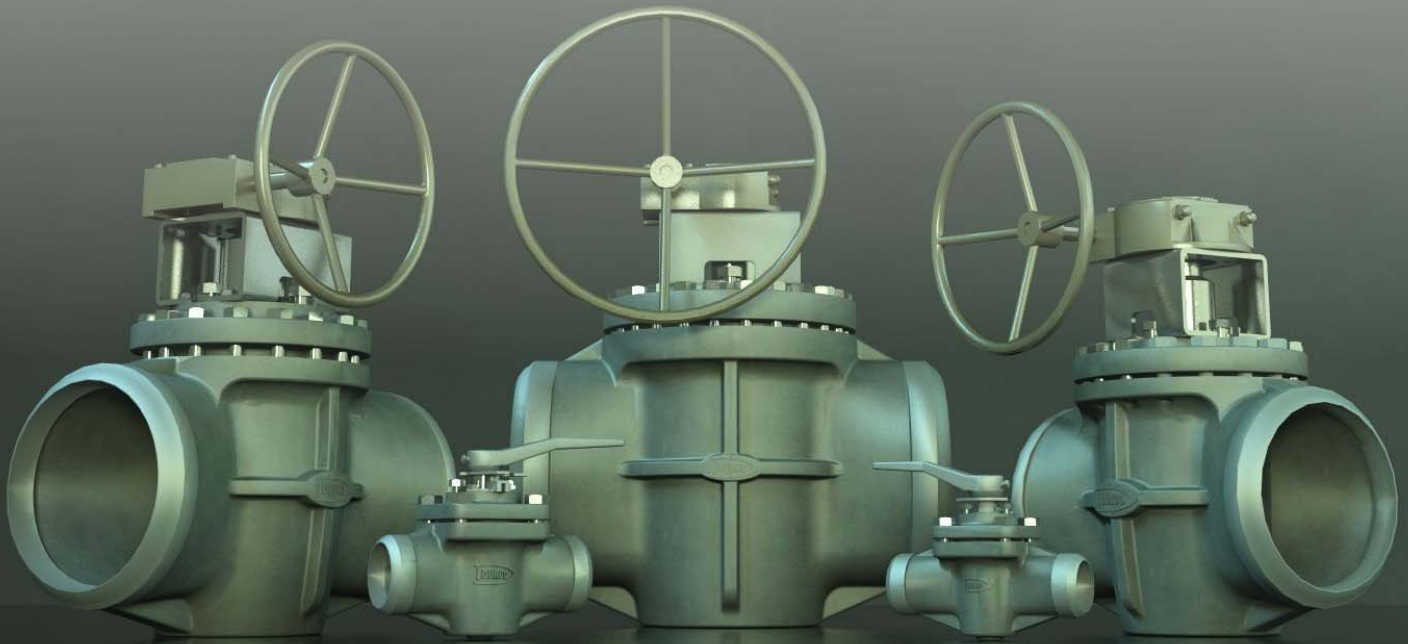




Installation, Operation and Maintenance

*PlugSeal*TM

PLUG VALVE



Breaking The Barriers

DVENIM0200

TABLE OF CONTENTS

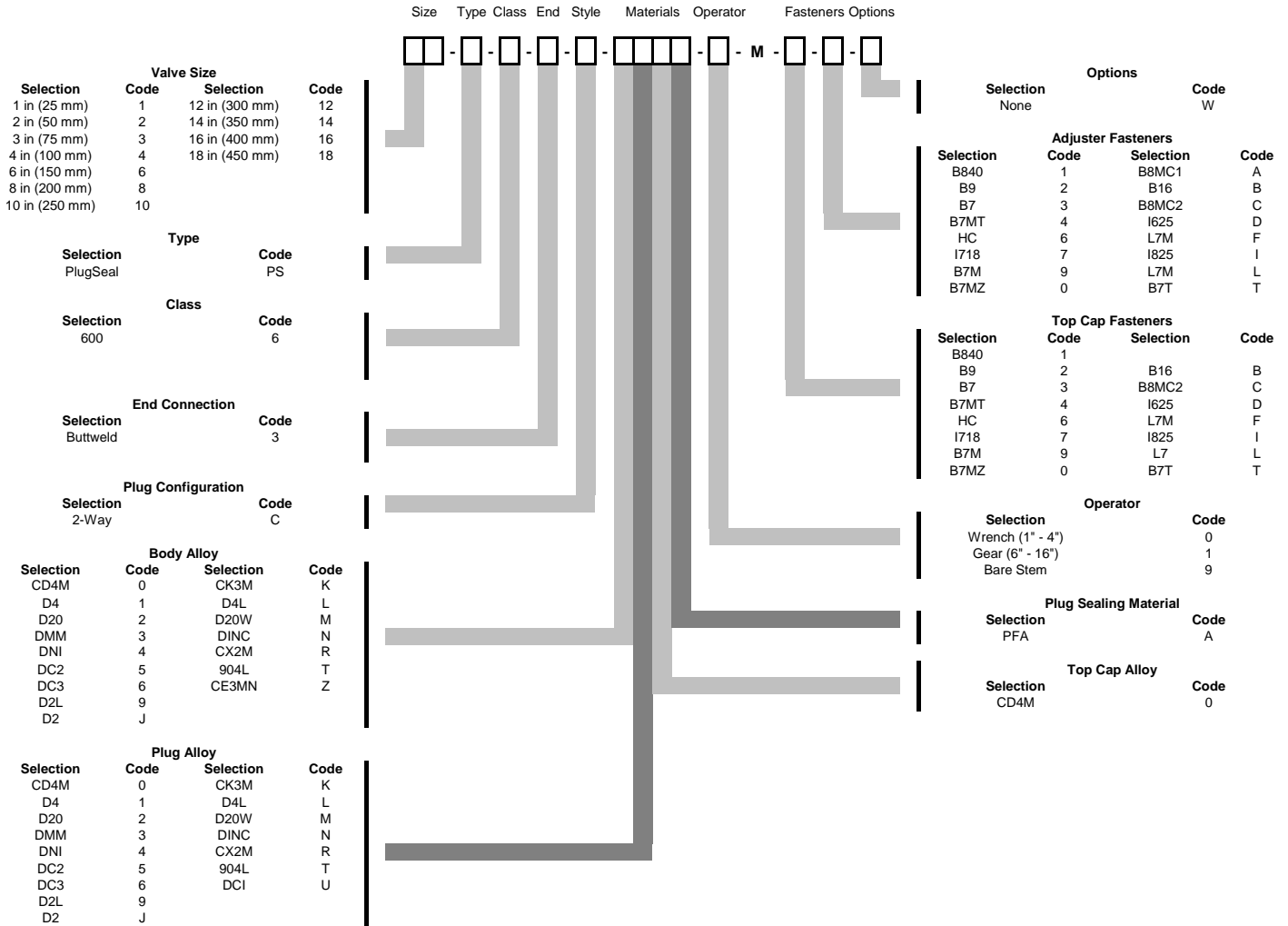
HOW TO SPECIFY PLUGSEAL VALVES	3
INTRODUCTION	4
SECTION I. SAFETY PRECAUTIONS.....	4
SECTION II. PRESSURE CONTAINING FASTENERS	2
SECTION III. INSTALLATION INSTRUCTION – FLANGED AND WELDED PLUGSEAL VALVES ...	2
SECTION IV. OPERATING / MAINTENCE INSTRUCTIONS	7
SECTION V. VALVE DISASSEMBLY AND REPLACEMENT OF PLUG.....	7
SECTION VI. VALVE ASSEMBLY.....	8
SECTION VII. RECOMMENDED SPARE PARTS LIST	9

FOREWORD

Flowserve Corporation, Flow Control Division, has established this Installation, Operating and Maintenance Manual to facilitate field installation, operation and repair of Mach 1 Cartridge Plug Valves.

