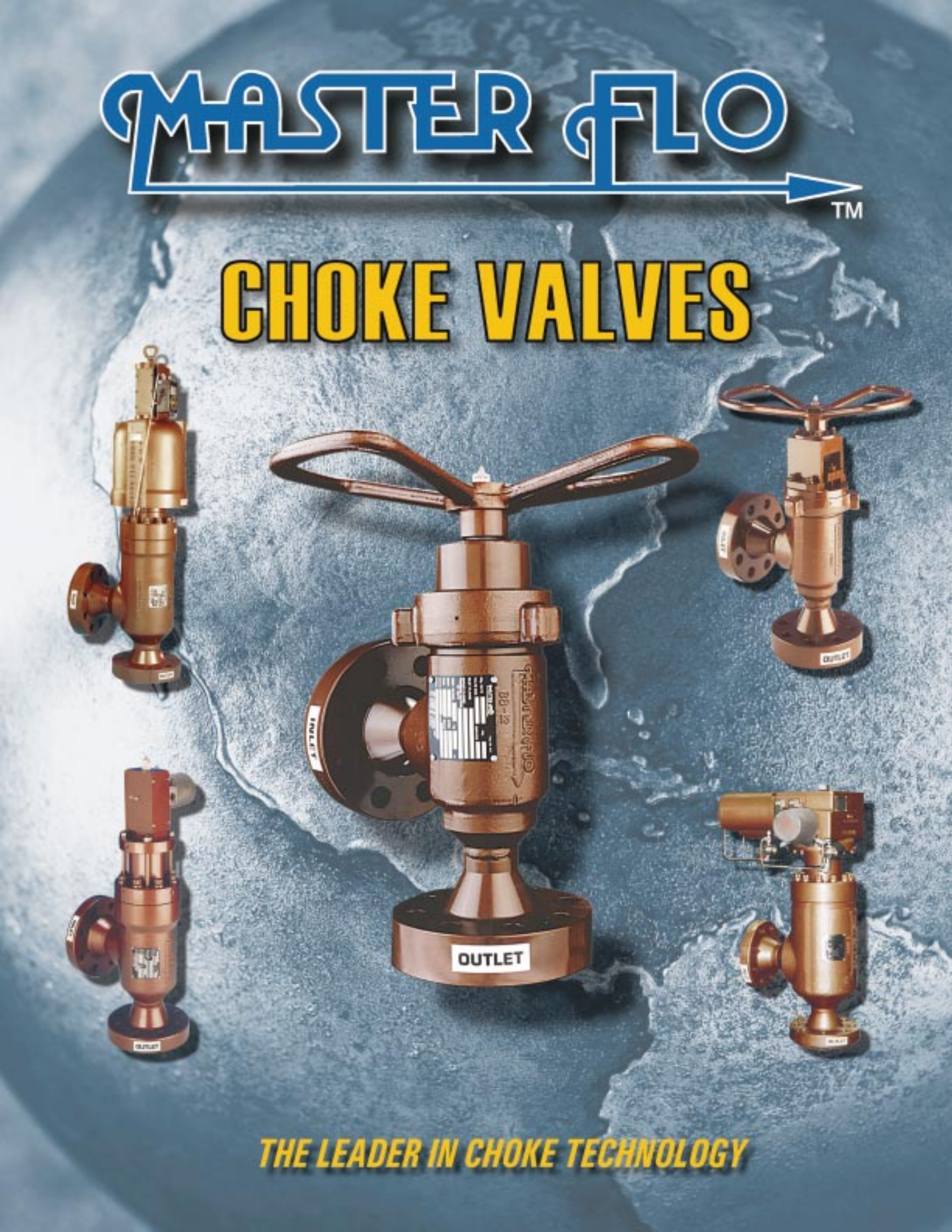
MASTER FLO™

# CHOKE VALVES




THE LEADER IN CHOKE TECHNOLOGY

# THE LEADER IN CHOKE TECHNOLOGY

## Our extensive engineering and production facilities make us a global leader in choke valve technology


Master Flo Valve is committed to giving total satisfaction in service, quality, and value to our customers.

Master Flo Valve Inc.
Edmonton, Alberta, Canada

Master Flo Valve Co. (UK) Ltd.
Aberdeen, Scotland

ISO 9001
REG. FIRM/94-74

6A-0138
17D-0008

Accredited by the Dutch Council for Certification

## TABLE OF CONTENTS

# COMPANY OVERVIEW

Master Flo Valve Inc. is an industry leader in choke valve, specialty control valve, and pig ball valve technology. Since our inception in 1979, we have manufactured high quality products supported by engineering, quality control, and service. Our leadership has been achieved through our commitment to continual development of trim and valve designs to ensure our products meet the requirements of high-pressure drops, severe erosion and corrosion conditions, as well as serviceability. Engineering capabilities are supported with three-dimensional CAD and FEA programs, and a fully equipped Research and Development Department.

Master Flo's extensive investment in research and development ensures that we stay on the Leading Edge of Technology. Testing facilities include Cv testing, slurry testing, API Appendix F testing, cycle testing, and hyperbaric testing. This ensures our customer receives a product that meets the demands of the application and stringent certification requirements of today's oil and gas industry. Our commitment is demonstrated by the performance of the surface and subsea choke valve product lines, which are complemented by our actuation and metal-to-metal seal technology.

Master Flo Valve Inc. maintains an accredited quality program in accordance to ISO 9001-94 and API Q1 while also manufacturing products under license to API 6A and API 17D. Master Flo Valve (UK) is accredited to ISO 9002.

Our staff pride themselves in their ability to respond to specific customer requirements, whether it be erosion, high temperature, or high-pressure service, or water depths of 18,000 feet. We work with our customers to provide a product that meets their service requirements.

# VALVE SIZES

| VALVE MODEL | STANDARD END CONNECTION SIZES | STANDARD TRIM | | MAXIMUM PRESSURE RATING | | MAXIMUM TURNING TORQUE AT 3000 PSI | | TURNS Close to Open |
|---|---|---|---|---|---|---|---|---|
| | | $C_v$ | BEAN SIZE | PSI | kPa | ft-lb | Nm | |
| P05 | 1", 2" | 2.5 | 24 | 10,000 | 69 000 | 10 | 15 | 6 |
| P1 | 1", 2" | 10 | 48 | 6,000 | 41 000 | 35 | 46 | 6 |
| P2 | 2", 3" | 20 | 72 | 10,000 | 69 000 | 60 | 83 | 11 |
| P25 | 2", 2½", 3" | 33 | 93 | 5,000 | 34 000 | 60 | 83 | 12 |
| | | | | 15,000 | 103 000 | 70 | 92 | 9 |
| | | | | 20,000 | 138 000 | 70 | 92 | 9 |
| P3 | 3", 4" | 50 | 116 | 6,000 | 41 000 | 45 | 62 | 17 |
| | | | | 10,000 | 69 000 | 45 | 62 | 17 |
| | | | | 15,000 | 103 000 | 70 | 92 | 13 |
| P35 | 4", 6" | 100 | 160 | 6,000 | 41 000 | 68 | 92 | 16 |
| | | | | 15,000 | 103 000 | | | |
| P4 | 4", 6" | 160 | 198 | 6,000 | 41 000 | 96 | 130 | 20 |
| | | | | 10,000 | 69 000 | | | |
| P5 | 5", 6", 8" | 250 | 240 | 6,000 | 41 000 | 81 | 110 | 22½ |
| | | | | 10,000 | 69 000 | | | |
| P6 | 6", 8" | 335 | 280 | 6,000 | 41 000 | 81 | 110 | 27 |
| P8 | 8", 10" | 650 | 392 | 6,000 | 41 000 | 96 | 130 | 33½ |

MASTER FLO

WE ARE LOCATED THROUGHOUT THE WORLD TO ENSURE PROMPT RESPONSE AND SUPPORT FOR OUR CUSTOMERS

**EDMONTON**
Alberta, Canada

**CALGARY**
Alberta, Canada

**HOUSTON**
Texas, U.S.A.

**NEW ORLEANS**
Louisiana, U.S.A.

**ABU DHABI**
United Arab Emirates

**ABERDEEN**
Scotland

**LONDON**
England

**PAU**
France

**JAKARTA**
Indonesia

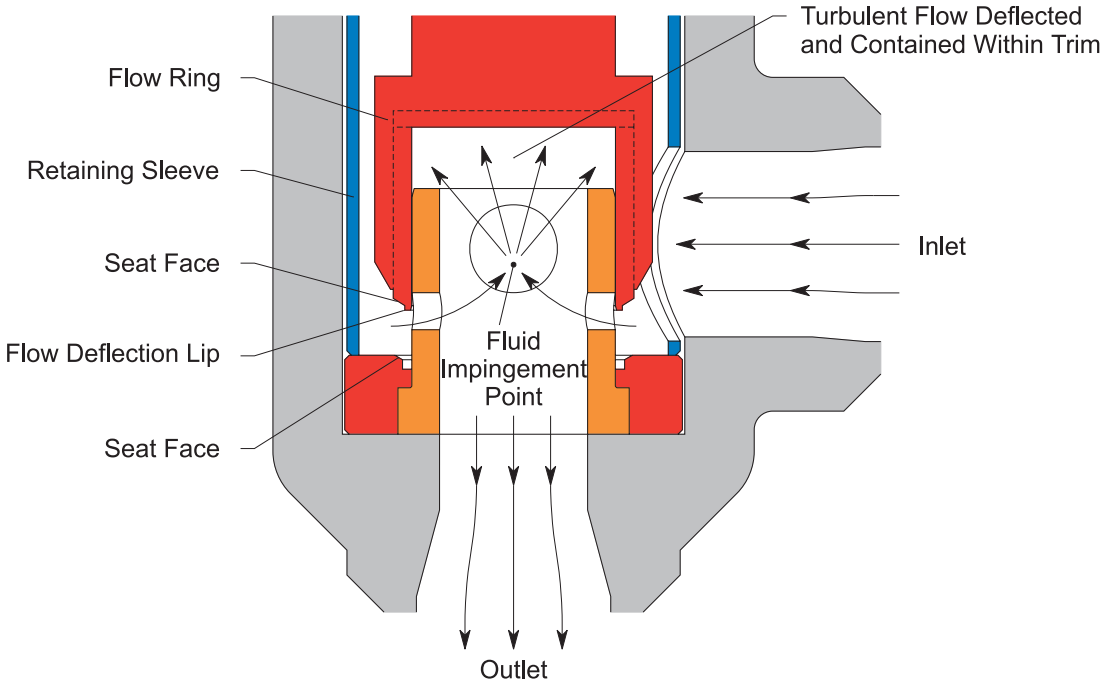
**KUALA LUMPUR**
Malaysia

# FLOW CHARACTERISTICS

## DESIGN BENEFITS

The Master Flo Production Choke features several unique characteristics that minimize wear and maximize durability. The cage with external sleeve trim design creates impinging flow in the cage center, thus dissipating the fluid energy onto itself. The external sleeve also diverts the flow upward into the flow trim (away from the outlet), containing turbulence and wear within the flow trim. The valve body outlet is isolated from wear because turbulence is dissipated before flow enters the outlet, thus eliminating the typical problems of wear in the valve outlet.

Another feature is the retaining sleeve which isolates the body bore from the incoming flow thus eliminating body wear. Containment and control of wear makes the Master Flo valve ideal for high-pressure, large-pressure drop, and severe service applications for both liquids and gases.




## FLOW TRIM

Master Flo's Flow Trim* consists of a cage with an external sliding sleeve. Our trim provides accurate, long life control by using two pairs of ports in the cage. The lower pair are small ports that provide the initial 15% control range while the upper pair are large ports that provide the overall capacity. This trim configuration produces an equal-percentage flow characteristic which offers maximum control throughout the operating range. Our cage port configuration incorporates an exceptionally high turndown ratio providing a wide control range and excellent versatility. This characteristic reduces the required number of trim sizes to one per body size.

The top entry trim system, with the seat being mechanically retained in place by the bonnet, provides for ease of servicing of the flow trim. The Master Flo Flow Trim system is universal between the control valve and production choke product lines.

