

M&H VALVE COMPANY
AWWA C504-00
BUTTERFLY VALVES
CLASS 150 & 250
SIZES 3" THRU 72"

TABLE OF CONTENTS

Section	Title	Page
1	Butterfly Valves for Water Works Applications	4
1.1	Introduction	4
1.2	AWWA Specification	4
1.3	Applications	4
1.4	Seat Design	5
1.5	Shaft & Vane Design	5
1.6	Actuation	5
1.7	Automation	6
1.8	Coating	6
1.7F	Automated Valve Information Form	7
2	Installation & Testing	8
2.1	General	8
2.2	Unloading & Storage	8
2.3	Installation Safety	9
2.4	Inside Diameter of Mating Pipe	9
2.4D	Mating Pipe Inside Diameter Drawing	10
2.5	Pipe Connection	11
2.5.1	Mechanical Joint Follower Glands	11
2.5.2	Flanged End Connections	11
2.5D	Valve Body Lay Length Dimensions	12
2.6	Assembly	13
3	Pressure Testing of M&H BFVs	15
3.1	General	15
3.2	Mechanical Issues	15
3.3	Compressed Air	15
3.4	Hydrostatic Test	16
3.5	Service Support	16
4	Operation of M&H BFVs with Traveling Nut Operators	17
4.1	General	17
4.2	Input Torque	17
4.3	Throttling	17
4.4	Water Hammer	17
4.5	Turns to Open	18

5	Maintenance	19
5.1	Safety	19
5.2	Vane Seat Ring Adjustment – Sizes 3” thru 72”	19
5.3	Vane Seat Ring Replacement	20
5.3.1.1	3” thru 24” Removal of Existing Vane Seat Ring	20
5.3.1.2	3” thru 24” Installation of New Vane Seat Ring	20
5.3.1.3	Service Details	20
5.3.2.1	30” thru 72” Removal of Existing Vane Seat Ring	21
5.3.2.2	30” thru 72” Installation of New Vane Seat Ring	22
5.3.2.3	Service Details	22
5.4	M&H BFV Traveling Nut Operator	23
5.4.1	General	23
5.4.2	External Obstruction	23
5.4.3	Internal to the Operator Obstruction	24
5.4.4	Internal to the Valve Obstruction	24
5.5	Vane Level Adjustment	25
5.5.1	Vane Level Adjustment Procedure for 3” thru 12” BFVs	25
5.5.2	Vane Level Adjustment Procedure for 14” thru 42” BFVs	25
5.5.3	Vane Level Adjustment Procedure for 48” thru 72” BFVs	26
5.6	Protective Coatings	27

SECTION 1

BUTTERFLY VALVES FOR WATER WORKS APPLICATIONS

SECTION 1.1 – INTRODUCTION

The M&H butterfly valve (BFV) was introduced in 1965 for clean water applications. The rubber seat provides a ‘zero leakage’ alternative to the metal-seated valves used at that time. BFVs offer flow control advantages and economy vs. gate valves, which become increasingly more significant with larger sizes. BFVs are commonly used in water transmission and distribution for sizes 12” and larger. For pump station and treatment plant applications, BFVs offer flow control advantages (such as throttling) over gate valves.

M&H butterfly valves are manufactured in accordance with the current version of the American Water Works Association (AWWA) C504 standard. They are constructed of ductile iron, stainless steel, rubber seats & seals, and Teflon trim. Corrosion resistance and strength of ductile iron makes this a very suitable material for buried service. Stainless steel components provide corrosion resistance as required for water service applications.

SECTION 1.2 – AWWA SPECIFICATION

Butterfly valves are addressed in the American Water Works Association (AWWA) standard C504(current edition). Sizes covered are 3” thru 72” with end configurations being mechanical joint (MJ) or 125# ANSI flanged (FLG) for all sizes and wafer style valves in 3” thru 20”. Mechanical joint x flanged ends are generally produced up to the 16” size.

Rubber seated butterfly valves are designed to provide a 100% shut off at operating pressures in accordance with AWWA C504. The current C504 standard covers pressure ratings from 25 to 250 psi with velocities from 8 to 16 fps. The most used rating is Class 150B which is a 150psi pressure rating at 16fps flow rate.

C504 also allows for Class 250B BFVs which have a pressure rating of 250psi at 16fps flow rate. Due to the increased pressure rating, CL250B BFVs require more torque to open and close the valve. The increased torque requirement may require larger operators for the operating conditions. CL250 BFVs can have ANSI Class 125 flanges to accommodate most water systems but can also have ANSI Class 250 flanges with either a CL125 hole pattern or a CL250 hole pattern. These options must be specified at the time of order.