It is recommended that questions or concerns involving the process described in this manual be directed to the local Sales Representative of Flowserve Corporation. Only Flowserve replacement repair parts and assembly tooling made or designed or approved by Flowserve Corporation should be used. Part numbers referenced in the following sections are available from Flowserve Corporation, Flow Control Division.

HOW TO SPECIFY PLUGSEAL VALVES



INTRODUCTION

The Plugseal valve is a superior plug valve utilizing a PFA coated plug in a machined body bore to provide exemplary sealing capabilities in non abrasive services. Designed for full rated class 600 service conditions with buttweld ends, the Plugseal valve is designed to ASME

B16.34 and pressures up to 1440 psi. Based on simplicity, the design allows easy plug removal and replacement, minimizing the number of spare parts and inventory required.

SECTION I.

SAFETY PRECAUTIONS

To avoid possible injury to personnel or damage to valve parts, WARNING and CAUTION notes must be strictly adhered to. Modifying this product, substituting non-factory parts, or using maintenance procedures other than outlined could drastically affect performance, be hazardous to personnel and equipment, and may void existing warranties.

1. **WARNING:** Standard industry safety practices must be adhered to when working on this, or any other, process control product. Specifically, personal protective and lifting devices must be used as warranted.
2. Depressurize and bleed the line on both sides of the valve before attempting to service the valve.
3. Check nameplate before installation to ensure that the valve is not installed in systems where service conditions exceed those for which the valve was designed.

IMPORTANT NOTES ABOUT YOUR WARRANTY AND SAFETY

Replacement Parts

The use of parts and components other than those supplied by Flowserve Corporation could severely restrict the operation and performance of this valve. Unauthorized modifications or substitution of components can lead to valve failure due to corrosion and/or premature failure of the substituted parts.

Selection, Installation, Operation and Maintenance

Flowserve Corporation has established industry leadership in the design and manufacture of its products. When properly selected, each product is designed to perform its intended function safely during its useful service life. However, it is necessary that Flowserve's customers be fully aware of their responsibilities when using these products.

Each Flowserve product may be used in numerous applications under a wide variety of industrial service conditions. 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 before installing, operating or repairing any valve. The purchaser/end user should train its employees and/or contractors in the safe use of the Flowserve products in connection with the purchaser's manufacturing processes.

Flowserve will continue to provide its customers with the best possible products and service available. We do not recommend substituting surplus or remanufactured valves over new Flowserve valves or those repaired in an authorized service center. Should you have any questions about these provisions or about Flowserve's products in general, please contact your local Flowserve representative, who will be happy to help.

Paying close attention to safety is always extremely important. However, there are often situations that require special attention. These situations are indicated throughout this book by the following symbols:

 **DANGER**

DANGER – Immediate hazards which WILL result in severe personal injury or death.

 **WARNING**

WARNING – Hazards or unsafe practices which COULD result in severe personal injury or death.

 **CAUTION**

CAUTION – Hazards or unsafe practices which COULD result in minor personal injury or product or property damage.

NOTE: ALWAYS COORDINATE REPAIR ACTIVITY WITH OPERATIONS PERSONNEL, AND FOLLOW ALL PLANT SAFETY REQUIREMENTS AND OSHA REGULATIONS.

SECTION II.

PRESSURE CONTAINING FASTENERS

MATERIAL SELECTION

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 (carbon steel) for ductile cast iron and carbon steel valves. For stainless steel and high alloy valves, B8, Class 2B (stainless steel) fasteners are supplied as standard. All fasteners used must have minimum yield strength of 40,000 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 alloy 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 (latest revision) as the standard for fastener type and design. This national standard 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 (latest revision), 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.

