



Mach 1™

HIGH PERFORMANCE PLUG VALVE



NEW



Quality System Certificate

Breaking The Barriers

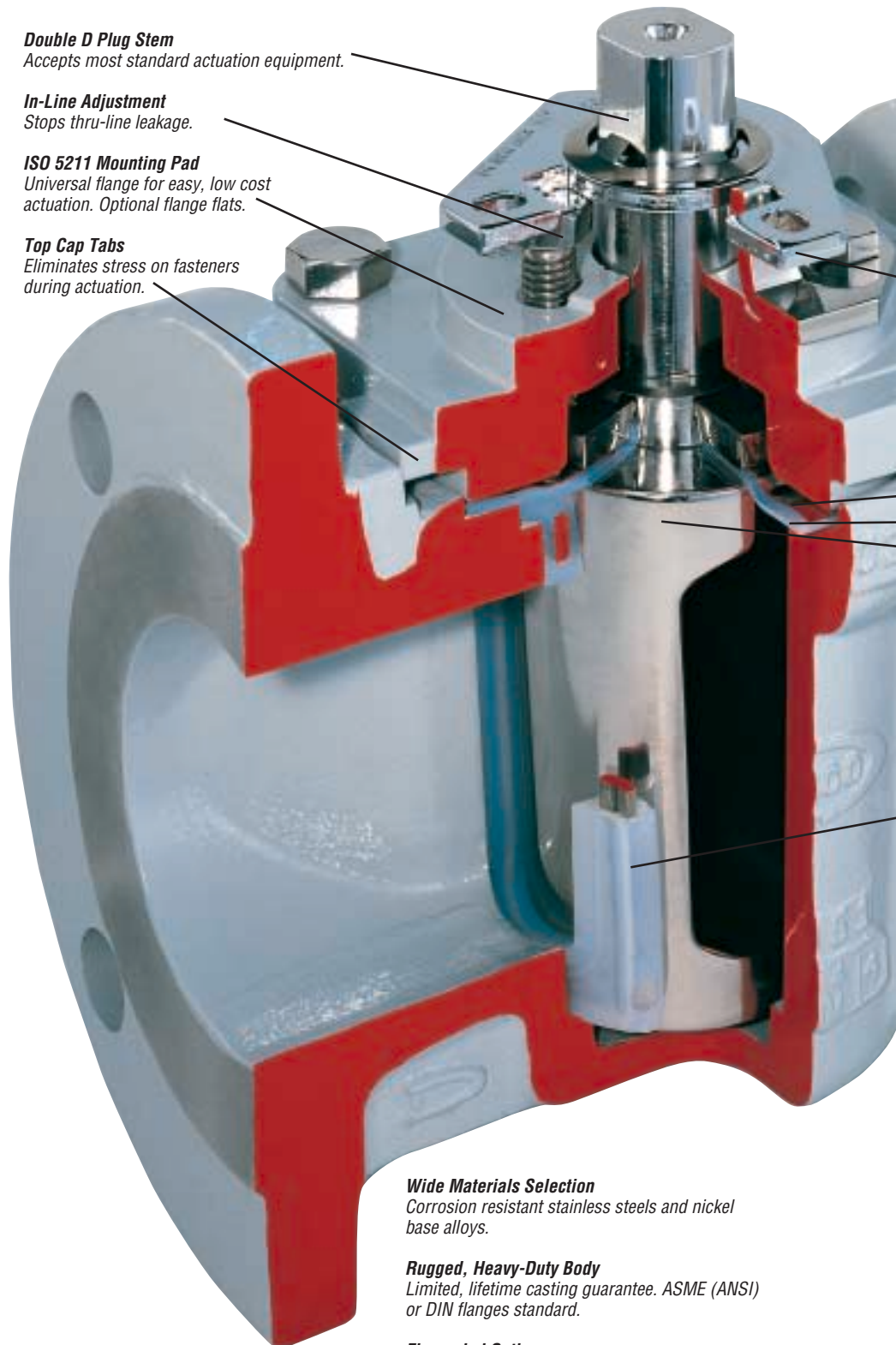
Bulletin V-30a (E)

Durco[®] Mach 1 High Performance Plug Valve

Flowserve has reinvented the non-lubricated plug valve to provide these new performance enhancing features:

- Lower, constant turning torques comparable to ball valves and significantly lower than other plug valves
- Higher temperature capability more comparable to gate and triple-offset butterfly valves (525°F / 274°C)*
- Easy seat replacement with valve in-line; no special tooling required
- ISO mounting pad
- ASME Class 150, 300 and 600 (derated) flanged DIN 25-150
PN 10-16, 25-40, 100

*Excursions to 550°F (288°C) contact factory.