## SEATING

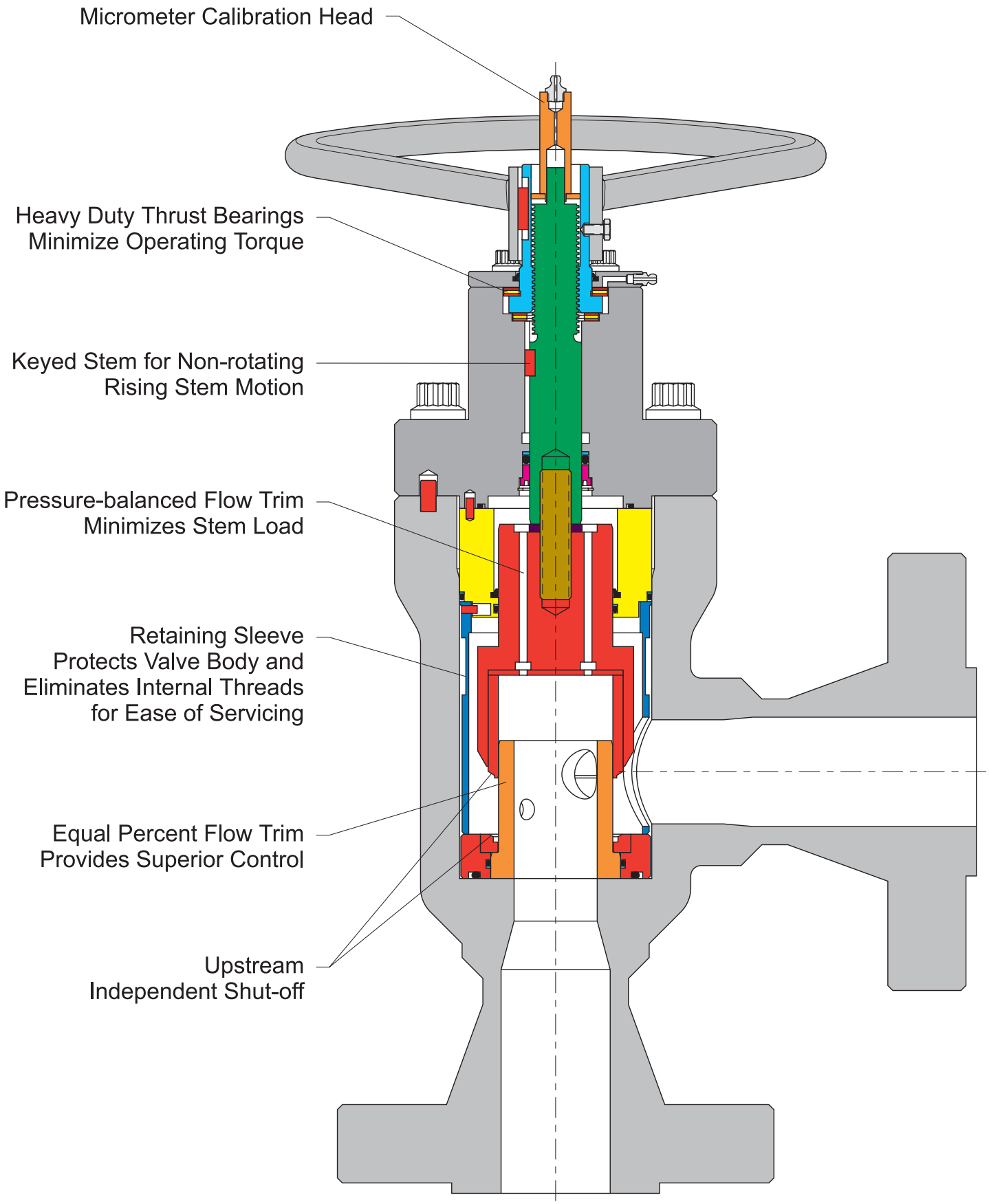
Master Flo's Flow Trim* is designed to eliminate seat wear and problems associated with screw-in seat assemblies. Our seating is comprised of an isolated sealing element upstream of the throttling components, which protects the seat from throttling wear.

Exceptional seating is provided by the self-aligned, isolated, tapered metal seal. The collar incorporates a flow deflection lip that isolates the seat face from the incoming flow. This maintains sealing integrity throughout the trim's service life.

Master Flo provides ANSI Class VI (bubble tight) or Class V shutoff per ANSI B16.104 1976 (FCI 70-2).

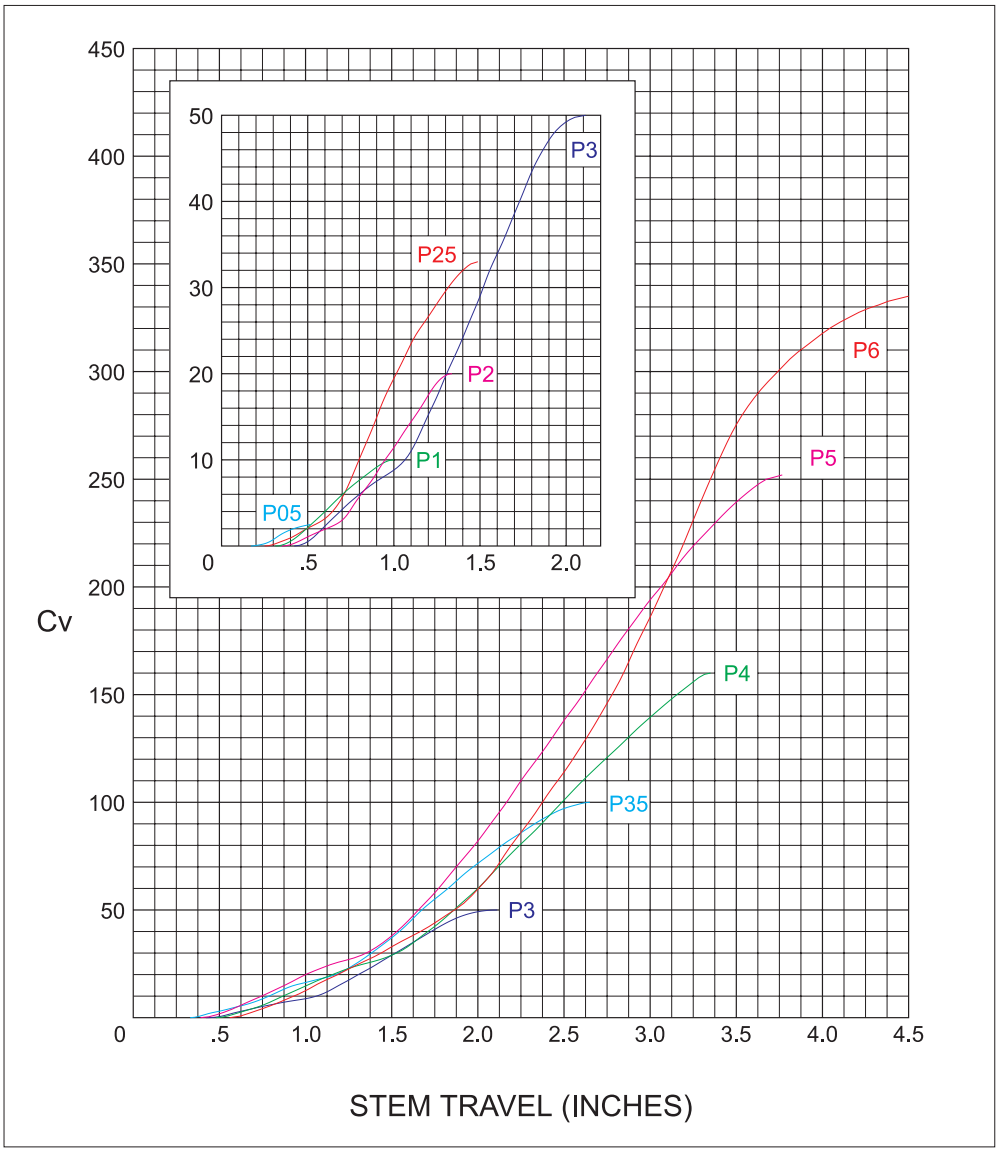
*patented

# VALVE FEATURES



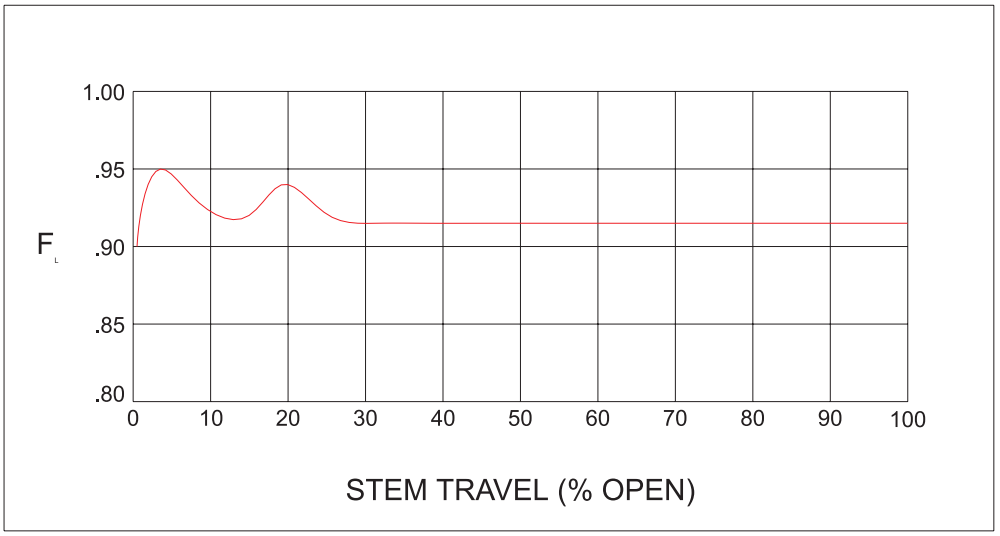
## $C_v$ CURVE

The $C_v$ Curve for each valve model is virtually identical at lower settings, illustrating the versatility of our equal percentage trim and verifying the requirement for only one trim size per body size.




## PRESSURE RECOVERY

The high-pressure recovery factor ($F_L$) throughout the control range of the Master Flo Choke minimizes noise levels, flow velocities, cavitation and valve trim wear.



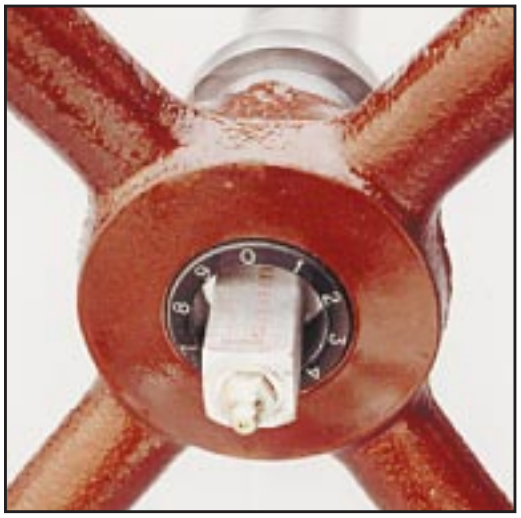
## MICROMETER CALIBRATION HEAD

Master Flo Chokes are supplied* with a micrometer calibration head to provide valve position indication to increments of 1/10 of a turn for manual operation. This provides exceptional repeatability of valve positioning throughout the valve stem travel.

The calibration head is square with a different scale on each of its four faces. This ensures that the valve position can be monitored in the desired units, including $C_v$, bean size, millimeters or number of turns (i.e. micrometer scale).

For P2 and larger chokes, the calibration head incorporates a grease fitting to allow for lubrication of the stem threads.

* optional on P6 and larger



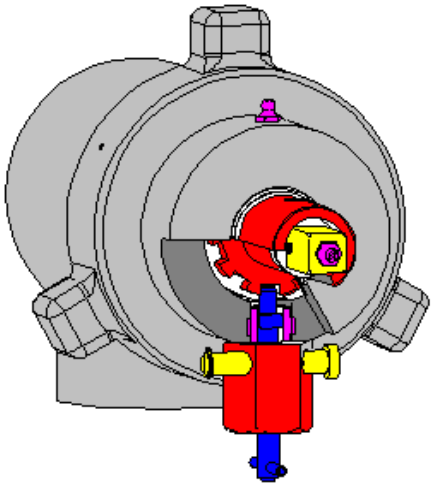
Micrometer Calibration Head

# OPTIONS

## STEM LOCK ASSEMBLY

Master Flo's optional Stem Lock for manually operated chokes allows the stem nut to be locked in 1/10 of a turn increments. This provides a large number of fixed valve positions between the closed and full-open position.

| Valve Model | Locking Positions |
|---|---|
| P2 | 110 |
| P25 | 120 |
| P3 | 170 |
| P35 | 160 |
| P4 | 200 |



Stem Lock Assembly

## REMOVAL OF INTERNAL ASSEMBLY

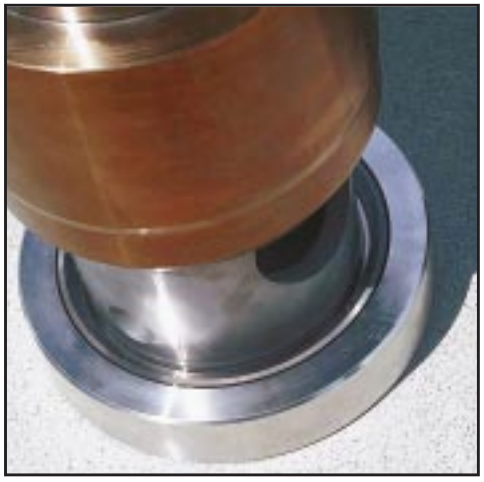
Servicing of our choke is exceptionally simple, with all internals being removable as a unit from the valve body, without the requirement of special tools. This provides for easy inspection and servicing of our product.

Servicing our valves requires no special tools

## FLOW TRIM MATERIALS

The flow trim is available in a wide range of materials to accommodate all service conditions and applications. Standard trim materials are listed along with service recommendations. Many special materials are available to accommodate specific service condition requirements.

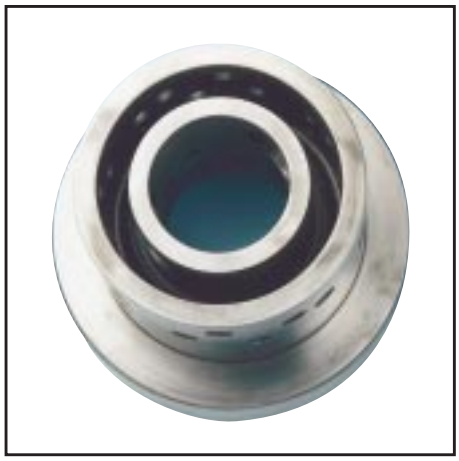
| MATERIAL | SERVICE RECOMMENDATION |
|---|---|
| UNS 17400 | A hardened stainless steel used for low or medium pressure drop applications with NACE MR-01-75 compliance. |
| Stellite | A cobalt alloy used for resisting cavitation and for sour service. |
| Tungsten Carbide | The premium flow trim material for all service conditions. Very high wear resistance makes this material suitable for high velocity or erosive applications. |



Flow Trim

## HIGH CAPACITY FLOW TRIM

Master Flo has available high $C_v$ flow trim for low-pressure drop applications providing a higher flow capacity. This trim is available in most valve sizes. For further details please contact our local office in your area.



