \end{array}$ | $\begin{aligned} & \hline 3.62 \\ & {[92]} \\ & \hline \end{aligned}$ | $\begin{aligned} & 13.21 \\ & {[336]} \\ & \hline \end{aligned}$ | $\begin{aligned} & \hline 14 \\ & {[356]} \end{aligned}$ | － | － |
| $8 \times 6[200 \times 150]$ <br> Short pattern | $\begin{aligned} & 16.5 \\ & {[419]} \end{aligned}$ | $\begin{aligned} & 6 \\ & \text { [152] } \end{aligned}$ | $\begin{aligned} & 8 \\ & \text { [203] } \end{aligned}$ | $\begin{aligned} & \hline 4.25 \\ & {[108]} \\ & \hline \end{aligned}$ | $\begin{aligned} & 7.75 \\ & {[197]} \end{aligned}$ | $\begin{aligned} & 8.05 \\ & {[205]} \end{aligned}$ | $\begin{aligned} & 15.43 \\ & {[392]} \\ & \hline \end{aligned}$ | $\begin{aligned} & 314.09 \\ & 1 \\ & \hline \end{aligned}$ | $\begin{aligned} & 2.36 \\ & {[60]} \end{aligned}$ | $\begin{aligned} & \hline 6.5 \\ & {[165]} \end{aligned}$ | $\begin{aligned} & 6.5 \\ & {[165]} \end{aligned}$ | $\begin{aligned} & \hline 3 \\ & {[76]} \end{aligned}$ | $\begin{aligned} & 3 \\ & {[76]} \end{aligned}$ | － | $\begin{aligned} & 0.75-(4) \\ & 0.81 \mathrm{dp} \end{aligned}$ | $\begin{aligned} & \text { 0.81-(4) } \\ & \text { thru } \end{aligned}$ | $\begin{aligned} & 0.75-(2) \\ & 1.06 \mathrm{dp} \end{aligned}$ | $\begin{aligned} & 0.75-(2) \\ & 1.06 \mathrm{dp} \end{aligned}$ | － | $\begin{aligned} & 17.05 \\ & {[433]} \end{aligned}$ | $\begin{aligned} & 18.98 \\ & {[482]} \end{aligned}$ | $\begin{aligned} & 3.62 \\ & {[92]} \end{aligned}$ | $\begin{aligned} & 13.21 \\ & {[336]} \end{aligned}$ | $\begin{aligned} & 14 \\ & {[356]} \end{aligned}$ | － | － |


| WKM 320F Valve Class 600 Dimensions |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Size, in [mm] | $\frac{\mathrm{A}}{\mathrm{RF}}$ |  | $\varnothing$ B | BB | D | E | J | JJ | K | $\varnothing$ L | $\varnothing$ M |  | M N | NN | P | $\varnothing 0$ | $\varnothing 00$ | $\varnothing$ R | $\varnothing$ RR | S | T | U | V | W | X | Y | Z |
| $\begin{aligned} & 1 / 2 \\ & {[13]} \end{aligned}$ | $\begin{aligned} & \hline 6.5 \\ & {[165]} \end{aligned}$ | $\begin{aligned} & \hline 6.5 \\ & {[165]} \end{aligned}$ | $\begin{aligned} & \hline 0.51 \\ & {[13]} \end{aligned}$ | $\begin{aligned} & \hline 0.51 \\ & {[13]} \end{aligned}$ | $\begin{aligned} & \hline 1.12 \\ & {[28.5]} \end{aligned}$ | $\begin{aligned} & 2.35 \\ & 1[59.7] \end{aligned}$ | $\begin{aligned} & 1.51 \\ & {[38.4]} \end{aligned}$ |  |  | $\begin{gathered} 0.47 \\ {[11.9]} \end{gathered}$ | $\begin{aligned} & \hline 1.88 \\ & {[47.6]} \end{aligned}$ |  | $\begin{aligned} & \hline 0.69 \\ & {[17.5]} \end{aligned}$ |  | $\begin{aligned} & \hline 0.35 \\ & {[8.92]} \end{aligned}$ | $10-24 \mathrm{unc}$ (4) 0.38 dp |  | $\begin{aligned} & \hline 0.125-(2) \\ & 0.19 \mathrm{dp} \end{aligned}$ |  | - | - |  | - | - | - | $\begin{aligned} & \hline 6 \\ & {[152]} \end{aligned}$ | $\begin{aligned} & \hline 3.37 \\ & {[85.6]} \end{aligned}$ |
