

Installation, Operation and Maintenance







Quality System Certificate

Bulletin DVENIM0333

Breaking The Barriers



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SECTION I

INSTALLATION INSTRUCTIONS - FLANGED MARATHON-MACH 1, CLASS 150, 300 AND 600

FLANGED:

Installation of Flowserve flanged valves is best accomplished by locating valves in pipeline flanges, assuring all corrosion and foreign materials are removed from pipe flanges and then center gaskets with the valve flanges. Fasteners or taper pins should be used to align holes and locate gaskets. Fasteners should be tightened to the corresponding valve and fastener size.

TABLE I-1 Temperature Limitations

Туре	Material Description	Maximum Service Temperature
	R-Seat (full, no insert)	400°F (274°C)
PFA	S-Seat (full, insert)	525°F (204°C)
	P-Seat (port seal, insert)	525°F (274°C)
UMPE		200°F (93°C)
Tefzel		300°F (149°C)



SECTION II OPERATING/MAINTENANCE INSTRUCTIONS FOR MARATHON-MACH 1

Maintenance requirements for Marathon-Mach 1 valves may vary due to operating conditions of the process. Factors such as operating temperature, pressure, solids content, and frequency of cycling can influence valve performance and maintenance requirements.

Seal wear is compensated by adjusting appropriate parts. For Mach 1 valves, there are three possible leak paths:

- 1. Top Cap (bonnet)
- 2. Stem
- 3. Line (through)

Corresponding adjustments for each leak path are as follows. NOTE: Refer to Figure II-1 for parts identification.

1. Top Cap (bonnet)

Leakage due to thermal or pressure cycling is eliminated by tightening the top cap fasteners (Part 10) in a "criss-cross" pattern to the torque values given in the tables. This adjustment is most effective when the valve is not pressurized. It is important that the top cap fasteners not be tightened excessively and that torque values applied be within industry standard for fasteners.

2. Stem

Leakage due to wear of the diaphragm, and/or wear to the sleeve (primary seal) is eliminated by tightening the adjuster fasteners (Part 11) in 1/4 turn increments. The adjuster fasteners must be tightened evenly for maximum adjustment. The valve should be operated between adjustments to assure that the plug properly seats itself into the sleeve. If leakage persists after repeated adjustments, the sleeve and diaphragm will require replacement as covered in Section V and Section VI.

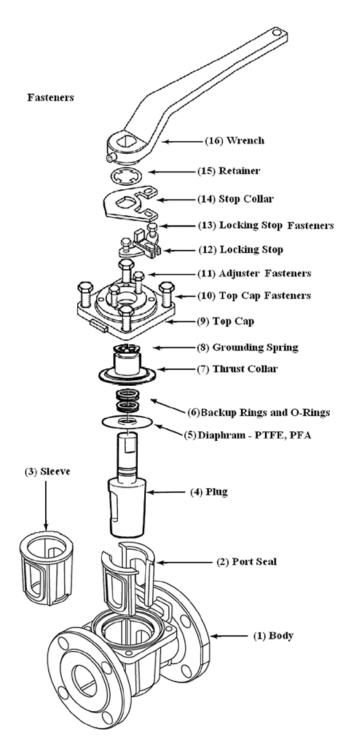
3. Line (through)

Through leakage due to wear of the primary seal can be eliminated by tightening the adjuster fasteners (Part 11) in 1/4 turn increments. The fasteners must be tightened evenly for maximum adjustment. The valve should be operated during adjustments to prevent excessive operating torque. Should leakage persist after repeated adjustments, the port seals or sleeve will require replacement as covered in Section V and Section VI.



To avoid personal injury and prevent damage to equipment, do not operate or repair this valve without observing the following procedures outlined in this manual. FIGURE II-1

Typical Assembly of Marathon-Mach 1 Valve





SECTION III

VALVE DISASSEMBLY - MARATHON-MACH 1

RECOMMENDED PRECAUTIONARY MEASURES

- **1.** Valves must be relieved of process fluid and pressure prior to disassembly.
- 2. Personnel performing disassembly must be suitably protected and alert for emission of hazardous process fluid.