Multi-stage Trim

## MULTI-STAGE TRIM

Master Flo has available multi-stage flow trims for high-pressure drop liquid-flow applications. This trim design provides control of high-pressure drops while maintaining metal-to-metal seating.

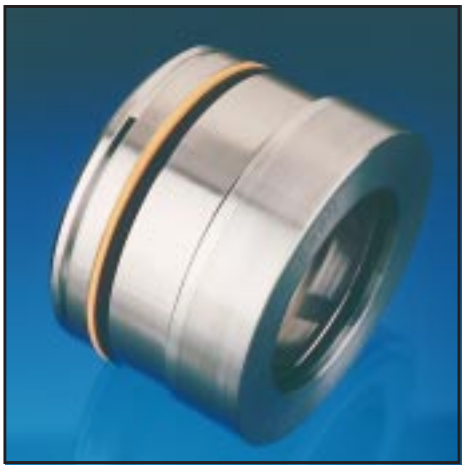
## BODY BLEED

Two types of bleed ports are available on selected models as an option on the Master Flo chokes:

- An API 6A bleed port, which utilizes a metal-to-metal seal, is designed for test and gauge connectors for 15,000 PSI working pressure.
- A ½" NPT port allows for a pressure relief fitting.

## METAL-TO-METAL STEM SEALS

Master Flo's metal stem seal is a mechanical and pressure energized sliding metal-to-metal seal requiring no elastomers for the sealing function. This seal system is generally available for 2" and larger valves.



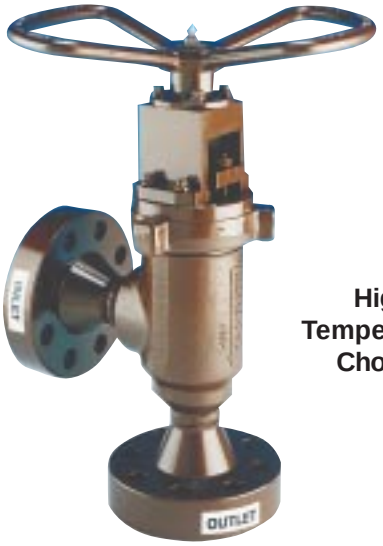
Metal-to-Metal Stem Seal

## METAL-TO-METAL BONNET SEALS

The static metal bonnet seal provides for sealing from a vacuum to over 20,000 PSIG. The seal is mechanically energized during installation and is pressure-energized by the fluid. The seal utilizes a single sealing lip, which reduces the required sealing areas in the valve.

This seal is available on select valves.

Metal-to-Metal Bonnet Seal




High Temperature Chokes

Utility Steam Application

## HIGH TEMPERATURE CHOKES

Master Flo manufactures a high temperature model of the Production Choke. The temperature rating of –20 to 850°F with pressures to 6,000 PSI ensures suitability for steam and high temperature applications. This valve style is available on P1 through P2 valve models with either manual or automated operation.

# TESTING FACILITIES

Master Flo Valve Inc. takes pride in our experience and the extensive facilities we have to support our product and customers. This overview of our assembly equipment and Research and Development facilities illustrates how we maintain our position as a leader in the field of Choke Valves.

## ASSEMBLY FACILITIES

Master Flo's production facilities utilize work areas that incorporate independent cleaning and assembly stations. Custom designed fixtures are utilized to provide high efficiency and accuracy in the assembly and testing of our products.


**Assembly Facilities**

## HYDROSTATIC TESTING FACILITIES

Master Flo's multi-station hydrostatic testing facilities are capable of testing to 30,000 PSI. Master Flo utilizes a high accuracy hydrotest system allowing full pressure and leakage monitoring combined with an environmentally conscious system for recycling the test fluid. Additional test facilities include high-pressure gas testing capabilities up to 30,000 PSI and low-pressure seat leakage testing.

**Hydrostatic Testing Facilities**

## $C_v$ TESTING

Master Flo's $C_v$ Test Facility features high versatility, accuracy and computerized data-acquisition software operated entirely from a central control panel.

Two centrifugal pumps, in parallel, supply in excess of 1,000 GPM. Pressure drop and flow rates are remotely controlled through the central control system. High precision instruments monitor flow rate, pressure differential, valve position, as well as upstream pressure and temperature. Three different flow meters provide wide rangeability and resolution. Real-time data is displayed graphically on a computer screen with data being stored for later retrieval.

**$C_v$ Testing Facility**

## CLEAN ROOM FACILITY

Master Flo Valve Inc. maintains an in-house clean room facility. This facility maintains hydraulic system cleanliness through the use of two flushing systems and a HIAC particle counter.

Clean Room Facility

## COLD ROOM ENVIRONMENTAL CHAMBER TEST FACILITY

Master Flo Valve Inc. has a temperature test facility in-house to perform testing to API 6A Appendix F PR2 and API 17D specifications. The equipment includes:

- an environmental chamber with cooling and heating facilities capable of maintaining low temperature extremes of -60° F and high temperatures in excess of 650° F .
- full pressure range test capabilities for valves and actuators when subject to temperature classification extremes.
- computer-based data acquisition monitoring equipment to continuously monitor and record temperatures and pressures as well as equipment operating characteristics throughout testing procedures.

Cold Room Test Facility

## SLURRY TESTING

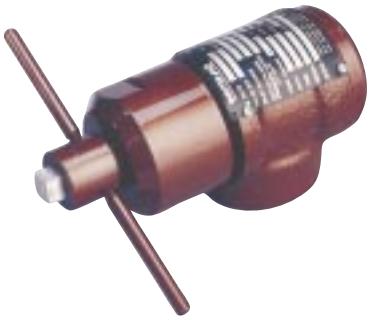
Product improvement is very important to Master Flo to maintain our capability as a critical-service valve supplier. To accomplish this goal, we have a custom-designed erosion test facility. This test loop allows continuous sand slurry testing at pressures up to 5,000 psi and flow rates up to 168 gpm. Abrasive media concentration, flow rates, and pressures are all variable, and data is collected using data acquisition software. This test facility is assisting Master Flo in maintaining our position as a leader in the supply of high-performance, wear-resistant valves.

Slurry Test Facility

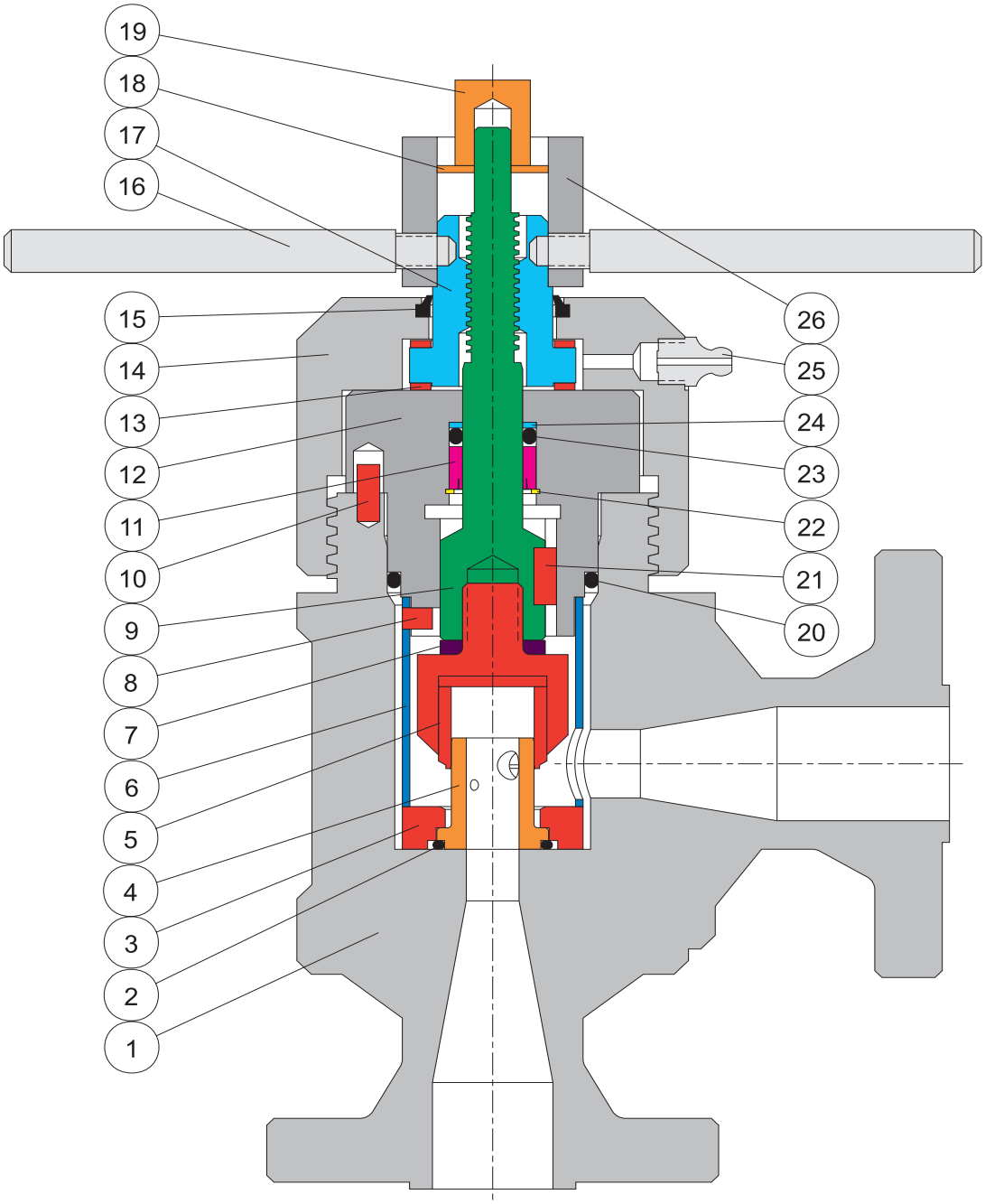
# VALVE SPECIFICS

## P05

The P05 Choke Valve provides for applications with end connections up to 2". The valve utilizes a threaded bonnet nut to retain the bonnet and flow trim in the valve body.



P05




### PARTS LIST

1. Body Assembly
2.* Seal: Seat - Body
3. Seat
4. Nozzle
5. Flow Ring
6. Retaining Sleeve
7. Lock Washer
8.* Groove Pin
9. Stem
10.* Groove Pin
11.* Stem Bearing
12. Bonnet
13.* Thrust Washer
14. Bonnet Nut
15.* Wiper
16. Handle
17. Stem Nut
18. Stem Washer
19. Calibration Head Assembly
20.* Seal: Bonnet - Body
21. Key
22.* Retaining Ring
23.* Seal: Stem - Bonnet
24.* B.U. Ring: Stem - Bonnet
25. Grease Nipple
26. Handle Ring

* Parts included in seal kit.

## P1

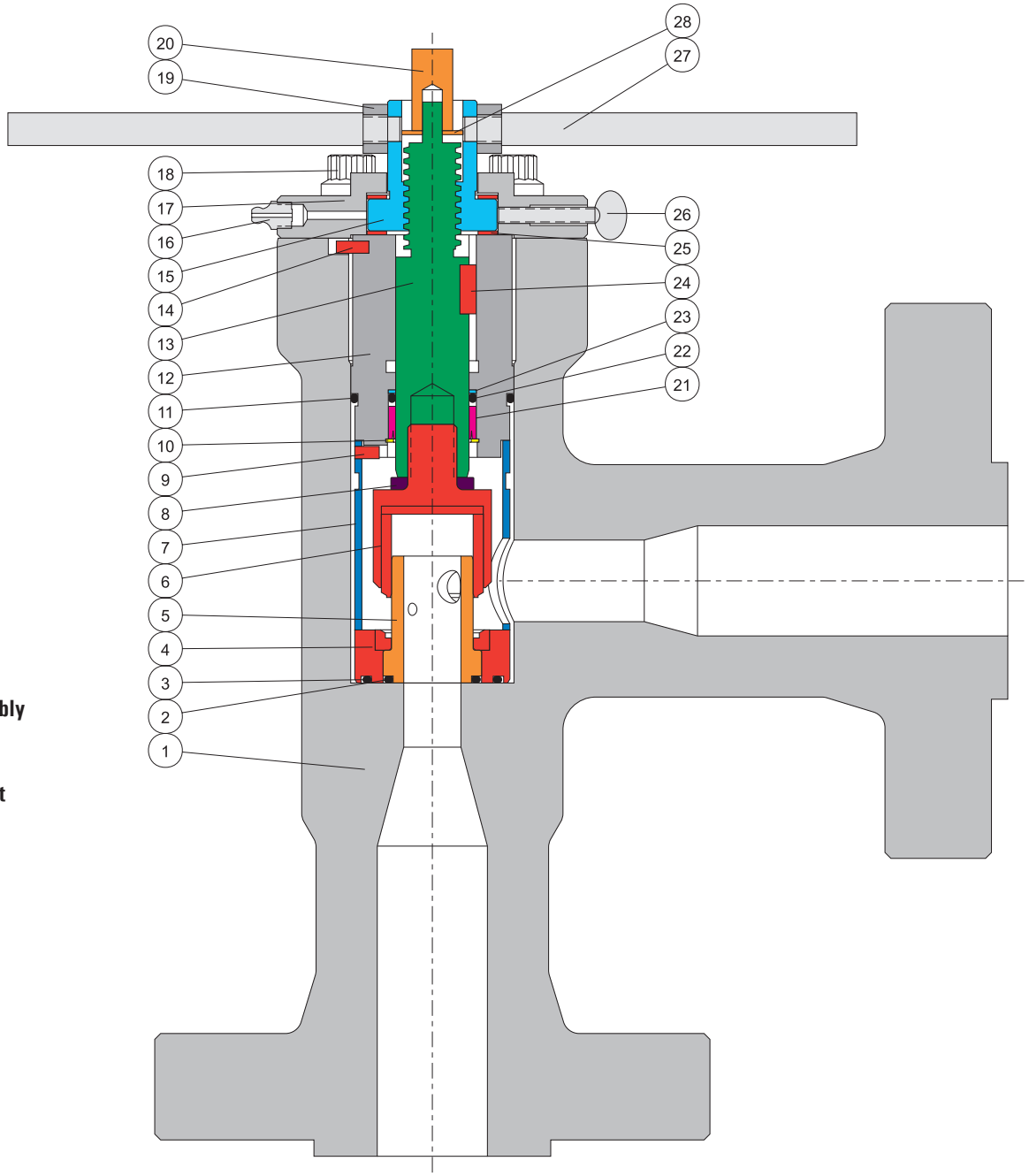
The P1 Choke Valve utilizes a bolted-bonnet flange to retain the bonnet and flow trim. This valve style is available with 1" and 2" end connections. Flanged, threaded, and special connections are available upon request. The P1 is available in inline or 90° valve body configuration.