| $\begin{aligned} & 3 / 4 \times 1 / 2 \\ & {[19 \times 13]} \end{aligned}$ | $\begin{aligned} & \hline 7.5 \\ & {[191]} \end{aligned}$ | $\begin{aligned} & 7.5 \\ & {[191]} \\ & \hline \end{aligned}$ | $\begin{aligned} & \hline 0.51 \\ & {[13]} \end{aligned}$ | $\begin{aligned} & \hline 0.76 \\ & {[19.3]} \end{aligned}$ | $\begin{gathered} 1.12 \\ \text { B] }[28.5] \\ \hline \end{gathered}$ | $\begin{gathered} 2.35 \\ \hline \text { [ }[59.7] \\ \hline \end{gathered}$ | $\begin{aligned} & 1.51 \\ & {[38.4]} \end{aligned}$ |  | $\begin{aligned} & 2.66 \\ & {[67.6]} \end{aligned}$ | $\begin{gathered} 0.47 \\ \text { i] [11.9] } \end{gathered}$ | $\begin{aligned} & 1.88 \\ & {[47.6]} \\ & \hline \end{aligned}$ |  | $\begin{aligned} & 0.69 \\ & {[17.5]} \end{aligned}$ |  | $\begin{aligned} & 0.35 \\ & {[8.92]} \end{aligned}$ | $\begin{aligned} & 10-24 \mathrm{unc} \\ & \text { (4) } 0.38 \mathrm{dp} \end{aligned}$ |  | $\begin{aligned} & 0.125-(2) \\ & 0.19 \mathrm{dp} \end{aligned}$ |  | - |  |  | - | - | - | $\begin{aligned} & \hline 6 \\ & {[152]} \end{aligned}$ | $\begin{aligned} & \hline 3.37 \\ & {[85.6]} \end{aligned}$ |
| $\begin{aligned} & 3 / 4 \times 3 / 4 \\ & {[19 \times 19]} \\ & \hline \end{aligned}$ | $\begin{aligned} & \hline 7.5 \\ & \text { [191] } \\ & \hline \end{aligned}$ | $\begin{aligned} & \hline 7.5 \\ & {[191]} \\ & \hline \end{aligned}$ | $\begin{aligned} & 0.76 \\ & {[19.3]} \\ & \hline \end{aligned}$ | $\begin{aligned} & \hline 0.76 \\ & {[19.3]} \\ & \hline \end{aligned}$ |  |  | $\begin{aligned} & 1.80 \\ & {[45.7]} \end{aligned}$ |  |  |  | $\begin{array}{r} 2.13 \\ \text { ] [54] } \end{array}$ |  | $\begin{aligned} & 0.81 \\ & {[20.6]} \end{aligned}$ |  | $\begin{aligned} & \hline 0.43 \\ & {[10.9]} \\ & \hline \end{aligned}$ | $\begin{aligned} & 0.25-(4) \\ & 0.44 \mathrm{dp} \end{aligned}$ | - | $\begin{aligned} & 0.187-(2) \\ & 0.31 \mathrm{dp} \\ & \hline \end{aligned}$ |  | - | - | - | - | - | - | $\begin{aligned} & 8 \\ & {[203]} \end{aligned}$ | $\begin{aligned} & 4.18 \\ & {[106]} \end{aligned}$ |
| $\begin{aligned} & 1 \times 3 / 4 \\ & {[25 \times 19]} \end{aligned}$ | $\begin{aligned} & 8.5 \\ & {[216]} \end{aligned}$ | $\begin{aligned} & 8.5 \\ & {[216]} \end{aligned}$ | $\begin{aligned} & \hline 0.76 \\ & {[19.3]} \end{aligned}$ | $\begin{aligned} & 1.01 \\ & {[25.7]} \end{aligned}$ | $\begin{gathered} 1.25 \\ 7[31.8] \\ \hline \end{gathered}$ | $\begin{aligned} & 2.66 \\ & {[67.6]} \end{aligned}$ | $\begin{aligned} & 1.80 \\ & {[45.7]} \end{aligned}$ | - |  | $\begin{array}{ll} 10.55 \\ 9] \\ \hline 13.9] \\ \hline \end{array}$ | $\begin{aligned} & 2.13 \\ & {[54]} \end{aligned}$ |  | $\begin{aligned} & 0.81 \\ & {[20.6]} \end{aligned}$ |  | $\begin{aligned} & \hline 0.43 \\ & {[10.9]} \\ & \hline \end{aligned}$ | $\begin{array}{r} 0.25-(4) \\ 10.44 \mathrm{dp} \end{array}$ | - | $\begin{aligned} & \hline 0.187-(2) \\ & 0.31 \mathrm{dp} \\ & \hline \end{aligned}$ |  | - | - |  | - | - |  | $\begin{aligned} & 8 \\ & \text { [203] } \end{aligned}$ | $\begin{gathered} \hline 4.18 \\ {[106]} \end{gathered}$ |
| $\begin{aligned} & 1 \\ & {[25]} \\ & \hline \end{aligned}$ | $\begin{aligned} & \hline 8.5 \\ & {[216]} \\ & \hline \end{aligned}$ | $\begin{aligned} & 8.5 \\ & {[216]} \end{aligned}$ | $\begin{aligned} & 1.01 \\ & {[26]} \end{aligned}$ |  |  |  | $\begin{array}{r} 2.39 \\ \hline[61] \\ \hline \end{array}$ | - | $\begin{gathered} 4.12 \\ \text { [105] } \end{gathered}$ | $\begin{aligned} & 0.71 \\ & {[18]} \end{aligned}$ | $\begin{aligned} & 2.76 \\ & {[70]} \end{aligned}$ |  | $\begin{aligned} & 1.21 \\ & {[31]} \\ & \hline \end{aligned}$ |  | $\begin{aligned} & 0.55 \\ & {[14]} \end{aligned}$ |  | - | $\begin{aligned} & 0.19-(2) \\ & 0.31 \mathrm{dp} \\ & \hline \end{aligned}$ | - | - | - | - | - | - | - | $\begin{aligned} & 10 \\ & \text { [254] } \end{aligned}$ | $\begin{aligned} & \hline 5.48 \\ & {[139]} \\ & \hline \end{aligned}$ |