Valve body material and related wall thickness are specified in AWWA C504, Table 1. The wall thickness required for CL250B and CL150B valves is the same, when the CL250B body material is ductile iron.

SECTION 1.3 – APPLICATIONS

M&H BFVs are designed primarily for potable water service and clean water applications. Because a BFV is a quarter-turn valve with the vane always in the waterway, BFVs are not recommended for wastewater or applications where debris or sediment may collect around the vane. Air service is acceptable for BFVs up to 25 psi assuming that the air does not contain abrasive ash or other corrosive

elements. EPDM rubber is used for the main seals of the BFV and has nominal temperature rating of 225 degrees F. The EPDM seals should not be used in any situation where contact with even trace amounts of petroleum-based products may occur. Throttling operations that generate velocities up to 16 feet per second (fps) are acceptable as covered in the C504 standard for class B. However, a BFV is not considered a pressure-regulating valve and is not designed for prolonged operation at less than 20 degrees open.

SECTION 1.4 – SEAT DESIGN

When selecting Butterfly Valves, the potential service life of the rubber seat and its serviceability should be considered. To provide for in line seat maintenance, provisions for safe access can be incorporated into the design of larger piping systems.

AWWA C504 states "Rubber seats shall be applied to the body or the vane". For valves 30" and larger, C504 requires the design "to permit removal and replacement without the removal of the valve from the installation site". A mechanically retained rubber seat, which is offset from the shaft, is commonly used due to its reliability and field serviceability.

The Valve Seat servicing is further referenced in the Appendix of C504 noting, "in some instances, valve design permits field adjustment or replacement of rubber seats". Configurations like this have mechanically retained seats and seat accessibility without disassembly of the shaft/vane assembly.

SECTION 1.5 – SHAFT & VANE DESIGN

AWWA C504 covers the use of either a single piece shaft or a two-piece "stub" shaft. A single piece shaft is common for the 3" thru 12" sizes. For 14" & larger sizes, a stub shaft is common. Stub shafts allow enhanced flow characteristics by use of a recessed vane back design and/or open vane structure. For corrosion resistance in potable water applications, valve shafts are generally type 304 stainless steel for CL150B valve or high strength 630 stainless steel for CL250B valves.

An offset shaft design can reduce seat wear since the vane does not make full contact with the seating surface in the body until closing. This is of greatest concern with the continual positioning associated with automated operation.

SECTION 1.6 – ACTUATION

An operator is used to open and close the BFV. Operators can be mechanical gear operators, pneumatic/hydraulic cylinder operators or electric motors. The most common mechanical operator is a traveling nut operator. One of the main advantages of the traveling nut operator is that assuming the operator input shaft is turned at a constant speed, the vane will slow as it reaches the closed position thus minimizing any water hammer effects. This operator will hold its place in any intermediate position and prohibit flow from moving the vane.

BFVs can be supplied with third-party manufactured worm gear operators as required by the purchaser or contract. Worm gear operators designed to the AWWA C504 standard must be capable of accepting 300 ft-lb of input torque on wrench nuts.

IMPORTANT – Do not remove a BFV operator while under flow and pressure. Without an operator in place holding the vane, a BFV will try to close in the presence of flow and can create a hazardous water hammer situation. Also, the operator may serve to retain shaft seals, which could be ejected without the operator mounted on the valve.

Valves equipped with manual operators for open, close, or throttling service generally do not require preventative maintenance. Operator settings are adjusted during the assembly process and tested at full closure; thus an operator adjustment is rarely required. Consult the specific manufacturer to obtain detailed information regarding the maintenance of each type of operator provided.

SECTION 1.7 – AUTOMATION

Selection of a valve type for automation includes numerous application specific considerations. From a cost standpoint, a quarter turn BFV is generally more economical to automate than a multi turn gate valve.

Manufacturers can provide automation to suit virtually all control even those with very specific design criteria. When specifying, pricing, or ordering automated valves, the information required includes pressure & velocity, open/close or modulating service, available power supply, control requirements, and type of protective enclosure. A data sheet that more fully covers application conditions is available on the following page.

For automation of existing manual operator installations, it is suggested to contact an area operator representative to determine and provide for those specific needs.

Variable degrees of preventative maintenance will be required based on the type of equipment and its application. Consult the manufacturer of the operator for service information including required preventative maintenance and detailed service procedures.