P1

## PARTS LIST

1. Body Assembly
2.* Seal: Nozzle - Body
3.* Seal: Seat - Body
4. Seat
5. Nozzle
6. Flow Ring
7. Retaining Sleeve
8. Lock Washer
9.* Groove Pin
10.* Retaining Ring
11.* Seal: Bonnet - Body
12. Bonnet
13. Stem
14.* Groove Pin
15. Stem Nut
16. Grease Nipple
17. Bonnet Flange
18. Cap Screw
19. Handle Ring
20. Calibration Head Assembly
21.* Stem Bearing
22.* Seal: Stem - Bonnet
23.* B.U. Ring: Stem - Bonnet
24. Key
25.* Thrust Washer
26. Thumb Screw
27. Handle
28. Stem Washer

* Parts included in seal kit.



## P2

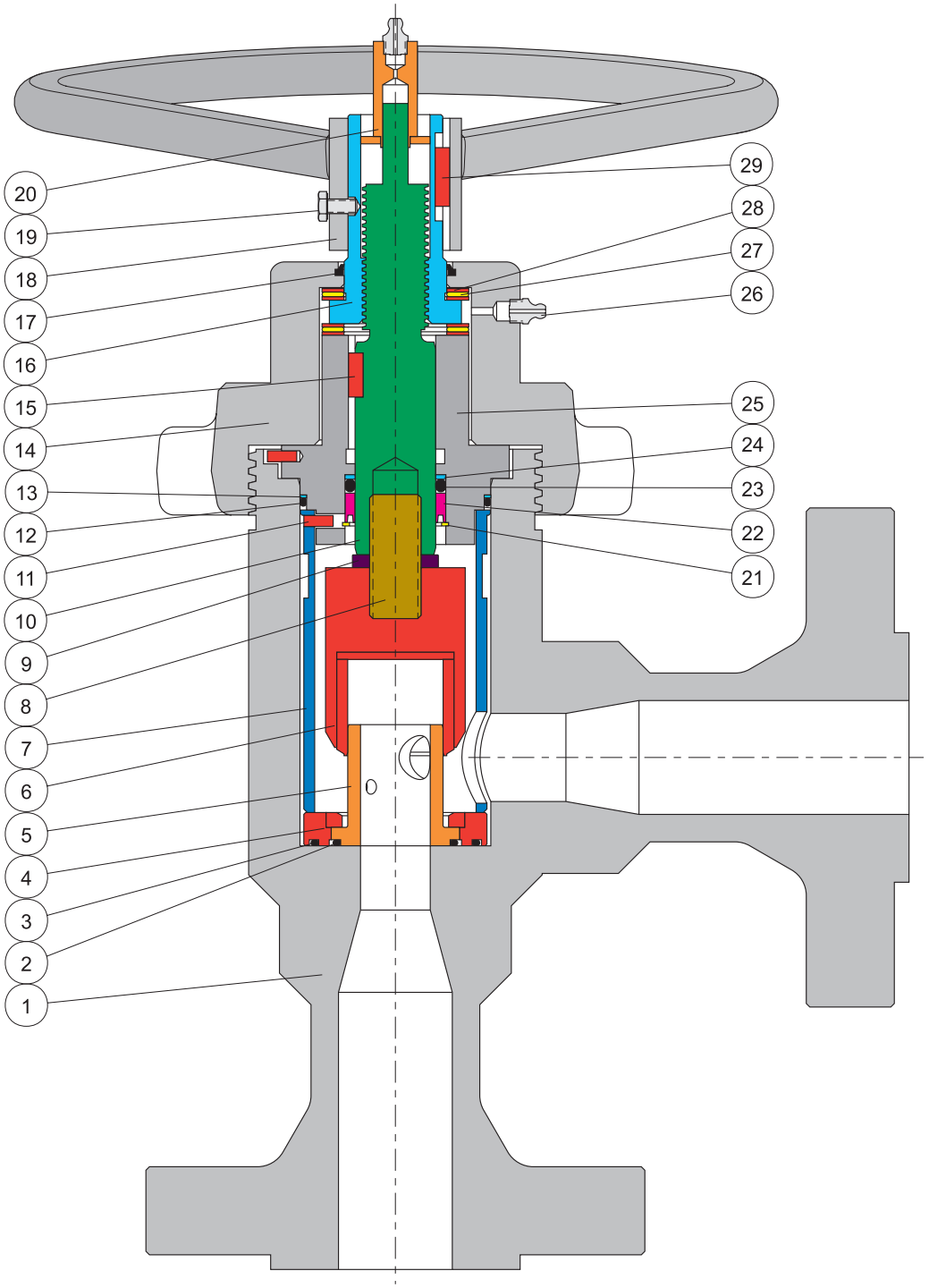
The P2 Choke Valve utilizes a threaded bonnet nut to retain the bonnet and flow trim in the valve body. A bolted-bonnet option is available upon request. Standard end connection sizes range from 2" to 3". The P2 is available in inline or 90° valve body configuration.

P2

## PARTS LIST

1. Body Assembly
2.* Seal: Nozzle - Body
3.* Seal: Seat - Body
4. Seat
5. Nozzle
6. Flow Ring
7. Retaining Sleeve
8. Stud
9. Lock Washer
10. Stem
11.* Groove Pin
12.* Seal: Bonnet - Body
13.* B.U. Ring: Bonnet - Body
14. Bonnet Nut
15. Key
16. Stem Nut
17.* Wiper
18. Handwheel
19. Cap Screw
20. Calibration Head Assembly
21.* Retaining Ring
22.* Stem Bearing
23.* Seal: Stem - Bonnet
24.* B.U. Ring: Stem - Bonnet
25. Bonnet
26. Grease Nipple
27.* Thrust Bearing
28.* Thrust Washer
29. Key

* Parts included in seal kit.



## P25

The P25 Choke Valve provides high capacity flow in a 2" line. The bonnet seal is metal to metal with only three elastomer seals in the valve. A threaded bonnet nut retains the bonnet and flow trim. A bolted-bonnet option is available upon request.

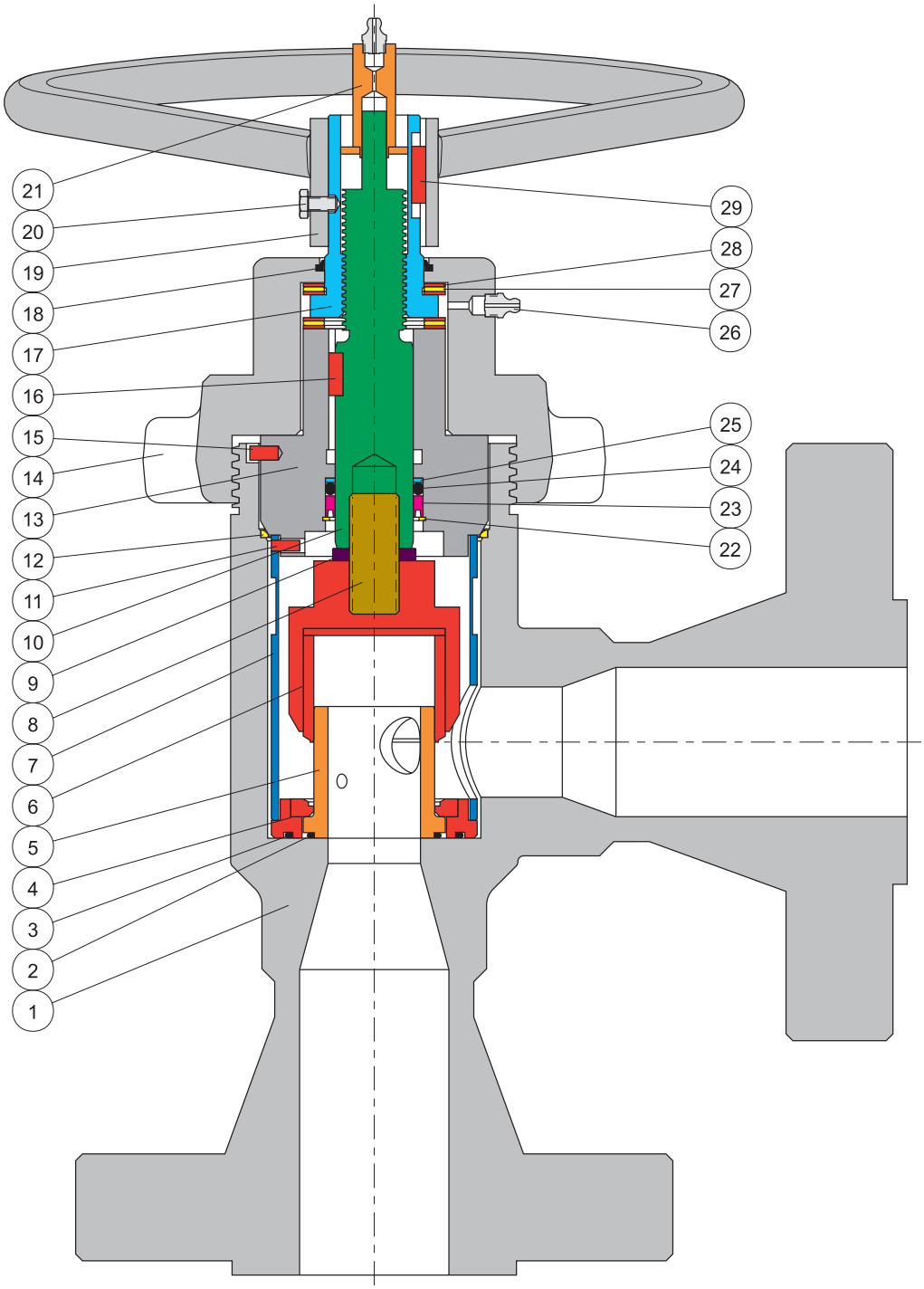
Standard end connection sizes range from 2" to 3". The P25 is available in inline or 90° valve body configuration.

P25

## PARTS LIST

1. Body Assembly
2.* Seal: Nozzle - Body
3.* Seal: Seat - Body
4. Seat
5. Nozzle
6. Flow Ring
7. Retaining Sleeve
8. Stud
9. Lockwasher
10. Stem
11.* Groove Pin
12.* Seal: Bonnet - Body
13. Bonnet
14. Bonnet Nut
15.* Groove Pin
16. Key
17. Stem Nut
18.* Wiper
19. Handwheel
20. Capscrew
21. Calibration Head Assembly
22.* Retaining Ring
23.* Stem Bearing
24.* Seal: Stem - Bonnet
25.* B.U. Ring: Stem - Bonnet
26. Grease Nipple
27.* Thrust Bearing
28.* Thrust Washer
29. Key

* Parts included in seal kit.



## P3 AND LARGER

The P3 and larger Choke Valves utilize bolted-bonnet construction with the valve bonnet retaining the flow trim. The flow trim is pressure balanced to minimize stem load and provide low operating torques.