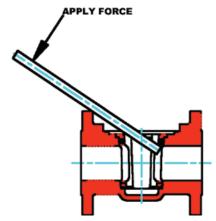
DISASSEMBLY STEPS

NOTE: Refer to Figure II-1 for parts identification. If an actuator or gearbox operates the valve, alignment marks should be noted to assure correct orientation when reassembled. This may best be accomplished by making matching marks on the plug stem and operator housing with no burrs made on the plug stem.

- 1. Remove the wrench (Part 16), if so equipped. Remove the stop collar retainer (Part 15), stop collar (Part 14) and locking stop (Part 12) after marking their orientation.
- Gradually loosen adjuster fasteners (Part 11) DO NOT REMOVE.
- 3. WARNING: Do not loosen or remove top cap fasteners (Part 10) when removing an operator. Remove the operator by unfastening it from the bracket.
- 4. Turn plug (Part 4) in order to raise the plug to vent any material trapped in the valve (see note below). NOTE: If there is no upward movement of the plug, it will be necessary to devise a method of lifting the plug upward. This may require removal of the valve operator (Step 3). This operation should be undertaken noting the above precautionary measures. Methods of plug removal must include protective measures on plug stem and plug end.
- **5.** Once the plug has lifted, the adjuster fasteners (Part 11) can be completely removed.
- 6. Gradually loosen but DO NOT REMOVE all of the top cap fasteners (Part 10). Turn the plug until it is loose from the port seal (Part 2) or sleeve (Part 3) and all pressure has been vented. (Again, it may be necessary to use a mechanical means to move the plug upwards.)
- **7.** Remove the top cap fasteners and top cap (Part 9) from the plug stem. Retain the tags for attachment during re-assembly.
- 8. Remove the plug (Part 4) from the body (Part 1).
- **9.** Remove the grounding spring (Part 8) and thrust gland (Part 7).

- **10.** For Marathon valves, be sure to remove the o-rings and backup rings first and then the PFA diaphram.
- Inspect the valve port seals or sleeve for wear or damage, especially scratches near the top, bottom, and port areas. If wear or damage is excessive, the port seals/sleeve should be replaced.
- Remove port seals or sleeve as follows: NOTE: Care must be taken not to damage the machined internal body bore.
 - a. Lift port seals out of body bowl.
 - b. To remove the sleeve, use a wooden dowel and pry the sleeve upward by engaging the dowel in the sleeve at the top of the port. A sharp blow may be necessary to dislodge the sleeve. Both sides of the sleeve may need to be pried upward for removal. (See Figure III-1)

FIGURE III-1



- **13.** Thoroughly clean all valve parts with an acceptable cleaner.
- **14.** Inspect parts for damage. Look for marred, scratched, or rough sealing surfaces on the valve plug or machined body bore.

NOTE: Reinstallation of damaged or unclean parts will ruin any replacement seals installed into the valve.





SECTION IV PRESSURE CONTAINING FASTENERS

MATERIAL SELECTION

TABLE I

Selecting the proper fastener material is the ultimate responsibility of the customer because the supplier does not typically know in what service the valves will be used or what elements may be present in the environment. Flowserve normally supplies B7 and B7M (carbon steel) for ductile cast iron and carbon steel valves. For stainless steel and high alloy valves, B8, Class 2B (stainless steel, Identified as B9) fasteners are supplied as standard. All fasteners used must have a minimum yield strength of 65,000 PSI, a minimum elongation of 12% and be compatible with the process fluid. Determining compatibility to the process fluid goes beyond a material being resistant to general corrosion because the more important consideration is a material's resistance to stress corrosion cracking. Depending on the service, it may make sense to use B7 fasteners on high allov valves. One such service would be marine environments because of stainless steel's susceptibility to stress corrosion cracking in chloride environments. Another key aspect of fasteners is frequent visual inspection. Because of the common practice of using steel fasteners rather than stainless steel to avoid chloride stress corrosion cracking, visual inspection is recommended to monitor the general corrosion of these fasteners. If jacketing or insulation is used on a valve, it must be periodically removed for visual inspection of the fasteners. If you wish assistance in determining the proper fasteners to use, please refer to the attached chart.