Double D Plug Stem
Accepts most standard actuation equipment.

In-Line Adjustment
Stops thru-line leakage.

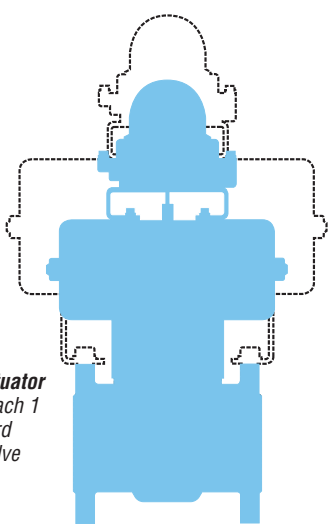
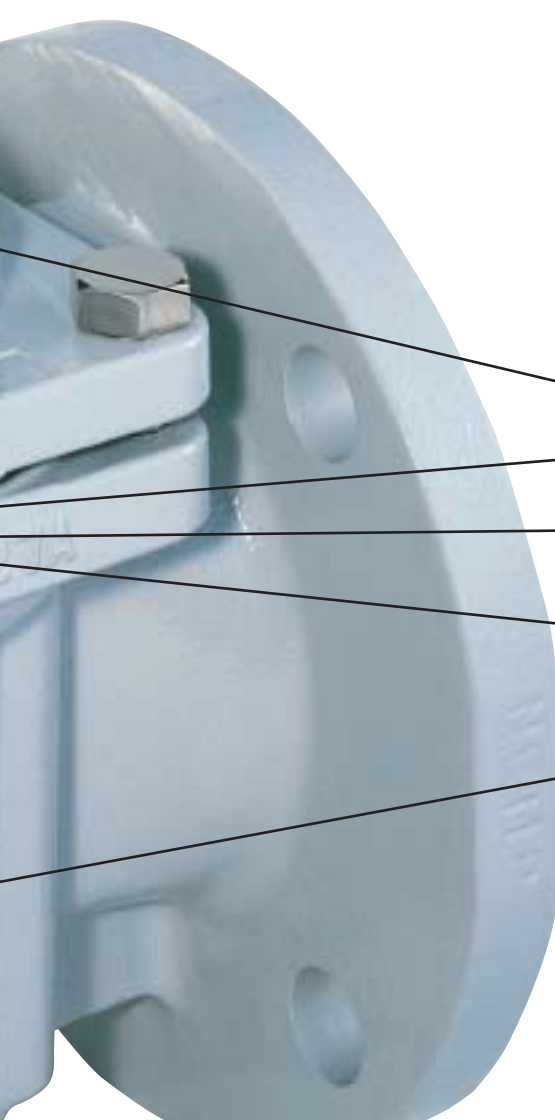
ISO 5211 Mounting Pad
Universal flange for easy, low cost actuation. Optional flange flats.

Top Cap Tabs
Eliminates stress on fasteners during actuation.

Wide Materials Selection
Corrosion resistant stainless steels and nickel base alloys.

Rugged, Heavy-Duty Body
Limited, lifetime casting guarantee. ASME (ANSI) or DIN flanges standard.

Firesealed Option
Fire tested in accordance with API 607, Fourth Edition.



Required Actuator
 ■ New Mach 1
 ---- Standard plug valve

Lockout
 Meets OSHA and plant safety requirements.

Metal Diaphragm
 Provides stem seal reinforcement.

PFA Reverse Lip Diaphragm
 Provides dynamic and static, self adjusting stem seal.

Tapered Plug
 Assures reduced turning torque and in-line seal adjustment for wear. Adjustment is independent of stem seals. With $\pm 3/16$ in (± 5 mm) adjustment, plug cannot bottom out.

Seats
 PFA with encapsulated alloy inserts standard for higher temperature and 360° sealing. Self-locking design. Easily removable for in-line replacement. Full sleeve option available.

Unique Port Seal Seats

The high alloy substrate extends the Mach 1's temperature range, reduces its turning torque and provides a 360° port seal.