SECTION 1.8 – COATINGS

M&H standard coating for BFVs is fusion bonded epoxy meeting the requirements of AWWA C550, Protective Epoxy Interior Coatings for Valves and Hydrants and NSF61, Drinking Water System Components. In certain cases, two-part sprayed-on epoxy may be used meeting the same requirements.

OPEN LEFT Operating Nuts and Handwheels are coated with black fusion bonded epoxy.

OPEN RIGHT Operating Nuts and Handwheels are coated with red fusion bonded epoxy.

AUTOMATED VALVE INFORMATION FORM

Date:

To:

Project:

Engineer:

Bid Date:

Quantity

Size

Valve type

Pressure Class

Max Operating PSI

Service

Current (Voltage/Phase)

Open / Close Time

Open Close Service

Throttling

Modulating

Maximum Temp

Type Motor, Weather/explosion proof. Etc

Type of Reversing Controller, Nema Class

Type of Pushbutton Station, Nema Class

Pushbutton Station

Control Voltage

Special Requirements

Suggested Operator

Estimating Cost

Price Quote

Delivery

Prior to order, complete specifications and operating conditions will be required. M&H will warranty valves with automation installed as per AWWA C504, Section 5.21 and 5.22.

SECTION 2

INSTALLATION OF M&H MODEL 4500 & 1450 BFVS

SECTION 2.1 – GENERAL

Butterfly valves are an important part of any water distribution system or treatment plant operation. Valve failure due to faulty installation, improper operation, or maintenance in such systems could result in damage, down time, and costly repairs. In buried or underground installations, problems or malfunctions can result in extensive and costly unearthing operations to correct or eliminate the problem. Many problems with butterfly valves can be traced to improper installation, operation, or maintenance procedures.

Make sure flange faces, joint sealing surfaces, body seats, and vane are clean. Check bolting attaching operator for loosening in transit and handling. If loose, tighten firmly. Open and close valve to make sure it operates properly and that the stops or limit switches are set correctly so the valve fully closes and seats. Close the valve before installing. For dry operation prior to installation, it is suggested that an NSF61 approved lubricant be applied to the rubber seat before moving the vane.

Handle valves carefully when positioning, avoiding contact or impact with other equipment, vault walls, or trench walls.

M&H BFVs are rated for the designated operating pressure with flow in either direction. The mechanically retained seat on the vane provides for adjustment or replacement with relative ease. It is recommended that BFVs be installed with the seat side positioned for best access to the seat for future maintenance.

Foreign material in a butterfly valve can damage the rubber seat when valves are operated. Be sure interiors and adjacent piping is cleaned of foreign material prior to assembling the pipe joint connection.

SECTION 2.2 – UNLOADING & STORAGE

Inspect valves on receipt for damage in shipment and conformance with quantity and description of the shipping notice and order. Unload all valves carefully to the ground without dropping. For valves 36 inches and larger, use forklifts or slings under skids. For smaller valves, do not lift valves with slings or chains around the operating shaft, operator, or through waterway. Lift these valves with eyebolts or rods through the flange holes.

After securing the valve with the chosen lifting method, always assume the valve can fall despite your best effort to secure the valve. It is critically important to never be too close to, or under, the valve being lifted due to the potential for failure of the lifting mechanism being used.

Protect the valve and operators from weather and the accumulation of dirt, rocks, and debris. When valves fitted with power operators and controls are stored, energize electric operators or otherwise protect electrical control equipment to prevent corrosion of electrical contacts due to condensation resulting from temperature variation.

SECTION 2.3 – INSTALLATION SAFETY

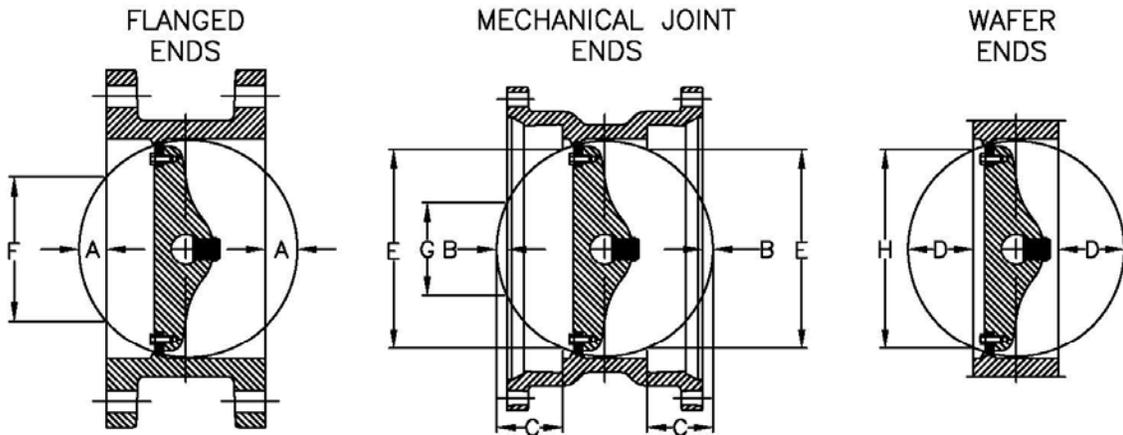
Before any installation of BFVs begins, make sure that all related safety procedures and protocols are followed.