DESIGN & TYPE

Flowserve's valve design standards adopt ASME B18.2.1 (1996, Addenda 1999) as the standard for fastener type and design. This national standards requires that finished hex 'head' cap screws be used when the head of the fastener is turned. A finished hex 'head' cap screw and a heavy hex cap screw have a bearing surface under the head to minimize frictional resistance during tightening. They also comply to qualified body diameters and fully formed head dimensions. Cookeville Valve Operation's policy is to use finished hex 'head' and heavy hex 'head' cap screws for all pressure retaining fasteners. This includes top caps, packing adjusters. plug adjusters, bottom caps, body halves or other pressure retaining components. Compliance is made with ANSI B18.2.2 (1987, reaffirmed 1993), Square and Hex Nuts, when studs and heavy hex nuts are required. Additional information on these items may be obtained from the Flowserve Corporation, Cookeville Valve Operation, Cookeville, Tennessee.

CAP SCRE	WS - STUDS			
HHCS - Finished Heavy Hex Head Cap Screw HCS - Finished Hex Head Cap Screw STUD - Stud Dimensions per ASME B18.2.1		Alloy identification stamp required on each piece. Certification required. Alloy Specification (40 KSI Minimum Yield Strength, 12% Minimum Elongation)		
B9 - B16** - B7** - B7M - B7MT - C20* - HC*- I625* - I825* -	Chromium - Molybdenum Alloy Steel per Type B - Color blue or green Carpenter C20, CB-3 (UNS N08020), AS Hastelloy C276 (UNS N10276), ASTM B5 Inconel 625 (UNS N006625), ASTM B44 Incoloy 825 (UNS N08825), ASTM B425	ardness tested r ASTM A193, Grade B7 r ASTM A193, Grade B7M, 100% hardness tested r ASTM A193, Grade B7M, 100% hardness tested, Teflon® coated, Dupont SP11C, TM B473, 40 KSI Min. Yield Strength, 12% Min. El 574 6 , 40 KSI Min. Yield Strength, 12% Min. El.		
M* - HB - I718** - MKH* - L7** - L7M - L7T** - L7MT - N200* -	 B - Hastelloy B (UNS 10665), ASTM B335 Incoloy 718, AMS 5595B IKH* - Monel K-500, Cold drawn and aged hardened, QQN-286 and ASTM F468 Chromium-Molybdenum Alloy Steel per ASTM A320, Grade L7 Chromium-Molybdenum Alloy Steel per ASTM A320, Grade L7M, 100% hardness tested Chromium-Molybdenum Alloy Steel per ASTM A320, Grade L7, Teflon® coated, Dupont SP11C, Type B - Color blue or gr TMT - Chromium-Molybdenum Alloy Steel per ASTM A320, Grade L7M, 100% hardness tested Chromium-Molybdenum Alloy Steel per ASTM A320, Grade L7M, 100% hardness tested, Teflon® coated, Dupont SP11C 			
B7YC** -		A193, Grade B7, Yellow Zinc Dichromate Plated		

* These options should be limited to the 150# valves only.

** 600# valves are limited to these options only.



SECTION IV

TABLE II NUTS					
HN - Finished Heavy Hex Nut XN - Finished Hex Nut HXN - Regular Heavy Hex Nut					
Dimension per ANSÍ B18.2.2 Alloy identification stamp is required on each piece.					
Certification required.					
 304 Stainless Steel per ASTM A194, Grade 8 316 Stainless Steel per ASTM A194, Grade 8M ASTM A194, Grade 2H ASTM A194, Grade 2HM ASTM A194, Grade 7M, 100% hardness tested 					
 ASTM A194, Grade 7M, 100% hardness tested, Teflon[®] coated, Dupont SP11C, Type B - Color blue or green Monel (UNS N04400), ASTM B164, Class A or B, QQN-281, Class B Hastelloy B (UNS 10665), ASTM B335 					
HC - Hastelloy C276 (UNS N10276), ASTM B574 I625 - Inconel 625 (UNS N06625), ASTM B446 I718 - Incoloy 718, AMS 5596B					
 Incoloy 825 (UNS N08825), ASTM B425 L7 - Chromium-Molybdenum Alloy Steel per ASTM A194, Grade 7 L7M - Chromium-Molybdenum Alloy Steel per ASTM A194, Grade 7M, 235 BHN Max, ASTM A320, Section 9 					
MKH - Monel K-500, Cold drawn and aged hardened, QQN-286 and ASTM F467 8F - 303 Stainless Steel per ASTM A194, Grade 8F 2HYC - ASTM A194, Grade 2H, Yellow Zinc Dichromate Plated					

SECTION V

A. VALVE ASSEMBLY 1"- 6" MARATHON-MACH 1 WITH PORT SEALS

NOTE: Part number reference is shown in Figure II-1.