U.S. Patent Pending



U.S. Patent Pending

Lower Torque

Actuator recommendations*			
Valve Size in (mm)	Competitor Plug	G4	Mach 1
1 (25)	100	100	85
1-1/2 (40)	125	115	85
2 (50)	150	125	100
3 (80)	150	150	115
4 (100)	175	175	125
6 (150)	250	250	175

*Automax SNA/SID Series, spring return, 80 psi air

Higher Temperature

Mach 1 °F (°C)	Soft seat °F (°C)
600 (315)	600 (315)
575 (302)	575 (302)
550 (288)*	550 (288)
525 (274)	525 (274)
500 (260)	500 (260)
475 (246)	475 (246)
450 (232)	450 (232)
425 (218)	425 (218)
400 (204)	400 (204)
375 (190)	375 (190)

*Excursions to 550°F (288°C)

Maximum PTFE operating temperature

Higher Pressure

The Mach 1 is available in a Class 600 (derated) version. This provides more opportunities to satisfy customer and process requirements.

Easier Repair

Equipment needed for standard plug valve repair:

- Inner plunger
- Outer plunger
- Coining die
- Sizing plug
- Locking plug
- Plunger pin
- Arbor press
- Various hand tools

Equipment needed for Mach 1 valve repair:

- "C" Clamp (in-line)
- Arbor press (in-shop)
- Various hand tools

Actuation Options For Mach 1 Valves



Manual Operation

A hand wrench is standard for manual operation through 6 in (150 mm). Gearbox is required on 6 in (150 mm) valves with optional sleeve.

Actuation

Flowserve's Automax® operation is a specialist in valve automation systems offering rack and pinion, heavy-duty and electric actuators along with positioners, limit switches, engineered special control circuits and related accessories.

Control Valves

V-Port control valves are available in a variety of trim configurations to satisfy your exact flow control needs.

Unaffected by ΔP , the turning torques for Mach 1 plug valves are constant. Actuation costs are significantly reduced since the Mach 1 uses actuators that are one, two and even three sizes smaller than those used with other plug valves...and even smaller than some ball valves.

Flow Rates (Estimated)

Size in (mm)	C _v (K _v) Value
1 (25)	41 (35)
1-1/2 (40)	81 (70)
2 (50)	161 (139)
3 (80)	267 (230)
4 (100)	548 (472)
6 (150)	1001 (863)

$C_v = \text{US gal/min at } 1 \text{ psi } \Delta P$ ($K_v = \text{m}^3/\text{h at } 1 \text{ bar } \Delta P$)



Mach 1/Automax Package

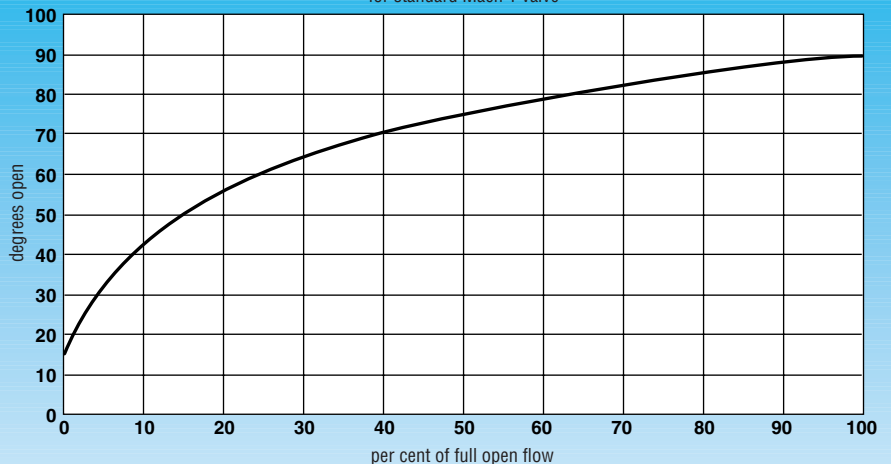
Mach 1 valves feature automation sizing torques comparable to ball valves along with the bi-directional, adjustable and bubble-tight sealing performance of a plug valve.