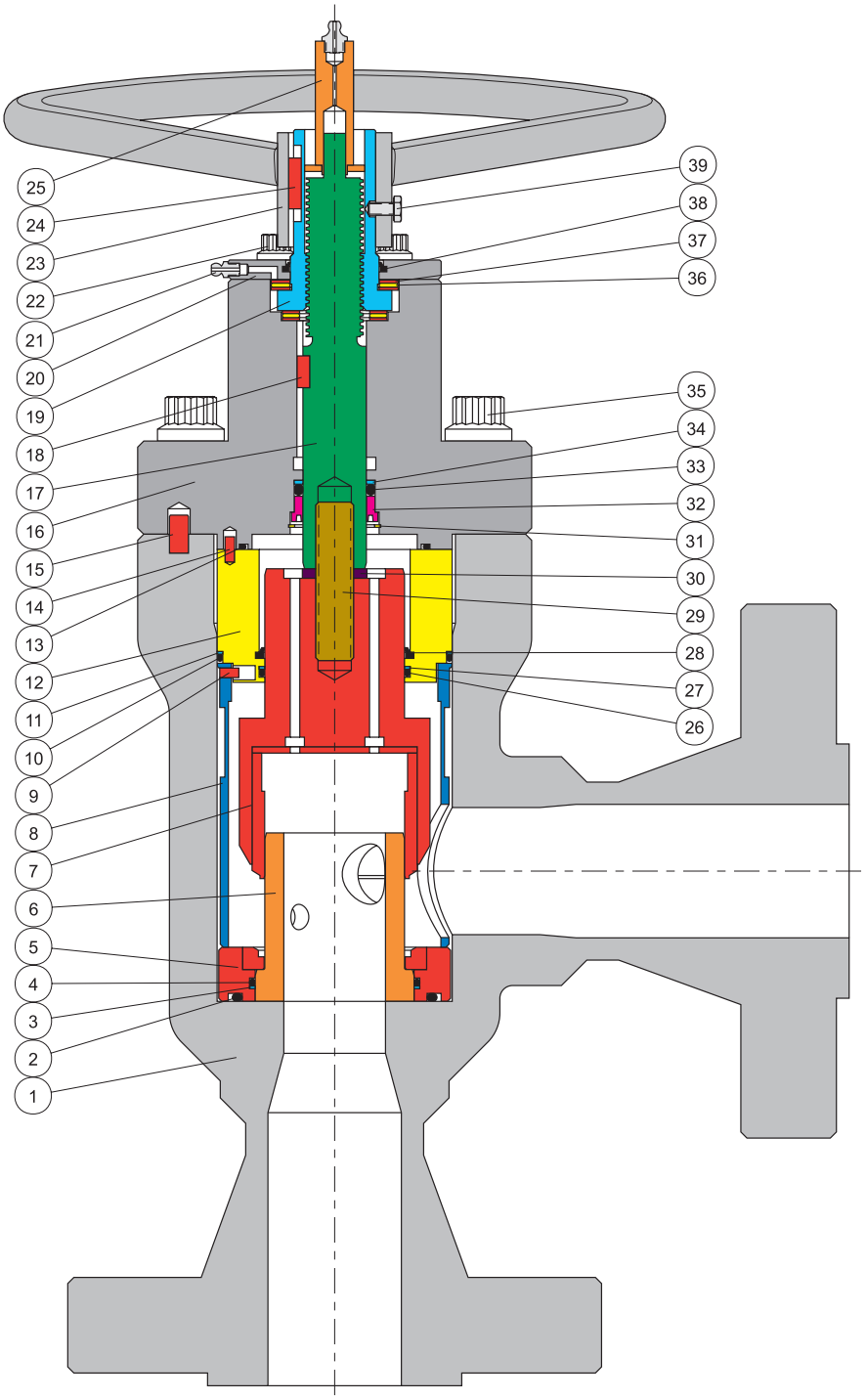
Flanged or special end connections are available.

P3

## PARTS LIST

1. Body Assembly
2.* Seal: Seat - Body
3.* B.U. Ring: Seat - Nozzle
4.* Seal: Seat - Nozzle
5. Seat
6. Nozzle
7. Flow Ring
8. Retaining Sleeve
9.* Groove Pin
10.* Seal: Balance Sleeve - Body
11.* B.U. Ring: Balance Sleeve - Body
12. Balance Sleeve
13.* Seal: Bonnet - Balance Sleeve
14.* Groove Pin
15.* Spring Pin
16. Bonnet
17. Stem
18. Key
19. Stem Nut
20. Cover Plate
21. Grease Nipple
22. Capscrew
23. Handwheel
24. Key
25. Calibration Head Assembly
26.* Seal: Flow Ring - Balance Sleeve
27.* B.U. Ring: Flow Ring - Balance Sleeve
28.* Wiper
29. Stud
30. Lockwasher
31.* Retaining Ring
32.* Stem Bearing
33.* Seal: Stem - Bonnet
34.* B.U. Ring: Stem - Bonnet
35. Capscrew
36.* Thrust Bearing
37.* Thrust Washer
38.* Wiper
39. Capscrew

* Parts included in seal kit.

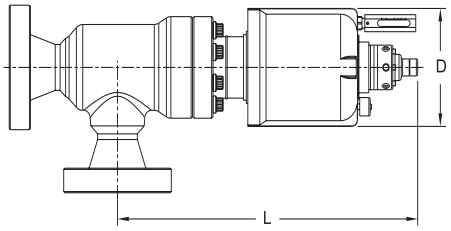


# ACTUATION

## SINGLE ACTING PNEUMATIC PISTON ACTUATOR

The Master Flo Piston Actuator is a fail closed, integrally mounted piston actuator. The actuator utilizes 100 PSI supply pressure with springs to provide the fail close function.

This actuator has been developed specifically for the Master Flo product line to provide a compact and efficient package.




Single Acting Pneumatic Piston Actuator

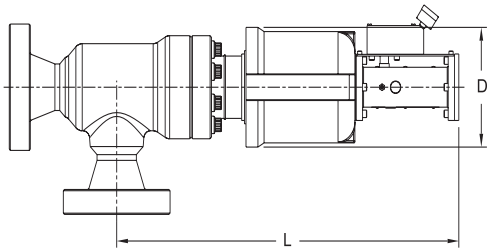
### SINGLE ACTING PNEUMATIC PISTON ACTUATOR DIMENSIONS

| VALVE MODEL | ACTUATOR SIZE | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PISTON 25 | | | | | | PISTON 50 | | | | | |
| | 'L' | | 'D' | | WEIGHT* | | 'L' | | 'D' | | WEIGHT* | |
| | inch | mm | inch | mm | lbs. | kg | inch | mm | inch | mm | lbs. | kg |
| P05 | 17.69 | 449 | 6.75 | 171 | 26 | 12 | - | - | - | - | - | - |
| P1 | 20.81 | 529 | 6.75 | 171 | 26 | 12 | 23.12 | 587 | 9.00 | 229 | 50 | 23 |
| P2 | 21.12 | 537 | 6.75 | 171 | 30 | 14 | 23.41 | 595 | 9.00 | 229 | 54 | 25 |
| P25 | - | - | - | - | - | - | 23.47 | 596 | 9.00 | 229 | 54 | 25 |
| P3 | - | - | - | - | - | - | 26.66 | 677 | 9.00 | 229 | 54 | 25 |
| P35 | - | - | - | - | - | - | 28.88 | 733 | 9.00 | 229 | 54 | 25 |

***Weights are in addition to Base Weights on Pages 24-25.**

## DOUBLE ACTING PNEUMATIC PISTON ACTUATOR

The Double Acting Piston Actuator design utilizes the air supply to open and close the valve with a spring assist for fail close operation. This actuator style provides high output thrust making it suitable for large valves and high pressure applications. Manual override is available in a top mounted configuration.




Double-Acting Pneumatic Piston Actuator

### DOUBLE ACTING PNEUMATIC PISTON ACTUATOR DIMENSIONS

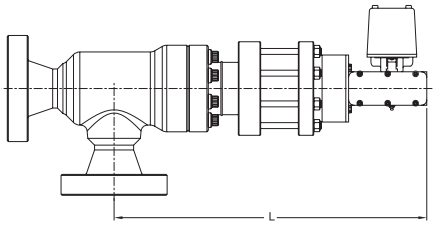
| VALVE MODEL | ACTUATOR SIZE | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PISTON 50 | | | | | | PISTON 100 | | | | | |
| | 'L' | | 'D' | | WEIGHT* | | 'L' | | 'D' | | WEIGHT* | |
| | inch | mm | inch | mm | lbs. | kg | inch | mm | inch | mm | lbs. | kg |
| P1 | 26.91 | 683 | 9.00 | 229 | 69 | 31 | - | - | - | - | - | - |
| P2 | 27.22 | 691 | 9.00 | 229 | 69 | 31 | 31.47 | 799 | 12.62 | 321 | 220 | 100 |
| P25 | 27.28 | 693 | 9.00 | 229 | 69 | 31 | 31.53 | 801 | 12.62 | 321 | 220 | 100 |
| P3 | 30.44 | 773 | 9.00 | 229 | 69 | 31 | 34.72 | 882 | 12.62 | 321 | 220 | 100 |
| P35 | 32.69 | 830 | 9.00 | 229 | 69 | 31 | 36.97 | 939 | 12.62 | 321 | 220 | 100 |
| P4 | - | - | - | - | - | - | 39.94 | 1014 | 12.62 | 321 | 220 | 100 |
| P5 | - | - | - | - | - | - | 41.16 | 1045 | 12.62 | 321 | 220 | 100 |
| P6 | - | - | - | - | - | - | 44.91 | 1141 | 12.62 | 321 | 220 | 100 |

***Weights are in addition to Base Weights on Pages 24-25.**

## HYDRAULIC ACTUATOR

Master Flo's Hydraulic Actuator is a double-acting unit integrally mounted to the valve bonnet. Our integral actuator mounting provides a compact assembly with no exposed linkages. This Hydraulic Actuator provides fail in position, fail close operation, or fail open operation. The valve position feedback is generated electrically by a 4-20 mA transmitter. Limit switches for open or closed position indication are available.

Hydraulic Actuator




### HYDRAULIC ACTUATOR DIMENSIONS

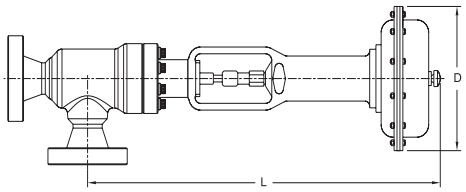
| VALVE MODEL | 'L' | | WEIGHT* | |
|---|---|---|---|---|
| | inch | mm | lbs. | kg |
| P05 | 15.16 | 385 | 40 | 18 |
| P1 | 18.28 | 464 | 40 | 18 |
| P2 | 24.31 | 618 | 78 | 35 |
| P25 | 24.38 | 619 | 78 | 35 |
| P3 | 27.78 | 706 | 90 | 41 |
| P35 | 37.25 | 946 | 120 | 54 |
| P4 | 40.25 | 1022 | 110 | 49 |
| P5 | 41.44 | 1053 | 110 | 49 |
| P6 | 45.19 | 1148 | 110 | 49 |
| P8 | 52.06 | 1322 | 147 | 67 |

***Weights are in addition to Base Weights on Pages 24-25.**

## PNEUMATIC DIAPHRAGM ACTUATOR

The Diaphragm Actuators provide fail close or fail open operation and are available with all standard Fisher accessories. Fisher mounting hardware is utilized to mount the actuator. Manual overrides are available in side or top mounted configurations.

Pneumatic Diaphragm Actuator




### PNEUMATIC DIAPHRAGM ACTUATOR DIMENSIONS

| | ACTUATOR SIZE | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 40 | | | 45 | | | 46 | | | 70 | | |
| VALVE MODEL | 'L' inch (mm) | 'D' inch (mm) | W* lbs. (kg) | 'L' inch (mm) | 'D' inch (mm) | W* lbs. (kg) | 'L' inch (mm) | 'D' inch (mm) | W* lbs. (kg) | 'L' inch (mm) | 'D' inch (mm) | W* lbs. (kg) |
| P1 | 29.94 (760) | 13.12 (333) | 50 (23) | 36.81 (935) | 16.00 (406) | 90 (41) | 36.81 (935) | 18.62 (473) | 121 (55) | - | - | - |
| P2 | 31.38 (797) | 13.12 (333) | 50 (23) | 38.25 (972) | 16.00 (406) | 90 (41) | 38.25 (972) | 18.62 (473) | 121 (55) | 43.12 (1095) | 21.12 (536) | 254 (115) |
| P25 | 31.44 (799) | 13.12 (333) | 50 (23) | 38.31 (973) | 16.00 (406) | 90 (41) | 38.31 (973) | 18.62 (473) | 121 (55) | 43.19 (1097) | 21.12 (536) | 254 (115) |
| P3 | - | - | - | 42.25 (1073) | 16.00 (406) | 90 (41) | 42.25 (1073) | 18.62 (473) | 121 (55) | 47.94 (1218) | 21.12 (536) | 254 (115) |
| P35 | - | - | - | - | - | - | - | - | - | 49.56 (1259) | 21.12 (536) | 254 (115) |

***Weights are in addition to Base Valve Weights on Pages 24-25.**

## STEPPING ACTUATOR

Master Flo's Stepping Actuator is available to operate our bolted bonnet 2" and larger valves. The actuator mounts directly on the valve cover plate to drive the valve stem nut. This feature provides for easy field conversion from manual to automated operation without requiring disassembly of the valve. Supply to the actuator can be either hydraulic or pneumatic.

The Master Flo Stepping Actuator is designed for remote operation of our Choke Valve. This actuator steps in 36° increments in both the clockwise and counter-clockwise direction, providing high precision operation.