Table 1

CAP SCREWS – STUDS
<p>HHCS - Finished Heavy Hex Head Cap Screw HCS - Finished Hex Head Cap Screw STUD - Stud</p> <p>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)</p>
ASTM Material Specifications
<p>B9 - Stainless Steel per ASTM A193, Class 2B, Grade B8 (AISI type 304) B16 - Stainless Steel per ASTM A193, 100% hardness tested B7 - Chromium - Molybdenum Alloy Steel per ASTM A193, Grade B7 B7M - Chromium - Molybdenum Alloy Steel per ASTM A193, Grade B7M, 100% hardness tested B7MT - Chromium - Molybdenum Alloy Steel per ASTM A193, Grade B7M, 100% hardness tested, Teflon coated, Dupont SP11C, Type B - Color blue or green B8M - 316 Stainless Steel per ASTM A193, Grade B8M, Class 1, 40 KSI Min. Yield Strength, 12% Min. El. B8C2 - 304 Stainless Steel per ASTM A193, Grade B8, Class 2 C20 - Carpenter C20, CB-3 (UNS NO8020), ASTM B473, 40 KSI Min. Yield Strength, 12% Min. El. HC - Hastelloy C276 (UNS N10276), ASTM B574 I625 - Inconel 625 (UNS N006625), ASTM B446 I825 - Incoloy 825 (UNS N08825), ASTM B425, 40 KSI Min. Yield Strength, 12% Min. El. IN - Inconel 600 (UNS N0660), ASTM B166, 40 KSI Min. Yield Strength, 12% Min. El. M - Monel (UNS N04400), ASTM B164, Class A or B, 40 KSI Min. Yield Strength, 12% Min. El. HB - Hastelloy B (UNS 10665), ASTM B335 I718 - Incoloy 718, AMS 5595B MKH - Monel K-500, Cold drawn and aged hardened, QQN-286 and ASTM F468 L7 - Chromium-Molybdenum Alloy Steel per ASTM A320, Grade L7 L7M - Chromium-Molybdenum Alloy Steel per ASTM A320, Grade L7M, 100% hardness tested L7T - Chromium-Molybdenum Alloy Steel per ASTM A320, Grade L7, Teflon[™] coated, Dupont SP11C, Type B - Color blue or green L7MT - Chromium-Molybdenum Alloy Steel per ASTM A320, Grade L7M, 100% hardness tested, Teflon[™] coated, Dupont SP11C, Type B - Color blue or green N - Nickel per ASTM B160 (UNS N0220), 40 KSI Min. Yield Strength, 12% Min. El. N7YC - Chromium-Molybdenum Alloy Steel per A193, Grade B7, Yellow Zinc Dichromate Plated</p>

Table 2

NUTS
<p>HN - Finished Heavy Hex Nut XN - Finished Hex Nut HXN - Regular Heavy Hex Nut</p> <p>Dimension per ANSI B18.2.2 Alloy identification stamp is required on each piece Certification required.</p>
ASTM Material Specifications
<p>8 - 304 Stainless Steel per ASTM A194, Grade 8 8M - 316 Stainless Steel per ASTM A194, Grade 8M 2H - ASTM A194, Grade 2H 2HM - ASTM A194, Grade 2HM 7M - ASTM A194, Grade 7M, 100% hardness tested 7MT - ASTM A194, Grade 7M, 100% hardness tested, Teflon[™] coated, Dupont SP11C, Type B - Color blue or green M - Monel (UNS N04400), ASTM B164, Class A or B, QQN-281, Class B HB - 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 I825 - 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</p>

SECTION III.

INSTALLATION INSTRUCTION – FLANGED AND WELDED PLUGSEAL VALVES

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 flange and then center gaskets with the valve flanges. Fasteners or taper pins should be use to align holes and locate gaskets. Fasteners should be tightened to the corresponding valve and fastener size.