Sizing Torque in-lbs (Nm)

Valve Size in (mm)	Port Seal	Sleeve
1 (25)	150 (16.9)	200 (22.6)
1-1/2 (40)	200 (22.6)	300 (33.9)
2 (50)	350 (39.5)	475 (53.7)
3 (80)	475 (53.7)	710 (80.2)
4 (100)	940 (106.2)	1440 (162.7)
6 (150)	2400 (271.2)	3600 (406.7)

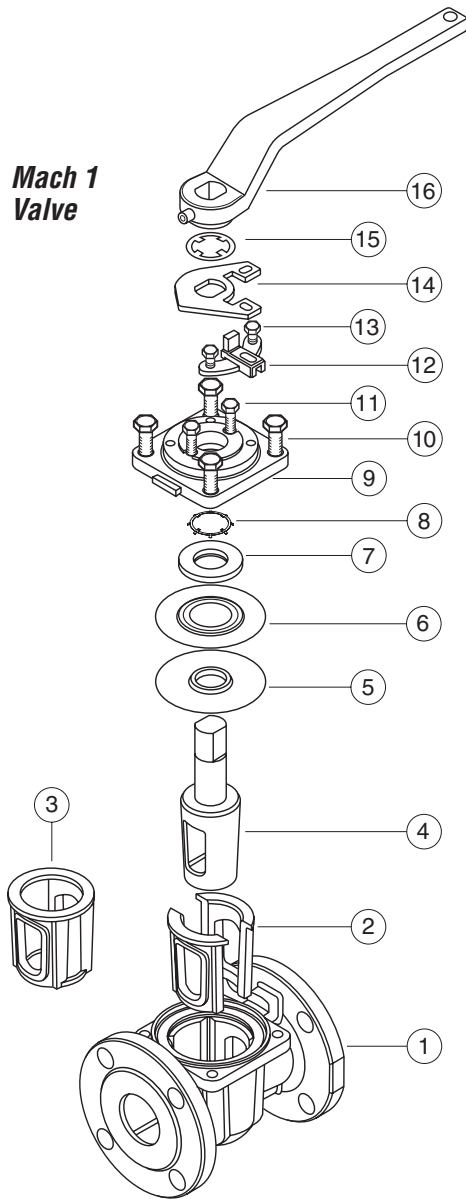
Flow Characteristics

Typical characteristic curve for standard Mach 1 valve



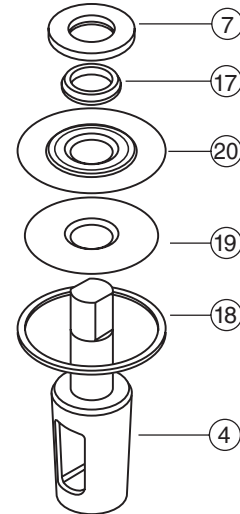
Parts and Materials

Mach 1 Valve



Mach 1 Parts and Materials			
Item No.	Description	Material of Construction	No. Req.
1	Body	Alloy or Ductile Cast Iron	1
2	Port Seal	PFA Encapsulated 316L SS	2
3	Sleeve	PFA Encapsulated 316L SS (Optional)	1
4	Plug	Alloy	1
5	Diaphragm	PFA	1
6	Diaphragm	A666	1
7	Thrust Gland	304SS/17-4PH	1
8	Grounding Spring	302SS	1
9	Top Cap	CD4M, Ductile Cast Iron	1
10	Top Cap Fastener	Grade B8 Class 2B AISI (304SS) or B7	4
11	Adjusting Bolts	1840 Generic 300 Series Stainless Steel or B7	2
12	Stop	CF8M	1
13	Stop Fastener	1840 Generic 300 Series Stainless Steel or B7	2
14	Stop Collar	Cadmium Plated Carbon Steel	1
15	Stop Collar Retainer	302 SS	1
16	Wrench	Ductile Cast Iron	1
17	Stem Packing	GA	1
18	Top Cap Gasket	GAWR	
19	Diaphragm	PFA	
20	Diaphragm	A666	

Mach 1 Firesealed Exclusive Parts



Optional sleeve with substrate

Applicable Valve Standards

Specification	Title
ASME B16.10	Face-to-face dimension
ASME B16.34	Steel valves, flanged
ASME B16.5	Flange & flange fitting
API 607	Fire safe valve testing
API 598	Valve inspection & test
M.S.S. SP-54	Radiographic
M.S.S. SP-55	Visual quality
M.S.S. SP-61	Hydrostatic testing