| $\begin{aligned} & 11 / 2 \\ & {[38]} \\ & \hline \end{aligned}$ | $\begin{aligned} & 9.5 \\ & {[241]} \\ & \hline \end{aligned}$ | $\begin{aligned} & 9.5 \\ & {[241]} \\ & \hline \end{aligned}$ | $\begin{aligned} & 1.51 \\ & {[38]} \end{aligned}$ | $\begin{aligned} & 1.51 \\ & {[38.4]} \end{aligned}$ | $\begin{gathered} 2.24 \\ \text { 4] }[56.9] \end{gathered}$ | $\begin{gathered} 3.88 \\ \left.y_{3} .88 .6\right] \\ \hline 98.6] \end{gathered}$ | $\begin{aligned} & 3.08 \\ & {[78]} \\ & \hline \end{aligned}$ | - | $\begin{aligned} & 5.27 \\ & {[134]} \end{aligned}$ | $\begin{aligned} & 0.86 \\ & {[22]} \\ & \end{aligned}$ | $\begin{aligned} & 3.38 \\ & \text { [86] } \end{aligned}$ |  | $\begin{aligned} & 1.38 \\ & {[35]} \end{aligned}$ |  | $\begin{aligned} & 0.67 \\ & {[17]} \\ & \hline \end{aligned}$ | $\begin{aligned} & 0.38-(4) \\ & 0.63 \mathrm{dp} \end{aligned}$ | - | $\begin{aligned} & 0.25-(2) \\ & 0.38 \mathrm{dp} \end{aligned}$ | - | - | - | - | - | - | - | $\begin{aligned} & 12 \\ & {[305]} \end{aligned}$ | $\begin{aligned} & 6.89 \\ & {[175]} \end{aligned}$ |
| $\begin{aligned} & 2 \times 11 / 2 \\ & {[50 \times 38]} \\ & \hline \end{aligned}$ | $\begin{aligned} & 11.5 \\ & {[292]} \\ & \hline \end{aligned}$ | $\begin{aligned} & 11.6 \\ & \text { [295] } \\ & \hline \end{aligned}$ | $\begin{aligned} & 1.51 \\ & {[38]} \\ & \hline \end{aligned}$ | $\begin{aligned} & 2.03 \\ & {[51.6]} \\ & \hline \end{aligned}$ | $\begin{gathered} 2.24 \\ 6] \\ 6565] \\ \hline \end{gathered}$ | $\begin{gathered} 3.88 \\ {[98.6]} \end{gathered}$ | $\begin{array}{r} 3.08 \\ \hline \text { i78] } \end{array}$ | - | $\begin{aligned} & 5.27 \\ & \text { [134] } \\ & \hline \end{aligned}$ | $\begin{aligned} & 0.86 \\ & {[22]} \\ & \hline \end{aligned}$ | $\begin{aligned} & \begin{array}{l} 3.38 \\ {[86]} \\ \hline \end{array} . \begin{array}{l}  \\ \hline \end{array} \\ & \hline \end{aligned}$ |  | $\begin{aligned} & 1.38 \\ & {[35]} \\ & \hline \end{aligned}$ |  | $\begin{aligned} & 0.67 \\ & {[17]} \\ & \hline \end{aligned}$ | $\begin{aligned} & 0.38-(4) \\ & 0.63 \mathrm{dp} \end{aligned}$ | - | $\begin{aligned} & \hline 0.25-(2) \\ & 0.38 \mathrm{dp} \\ & \hline \end{aligned}$ | - | - | - | - | - | - | - | $\begin{aligned} & 12 \\ & {[305]} \\ & \hline \end{aligned}$ | $\begin{aligned} & \hline 6.89 \\ & {[175]} \\ & \hline \end{aligned}$ |
| $\begin{aligned} & 2 \\ & {[50]} \\ & \hline \end{aligned}$ | $\begin{aligned} & 11.5 \\ & {[292]} \\ & \hline \end{aligned}$ | [295] | $\begin{aligned} & \hline 2.03 \\ & {[51.6]} \\ & \hline \end{aligned}$ | $\begin{aligned} & 2.03 \\ & {[51.6]} \end{aligned}$ | $\begin{gathered} 2.5 \\ b][63.5] \end{gathered}$ | $\begin{gathered} 4.38 \\ {[111]} \\ \hline \end{gathered}$ | $\begin{aligned} & 3.70 \\ & {[94]} \end{aligned}$ | $\begin{aligned} & \hline 7.2 \\ & {[183]} \\ & \hline \end{aligned}$ | $\begin{aligned} & 6.19 \\ & {[157]} \end{aligned}$ | $\begin{aligned} & 1.10 \\ & {[28]} \\ & \hline \end{aligned}$ | $\begin{aligned} & 4.02 \\ & {[102]} \\ & \hline \end{aligned}$ | $\begin{gathered} 4.02 \\ {[102]} \\ \hline \end{gathered}$ | $\begin{array}{cc} 2 & 1.63 \\ 12] \\ \hline 241] \\ \hline \end{array}$ | [41] | $\begin{aligned} & 0.86 \\ & {[22]} \end{aligned}$ | $\begin{aligned} & 0.38-(4) \\ & 0.63 \mathrm{dp} \end{aligned}$ | thru | $\begin{aligned} & 0.31-(2) \\ & 0.38 \mathrm{dp} \end{aligned}$ | $\begin{aligned} & 0.31-(2) \\ & 0.53 \mathrm{dp} \end{aligned}$ | - | $\begin{aligned} & 8.3 \\ & {[211]} \end{aligned}$ | $\begin{aligned} & 9.85 \\ & {[250]} \end{aligned}$ | [44.5] | $\begin{aligned} & 9.08 \\ & {[231]} \end{aligned}$ | $\begin{aligned} & 6 \\ & {[152]} \end{aligned}$ | $\begin{aligned} & 16 \\ & {[406]} \end{aligned}$ | $\begin{aligned} & \hline 7.61 \\ & {[193]} \\ & \hline \end{aligned}$ |
| $\begin{aligned} & 3 \times 2 \\ & {[80 \times 50]} \end{aligned}$ | $\begin{aligned} & 14 \\ & {[356]} \end{aligned}$ | $\begin{gathered} 14.1 \\ \text { [359] } \\ \hline \end{gathered}$ | $\begin{aligned} & \hline 2.03 \\ & {[51.6]} \\ & \hline \end{aligned}$ | $\begin{aligned} & 3.03 \\ & {[77]} \\ & \hline \end{aligned}$ | $\begin{aligned} & 2.5 \\ & {[63.5]} \\ & \hline \end{aligned}$ | $\begin{array}{r} 4.38 \\ \text { [ [111] } \\ \hline \end{array}$ | $\begin{aligned} & 3.70 \\ & {[94]} \\ & \hline \end{aligned}$ | $\begin{aligned} & \hline 7.2 \\ & {[183]} \\ & \hline \end{aligned}$ | $\begin{gathered} 6.19 \\ {[157]} \end{gathered}$ | $\begin{aligned} & 1.10 \\ & {[28]} \end{aligned}$ | $\begin{aligned} & \hline 4.02 \\ & {[102]} \\ & \hline \end{aligned}$ | $\begin{aligned} & \hline 4.02 \\ & {[102]} \\ & \hline \end{aligned}$ | $\begin{array}{ll} 2 & 1.63 \\ 2] & {[41]} \\ \hline \end{array}$ | $\begin{aligned} & 1.63 \\ & \text { [41] } \end{aligned}$ | $\begin{aligned} & \hline 0.86 \\ & {[22]} \end{aligned}$ | $\begin{aligned} & \hline 0.38-(4) \\ & 0.63 \mathrm{dp} \\ & \hline \end{aligned}$ | $\begin{aligned} & \text { 0.44-(4) } \\ & \text { thru } \end{aligned}$ | $\begin{aligned} & 0.31-(2) \\ & 0.38 \mathrm{dp} \end{aligned}$ | $\begin{aligned} & 0.31-(2) \\ & 0.53 \mathrm{dp} \\ & \hline \end{aligned}$ | - | $\begin{aligned} & 8.3 \\ & {[211]} \end{aligned}$ | $\begin{aligned} & 9.85 \\ & \text { [250] } \\ & \hline \end{aligned}$ | $\begin{aligned} & 1.75 \\ & {[44.5]} \end{aligned}$ | $\begin{array}{r} 9.08 \\ 1][231] \\ \hline \end{array}$ | $\begin{aligned} & 6 \\ & {[152]} \end{aligned}$ | $\begin{aligned} & 16 \\ & {[406]} \end{aligned}$ | $\begin{aligned} & \hline 7.61 \\ & {[193]} \\ & \hline \end{aligned}$ |
| $\begin{aligned} & 3 \\ & \text { [80] } \\ & \hline \end{aligned}$ | $\begin{aligned} & 14 \\ & {[283]} \\ & \hline \end{aligned}$ | [359] | $\begin{aligned} & 3.03 \\ & {[77]} \end{aligned}$ | $\begin{aligned} & 3.03 \\ & {[77]} \\ & \hline \end{aligned}$ | $\begin{aligned} & 3 \\ & {[76.2]} \\ & \hline \end{aligned}$ | $\begin{gathered} 5.38 \\ {[137]} \\ \hline \end{gathered}$ | $\begin{aligned} & 5.14 \\ & {[131]} \\ & \hline \end{aligned}$ | $\begin{aligned} & 9.76 \\ & {[248]} \end{aligned}$ | $\begin{aligned} & 8.57 \\ & {[217]} \\ & \hline \end{aligned}$ | $\begin{aligned} & 1.41 \\ & {[36]} \end{aligned}$ | $\begin{aligned} & \hline 4.92 \\ & {[125]} \\ & \hline \end{aligned}$ | $\begin{aligned} & \hline 4.92 \\ & {[125]} \\ & \hline \end{aligned}$ | $\begin{array}{ll} 2 & 1.94 \\ .5] \\ \hline 59] \\ \hline \end{array}$ | $\begin{aligned} & 1.94 \\ & {[49]} \\ & \hline \end{aligned}$ | $\begin{aligned} & 1.06 \\ & {[27]} \\ & \hline \end{aligned}$ | $0.75 \mathrm{dp}$ | $\begin{aligned} & 0.56-(4) \\ & \text { thru } \end{aligned}$ | $\begin{aligned} & 0.44-(2) \\ & 0.63 \mathrm{dp} \\ & \hline \end{aligned}$ | $\begin{aligned} & 0.44-(2) \\ & 0.63 \mathrm{dp} \end{aligned}$ | $\begin{aligned} & 9.56 \\ & {[243]} \\ & \hline \end{aligned}$ | $\begin{aligned} & 11.1 \\ & {[283]} \end{aligned}$ | $\begin{aligned} & 12.8 \\ & {[326]} \\ & \hline \end{aligned}$ | $\begin{aligned} & 2.51 \\ & {[63.8]} \\ & \hline \end{aligned}$ | $\begin{aligned} & 12.2 \\ & {[310]} \\ & \hline \end{aligned}$ | $\begin{aligned} & 12 \\ & {[305]} \\ & \hline \end{aligned}$ | $\begin{aligned} & \hline 24 \\ & {[610]} \\ & \hline \end{aligned}$ | $\begin{aligned} & \hline 10.8 \\ & {[273]} \\ & \hline \end{aligned}$ |
| $\begin{aligned} & 4 \times 3 \\ & {[100 \times 80]} \end{aligned}$ | $\begin{aligned} & 17 \\ & {[432]} \end{aligned}$ | $\begin{aligned} & 17.1 \\ & {[435]} \end{aligned}$ | $\begin{aligned} & 3.03 \\ & {[77]} \\ & \hline \end{aligned}$ | $\begin{aligned} & 4.08 \\ & {[104]} \end{aligned}$ | $\begin{aligned} & 3 \\ & {[76.2]} \end{aligned}$ | $\begin{gathered} 5.38 \\ {[137]} \end{gathered}$ | $\begin{aligned} & 5.14 \\ & \text { [131] } \end{aligned}$ | $\begin{aligned} & 9.76 \\ & {[248]} \end{aligned}$ | $\begin{aligned} & 8.57 \\ & {[217]} \end{aligned}$ | $\begin{aligned} & 1.41 \\ & {[36]} \end{aligned}$ | $\begin{aligned} & 4.92 \\ & \text { [125] } \end{aligned}$ | $\begin{aligned} & 4.92 \\ & \text { [125] } \end{aligned}$ | $\begin{aligned} & 121.94 \\ & \hline 5] \\ & \hline 5] \\ & \hline \end{aligned}$ | $\begin{aligned} & 1.94 \\ & {[49]} \end{aligned}$ | $\begin{aligned} & 1.06 \\ & {[27]} \\ & \hline[2 \end{aligned}$ | $\begin{aligned} & 0.50-(4) \\ & 0.75 \mathrm{dp} \end{aligned}$ | $\begin{aligned} & 0.56-(4) \\ & \text { thru } \end{aligned}$ | $\begin{aligned} & 0.44-(2) \\ & 0.63 \mathrm{dp} \end{aligned}$ | $\begin{aligned} & 0.44-(2) \\ & 0.63 \mathrm{dp} \end{aligned}$ | $\begin{aligned} & 9.56 \\ & {[243]} \end{aligned}$ | $\begin{aligned} & 11.3 \\ & {[286]} \end{aligned}$ | $\begin{aligned} & 13.0 \\ & {[331]} \end{aligned}$ | $\begin{aligned} & \hline 3 \\ & \hline 76.2] \end{aligned}$ | $\begin{gathered} 11.7 \\ {[297]} \\ \hline \end{gathered}$ | $\begin{aligned} & \hline 12 \\ & {[305]} \end{aligned}$ | $\begin{aligned} & 24 \\ & {[610]} \end{aligned}$ | $\begin{aligned} & 10.8 \\ & {[273]} \end{aligned}$ |