WELDED:

Flowserve Corporation, Flow Control Division recommends using only qualified welding procedures and personnel for weld installation of Plugseal valves.

The following precautions should be observed:

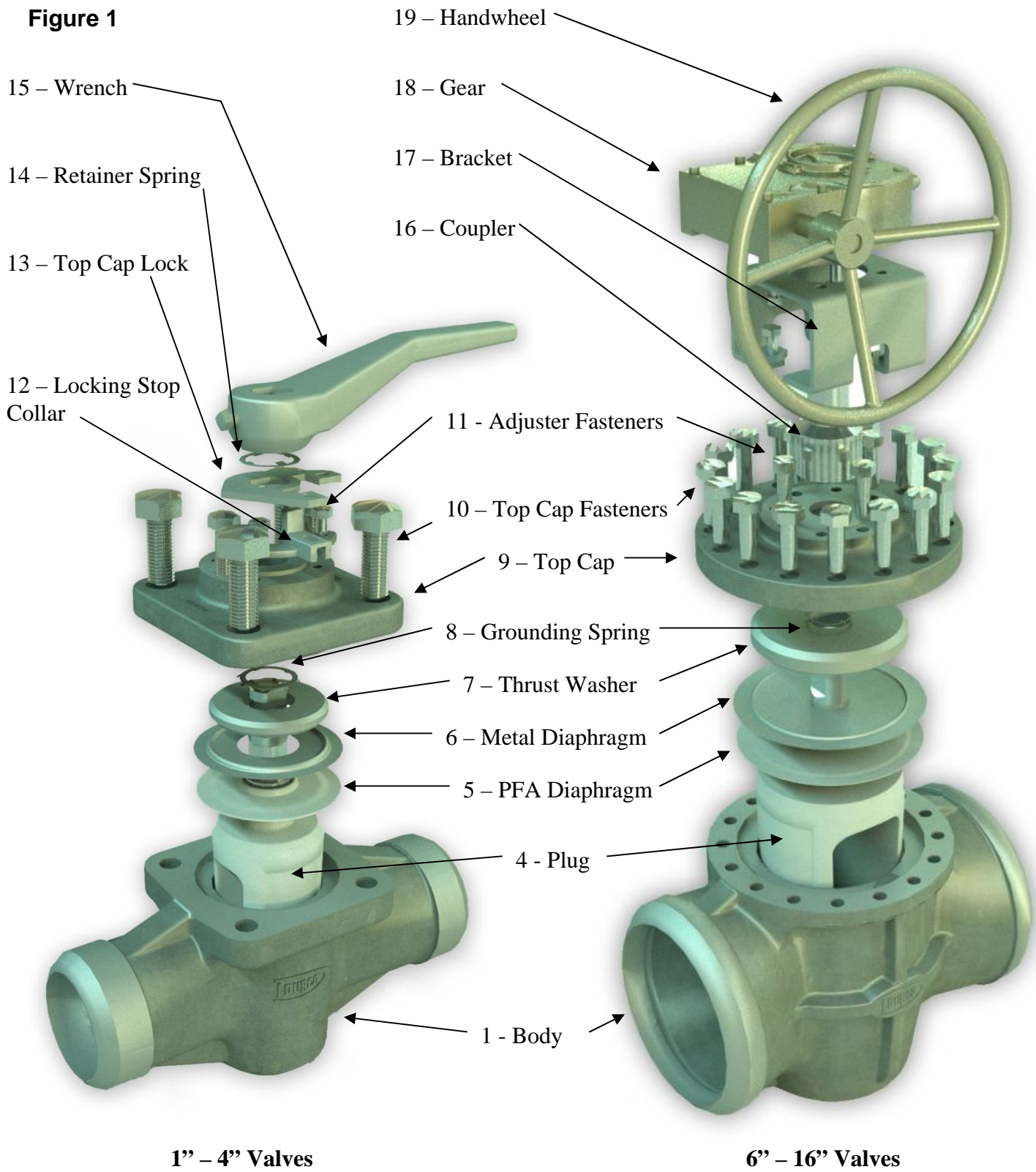
1. The valve should be inspected prior to welding to assure that no foreign materials obstruct the flow passageway and that the weld preparation area is free of corrosion and physical damage.
2. The valve plug can be removed during welding procedure to ensure the plug and diaphragm do not permanently deform at elevated temperature.