Materials Selection Chart A

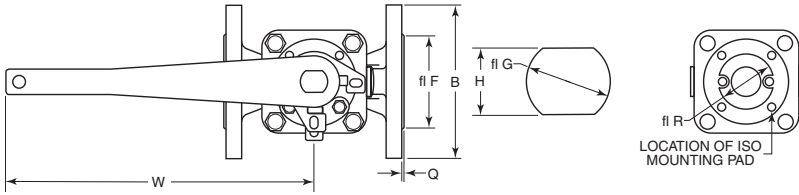
DCI =	ASTM A395 Ductile Cast Iron
DS =	ASTM A216 Gr. WCB (Cast Steel)
D2L =	ASTM A351/A744 Gr. CF3 (304L S.S.)
D4 =	ASTM A351/A744 Gr. CF8M (316 S.S.)
DV =	Durcomet 5 (Durco's High Silicon Stainless Steel)
CD =	ASTM A351/A744 Gr. CD4M Cu (Durcomet 100)
D20 =	ASTM A351/A744 Gr. CN-7M (Durimet 20)
CK3M =	ASTM A351/A744 Gr. CK-3MCuN (254 SMO) ¹
DM1 =	ASTM A494 Gr. M35-1 (Monel 400) ²
DNI =	ASTM A494 Gr. CZ-100 (Nickel 200)
DC2 =	ASTM A494 Gr. N-7M (Chlorimet 2)
DC3 =	STM A494 Gr. CW-6M (Chlorimet 3)

1. Registered trademark of Avesta AB

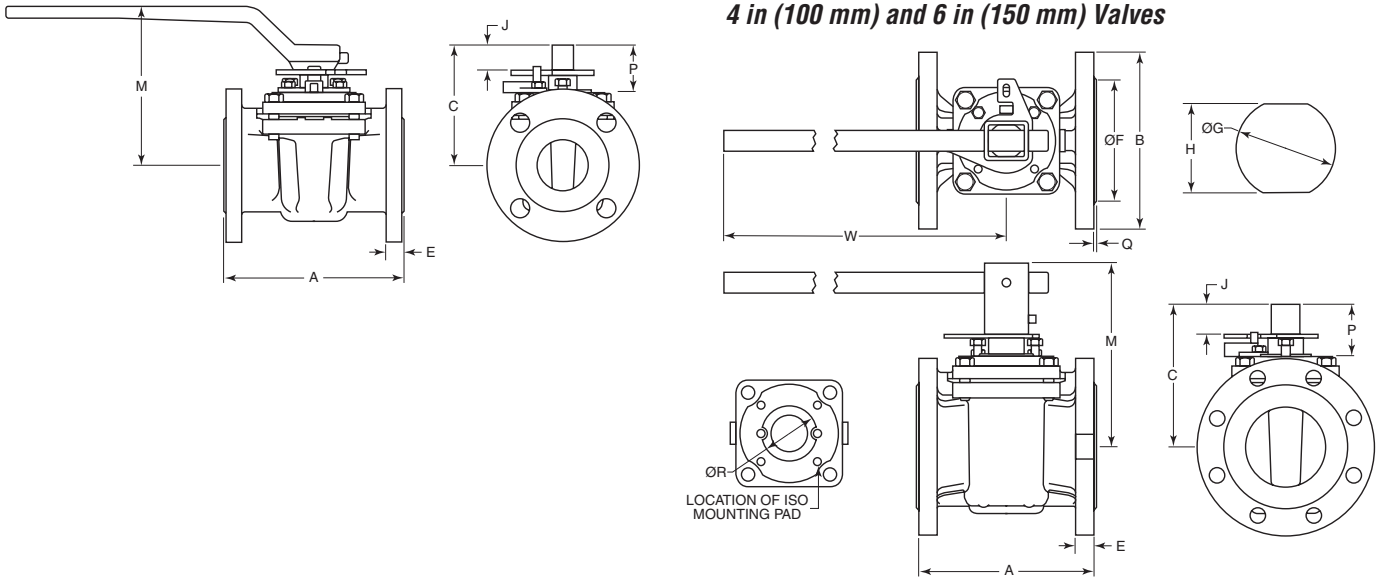
2. Registered trademark of the International Nickel Company, Inc.