- For Buried Service BFVs, any work to be done in an open trench should be in accordance with OSHA regulation CFR 1926, Subpart P “Excavations”.
- For Vault Service BFVs, all entry should be in accordance with OSHA regulation CFR 1910.146 “Confined Spaces”.
- For In-Plant BFVs, installation and design should be in accordance with ASME Pressure Vessel Code and other applicable standards.

Individual states may have more stringent regulations. Contact the appropriate state agency before any work is begun for additional information and any potential permitting requirements.

SECTION 2.4 – INSIDE DIAMETER OF MATING PIPE

The Inside Diameter (ID) of the mating of the piping system should be considered BEFORE installing the valve. When BFVs open, the vane will extend into the mating piping system. With many thick wall plastic piping systems, there is the potential for the BFV vane to interfere with the pipe wall during opening. This situation applies to all AWWA BFVs, barring a substantially undersized vane. For the Mating Pipe wall clearance for M&H BFVs, see Drawing BFV-VANE:



SIZE	A	B	C	D	E	F	G	H
3"	0	0	0	0	NA	NA	NA	NA
4"	0	0	.88	.88	3 3/8"	NA	NA	3.35
6"	.62	0	1.69	1.88	5 11/16"	3.68	NA	5.63
8"	1.06	.25	2.75	2.73	7 3/4"	5.63	1.75	7.7
10"	1.12	.50	3.00	3.50	9 7/16"	6.5	4.38	9.75
12"	2.12	1.50	4.00	2.00	11 9/16"	9.2	7.88	11.8
14"	2.75	1.56	4.06	4.50	12 7/8"	11.25	6.13	12.95
16"	3.75	1.62	5.12	5.50	14 15/16"	13.5	9.75	14.5
18"	4.75	2.19	5.69	5.88	16 15/16"	15.9	12	16.9
20"	5.75	3.19	6.69	6.88	18 15/16"	18.13	14.75	18.9
24"	7.75	4.50	8.00	NA	22 7/8"	22.5	19	NA
30"	8.78	4.78	9.16	NA	26 1/2"	27.7	22.63	NA
36"	11.78	7.78	12.16	NA	33 1/8"	34.2	30.15	NA
42"	14.78	10.78	15.16	NA	39 1/8"	40.25	37.25	NA
48"	16.28	12.28	16.66	NA	44 1/8"	45.7	42.3	NA
54"	19.75	NA	NA	NA	NA	52.38	NA	NA
60"	22.75	NA	NA	NA	NA	58.6	NA	NA
66"	24.25	NA	NA	NA	NA	63.9	NA	NA
72"	27.15	NA	NA	NA	NA	70.1	NA	NA

- A,B,D=DISTANCE VANE EXTENDS PAST BFV BODY. THIS MEASUREMENT CAN BE CRITICAL WHEN INSTALLING VALVES CLOSE TOGETHER ON CAST OR FABRICATED FITTINGS.
- C=DISTANCE VANE EXTENDS FROM MJ BELL PIPE STOP.
- E=MINIMUM REQUIRED INSIDE DIAMETER OF MATING PIPE OR ADAPTER AT MJ BELL PIPE STOP
- TO ASSURE COMPLETE VANE/DISC OPENING, PLASTIC PIPE CAN BE BEVELED USING A ROUTER FOR ADDITIONAL CLEARANCE.
- A SPOOL PIECE OR FLANGE CAN ALSO BE ADDED TO GIVE ADDITIONAL CLEARANCE
- CARE SHOULD BE TAKEN ON CHECKING MINIMUM ID ON ALL C900 / C905 PVC PIPE. DR18 PLASTIC PIPE IS MOST CRITICAL. HISTORICALLY, HDPE PIPE IS ONLY INSTALLED ON FLANGED BFV. FLANGED SPOOL PIECES OF THE CORRECT LENGTH ARE INSTALLED TO PREVENT VANE FROM TOUCHING HDPE ID.
- PIPE DEFLECTION IN THE MJ JOINT SHOULD ALSO BE FACTORED
- FOR ANY VALVE LARGER THAN 72" PLEASE CONTACT M&H VALVE

M&H VALVE COMPANY
ANNISTON, ALABAMA
A DIVISION OF MCWANE INC.