- 1. Mount body (Part 1) on arbor press or table vise holding one flange.
- 2. Place port seals (Part 2) in position into body. Align port seal ports with body ports. (See Figure V-A-1)

FIGURE V-A-1



- **3.** Place the plug (Part 4) into the port seals in the closed position.
- 4. Push the plug (still in the closed position) downward, using the arbor press, c-clamp or other suitable means, until the top of the plug taper is 1/16" above the top port seal surface. Allow the plug to remain in this position for the time listed in Table V-A-I, Port Seal Sizing Times.

TABLE V-A-I PORT SEAL SIZING TIMES

VALVE SIZES	1" - 3"	4" - 6"
TIME (min)	5	8

- 5. Remove the plug.
- 6. Ensure the plug stem is free of any nicks or gouges. If damaged, the plug taper and 1" of the lower part of the stem must be re-polished to a surface finish of 16.



SECTION V

- **7.** On a flat surface place the top cap over the thrust gland. Thread the adjuster fasteners until snug.
- 8. The plug stem and diaphragm guide should be checked for nicks before installing the diaphragm. Nicks on these surfaces could result in scratches on the lip of the diaphragm. The diaphragm (Part 5) is assembled over the plug stem with the aid of the Mach 1 diaphragm guide, part series #BY86272A (Figure V-A-2).
- 9. Using the diaphragm guide to protect the o-ring from the stem edge, install the first o-ring by "rolling" it with your fingers over the guide and into the lower stem groove (Figure V-A-3). Install Teflon split ring in a similar manner such that it is located above the o-ring inside the lower groove. See Figure V-A-2.
- 10. Install second o-ring and split ring in upper groove in a similar manner, except that the diaphragm guide should be raised by hand so that the lower edge of the guide does not contact the lower o-ring assembly. Remove the guide. See Figure V-A-3. Coat both o-ring assemblies liberally with Krytox[®] grease.
- **11.** Place the thrust gland over the plug stem and gently maneuver it over the o-rings onto the PFA diaphragm. The thrust collar is driven into place through the use of the thrust collar guide, part series #BY90431A, and an arbor press (Figure V-A-4a). Press the guide until the thrust collar bottoms out and then hold for 3 seconds. Remove the guide.
- **12.** Place the grounding spring (Part 17) over the plug stem.
- **13.** Apply a thin, even coat of silicone on the entire surface of the 2° plug taper.
- 14. Place the top cap over the plug stem. Place this subassembly into the valve body. Align top cap antirotation lugs with the stops in the body. Using an arbor press or c-clamp, push down on the top cap evenly until the top cap gasket pad seats firmly against the body counterbore. When pressing make sure the top cap does not bind with the stops. It is also very important not to press with the plug stem. Use part series AY97223A to push the top cap while clearing the plug stem (Figure V-A-4b). Apply thread locking compound to the threads of the top cap fasteners. Tighten the top cap fasteners to the torque values found in Torque Tables V-A-II, V-A-III and V-A-IV.
- **15.** Remove the valve from the arbor press, loosen the adjuster fasteners, and operate the plug several times. It will turn hard at first but will then loosen and turn freely.

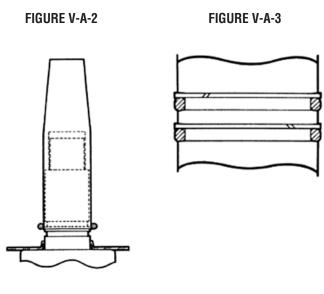


FIGURE V-A-4a

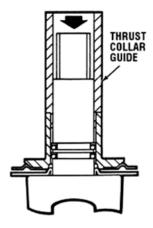
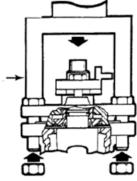


FIGURE V-A-4b

ASSEMBLE TOP CAP ASSEMBLY OVER PLUG AND PUSH INTO BODY. APPLY THREAD LOCKING COMPOUND.