Mach 1 Straightway Valve Dimensions

1 in (25 mm) to 3 in (80 mm) Valves



4 in (100 mm) and 6 in (150 mm) Valves



English Units

Valve Size	Drilling Class 150		Drilling Class 300		Drilling Class 600		ISO Mounting Pad			A			B			C	E			F	G	H	J	M	P	Q			R	W						
	No.	Size	BC	No.	Size	BC	No.	Size	BC	No.	Size	BC	150	300	600		150	300	600							150	300	600			150	300	600	150	300	600
	1	4	0.63	3.13	4	0.75	3.50	4	0.75	3.50	F05	M6	1.97	5.00	6.50		8.50	4.25	4.88							4.88	3.49	0.44			0.69	0.94	2.00	0.787/0.782	0.656/0.651	0.62
1.50	4	0.63	3.88	4	0.88	4.50	4	0.88	4.50	F05	M6	1.97	6.50	7.50	9.50	5.00	6.13	6.13	3.93	0.56	0.81	1.13	2.88	0.787/0.782	0.656/0.651	0.75	4.96	1.56	0.06	0.06	0.25	1.38	9.00			
2	4	0.75	4.75	8	0.75	5.00	8	0.75	5.00	F07	M8	2.76	7.00	8.50	11.50	6.00	6.50	6.50	4.74	0.63	0.88	1.25	3.63	1.075/1.065	0.875/0.870	1.00	6.24	1.88	0.06	0.06	0.25	2.17	12.00			
3	4	0.75	6.00	8	0.88	6.63	8	0.88	6.63	F07	M8	2.76	8.00	11.13	14.00	7.50	8.25	8.25	5.21	0.75	1.13	1.50	5.00	1.075/1.065	0.875/0.870	1.00	6.71	1.89	0.06	0.06	0.25	2.17	20.00			
4	8	0.75	7.50	8	0.88	7.88	8	1.00	8.50	F10	M10	4.02	9.00	12.00	17.00	9.00	10.00	10.75	7.18	0.94	1.25	1.75	6.19	1.687/1.677	1.421/1.416	1.50	9.31	2.60	0.06	0.06	0.25	2.76	29.88			
6	8	0.88	9.50	12	0.88	10.58	12	1.13	11.50	F12	M12	4.92	10.50	15.88	22.00	11.00	12.50	14.00	8.44	1.00	1.44	2.13	8.50	1.687/1.677	1.421/1.416	1.47	10.60	2.59	0.06	0.06	0.25	3.34	46.00			

Metric Units

Valve Size	Drilling Class PN 10-16		Drilling Class PN 25-40		ISO Mounting Pad			A		B		C	E		F		G	H	J	M	P	Q		R	W		
	No.	Size	BC	No.	Size	BC	No.	Size	BC	10-16	25-40		10-16	25-40	10-16	25-40						10-16	25-40			10-16	25-40
	25	4	13.9	84.9	4	13.9	84.9	F05	M6	50.0	160.0		160.0	115.1	115.1	88.7						19.4	19.4			68.1	68.1
32	4	18.0	100.1	4	18.0	100.1	F05	M6	50.0	184.5	184.5	140.0	140.0	88.7	20.3	20.3	80.9	80.9	20.00/19.86	16.66/16.54	15.8	118.1	36.3	1.6	1.6	35.0	177.8
40	4	18.0	110.0	4	18.0	110.0	F05	M6	50.0	199.9	199.9	150.1	150.1	99.8	19.8	19.8	88.1	88.1	20.00/19.86	16.66/16.54	19.0	126.0	39.5	1.6	1.6	35.0	228.6
50	4	18.0	125.0	4	18.0	125.0	F07	M8	70.0	229.0	229.0	165.1	165.1	120.4	21.7	21.7	102.1	102.1	27.31/27.05	22.23/22.10	25.4	158.5	45.5	1.6	1.6	55.0	304.8
65	4	18.0	145.0	4	18.0	145.0	F07	M8	70.0	290.0	290.0	184.9	184.9	132.3	23.6	23.6	123.0	123.0	27.31/27.05	22.23/22.10	25.4	170.4	48.1	1.6	1.6	55.0	508.0
80	4	18.0	160.0	4	18.0	160.0	F07	M8	70.0	310.0	310.0	200.0	200.0	132.3	25.6	25.6	138.2	138.2	27.31/27.05	22.23/22.10	25.4	170.4	48.1	1.6	1.6	55.0	508.0
100	8	18.0	180.1	8	22.0	190.0	F10	M10	102.0	350.0	350.0	219.9	235.0	182.3	21.8	25.8	158.0	162.0	42.85/42.60	36.09/35.97	38.1	236.5	65.9	1.6	6.4	70.0	759.0
125	8	18.0	210.0	8	26.0	220.0	F10	M10	102.0	400.1	400.1	249.9	269.9	182.3	23.6	27.6	190.2	190.2	42.85/42.60	36.09/35.97	38.1	236.5	65.9	1.6	6.4	70.0	759.0
150	8	22.0	240.0	8	26.0	249.9	F12	M12	125.0	480.1	480.1	285.5	300.0	214.13	27.0	29.8	212.0	218.0	42.85/42.60	36.09/35.97	37.3	269.2	65.9	1.6	6.4	84.8	1168.4

All dimensions are approximate and for illustrative purposes only. For exact dimensions request certified dimensional prints.