**Table 3
TEMPERATURE LIMITATIONS**

Material Description	Maximum Service Temperature
PFA	500°F (260°C)

3. The valve plug and diaphragm must not exceed these temperatures during welding. This includes preheats, interpasses or post weld heat treatments, as applicable. Refer to Figure 1 for locations of the plug and diaphragm in the center valve section.
4. The temperature of the center or bowl area of the valve must not exceed the listed temperature of the material. Valves, two inch and smaller, must be wrapped with water soaked fire-resistant material to cool the valve bowl inlet where the weld is to be made. Use temperature melt crayons equal to the plug and diaphragm rating to mark the body welding end and monitor the temperature. Thermocouples may be attached to the welding end or the body surface. Pyrometers may be used to monitor the body bowl temperature.
5. Welding of the PlugSeal Valve without disassembly may be accomplished with no damage to the plug or diaphragms. Precautions must be taken to cool the valve bowl and monitor temperatures. **CAUTION: DO NOT ALLOW WATER FROM THE SOAKED WRAPPING MATERIAL TO ENTER THE WELDMENT.**

Figure 1



SECTION IV.

OPERATING / MAINTENANCE INSTRUCTIONS

Maintenance requirements for Plugseal 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 Plugseal 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 1 for parts identification.

1. **Top Cap (bonnet)**

Leakage due to thermal or pressure cycling is eliminated by snugging the top cap fasteners (Part 10) in a criss-cross pattern. 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 remain 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. It is recommended that the adjuster fasteners be tightened evenly. The valve should be operated between adjustments to assure that the plug properly seats itself into the body. If leakage persists after repeated adjustments, the plug and diaphragm will require replacement as covered in SECTION V.

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. It is recommended that the fasteners be tightened evenly. The valve should be operated during adjustments to prevent excessive operating torque. Should leakage persist after repeated adjustments, the plug will require replacement as covered in SECTION V.

SECTION V.

VALVE DISASSEMBLY AND REPLACEMENT OF PLUG

RECOMMENDED PRECAUTIONARY MEASURES:

1. Valves must be relieved of process product and pressure prior to disassembly.
2. Personnel performing disassembly must be suitably trained, protected and alert for emission of hazardous process product.

DISASSEMBLY STEPS

NOTE: Refer to Figure 1 for parts identification.

REMOVAL OF TOPWORKS SIZES 1" – 4"

1. Note the orientation of the wrench relative to the body for proper reassembly.
2. Loosen the set screw securing the wrench and remove the wrench (Part 15) from the stem.
3. Lift retainer spring (Part 17) and top cap lock (Part 16) off of the stem.

REMOVAL OF TOPWORKS SIZES 6" – 16"

1. 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.
2. Remove handwheel and gear by removing fasteners between gear and bracket.
3. Lift coupler off stem and remove bracket by removing fasteners between bracket and valve.

VALVE DISASSEMBLY

4. Gradually loosen adjuster fasteners (Part 11) - DO NOT REMOVE.
5. **WARNING:** Do not loosen or remove top cap fasteners (Part 10) when removing an operator. Remove the operator by unfastening it from the bracket and removing the bracket from the valve.