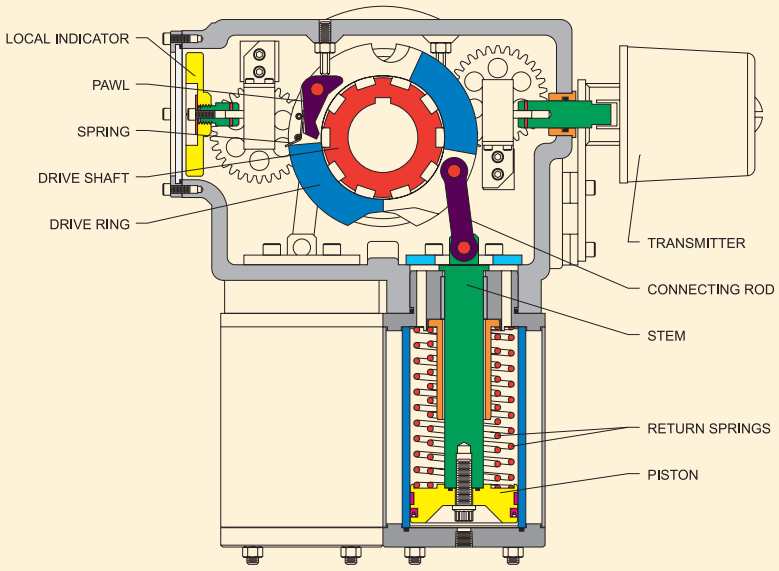
Stepping Actuator

## OPERATING PRINCIPLE

The precise, durable stepping action is accomplished by a ratchet pawl, that engages a drive shaft, to directly operate the choke stem nut. Contact between the ratchet pawl and drive shaft is designed to maintain full face contact during an operating cycle. The back face on the pawl is tapered to ensure that during the return cycle no loads are transmitted to the drive shaft.

The pawl is spring loaded to engage the drive shaft by dual torsion springs and is mechanically disengaged at the rest position to allow for reverse direction operation or manual operation.

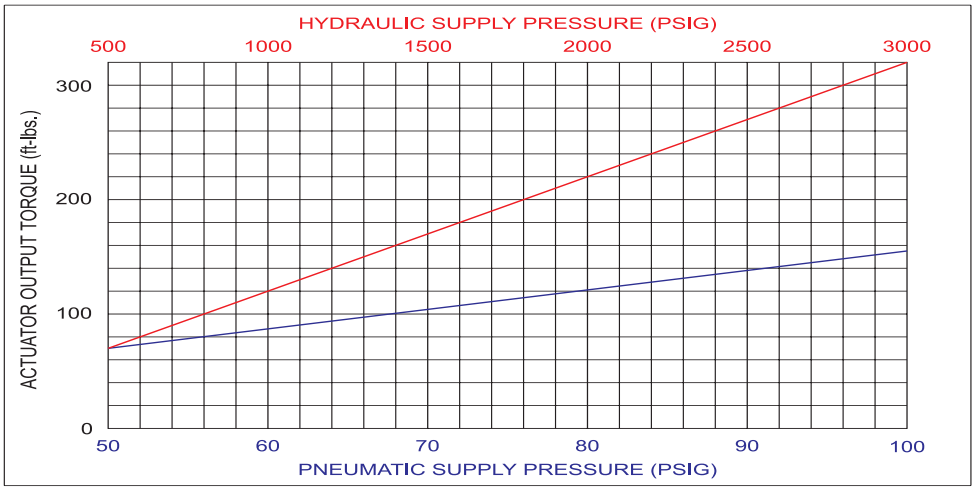
The Master Flo actuator utilizes pneumatic or hydraulic spring-return cylinders. The operating cylinder incorporates a self-lubricating shaft bushing and non-metallic piston wear ring. These features ensure the cylinder will have minimal operating friction, withstand the operating loads and provide a long service life. The vent side of the cylinder is internal to the actuator housing to eliminate contamination or corrosion of the cylinder



## PERFORMANCE

The actuator output torque is regulated by the supply pressure to the actuator. The actuator was developed to work continuously at maximum torque loads.

The actuator housing package is of ductile iron construction. This weatherproof housing protects the actuator from the external environment.




## POSITION FEEDBACK SYSTEM

The actuator incorporates a 4-20 mA transmitter to provide remote monitoring of the choke position. Two limit switches are included to show full open, full closed or an intermediate setting. The position transmitter and switch assembly are available with various certification options. Typical certifications include explosion proof to UL and CSA Class 1, Division 1, Groups C & D, or to CENELEC EEx d IIC T6 IP66; or intrinsically safe to EEx d IIC T6 IP66; or intrinsically safe to EEx ia IIC T4 IP66. The transmitter housing is available in anodized aluminum, bronze or stainless steel.

## AVAILABLE OPTIONS

### JUNCTION BOX

A wiring junction box is available to provide one electrical connection point for the actuator.

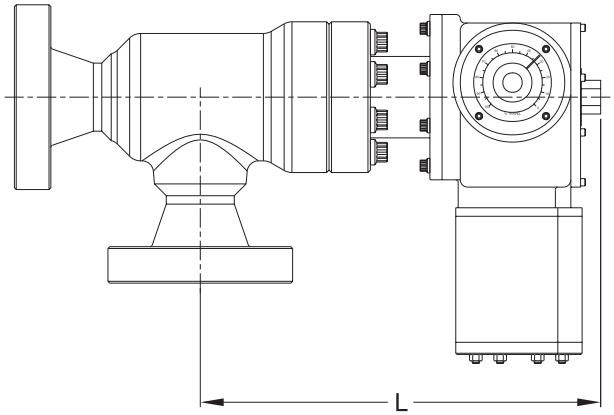
### POSITION INDICATION

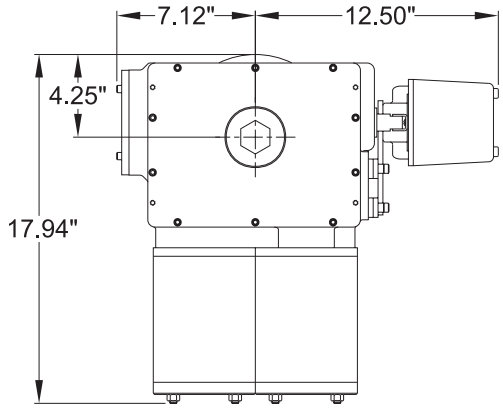
The local position indicator is marked in % open as a standard but is available with markings of $C_v$, bean size or millimetres.

### SOLENOID VALVES

The actuator may be supplied complete with solenoid valves piped into the operating cylinders.

## ACTUATION CONTINUED




### STEPPING ACTUATOR DIMENSIONS

| VALVE MODEL | 'L' | | WEIGHT* | | STEPS |
|---|---|---|---|---|---|
| | inch | mm | lbs. | kg | Open to Close |
| P2 | 17.72 | 450 | 165 | 75 | 107 |
| P25 | 16.72 | 425 | 165 | 75 | 119 |
| P25-15k | 20.41 | 518 | 165 | 75 | 89 |
| P25-20k | 22.66 | 576 | 165 | 75 | 89 |
| P3 | 20.31 | 516 | 165 | 75 | 169 |
| P3-10k | 21.31 | 541 | 165 | 75 | 169 |
| P3-15k | 21.91 | 557 | 165 | 75 | 127 |
| P35 | 23.78 | 604 | 165 | 75 | 159 |
| P35-15k | 24.53 | 623 | 165 | 75 | 159 |
| P4 | 27.03 | 686 | 165 | 75 | 201 |
| P4-10k | 27.03 | 686 | 165 | 75 | 201 |
| P5 | 28.50 | 724 | 165 | 75 | 226 |
| P5-10k | 28.50 | 724 | 165 | 75 | 226 |
| P6 | 32.28 | 820 | 165 | 75 | 270 |
| P8 | 37.50 | 953 | 165 | 75 | 370 |

***Weights are in addition to Base Valve Weights on Pages 24-25.**

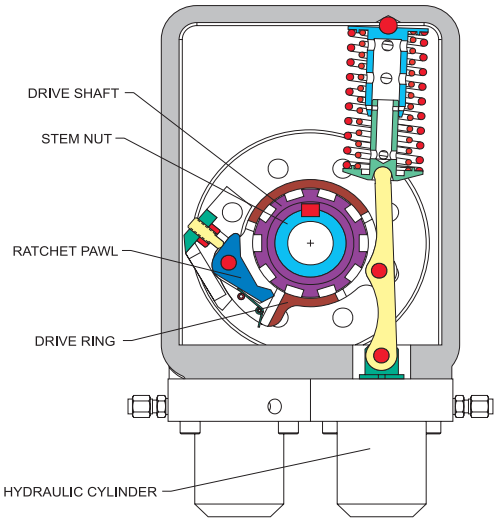
# SUBSEA CHOKES

Master Flo Valve Inc. is a leader in the design and manufacture of Subsea Choke Valves and Actuators. A commitment to continuous improvement through extensive research and development ensures the latest proven technology is incorporated in our designs. A brief overview of our subsea product line follows. If you have questions, please contact our local office for further details.

## SL SUBSEA STEPPING ACTUATOR

Subsea Choke Valves require lightweight, compact, powerful actuators that are capable of providing the reliability, precision, and durability expected in a subsea environment. These requirements are met with Master Flo's SL Subsea Stepping Actuator.

This actuator operates on the same principle as the surface stepping actuator. In addition, it incorporates a pressure compensation system and an internal LVDT position transmitter. The manual override is available in a top-drive configuration or in a side-drive configuration that is positionable in 90° increments. The override interface is also available for diver or R.O.V. operation.




| TECHNICAL SPECIFICATIONS | |
|---|---|
| Actuator Weight | 150 lbs |
| Hydraulic Pressure Rating | 3300 PSIG |
| Operating Temperature Range | 0 to 150°F |
| Maximum Working Depth | 18,000 feet |
| Rated Output Torque | 320 ft-lbs @ 3000 PSIG supply |
| Output Rotation per Step | 36 degrees |
| Typical Operating Cycle Speed | .25 seconds per complete step (dependent on control system) |
| Hydraulic Oil Consumption | 1.28 $in.^3$/step |
| Position Transmitter | LVDT |

## NON-RETRIEVABLE CHOKE

The Non-Retrievable Bolted-Bonnet Choke is ideal for modular retrieval systems or applications where valve maintenance is not required. Right angle, inline or custom piping configurations are available to meet our customer's needs. This product is available in a full range of sizes and pressures up to 15,000 PSIG.

Manual operation by diver or R.O.V. is available as well as remote operation with Master Flo's SL Subsea Stepping Actuator. The SL actuator also provides a diver or R.O.V. override interface for manual operation.

**Non-Retrievable Choke**

## DIVER-ASSISTED INSERT RETRIEVABLE CHOKE

This choke features a diver operated clamp style bonnet. Retrieval of the compact insert is achieved with diver assistance. The visual indication has been designed to ensure good visibility allowing a diver to easily verify the valve position. As with the non-retrievable choke above, manual and remote operation is available.

Diver Assisted Insert Retrievable

## TOOL INSERT RETRIEVABLE CHOKE

Master Flo's third-generation Tool Insert Retrievable Choke utilizes a cable-deployed tool for insert installation and retrieval. The tool is designed to provide positional and rotational alignment of the insert. R.O.V. assistance allows the tool to be purely mechanical with no hydraulic or electrical requirements. This eliminates the need for increased tool complexity. The insert-retaining bonnet clamp is R.O.V. operated and is available with vertical or horizontal access.

Master Flo's metal-to-metal seal technology is utilized throughout the valve.

The Tool Insert Retrievable choke incorporates the SL Subsea Stepping Actuator with a top-drive R.O.V. override. Actuator hydraulic connections are accommodated through the body and bonnet with a subsea mateable electrical connection system.

This product has been qualified to API-6A Appendix F and API-17D and qualified to water depths of 18,000 feet. Valves are available up to 15,000 PSIG pressure ratings.


Insert Retrievable

## TEST AND TRANSPORT SKID

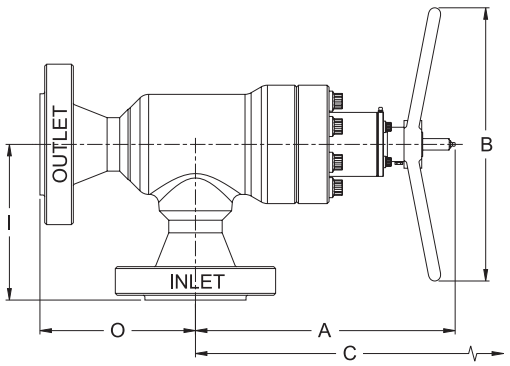
Master Flo's Test andTransport Skid is designed to secure and protect the choke insert module during transport and storage and to facilitate testing of the insert before deployment.

Test and Transport Skid

## HYPERBARIC TESTING

Master Flo's dedication to be a leader in the subsea choke market is demonstrated by our extensive investment in specialized equipment. An example of this includes an in-house hyperbaric test chamber for performance verification at simulated depths. The test chamber utilizes a data acquisition system for monitoring environmental parameters and choke position while facilitating both manual and actuated operation.

# VALVE DIMENSIONS




## ENVELOPE DIMENSIONS (inches)

| Choke | 'A' | 'B' | 'C' |
|---|---|---|---|
| P05 | 6.12 | 8.25 | 8.75 |
| P1 | 8.56 | 13.00 | 14.38 |
| P2 | 13.00 | 18.00 | 19.00 |
| P25 | 13.19 | 18.00 | 19.25 |
| P3 | 17.50 | 18.00 | 25.00 |
| P35 | 21.75 | 18.00 | 30.50 |
| P4 | 26.00 | 18.00 | 37.62 |
| P5 | 28.50 | 18.00 | 40.75 |
| P6 | 33.50 | 28.00 | 48.00 |
| P8 | 34.00 | 28.00 | 49.12 |

Note: 'C' is the Disassembly Clearance

**Note:** 'I' and 'O' dimensions depend on the type of end connection. When inlet and outlet end connections are the same, 'I' and 'O' are equal. Standard dimensions and weights are tabulated below for valves with threaded, butt welded, ANSI flanged, and API flanged end connections. Other end connections and special dimensions are available upon request.