DWN: CTJ
DATE: 8/16/18
DWG. NO.
BFV-VANE

VANE CLEARANCE DIMENSIONS
FOR 3"-72" M&H BFVS
VANE / OUTSIDE BODY FLANGE
ORIENTATION (OPEN POSITION)

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SECTION 2.5 – PIPE CONNECTIONS

For connecting pipe to the BFV, do not deflect the pipe to connect the valve. Do not use as a jack to pull into alignment. As much as reasonably possible, the BFV should be in an “unconstrained” position with the weight of the valve being supported independently of the pipe connection. Pipe connections can put undo stress on the valve pulling the valve body out of shape and causing it not to seal properly. This becomes increasingly important as the piping size get larger.

Section 2.5.1 – Mechanical Joints

For Mechanical Joints (MJs) bolting torques should not exceed the recommended torque limits in the appendix of AWWA C-111.

- a. The use of an NSF61 approved pipe grade lubricant is recommended to minimize gasket to pipe binding.
- b. The most important factor is pulling the gland down uniformly so that the face of the gland follower remains parallel to the face of the valve flange throughout the tightening cycle. The torque on the nuts should be uniform, utilizing an alternating star pattern with as many as five repetitions of tightening to assure even torque stress.
- c. The MJ bolts should be torqued in accordance with the AWWA C111 specification. See the chart below for a quick reference. Torques in excess of the recommendations below may damage the BFV, the Mechanical Joint gland or both.

Valve Size	Bolt Size		Range of Torque	
	in.	mm	lbf-ft	N-m
3”	5/8	15.9	45-60	61-81
4” – 24”	3/4	19.1	75-90	102-122
30” – 36”	1	25.4	100-120	136-163
42” – 60”	1 ¼	31.8	120-150	163-203

*AWWA C111-17, Table A.1, Mechanical-joint torque loads

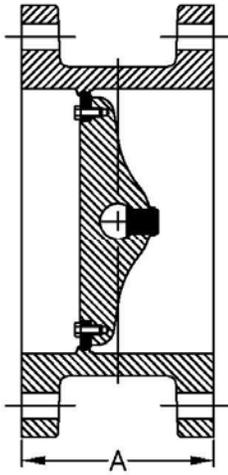
Section 2.5.2 – Flanged Ends

Standard flanged ends for M&H BFVs are Class 125B flanges as per ANSI B16.1.

For 100-degree water, ANSI Class 125B flanges for 12” and smaller valves are rated for 300 psi and 14” thru 48” flanges are rated for 230 psi. For cold water service, M&H recommends a maximum of 250 psi for 14” and larger Class 125B flanges. ANSI Class 250B flanges are an available option for M&H BFVs, having hydrostatic shell test pressure rating of 450 psi for cold water service.

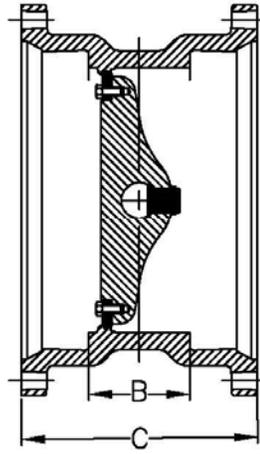
The lay length of M&H BFVs is in accordance with AWWA C504, see drawing BFV-LENGTH.

FLANGED ENDS



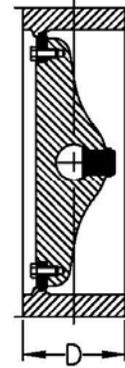
SIZE	A
3"	5.00
4"	5.00
6"	5.00
8"	6.00
10"	8.00
12"	8.00
14"	8.00
16"	8.00
18"	8.00
20"	8.00
24"	8.00
30"	12.00
36"	12.00
42"	12.00
48"	15.00
54"	15.00
60"	15.00
66"	18.00
72"	18.00

MECHANICAL JOINT ENDS



SIZE	B	C
4"	2.50	7.50
6"	2.88	7.88
8"	3.00	8.00
10"	4.25	9.25
12"	4.25	9.25
14"	5.25	12.25
16"	5.25	12.25
18"	6.13	13.13
20"	6.13	13.13
24"	7.50	14.50
30"	12.00	20.00
36"	12.00	20.00
42"	12.00	20.00
48"	15.00	23.00