TOP CAP Assembly Push plate

NOTE: All fastening torques are for corrosion free fasteners and nuts. Precautions must be taken not to exceed recommended fastening torques.





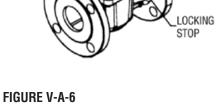


SECTION V

- 16. Tighten the adjuster fasteners (Part 11) until a reasonable plug stem turning torque is obtained (Ref. Table V-A-V). The height of the plug port should be positioned approximately 1/16" above to flush with the body port. Examples: 1" Valve = 8 ft·lb, 3" Valve = 20 ft·lb, 6" Valve = 100 ft·lb.
- 17. Place the locking stop (Part 12) on the top cap as shown in Figure V-A-5 and tighten the locking stop fasteners (Part 13) to a reasonable torque. Check their orientation based on the location marks made during disassembly (Section III, step 1).
- **18.** Place the stop collar (Part 14) and retainer (Part 15) on the plug stem as shown in Figure V-A-6. The stop collar should point in the direction of the flow. Check the orientation based on the location marks made during disassembly (Section III, step 1). Proper rotation is clockwise to close.
- **19.** The valve should turn clockwise to close. The valve is now ready for test and use.
- **20.** LEAK TESTING: Anytime a valve has been modified in any manner, including fastener changes, it must be re-tested. Normal testing, using gas, should be at 80 PSI for Class 150 through Class 600. Refer to API or MSS for test procedures complying with these specifications.

TIGHTEN

FIGURE V-A-5



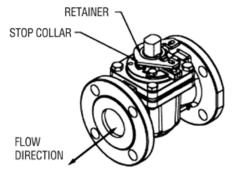


TABLE V-A-II *Apply Loctite[®] 242 to fastener threads, top cap only. TORQUE REQUIRED ON TOP CAP FASTENERS OF <u>CLASS 150 MACH 1 VALVES</u>

VALVE SIZE	1"	1.5"	2"	3"	4"	6"
MAX. TORQUE (ft-lbs)	10	10	15	28	40	80

TABLE V-A-III

*Apply Loctite[®] 242 to fastener threads, top cap only. TORQUE REQUIRED ON TOP CAP FASTENERS OF <u>CLASS 300 MACH 1 VALVES</u>

VALVE SIZE	1"	1.5"	2"	3"	4"	6"
MAX. TORQUE (ft-lbs)	12	12	22	35	62	115

TABLE V-A-IV

*Apply Loctite[®] 242 to fastener threads, top cap only. TORQUE REQUIRED ON TOP CAP FASTENERS OF <u>CLASS 600 MACH 1 VALVES</u>

VALVE SIZE	1"	1.5"	2"	3"	4"	6"
MAX. TORQUE (ft-lbs)	14	20	35	45	42	70

TABLE V-A-V

TORQUE ON PLUG ADJUSTER OF MACH 1 VALVES, 150#, 300# AND 600#

VALVE SIZE	1"	1.5"	2"	3"	4"	6"
MAX. TORQUE (in-lbs)	35	35	35	50	75	150



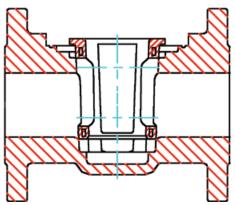
SECTION V

B. VALVE ASSEMBLY 1"- 6" MARATHON-MACH 1 WITH SLEEVE

1. Mount body (Part 1) on arbor press or table vise holding one flange.

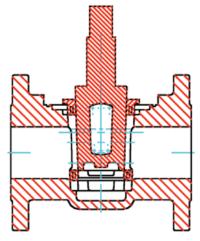
Place the sleeve (Part 3) into the bowl of the body. WARNING: Sleeve port must be aligned with body port. (See Figure V-B-1)

FIGURE V-B-1



- 3. Apply a thin film of lubricant on the plug (Part 4).
- 4. Place the plug in the closed position into the sleeve which is in the body. (See Figure V-B-2)

FIGURE V-B-2



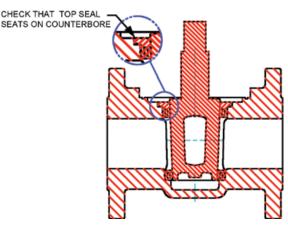
 Position the top cap (Part 9) over the plug with the antirotation lugs aligned with the body lugs, making sure the top cap is free to move downward (Figure V-B-3). Using all top cap fasteners (Part 10), tighten evenly in a crosscross method until the top cap bottoms on the body counterbore.