Testing and Pressure/Temperature Ratings

Mach 1 valves have been extensively tested to ensure the highest level of reliability possible.

The unique reverse lip stem seal has been tested from -50°F (-46°C) at 720 psi to 525°F (274°C) at 525 psi (36 bar).

High temperature throttling tests at 525°F (274°C) with pressure drops of 175 psig (12 bar) have proven the superiority of Mach 1 valves over other soft-seated valves. Ask Durco Valve Sales Representatives for specific test results.

The valves have been temperature cycled to 525°F (274°C), and have provided performance superior to any other soft-seated valve available for cyclical temperature situations.

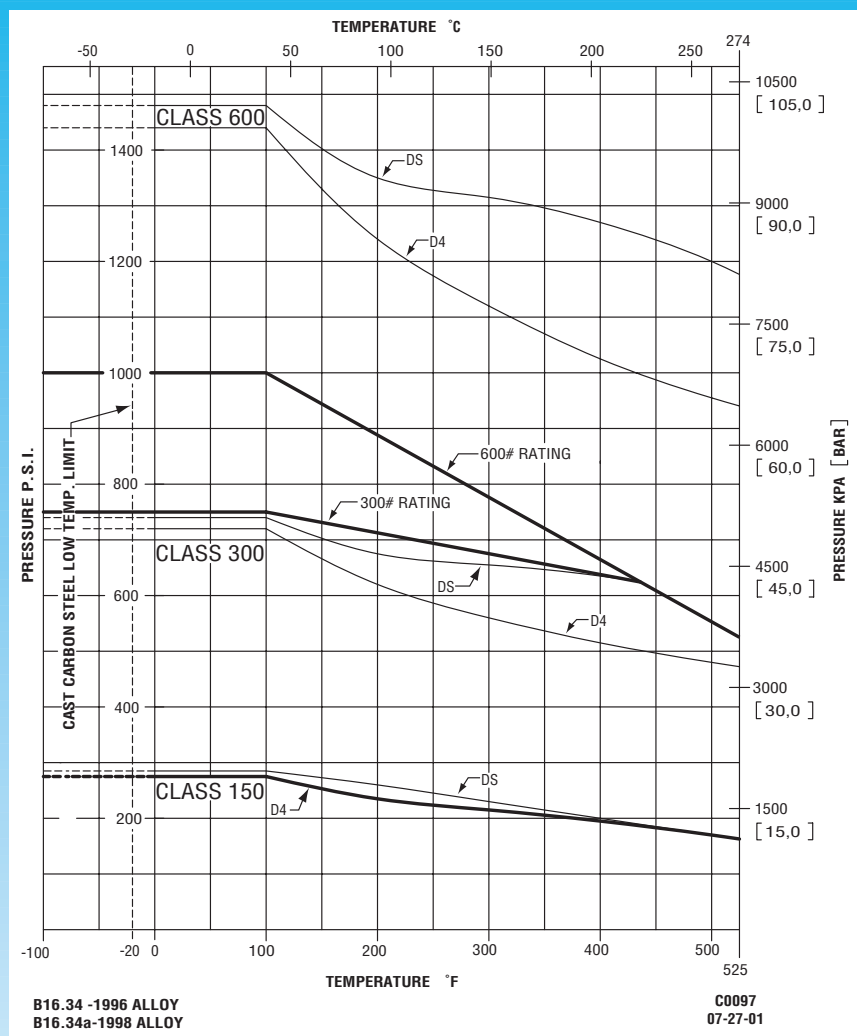
We believe the Mach 1 valve is the best soft-seated valve on the market today, and will outlast and outperform all competitive valves.

Pressure-Temperature Ratings

The pressure-temperature ratings of the materials shown are based on mechanical property requirements cited in the latest ASTM or ASME specifications.

Valves may require adjustment to remain drop tight at the lower end of temperature range when operating below 0°F (-17°C) or during extreme temperature cycles.