WAFER ENDS



SIZE	D
4"	2.50
6"	2.53
8"	2.78
10"	3.25
12"	3.28
14"	4.50
16"	4.50
18"	5.75
20"	5.75

FOR FLANGED END VALVES:

- LAY LENGTHS PER AWWA C504-10
- TOLERANCE FOR VALVES 10IN. AND SMALLER IS $\pm 1/8$ IN.
- TOLERANCE FOR VALVES 12IN. AND LARGER IS $\pm 3/16$ IN.
- LAY LENGTHS DO NOT APPLY TO CL250 FLANGED-END VALVES.

M&H VALVE COMPANY
ANNISTON, ALABAMA
A DIVISION OF MCWANE INC.

DWN: EMW
DATE: 6/22/2020
DWG. NO.
BFV-LENGTH

3"-72"
M&H BUTTERFLY VALVE
LAY LENGTH BY BODY TYPE

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All bolting patterns are in accordance with ANSI B16.1. Bolt torques for flanged valves should be based on the yield strength of the bolt. Due size and casting restrictions, BFV sizes 14" and larger have some number of tapped holes (instead of thru holes) in the flanges. These are located around the Operator or Thrust Ends. Studs or threaded rods are used at locations where there is not enough room for standard bolts & nuts.

The chart below shows Thread Depth (or flange thickness), Thread Size and number of threaded holes per flange for sizes 14" and above. To determine the total required length of the stud, add this dimension to the thickness of the adjoining flange plus the thickness of the appropriate nut.

Valve Size	Thread Depth / Flange Thickness	Thread Size	# OF THREADED HOLES PER FLANGE
14"	1 3/8"	1"-8 UNC	4
16"	1 7/16"	1"-8 UNC	4
18"	1 9/16"	1 1/8"-7 UNC	4
20"	1 11/16"	1 1/8"-7 UNC	4
24"	1 7/8"	1 1/4"-7 UNC	4
30"	2 1/8"	1 1/4"-7 UNC	4 (DOM); 8 (IMP)
36"	2 3/8"	1 1/2"-6 UNC	4 (DOM); 6 (IMP)
42"	2 5/8"	1 1/2"-6 UNC	4
48"	2 3/4"	1 1/2"-6 UNC	8
54"	3"	1 3/4"-5 UNC	12
60"	3 1/8"	1 3/4"-5 UNC	12
66"	3 3/8"	1 3/4"-5 UNC	12
72"	3 1/2"	1 3/4"-5 UNC	12

DOM – Domestic Valve, IMP – Imported Valve

If it is determined to use a bolt rather than a stud, add the tapped bore dimension plus the adjoining flange dimension to acquire the required bolt length. (Bolt length as measured from the base of the bearing surface - or head - to the end of threads). Also, check the adjoining fitting and flange clearances to confirm there exist enough room to swing the bolt into place.

SECTION 2.6 – ASSEMBLY

The weight of the valve should be supported independent of the pipe connection. Provisions for thrust restraint must be adequate to absorb closing thrust.

Prior to assembly, flange faces must be cleaned to remove rust, paint runs, or other impediments to smooth surfaces. This will aid in gasket sealing without applying excessive bolt up torques.

Butterfly valves having an AWWA C550 epoxy coating must be checked for an uneven finish or runs. If allowed by the project specifications - use a mild abrasive to smooth the flange end surface.

Rubber gaskets must be suitable for cold water service and compatible with any other special requirements of the application.

Butterfly valves should not be installed at a dead end or near a bend in a pipeline without proper & adequate restraint to support the valve and prevent it from blowing off the end of the line. It is good engineering practice to consider whether or not thrust blocks, restrained joints, or other means of restraint are needed on or adjacent to valves on pipelines and/or where unusual conditions exist, such as high internal pressures, adjacent fittings, or unsuitable soils.

Buried valves installed with valve boxes shall be installed so that the valve box does not transmit shock or stress to the valve operator as a result of shifting soil or traffic load.

SECTION 3

PRESSURE TESTING OF M&H BUTTERFLY VALVES

SECTION 3.1 – GENERAL

Testing of newly installed waterlines is a time-consuming process that can be complicated by failure to retain specified pressures. This information is intended to aid in both the prevention of - and determining the source of - a waterline testing problem.