### P05

| CONNECTION TYPE | 1" CONNECTIONS | | | | 2" CONNECTIONS | | | |
|---|---|---|---|---|---|---|---|---|
| | inch | mm | lbs. | kg | inch | mm | lbs. | kg |
| Threaded | 2.38 | 60 | 16 | 7 | x | x | - | - |
| 150 RF | 4.56 | 116 | 21 | 10 | 4.88 | 124 | 28 | 13 |
| 300 RF | 4.81 | 122 | 24 | 11 | 5.12 | 130 | 32 | 15 |
| 600 RF | 5.06 | 129 | 24 | 11 | 5.50 | 140 | 36 | 16 |
| 600 RTJ | 5.06 | 129 | 24 | 11 | 5.56 | 141 | 36 | 16 |
| 900 RF | 5.50 | 140 | 33 | 15 | 6.62 | 168 | 64 | 29 |
| 900 RTJ | 5.50 | 140 | 33 | 15 | 6.69 | 170 | 64 | 29 |
| 1500 RTJ | 5.50 | 140 | 33 | 15 | 6.69 | 170 | 64 | 29 |
| 2500 RTJ | 6.12 | 156 | 42 | 19 | 7.69 | 195 | 100 | 45 |
| 2000 API | x | x | - | - | 5.56 | 141 | 36 | 16 |
| 3000 API | x | x | - | - | 6.69 | 170 | 64 | 29 |
| 5000 API | x | x | - | - | 6.69 | 170 | 64 | 29 |
| Butt Weld | 2.38 | 60 | 16 | 7 | x | x | - | - |

### P1

| CONNECTION TYPE | 1" CONNECTIONS | | | | 2" CONNECTIONS | | | |
|---|---|---|---|---|---|---|---|---|
| | inch | mm | lbs. | kg | inch | mm | lbs. | kg |
| Threaded | 4.50 | 114 | 39 | 18 | 4.50 | 114 | 39 | 18 |
| 150 RF | 6.69 | 170 | 41 | 19 | 7.00 | 178 | 48 | 22 |
| 300 RF | 6.94 | 176 | 44 | 20 | 7.25 | 184 | 52 | 24 |
| 600 RF | 7.19 | 183 | 44 | 20 | 7.62 | 194 | 56 | 25 |
| 600 RTJ | 7.19 | 183 | 44 | 20 | 7.69 | 195 | 56 | 25 |
| 900 RF | 7.62 | 194 | 53 | 24 | 8.75 | 222 | 84 | 38 |
| 900 RTJ | 7.62 | 194 | 53 | 24 | 8.81 | 224 | 84 | 38 |
| 1500 RTJ | 7.62 | 194 | 53 | 24 | 8.81 | 224 | 84 | 38 |
| 2500 RTJ | 8.25 | 210 | 62 | 28 | 9.81 | 249 | 120 | 54 |
| 2000 API | x | x | - | - | 7.69 | 195 | 56 | 25 |
| 3000 API | x | x | - | - | 8.81 | 224 | 84 | 38 |
| 5000 API | x | x | - | - | 8.81 | 224 | 84 | 38 |
| Butt Weld | 4.50 | 114 | 39 | 18 | 4.50 | 114 | 39 | 18 |

### P2

| CONNECTION TYPE | 2" CONNECTIONS | | | | 3" CONNECTIONS | | | |
|---|---|---|---|---|---|---|---|---|
| | inch | mm | lbs. | kg | inch | mm | lbs. | kg |
| Threaded | 4.50 | 114 | 82 | 37 | 4.50 | 114 | 82 | 37 |
| 150 RF | 7.00 | 178 | 92 | 42 | 7.25 | 184 | 103 | 47 |
| 300 RF | 7.25 | 184 | 96 | 44 | 7.62 | 194 | 114 | 52 |
| 600 RF | 7.62 | 194 | 100 | 45 | 8.00 | 203 | 116 | 53 |
| 600 RTJ | 7.69 | 195 | 100 | 45 | 8.06 | 205 | 116 | 53 |
| 900 RF | 8.75 | 222 | 128 | 58 | 8.75 | 222 | 138 | 63 |
| 900 RTJ | 8.81 | 224 | 128 | 58 | 8.81 | 224 | 138 | 63 |
| 1500 RTJ | 8.81 | 224 | 128 | 58 | 9.44 | 240 | 176 | 80 |
| 2500 RTJ | 9.81 | 249 | 164 | 74 | 11.50 | 292 | 268 | 122 |
| 2000 API | 7.69 | 195 | 100 | 45 | 8.06 | 205 | 116 | 53 |
| 3000 API | 8.81 | 224 | 128 | 58 | 8.81 | 224 | 138 | 63 |
| 5000 API | 8.81 | 224 | 128 | 58 | 9.44 | 240 | 177 | 80 |
| 10 000 API | 8.81 | 224 | 124 | 56 | 11.38 | 289 | 195 | 89 |
| Butt Weld | 4.50 | 114 | 82 | 37 | 4.50 | 114 | 82 | 37 |

### P25

| CONNECTION TYPE | 2" CONNECTIONS | | | | 3" CONNECTIONS | | | |
|---|---|---|---|---|---|---|---|---|
| | inch | mm | lbs. | kg | inch | mm | lbs. | kg |
| Threaded | 4.50 | 114 | 82 | 37 | 4.50 | 114 | 82 | 37 |
| 150 RF | 7.00 | 178 | 92 | 42 | 7.25 | 184 | 103 | 47 |
| 300 RF | 7.25 | 184 | 96 | 44 | 7.62 | 194 | 114 | 52 |
| 600 RF | 7.62 | 194 | 100 | 45 | 8.00 | 203 | 116 | 53 |
| 600 RTJ | 7.69 | 195 | 100 | 45 | 8.06 | 205 | 116 | 53 |
| 900 RF | 8.75 | 222 | 128 | 58 | 8.75 | 222 | 138 | 63 |
| 900 RTJ | 8.81 | 224 | 128 | 58 | 8.81 | 224 | 138 | 63 |
| 1500 RTJ | 8.81 | 224 | 128 | 58 | 9.44 | 240 | 176 | 80 |
| 2500 RTJ | 9.81 | 249 | 164 | 74 | 11.50 | 292 | 268 | 122 |
| 2000 API | 7.69 | 195 | 100 | 45 | 8.06 | 205 | 116 | 53 |
| 3000 API | 8.81 | 224 | 128 | 58 | 8.81 | 224 | 138 | 63 |
| 5000 API | 8.81 | 224 | 128 | 58 | 9.44 | 240 | 177 | 80 |
| Butt Weld | 4.50 | 114 | 82 | 37 | 4.50 | 114 | 82 | 37 |

### P25 - RATED FOR 15,000 PSI

| CONNECTION TYPE | 2" CONNECTIONS | | | | 3" CONNECTIONS | | | |
|---|---|---|---|---|---|---|---|---|
| | inch | mm | lbs. | kg | inch | mm | lbs. | kg |
| 2 000 API | 8.44 | 214 | 206 | 94 | 8.81 | 224 | 258 | 117 |
| 3 000 API | 9.56 | 243 | 218 | 99 | 9.56 | 243 | 269 | 122 |
| 5 000 API | 9.56 | 243 | 218 | 99 | 10.19 | 259 | 289 | 131 |
| 10 000 API | 9.56 | 243 | 218 | 99 | 10.75 | 273 | 293 | 133 |
| 15 000 API | 10.06 | 256 | 229 | 104 | 11.25 | 286 | 318 | 144 |
| Butt Weld | 5.25 | 133 | 165 | 75 | 5.25 | 133 | 165 | 75 |

### P3

| CONNECTION TYPE | 3" CONNECTIONS | | | | 4" CONNECTIONS | | | |
|---|---|---|---|---|---|---|---|---|
| | inch | mm | lbs. | kg | inch | mm | lbs. | kg |
| Threaded | 5.25 | 133 | 154 | 70 | 5.25 | 133 | 154 | 70 |
| 150 RF | 8.00 | 203 | 177 | 80 | 8.25 | 210 | 187 | 85 |
| 300 RF | 8.38 | 213 | 190 | 86 | 8.62 | 219 | 207 | 94 |
| 600 RF | 8.75 | 222 | 190 | 86 | 9.50 | 241 | 228 | 104 |
| 600 RTJ | 8.81 | 224 | 190 | 86 | 9.56 | 243 | 228 | 104 |
| 900 RF | 9.50 | 241 | 212 | 96 | 10.00 | 254 | 256 | 116 |
| 900 RTJ | 9.56 | 243 | 212 | 96 | 10.06 | 256 | 256 | 116 |
| 1500 RTJ | 10.19 | 259 | 250 | 114 | 10.44 | 265 | 292 | 133 |
| 2500 RTJ | 12.25 | 311 | 342 | 155 | 13.19 | 335 | 446 | 202 |
| 2000 API | 8.81 | 224 | 190 | 86 | 9.56 | 243 | 228 | 104 |
| 3000 API | 9.56 | 243 | 212 | 96 | 10.06 | 256 | 256 | 116 |
| 5000 API | 10.19 | 259 | 250 | 114 | 10.44 | 265 | 292 | 133 |
| Butt Weld | 5.25 | 133 | 154 | 70 | 5.25 | 133 | 154 | 70 |

### P3 - RATED FOR 10,000 PSI

| CONNECTION TYPE | 3" CONNECTIONS | | | | 4" CONNECTIONS | | | |
|---|---|---|---|---|---|---|---|---|
| | inch | mm | lbs. | kg | inch | mm | lbs. | kg |
| 2 000 API | 10.06 | 256 | 407 | 185 | 10.81 | 275 | 476 | 216 |
| 3 000 API | 10.81 | 275 | 418 | 190 | 11.31 | 287 | 490 | 222 |
| 5 000 API | 11.44 | 291 | 438 | 199 | 11.69 | 297 | 509 | 231 |
| 10 000 API | 12.00 | 305 | 441 | 200 | 13.00 | 330 | 541 | 246 |
| Butt Weld | 6.50 | 165 | 338 | 153 | 6.50 | 165 | 338 | 153 |

### P3 - RATED FOR 15,000 PSI

| CONNECTION TYPE | 3" CONNECTIONS | | | | 4" CONNECTIONS | | | |
|---|---|---|---|---|---|---|---|---|
| | inch | mm | lbs. | kg | inch | mm | lbs. | kg |
| 2000 API | 10.06 | 256 | 467 | 212 | 10.81 | 275 | 561 | 255 |
| 3000 API | 10.81 | 275 | 478 | 217 | 11.31 | 287 | 575 | 261 |
| 5000 API | 11.44 | 291 | 497 | 226 | 11.69 | 297 | 593 | 269 |
| 10000 API | 12.00 | 305 | 501 | 227 | 13.00 | 330 | 626 | 284 |
| 15000 API | 12.50 | 318 | 526 | 239 | 13.56 | 344 | 676 | 307 |
| Butt Weld | 6.50 | 165 | 373 | 169 | 6.50 | 165 | 373 | 169 |

### P35

| CONNECTION TYPE | 4" CONNECTIONS | | | | 6" CONNECTIONS | | | |
|---|---|---|---|---|---|---|---|---|
| | inch | mm | lbs. | kg | inch | mm | lbs. | kg |
| 150 RF | 9.50 | 241 | 410 | 186 | 10.00 | 254 | 429 | 195 |
| 300 RF | 9.88 | 251 | 430 | 195 | 10.38 | 264 | 467 | 212 |
| 600 RF | 10.75 | 273 | 451 | 205 | 11.38 | 289 | 523 | 237 |
| 600 RTJ | 10.81 | 275 | 451 | 205 | 11.44 | 291 | 523 | 237 |
| 900 RF | 11.25 | 286 | 479 | 217 | 12.25 | 311 | 597 | 271 |
| 900 RTJ | 11.31 | 287 | 479 | 217 | 12.31 | 313 | 597 | 271 |
| 1500 RTJ | 11.69 | 297 | 515 | 234 | 13.62 | 346 | 705 | 320 |
| 2500 RTJ | 14.44 | 367 | 669 | 304 | 17.75 | 451 | 1133 | 514 |
| 2000 API | 10.81 | 275 | 451 | 205 | 11.44 | 291 | 523 | 237 |
| 3000 API | 11.31 | 287 | 479 | 217 | 12.31 | 313 | 597 | 271 |
| 5000 API | 11.69 | 297 | 515 | 234 | 13.62 | 346 | 705 | 320 |
| Butt Weld | 6.50 | 165 | 377 | 171 | 6.50 | 165 | 377 | 171 |

### P35 - RATED FOR 15,000 PSI

| CONNECTION TYPE | 4" CONNECTIONS | | | | 6" CONNECTIONS | | | |
|---|---|---|---|---|---|---|---|---|
| | inch | mm | lbs. | kg | inch | mm | lbs. | kg |
| 2 000 API | 11.81 | 300 | 623 | 283 | 12.44 | 316 | 864 | 392 |
| 3 000 API | 12.31 | 275 | 637 | 289 | 13.31 | 338 | 901 | 409 |
| 5 000 API | 12.69 | 287 | 655 | 297 | 14.62 | 371 | 955 | 434 |
| 10 000 API | 14.00 | 356 | 688 | 313 | 16.65 | 423 | 1097 | 498 |
| 15 000 API | 14.56 | 370 | 753 | 342 | 17.50 | 445 | 1279 | 581 |
| Butt Weld | 7.50 | 191 | 485 | 220 | 7.50 | 191 | 485 | 220 |