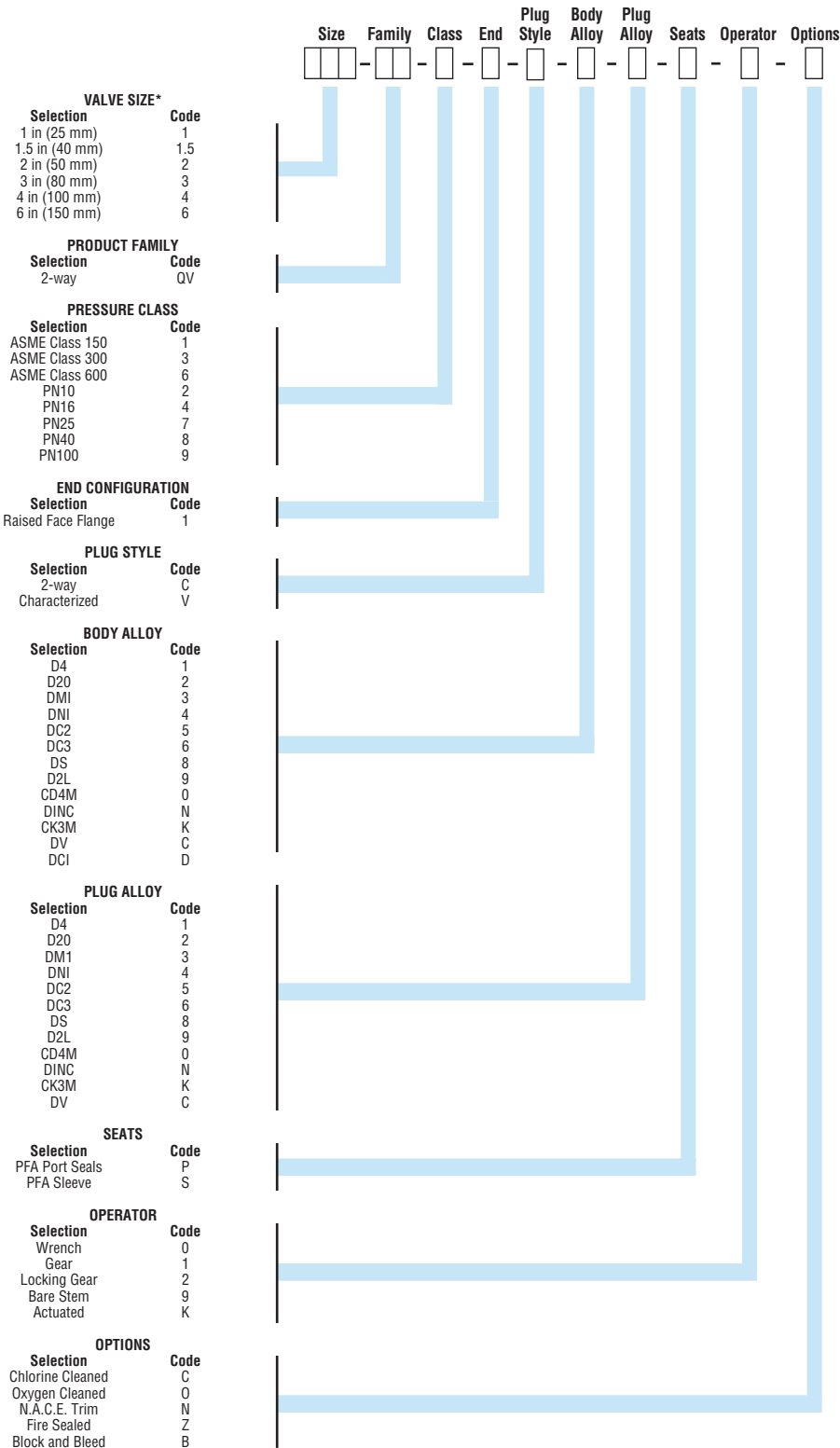
Mach 1 Pressure/Temperature Ratings — Class 150, 300 and 600 Valves



D4 = Cast 316 SS (CF-8M), DS = Cast Carbon Steel (WCB)
Consult factory for other materials



How To Order



*Sizes 1-1/4 in (32 mm), 2-1/2 in (65 mm) and 5 in (125 mm) are DIN only. Code mm as size. Consult factory for more information.

Selection, Installation, Operation and Maintenance

Although Flowserve can, and often does, provide general guidelines, it is obviously not possible to provide application specific data and warnings for all conceivable applications. The purchaser/end user must therefore assume the ultimate responsibility for the proper selection, installation, operation and maintenance of the products. Read the appropriate IOM available from Flowserve Corporation, Cookeville, TN 38501 before installing, operating or repairing any valve. The purchasers/end user should train its employees and/or contractors in the safe use of the Durco products in connection with the purchaser's manufacturing processes.

Design Changes

In order to follow Flowserve's commitment to continuous improvement, we reserve the right to change product and performance specifications without notice.

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