6. Turn plug (Part 4) in order to raise the plug to vent any material trapped in the valve.
7. Once the plug has been turned, the adjuster fasteners (Part 11) can be completely removed.
8. Gradually loosen but DO NOT REMOVE all of the top cap fasteners (Part 10). Turn the plug until it is loose from the body bore and all pressure has been vented. (It may be necessary to use a mechanical means to move the plug upwards.)
9. Remove the top cap fasteners and top cap (Part 9) from the plug stem. Retain any identification tags for attachment during re-assembly.
10. Remove the plug (Part 4) from the body (Part 1).
11. Remove the grounding spring (Part 8) and thrust washer (Part 7) from the plug.
12. Remove the metal diaphragm (Part 6) and the PFA diaphragm (Part 5) from the plug stem.
13. Inspect the plug for wear or damage, especially scratches near the waterway on the sealing bands. If wear or damage is excessive, the plug may require replacement. Similarly, inspect the body bore for wear or damage incurred by the process fluid. Excessive scoring or erosion will reduce the valves ability to seal.
14. Thoroughly clean all valve parts with an acceptable cleaner.
15. 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. Plugs will need to be replaced when leakage rates exceed tolerable levels due to PFA erosion or wear. Bodies must maintain an RMS 16 surface finish for proper operation.

SECTION VI.

VALVE ASSEMBLY

NOTE: Part number reference is shown in Figure 1.

1. Mount body (Part 1) in arbor press or table vise holding one flange or supported in v-blocks near the butt weld face. Ensure the body is supported adequately to avoid movement while assembling.
2. Assemble the PFA diaphragm (Part 5) over the plug stem (Part 4) with the aid of a diaphragm guide, Part series BY77543A (Figure V-A2). 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 and must be removed by polishing or replacement.
3. Place the metal diaphragm (Part 6) over the plug stem with the raised center section up.
4. Place the thrust washer (Part 7) over the plug stem.
5. Apply a thin film of lubricant to the plug and place the assembled plug (complete with PFA diaphragm, metal diaphragm and thrust washer), in the open position into the body.
7. With the top cap on a table, thread the adjuster fasteners into the top cap until the bottoms of the fasteners are flush with the recessed underside of the top cap.
8. Position the top cap (Part 9) over the plug making sure the top cap is free to move downward (Figure V-B3).
9. Place an H shaped support over the top of the valve, resting on the top cap. Press the top cap downward until the top cap is firmly seated in the counterbore of the body.
10. Using all top cap fasteners (Part 10), tighten evenly in a criss-cross method until the top cap bottoms on the body counter bore. Recommended top cap fastener torques are shown in Table 4.
11. Tighten all adjuster fasteners in a criss-cross pattern to the recommended torque in Table 5.