ALIGN ANTI-ROTATION LUGS ON BODY AND TOP CAP UP TOP CAP BOWL UP TOP CAP UP TOP CAP UP TOP CAP PUSHES SLEEVE INTO BODY BOWL UP TOP CAP UP TO BODY BOWL

6. Check that the top seal of the sleeve is seated into the body counterbore. (See Figure V-B-4) Remove the top cap fasteners and top cap.

FIGURE V-B-4

FIGURE V-B-3



7. Push the plug downward, while still in the closed position, until the top of the plug taper is 1/16" above the top of the sleeve surface. Allow the plug to remain in this position for the time listed in Table V-B-I.

TABLE V-B-I Sleeve Sizing Times

VALVE SIZES	1" - 3"	4" - 6"
TIME (min)	5	8

- 8. Remove the plug.
- Continue with assembly as in V-A, Valve Assembly of 1"-6" Marathon-Mach 1 with port seals, starting at number 6, assembling diaphragms on plug stem.



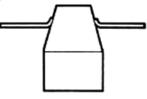
SECTION VI

ASSEMBLY SPECIFICATIONS - FIRESEAL VALVES 1"- 6" MARATHON-MACH 1

- 1. Normal procedures for field replacement of port seals or sleeves are to be followed. Refer to V-A, steps 1-5, and V-B, steps 1-8.
- 2. The fireseal top seal assembly differs from the standard Marathon-Mach 1 top seal and is completed per the following instructions.
- **3.** The plug stem should be checked for nicks before installing the PFA diaphragm. Nicks on this surface could result in scratches on the lip of the diaphragm. The PFA diaphragm is to be flared on the diaphragm guide (Part Series BY86272A) just enough to slip over the plug stem. FIGURE VI-1
- 4. The PFA diaphragm is turned over and placed over the plug stem with the lip down using the diaphragm guide. FIGURE VI-2
- 5. Remove the diaphragm guide. The metal diaphragm is placed over the plug stem just far enough to enlarge the ID to conform to the plug stem and then removed.
- 6. The metal diaphragm is removed from and replaced on the plug stem with the ID lip down.
- 7. The Grafoil packing ring is placed over the stem. FIGURE VI-3

FIGURE VI-1

Flare PFA diaphragm over tapered bar.



Place PFA diaphragm over plug

stem with lip down.

FIGURE VI-2

If damaged, the plug taper and 1" in length of stem must be repolished to a surface finish of 16 on the taper and stem.

FIGURE VI-3

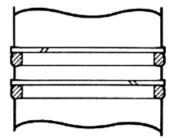
Grafoil packing ring placed over stem.



SECTION VI

- 8. Using the diaphragm guide (Part Series BY86272A) to protect the o-ring from the stem edge, install the first o-ring by "rolling" it with your fingers over the guide and into the lower stem groove (Figure VI-4). Install Teflon split ring in a similar manner such that it is located above the o-ring inside the lower groove.
- 9. Install second o-ring and split ring in upper groove in a similar manner, except that the diaphragm guide should be raised by hand so that the lower edge of the guide does not contact the lower o-ring assembly. Remove the guide. Coat both o-ring assemblies liberally with Krytox[®] grease.
- **10.** The thrust gland is then assembled over the plug and driven into place using the thrust gland guide, part series BY90431 and arbor press.
- **11.** The entire assembly is turned over and the Grafoil gasket placed on the metal diaphragm. A small amount of rubber cement is placed on the Grafoil in several places to cause it to adhere to the metal diaphragm.
- **12.** Continue to assemble the valve per Section V-A, beginning at step 13.

FIGURE VI-4







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