| $\begin{aligned} & 4 \\ & {[100]} \end{aligned}$ | $\begin{aligned} & 17 \\ & {[432]} \end{aligned}$ | $\begin{aligned} & 17.1 \\ & {[435]} \end{aligned}$ | $\begin{aligned} & 4.03 \\ & {[102]} \end{aligned}$ | $\begin{gathered} 4.03 \\ {[102]} \end{gathered}$ | $\begin{aligned} & 3.5 \\ & {[88.9]} \end{aligned}$ | $\begin{aligned} & 6.25 \\ & {[159]} \end{aligned}$ | $\begin{aligned} & 6.22 \\ & {[158]} \end{aligned}$ | $\begin{aligned} & 12.2 \\ & {[310]} \end{aligned}$ | $\begin{aligned} & 10.8 \\ & {[275]} \end{aligned}$ | $\begin{aligned} & 1.89 \\ & {[48]} \end{aligned}$ | $\begin{aligned} & 5.51 \\ & {[140]} \end{aligned}$ | $\begin{aligned} & 6.5 \\ & {[165]} \end{aligned}$ | $\begin{aligned} & 2.38 \\ & \text { i5] } \\ & {[60]} \end{aligned}$ | $\begin{aligned} & 2.38 \\ & {[60]} \end{aligned}$ | $\begin{aligned} & 1.41 \\ & \text { [36] } \end{aligned}$ | $\begin{aligned} & 0.63-(4) \\ & 1.00 \mathrm{dp} \end{aligned}$ | $\begin{aligned} & \text { 0.81-(4) } \\ & \text { thru } \end{aligned}$ | $\begin{aligned} & 0.63-(2) \\ & 0.75 \mathrm{dp} \end{aligned}$ | $\begin{aligned} & 0.63-(2) \\ & 0.81 \mathrm{dp} \end{aligned}$ | $\begin{aligned} & 12.1 \\ & {[306]} \end{aligned}$ | $\begin{aligned} & 13.7 \\ & {[348]} \end{aligned}$ | $\begin{aligned} & 15.5 \\ & {[393]} \end{aligned}$ | $\begin{aligned} & 3 \\ & \hline \text { [76.2] } \end{aligned}$ | $\begin{aligned} & 11.6 \\ & \text { [294] } \end{aligned}$ | $\begin{aligned} & 14 \\ & {[356]} \end{aligned}$ | - | - |
| $\begin{aligned} & 6 \times 4 \\ & {[150 \times 100]} \\ & \hline \end{aligned}$ | $\begin{aligned} & 22 \\ & {[559]} \\ & \hline \end{aligned}$ | $\begin{gathered} 22.1 \\ {[562]} \\ \hline \end{gathered}$ | $\begin{aligned} & 4.03 \\ & {[102]} \\ & \hline \end{aligned}$ | $\begin{aligned} & 6.00 \\ & {[152]} \\ & \hline \end{aligned}$ | $\begin{aligned} & 3.5 \\ & {[88.9]} \\ & \hline \end{aligned}$ | $\begin{gathered} 6.25 \\ {[159]} \\ \hline \end{gathered}$ | $\begin{gathered} 6.22 \\ {[158]} \\ \hline \end{gathered}$ | $\begin{aligned} & 12.2 \\ & {[310]} \\ & \hline \end{aligned}$ | $\begin{aligned} & 10.8 \\ & \text { [275] } \end{aligned}$ | $\begin{aligned} & 1.89 \\ & {[48]} \\ & \hline \end{aligned}$ | $\begin{aligned} & 5.51 \\ & {[140]} \\ & \hline \end{aligned}$ | $\begin{aligned} & 6.5 \\ & {[165]} \end{aligned}$ | $\begin{aligned} & 2.38 \\ & \hline 55] \\ & \hline 600] \\ & \hline \end{aligned}$ | $\begin{aligned} & 2.38 \\ & {[60]} \\ & \hline \end{aligned}$ | $\begin{aligned} & 1.41 \\ & {[36]} \\ & \hline \end{aligned}$ | $\begin{aligned} & 0.63-(4) \\ & 1.00 \mathrm{dp} \\ & \hline \end{aligned}$ | $\begin{aligned} & 0.87 \\ & \text { thru } \end{aligned}$ | $\begin{aligned} & \hline 0.63-(2) \\ & 0.75 \mathrm{dp} \\ & \hline \end{aligned}$ | $\begin{aligned} & 0.63-(2) \\ & 0.81 \mathrm{dp} \end{aligned}$ | $\begin{aligned} & 12.1 \\ & {[306]} \\ & \hline \end{aligned}$ | $\begin{aligned} & 13.7 \\ & {[348]} \\ & \hline \end{aligned}$ | $\begin{aligned} & 15.5 \\ & {[393]} \\ & \hline \end{aligned}$ | $\begin{aligned} & \hline 3 \\ & {[76.2]} \\ & \hline \end{aligned}$ | $\begin{aligned} & 11.6 \\ & \text { [294] } \\ & \hline \end{aligned}$ | $\begin{aligned} & 14 \\ & {[356]} \\ & \hline \end{aligned}$ | - | - |