Table 4: Top Cap Fastener Torque

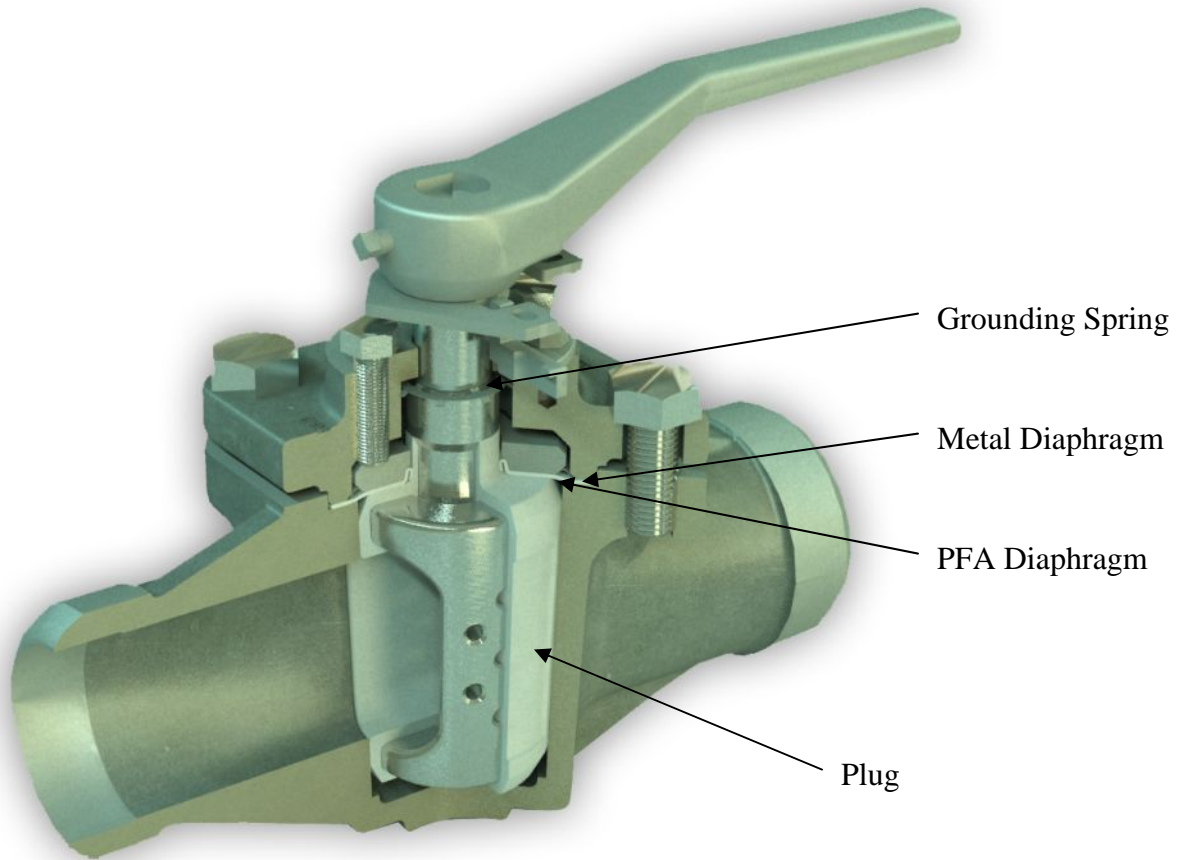
	1	2	3	4	6	8	10	12	14	16
Ft-lbs	40	70	120	250	325	425	450	500	700	

Table 5: Adjuster Fastener Torque

	1	2	3	4	6	8	10	12	14	16
In-lbs	80	100	120							
ft-lbs				20	40	50				

* Torques are preproduction estimates and subject to change. Contact Factory for updated torques

SECTION VII.
RECOMMENDED SPARE PARTS LIST



-- THIS PAGE INTENTIONALLY LEFT BLANK --



Flowserve has the answer to your corrosion resistant, quarter-turn valving needs.

Clockwise from top right.

Durco® BTV-2000
PTFE or UHMWPE lined
chemical service valve

Atomac®
Lined ball valves
• ANSI/ISO, standard and full port
• Specialty valves
• Valve products and accessories

Durco® SleeveLine®
Non-lubricated, PTFE-sleeved
plug valves
• G4 Isolation
• G4E – DIN Mounting Pad
• G4 Marathon™
• TSG4 Severe Service

Durco® T-Line®
Non-lubricated, PTFE-lined
plug valves

Big Max® Butterfly
High performance valves

Durco® Microfinish™
Alloy ball valves

Automax®
Valve automation
systems
• Actuators
• Controls with
smart technology
• Accessories

For more information, contact:



Flowserve Corporation
Flow Control Division
1978 Foreman Drive
Cookeville, Tennessee 38501
Phone: 931 432 4021
Fax: 931 432 3105
www.flowserve.com



Or Consult Your Local Stocking Distributor

Flowserve Ahaus GmbH
Von Braun Straße 19a
D-48683 Ahaus
Germany
Phone: +49 2561 686-0
Fax: +49 2561 686-39

Flowserve Pte. Ltd.
12 Tuas Avenue 20
Republic of Singapore 638824
Phone: 65 862 3332
Fax: 65 862 2800

Printed in U.S.A.
December 2002
© Flowserve Corporation