### P4

| CONNECTION TYPE | 4" CONNECTIONS | | | | 6" CONNECTIONS | | | |
|---|---|---|---|---|---|---|---|---|
| | inch | mm | lbs. | kg | inch | mm | lbs. | kg |
| 150 RF | 9.50 | 241 | 410 | 186 | 10.00 | 254 | 429 | 195 |
| 300 RF | 9.88 | 251 | 430 | 195 | 10.38 | 264 | 467 | 212 |
| 600 RF | 10.75 | 273 | 451 | 205 | 11.38 | 289 | 523 | 237 |
| 600 RTJ | 10.81 | 275 | 451 | 205 | 11.44 | 291 | 523 | 237 |
| 900 RF | 11.25 | 286 | 479 | 217 | 12.25 | 311 | 597 | 271 |
| 900 RTJ | 11.31 | 287 | 479 | 217 | 12.31 | 313 | 597 | 271 |
| 1500 RTJ | 11.69 | 297 | 515 | 234 | 13.62 | 346 | 705 | 320 |
| 2500 RTJ | 14.44 | 367 | 669 | 304 | 17.75 | 451 | 1133 | 514 |
| 2000 API | 10.81 | 275 | 451 | 205 | 11.44 | 291 | 523 | 237 |
| 3000 API | 11.31 | 287 | 479 | 217 | 12.31 | 313 | 597 | 271 |
| 5000 API | 11.69 | 297 | 515 | 234 | 13.62 | 346 | 705 | 320 |
| Butt Weld | 6.50 | 165 | 377 | 171 | 6.50 | 165 | 377 | 171 |

### P4 - RATED FOR 10,000 PSI

| CONNECTION TYPE | 4" CONNECTIONS | | | | 6" CONNECTIONS | | | |
|---|---|---|---|---|---|---|---|---|
| | inch | mm | lbs. | kg | inch | mm | lbs. | kg |
| 2000 API | 11.81 | 300 | 623 | 283 | 12.44 | 316 | 864 | 392 |
| 3000 API | 12.31 | 313 | 637 | 289 | 13.31 | 338 | 901 | 409 |
| 5000 API | 12.69 | 322 | 655 | 297 | 14.62 | 371 | 955 | 434 |
| 10000 API | 14.00 | 356 | 688 | 313 | 16.65 | 423 | 1097 | 498 |
| Butt Weld | 7.50 | 191 | 485 | 220 | 7.50 | 191 | 485 | 220 |

### P5

| CONNECTION TYPE | 5" CONNECTIONS | | | | 6" CONNECTIONS | | | |
|---|---|---|---|---|---|---|---|---|
| | inch | mm | lbs. | kg | inch | mm | lbs. | kg |
| 150 RF | 11.00 | 279 | 516 | 234 | 11.00 | 279 | 516 | 234 |
| 300 RF | 11.38 | 289 | 554 | 252 | 11.38 | 289 | 554 | 252 |
| 600 RF | 12.25 | 311 | 575 | 261 | 12.38 | 314 | 610 | 277 |
| 600 RTJ | 12.31 | 313 | 575 | 261 | 12.44 | 316 | 610 | 277 |
| 900 RF | 12.75 | 324 | 625 | 284 | 13.25 | 337 | 684 | 311 |
| 900 RTJ | 12.81 | 325 | 625 | 284 | 13.31 | 338 | 684 | 311 |
| 1500 RTJ | 13.94 | 354 | 697 | 316 | 14.62 | 371 | 792 | 360 |
| 2500 RTJ | 17.00 | 432 | 988 | 449 | 18.75 | 476 | 1220 | 554 |
| 2000 API | 12.31 | 313 | 575 | 261 | 12.44 | 316 | 610 | 277 |
| 3000 API | 12.81 | 325 | 625 | 284 | 13.31 | 338 | 684 | 311 |
| 5000 API | 13.94 | 354 | 697 | 316 | 14.62 | 371 | 792 | 360 |
| Butt Weld | 7.50 | 191 | 464 | 211 | 7.50 | 191 | 464 | 211 |

### P5 - RATED FOR 10,000 PSI

| CONNECTION TYPE | 5" CONNECTIONS | | | | 6" CONNECTIONS | | | |
|---|---|---|---|---|---|---|---|---|
| | 'I' & 'O' | | Weights | | 'I' & 'O' | | Weights | |
| | inch | mm | lbs. | kg | inch | mm | lbs. | kg |
| 2,000 API | 14.31 | 363 | 894 | 406 | 14.44 | 367 | 929 | 422 |
| 3,000 API | 14.81 | 376 | 944 | 429 | 15.31 | 389 | 1003 | 455 |
| 5,000 API | 15.94 | 405 | 1016 | 461 | 16.62 | 422 | 1111 | 504 |
| 10,000 API | 16.81 | 427 | 1051 | 477 | 18.65 | 474 | 1395 | 633 |
| Butt Weld | 9.50 | 241 | 783 | 355 | 9.50 | 241 | 783 | 355 |

### P6

| CONNECTION TYPE | 6" CONNECTIONS | | | | 8" CONNECTIONS | | | |
|---|---|---|---|---|---|---|---|---|
| | 'I' & 'O' | | Weights | | 'I' & 'O' | | Weights | |
| | inch | mm | lbs. | kg | inch | mm | lbs. | kg |
| 150 RF | 13.00 | 330 | 835 | 379 | 13.50 | 343 | 867 | 394 |
| 300 RF | 13.38 | 340 | 873 | 396 | 13.88 | 352 | 921 | 418 |
| 600 RF | 14.38 | 365 | 929 | 422 | 15.00 | 381 | 1007 | 457 |
| 600 RTJ | 14.44 | 368 | 929 | 422 | 15.06 | 383 | 1007 | 457 |
| 900 RF | 15.25 | 387 | 1003 | 455 | 16.12 | 410 | 1157 | 525 |
| 900 RTJ | 15.31 | 389 | 1003 | 455 | 16.12 | 410 | 1157 | 525 |
| 1500 RTJ | 16.62 | 422 | 1111 | 504 | 18.31 | 465 | 1329 | 603 |
| 2500 RTJ | 20.75 | 527 | 1539 | 699 | 22.56 | 573 | 1935 | 878 |
| 2,000 API | 14.44 | 367 | 929 | 422 | 15.06 | 383 | 1007 | 457 |
| 3,000 API | 15.31 | 389 | 1003 | 455 | 16.19 | 411 | 1157 | 525 |
| 5,000 API | 16.62 | 422 | 1111 | 504 | 18.31 | 465 | 1329 | 603 |
| Butt Weld | 9.50 | 241 | 783 | 355 | 9.50 | 241 | 783 | 355 |

### P8

| CONNECTION TYPE | 8" CONNECTIONS | | | | 10" CONNECTIONS | | | |
|---|---|---|---|---|---|---|---|---|
| | 'I' & 'O' | | Weights | | 'I' & 'O' | | Weights | |
| | inch | mm | lbs. | kg | inch | mm | lbs. | kg |
| 150 RF | 15.25 | 387 | 1365 | 620 | 15.25 | 387 | 1405 | 640 |
| 300 RF | 15.62 | 397 | 1420 | 645 | 15.88 | 403 | 1490 | 675 |
| 600 RF | 16.75 | 425 | 1505 | 685 | 17.50 | 445 | 1690 | 768 |
| 600 RTJ | 16.81 | 427 | 1505 | 685 | 17.56 | 446 | 1690 | 768 |
| 900 RF | 17.88 | 454 | 1655 | 750 | 18.75 | 476 | 1835 | 835 |
| 900 RTJ | 17.94 | 456 | 1655 | 750 | 18.81 | 478 | 1835 | 835 |
| 1500 RTJ | 20.06 | 510 | 1825 | 830 | 21.69 | 551 | 2300 | 1045 |
| 2500 RTJ | 24.31 | 618 | 2430 | 1105 | 28.44 | 722 | 3295 | 1495 |
| 2,000 API | 16.81 | 427 | 1505 | 685 | 17.56 | 446 | 1675 | 760 |
| 3,000 API | 17.94 | 456 | 1655 | 750 | 18.81 | 478 | 1860 | 845 |
| 5,000 API | 20.06 | 510 | 1825 | 830 | 21.69 | 551 | 2310 | 1050 |
| Butt Weld | 11.25 | 286 | 1280 | 580 | 11.25 | 286 | 1280 | 580 |

# MATERIAL SPECIFICATIONS

## SERVICE APPLICATION

| SIZE | VALVE PART | STANDARD | SOUR | SOUR LOW TEMP | STAINLESS STEEL | |
|---|---|---|---|---|---|---|
| P05 | Temp. Range | -20°F to 250°F | -20°F to 400°F | -50°F to 400°F | -50°F to 400°F | |
| | Body | ASTM A105 | ASTM A105 | AISI 4130 | ASTM A182 F316 | |
| | I & O Flanges | ASTM A105 | ASTM A105 | ASTM A350 LF2 | ASTM A182 F316 | |
| | Stem | AISI 4140 | AISI 17-4 PH | AISI 17-4 PH | AISI 17-4 PH | |
| | Retaining Sleeve | AISI 1020 | AISI 1020 | AISI 1020 | AISI 316 | |
| | Bolting | ASTM A193 B7 | ASTM A193 B7M | ASTM A320 L7M | ASTM A320 L7M | |
| | O-Ring | Nitrile | Viton | Viton | Viton | |
| | BU Ring | Nitrile | Teflon | Teflon | Teflon | |
| **SIZE** | **VALVE PART** | **STANDARD** | **SOUR** | **SOUR LOW TEMP** | **STAINLESS STEEL** | **HIGH TEMP** |
| P1 | Temp. Range | -20°F to 250°F | -20°F to 400°F | -50°F to 400°F | -50°F to 400°F | -20°F to 850°F |
| | Body | AISI 1020 | AISI 1020 | AISI 8620 | ASTM A182 F316 | AISI 8620 |
| | I & O Flanges | ASTM A105 | ASTM A105 | ASTM A350 LF2 | ASTM A182 F316 | ASTM A105 |
| | Stem | AISI 17-4 PH | AISI 17-4 PH | AISI 17-4 PH | AISI 17-4 PH | AISI 4140 |
| | Retaining Sleeve | AISI 1020 | AISI 1020 | AISI 1020 | AISI 316 | AISI 1020 |
| | Bolting | ASTM A193 B7 | ASTM A193 B7M | ASTM A320 L7M | ASTM A320 L7M | ASTM A193 B7 |
| | O-Ring | Nitrile | Viton | Viton | Viton | SS/GRAPHOIL |
| | BU Ring | Nitrile | Teflon | Teflon | Teflon | n/a |
| **SIZE** | **VALVE PART** | **STANDARD** | **SOUR** | **SOUR LOW TEMP** | **STAINLESS STEEL** | **HIGH TEMP** |
| P2<br>P25 | Temp. Range | -20°F to 250°F | -20°F to 400°F | -50°F to 400°F | -50°F to 400°F | -20°F to 850°F |
| | Body | AISI 8620 | AISI 8620 | AISI 8620 | ASTM A182 F316 | AISI 8620 |
| | I & O Flanges | ASTM A105 | ASTM A105 | ASTM A350 LF2 | ASTM A182 F316 | ASTM A105 |
| | Stem | AISI 17-4 PH | AISI 17-4 PH | AISI 17-4 PH | AISI 17-4 PH | AISI 4140 |
| | Retaining Sleeve | AISI 1020 | AISI 1020 | AISI 1020 | AISI 316 | AISI 1020 |
| | Bolting | ASTM A193 B7 | ASTM A193 B7M | ASTM A320 L7M | ASTM A320 L7M | ASTM A193 B7 |
| | O-Ring | Nitrile | Viton | Viton | Viton | SS/GRAPHOIL |
| | BU Ring | Nitrile | Teflon | Teflon | Teflon | n/a |
| **SIZE** | **VALVE PART** | **STANDARD** | **SOUR** | **SOUR LOW TEMP** | **STAINLESS STEEL** | ***Materials subject to change or substitution as determined by Master Flo.** |
| P3<br>P35<br>P4<br>P5<br>P6<br>P8 | Temp. Range | -20°F to 250°F | -20°F to 400°F | -50°F to 400°F | -50°F to 400°F | |
| | Body | AISI 8620 | AISI 8620 | AISI 8620 | ASTM A182 F316 | |
| | I & O Flanges | ASTM A105 | ASTM A105 | ASTM A350 LF2 | ASTM A182 F316 | |
| | Stem | AISI 17-4 PH | AISI 17-4 PH | AISI 17-4 PH | AISI 17-4 PH | |
| | Retaining Sleeve | AISI 1020 | AISI 1020 | AISI 1020 | AISI 316 | |
| | Bolting | ASTM A193 B7 | ASTM A193 B7M | ASTM A320 L7M | ASTM A320 L7M | |
| | O-Ring | Nitrile | Viton | Viton | Viton | |
| | BU Ring | Nitrile | Teflon | Teflon | Teflon | |

# OTHER PRODUCTS MANUFACTURED BY MASTER FLO

## SUBSEA CONTROL VALVES

- Manually operated, non-retrievable bolted bonnet
- Actuated, non-retrievable bolted bonnet
- Diver-assist insert retrievable complete with clamp bonnet
- Tool Insert retrievable

## CONTROL VALVES

- Manual
- Pneumatic
- Hydraulic
- Electric

## PIG BALL VALVES

- Bypass Style
- Shut off Style


**Master Flo's latest valve and actuator sizing is available on CDROM. This Windows™ based software allows our customers to easily and accurately select Master Flo products to meet their application needs.**