| $\begin{aligned} & \overline{6} \\ & {[150]} \end{aligned}$ | $\begin{aligned} & 22 \\ & {[559]} \\ & \hline \end{aligned}$ | $\begin{aligned} & 22.13 \\ & {[562]} \end{aligned}$ | $\begin{aligned} & 6.00 \\ & {[152]} \end{aligned}$ | $\begin{aligned} & 6.00 \\ & {[152]} \end{aligned}$ | $\begin{aligned} & 4.25 \\ & {[108]} \end{aligned}$ | $\begin{gathered} 7.75 \\ {[197]} \end{gathered}$ | $\begin{aligned} & 15.4 \\ & {[392]} \end{aligned}$ | $\begin{aligned} & 15.4 \\ & {[392]} \end{aligned}$ | $\begin{aligned} & 14.1 \\ & {[358]} \end{aligned}$ | $\begin{aligned} & \hline 2.36 \\ & {[60]} \end{aligned}$ | $\begin{aligned} & 6.5 \\ & {[165]} \end{aligned}$ | $\begin{aligned} & 6.5 \\ & {[165]} \end{aligned}$ | $\begin{gathered} 3 \\ {[5]} \\ {[76]} \end{gathered}$ | $\begin{aligned} & 3 \\ & {[76]} \end{aligned}$ | - | $\begin{aligned} & 0.75-(4) \\ & 0.81 \mathrm{dp} \end{aligned}$ | $\begin{aligned} & 0.81-(4) \\ & \text { thru } \end{aligned}$ | $\begin{aligned} & 0.75-(2) \\ & 1.00 \mathrm{dp} \end{aligned}$ | $\begin{aligned} & 0.75-(2) \\ & 1.06 \mathrm{dp} \end{aligned}$ | - | $\begin{aligned} & 17.1 \\ & {[433]} \end{aligned}$ | $\begin{aligned} & 18.98 \\ & {[482]} \end{aligned}$ | $\begin{aligned} & 3.63 \\ & {[92.1]} \end{aligned}$ | $\begin{aligned} & 13.2 \\ & {[336]} \end{aligned}$ | $\begin{aligned} & 20 \\ & {[508]} \end{aligned}$ | - | - |
| $\begin{aligned} & 8 \times 6 \\ & {[200 \times 150]} \end{aligned}$ | $\begin{aligned} & 26 \\ & {[660]} \\ & \hline \end{aligned}$ | - | $\begin{aligned} & \hline 6.00 \\ & {[152]} \\ & \hline \end{aligned}$ | $\begin{aligned} & 8.06 \\ & {[205]} \end{aligned}$ | $\begin{aligned} & 4.25 \\ & {[108]} \\ & \hline \end{aligned}$ | $\begin{aligned} & \hline 7.75 \\ & 1 \\ & \hline \end{aligned}$ | $\begin{aligned} & 15.4 \\ & {[392]} \\ & \hline \end{aligned}$ | $\begin{aligned} & 15.4 \\ & {[392]} \\ & \hline \end{aligned}$ | $\begin{aligned} & 14.1 \\ & {[358]} \\ & \hline \end{aligned}$ | $\begin{aligned} & 2.36 \\ & {[60]} \\ & \hline \end{aligned}$ | $\begin{aligned} & 6.5 \\ & {[165]} \\ & \hline \end{aligned}$ | $\begin{aligned} & 6.5 \\ & {[165]} \end{aligned}$ | $\begin{gathered} 3 \\ \\ \hline 5] \\ \hline 76] \\ \hline \end{gathered}$ | $\begin{aligned} & 3 \\ & {[76]} \end{aligned}$ | - | $0.81 \mathrm{dp}$ | $\begin{aligned} & \hline 0.81-(4) \\ & \text { thru } \end{aligned}$ | $\begin{aligned} & 0.75-(2) \\ & 1.00 \mathrm{dp} \\ & \hline \end{aligned}$ | $\begin{aligned} & 0.75-(2) \\ & 1.06 \mathrm{dp} \\ & \hline \end{aligned}$ | - | $\begin{aligned} & 17.1 \\ & {[433]} \\ & \hline \end{aligned}$ | $\begin{aligned} & 18.98 \\ & {[482]} \end{aligned}$ | $\begin{aligned} & 3.63 \\ & {[92.1]} \\ & \hline \end{aligned}$ | $\begin{gathered} 13.2 \\ {[336]} \\ \hline \end{gathered}$ | $\begin{aligned} & 20 \\ & {[508]} \\ & \hline \end{aligned}$ | - | - |

## Torque Estimation and MAST

| Delrin or Teflon ${ }^{\text {® }}$ Seat with Teflon Stem Packing |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
| Valve Port Size, in [mm] | Pressure Class | Gauge <br> Pressure (P), <br> psi | Run Torque at Max. P, in.lbf | Break Torque at Max. P, <br> in.Ibf | MAST ${ }^{\dagger}$, in.Ibf |
| 1/2[12.7] | 150 | 80-290 | 11 | 20 | 228 |
|  | 300 | 286-750 | 14 | 31 | 228 |
|  | 600 | 741-1,500 | 19 | 45 | 228 |
| $3 / 4$ [19.05] | 150 | 80-290 | 17 | 37 | 228 |
|  | 300 | 286-750 | 27 | 65 | 401 |
|  | 600 | 741-1,500 | 37 | 97 | 401 |
| 1 [25] | 150 | 80-290 | 29 | 69 | 401 |
|  | 300 | 286-750 | 52 | 125 | 881 |
|  | 600 | 741-1,500 | 73 | 187 | 881 |
| 11/2[38.1] | 150 | 80-290 | 67 | 185 | 881 |