This summary is based on field conditions common to new pipeline installation with specific emphasis on valve installations. References are made to American Water Works Association (AWWA) C600 “Installation of Ductile Iron Water Mains and their Appurtenances”, AWWA C504 “Rubber Seated Butterfly Valves” Appendix “A”, “Installation, Operation, and Maintenance of Rubber Seated Butterfly Valves”.

While manufacturing issues are rarely the cause of testing failures. Most testing problems are related to testing procedures, construction procedures, or an improper application.

Before field servicing of valves is performed, contact the area M&H Valve distributor or representative for complete service information. Note that a BFV operator should never be removed with the waterline under flow or pressure.

SECTION 3.2 – MECHANICAL ISSUES

Hydrostatic testing of waterlines is addressed in AWWA C600. Section 4.3.9, “Flushing”, recognizes that “Foreign material left in pipeline during installation often results in valve or hydrant leakage during pressure testing”. This remains a common cause of testing failure relating to valves & hydrants. Thorough flushing of the waterline is recommended prior to pressure testing and help to remove any foreign matter inadvertently left in the line.

Performing an inspection of the valve prior to installation as recommend in the Appendix of AWWA C504 and can also avert testing problems. This includes checking for shipping damage, verifying bolt tightness, and operating the valve through one complete open - closing cycle.

In normal service, seat lubrication is achieved by water in the line. Thus, before testing, operating the valve to achieve full wetting of seating surfaces will facilitate better testing results. An NSF61 approved lubricant should be used provide lubrication for dry testing before installation.

Test pump equipment and its connection to the pipeline needs to be fully checked for leakage. All fittings must be wiped dry to aid in detection of leaking connections.

According to AWWA C504, gear operated BFV’s are to provide for closure with a maximum rim pull of 80 lb on the handwheel or chainwheel and a maximum input of 150 ft-lbs on wrench nuts. The range of vane travel can normally be adjusted by an external operator adjustment. Reference SECTION 5, Maintenance, for information related to the adjustment procedures for operators.

SECTION 3.3 – COMPRESSED AIR

The foremost consideration regarding air in line is operational safety. When a waterline is installed or repaired it is essential to properly bleed off all air within the pipeline. Keep in mind that, unlike water, air compresses and can create an extraordinary hazard - multiplying the effect of water hammer. If air is encountered during operation, stand clear of all equipment until the air flow ceases - and do not close any valve while blowing off air!

It is essential to fill lines slowly, while providing for evacuation of all air in the line at the ends and high points. AWWA C600, states, "Before applying the specified test pressure, air shall be expelled completely from the section of piping under test".

Compression of residual air may provide a false indication of leakage. This can cause the pressure reading to fall off from the desired pressure and perhaps stabilize at a lower reading. AWWA C600, states "It is good practice to allow the system to stabilize at the test pressure before conducting the leakage test".

Compressed air may bypass valve and hydrant O-rings seals allowing the test gauge reading to fall off. AWWA valves are rated for the specified water pressure - not necessarily compressed air pressure.

SECTION 3.4 – HYDROSTATIC TEST

Per AWWA C600, the seat test pressures should not exceed the rated pressure of the valve. M&H butterfly valves (BFV) are usually produced to meet the requirements of AWWA C504, Class 150B. Requirements for higher pressure rated valves (such as CL 250B) must be specifically noted at the time of purchase.

Leakage for pipeline testing is defined as the quantity of water that must be supplied to maintain pressure within 5 psi of the specified test pressure (AWWA C600, sec 4.1.5). Allowable leakage in gallons per hour for pipelines with rubber seated valves is stipulated in Table 6A of the AWWA C600 specification.

Upon completion of the installation, a permanent record should be generated regarding the BFV location, size, type, date of installation, number of turns to open, direction of opening, and any other special information.

SECTION 3.5 – SERVICE SUPPORT

If a testing problem persists after conformance to all recommended installation and test procedures, it is essential to contact the area valve distributor or representative for further assistance. In some cases, servicing procedures may allow for repairs or adjustment of the valve without removal from the line.

Most manufacturers specifically provide warranty terms to be limited to the valve itself - and in no event shall the buyer be entitled to incidental or consequential damages. If all recommended procedures stipulated within the AWWA standards are followed, situations requiring removal and replacement of valves will be a rarity.

Note that these suggested procedures are not to be considered a complete guideline for resolution of waterline testing issues. This information should be supplemented by the field experience of the installer and dictated by conditions and components specific to each installation.