|  | 300 | 286-750 | 117 | 335 | 1,549 |
|  | 600 | 741-1,500 | 164 | 506 | 1,549 |
| 2 [50] | 150 | 80-290 | 136 | 385 | 1,549 |
|  | 300 | 286-750 | 215 | 677 | 3,290 |
|  | 600 | 741-1,500 | 301 | 1,026 | 3,290 |
| 3 [80] | 150 | 80-290 | 301 | 1,037 | 3,290 |
|  | 300 | 286-750 | 498 | 1,865 | 6,944 |
|  | 600 | 741-1,500 | 696 | 2,843 | 6,944 |
| 4 [100] | 150 | 80-290 | 611 | 2,158 | 6,944 |
|  | 300 | 286-750 | 995 | 3,866 | 16,747 |
|  | 600 | 741-1,500 | 1,392 | 5,899 | 16,747 |
| 6 [150] | 150 | 80-290 | 1,562 | 6,013 | 16,747 |
|  | 300 | 286-750 | 2,439 | 10,699 | 40,040 |
|  | 600 | 741-1,500 | 3,372 | 16,339 | 40,040 |


| Delrin or Teflon Seat with Graphite Stem Packing |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
| Valve Port Size, in [mm] | Pressure Class | Gauge Pressure (P), psi | Run Torque at Max. P, in.lbf | Break Torque at Max. P, in.lbf | MAST, in.lbf |
| 1/2 [12.7] | 150 | 80-290 | 42 | 51 | 228 |
|  | 300 | 286-750 | 45 | 61 | 228 |
|  | 600 | 741-1,500 | 49 | 74 | 228 |
| $3 / 4$ [19.05] | 150 | 80-290 | 48 | 68 | 228 |
|  | 300 | 286-750 | 88 | 126 | 401 |
|  | 600 | 741-1,500 | 94 | 154 | 401 |
| 1 [25] | 150 | 80-285 | 90 | 129 | 401 |
|  | 300 | 286-740 | 183 | 256 | 881 |
|  | 600 | 741-1,480 | 196 | 311 | 881 |
| 11⁄2 [38.1] | 150 | 80-285 | 198 | 315 | 881 |
|  | 300 | 286-740 | 391 | 609 | 1,549 |
|  | 600 | 741-1,480 | 423 | 764 | 1,549 |
| 2 [50] | 150 | 80-285 | 410 | 659 | 1,549 |
|  | 300 | 286-740 | 652 | 1,114 | 3,290 |
|  | 600 | 741-1,480 | 713 | 1,438 | 3,290 |
| 3 [80] | 150 | 80-285 | 738 | 1,474 | 3,290 |
|  | 300 | 286-740 | 1,367 | 2,734 | 6,944 |
|  | 600 | 741-1,480 | 1,516 | 3,662 | 6,944 |
| 4 [100] | 150 | 80-285 | 1,480 | 3,027 | 6,944 |
|  | 300 | 286-740 | 2,540 | 5,411 | 16,747 |
|  | 600 | 741-1,480 | 2,850 | 7,356 | 16,747 |
| 6 [150] | 150 | 80-285 | 3,108 | 7,559 | 16,747 |
|  | 300 | 286-740 | 5,343 | 13,603 | 40,040 |
|  | 600 | 741-1,480 | 6,110 | 19,077 | 40,040 |

${ }^{\dagger}$ Maximum allowable stem torque (MAST).
Weights

| Valve Size, in [mm] | Weight, Ibm [kg] |  |  |
| :---: | :---: | :---: | :---: |
|  | 150 | 300 | 600 |
| 1/2[12.7] | 5.6 [2.5] | 7.6 [3.4] | 9.0 [4.1] |
| $3 / 4 \times 1 / 2[19.05 \times 12.7]$ | 6.6 [3] | 9.9 [4.5] | 11.7 [5.3] |
| $3 / 4 \times 3 / 4$ [19.05 $\times 19.05]$ | 7.2 [3.3] | 11.7 [5.3] | 14.3 [6.5] |
| $1 \times 3 / 4[25 \times 19.05]$ | 8.4 [3.8] | 13.2 [6] | 16.3 [7.4] |
| 1 [25] | 9.7 [4.4] | 17.1 [7.8] | 22.9 [10.4] |
| $11 / 2[38]$ | 20.1 [9.1] | 32.1 [14.5] | 40.9 [18.5] |
| $\underline{2 \times 1 / 2}[50 \times 38]$ | 24.4 [11.1] | 37.1 [16.8] | 46.9 [21.3] |
| 2 [50] | 33.4 [15.1] | 44.4 [20.1] | 57.3 [26] |
| $3 \times 2[80 \times 50]$ | 44.3 [20.1] | 63.3 [28.7] | 80.2 [36.3] |
| 3 [80] | 82.5 [37.4] | 96.8 [43.9] | 118.6 [53.7] |
| $4 \times 3$ [100 $\times 80$ ] | 73.1 [33.1] | 118.9 [53.9] | 165.4 [74.9] |
| 4 [100] | 110.0 [49.8] | 162.2 [73.5] | 236.3 [107] |
| $\underline{6 \times 4}$ [150 $\times 100]$ | 132.9 [60.2] | 213.2 [96.6] | 335.6 [152] |
| 6 [150] | 251.2 [113.8] | 332.9 [150.8] | 487.8 [221] |
| $8 \times 6[200 \times 150]$ | 356 [161.5] | 452.6 [205.3] | 599.7 [271.7] |

## WWKI 32OF


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