SECTION 4

OPERATION OF M&H BFVS WITH TRAVELING NUT OPERATORS

SECTION 4.1 – GENERAL

Operational criteria for rubber seated Butterfly Valves (BFV) is covered in the Appendix section of AWWA C504. Briefly stated, some of the important information includes:

- Does not permit the operation of any valve at pressures above the rated pressure of the valve.
- Do not exceed 300 ft-lb input torque on operators with wrench nuts and do not exceed 200 lb rim pull for handwheel or chainwheels against the Open or Closed Stops.
- If a valve is stuck in some intermediate position between open and closed, check first for jamming in the operator - and “do not force the vane open or closed” which can severely damage internal parts.

SECTION 4.2 – INPUT TORQUE

M&H traveling nut operators exceed with the AWWA C504 torque recommendations. They are designed to OPEN or CLOSE the valve at LESS THAN 150ft-lbs of input torque. M&H traveling nut operators are also designed to withstand 450ft-lbs of input torque against the STOPS (in the full OPEN or CLOSED position). Torque in excess of these limits may damage the valve or operator or both. This safety factor may be less prevalent with third party operators that may or may not be AWWA C504 compliant. Maintenance personnel should be aware of the type of operators being used before actuating the valves.

SECTION 4.3 – THROTTLING

The M&H traveling nut operator is designed hold in place at any intermediate position and not allowing line flow to move the vane. Throttling operations that generate velocities up to 16 feet per second (fps) are acceptable and covered in the AWWA standard for class ‘B’. However, a BFV is not considered a pressure regulating valve and is not designed for prolonged operation at less than 20 degrees open.

SECTION 4.4 – WATER HAMMER

Water Hammer is a hydraulic shock to a water system from a pressure surge, sudden stoppage or change in direction. Extreme water hammer effects can severely damage a water system (lines, valves, and other components). When opening or closing valves, consideration must be given to the potential for water hammer as a result of opening or closing a valve too rapidly.

An M&H traveling nut operator incorporates the benefit of opening and closing slowly (assuming a consistent input speed) as the operator reaches the ends of its travel. This serves to minimize the potential for water hammer effects. Despite the anti-water hammer characteristics, it is still encouraged to establish operational policies relating to valve closure speed that will reflect all possible hydraulic conditions. This should include the possibility of high velocity line break conditions. Despite the urgency of a line break, slow closure is critical to minimize the potential for operational failure of the valve or the piping system and its restraining systems.

Quarter turn lever operated valves are especially susceptible to closing too quickly. A Lever operator should only be used for small diameter applications with very low flows & pressure. A slow closure procedure must be utilized for lever operated valves.

SECTION 4.5 – TURNS TO OPERATE

M&H Valve traveling nut operators for the #4500 / #1450 butterfly valves (BFV) are sized to meet requirements of AWWA C504 CL150B. Standard applications utilize the following operators.

SIZE	MODEL	TURNS
3" THRU 12"	FA12	29
14" THRU 20"	1250 FA16	48
24"	2200 FA25	72
30" & 36" CL150B	2200	72
36" CL250B & 42"	4350	90
48" THRU 72	CONSULT FACTORY	TBD

NOTE: At the customer's request, M&H BFVs may be equipped with alternate third-party operators that meet the needs of a specific application. The manufacturer of the third-party operator should be contacted about the Opening/Closing speeds and turns of their product.

SECTION 5

MAINTENANCE OF M&H BUTTERFLY VALVES

SECTION 5.1 – SAFETY

Before any maintenance or service work is conducted on an M&H BFV, whether above or below ground, all potential safety issues should be considered.

For In-Plant BFVs, all work should be done in accordance with ASME Pressure Vessel Code and other applicable standards.

For Vault Service BFVs, note that all entry into confined spaces, including trenches, may contain hazardous atmospheres or other hazards and is regulated by OSHA* regulation CFR 1910.146, Confined Spaces.

For Buried Service BFVs, at a minimum, prior to any excavation,

- Obtain location of all underground utilities in the area to be excavated.
- Obtain shut down of water, electricity, gas, or other utilities if there exist any potential to damage these conduits.
- Provide protection from trench wall cave in by proper sloping, shoring or other means in accordance with OSHA* Regulation CFR 1926, Subpart P, Excavations.

NOTE: It is the responsibility of the servicing individual to make sure that all regulations and best practices are followed for any service work. Individual states may have more stringent regulations. Contact the appropriate state agency before any work is begun for additional information and any potential permitting requirements.

SECTION 5.2 – VANE SEAT RING ADJUSTMENT – Sizes 3” thru 72”

1. If there is a small leak at a specific location around the circumference of the vane, this may be corrected by adjusting the Vane Ring Bolts on the Vane.
2. Before attempting to adjust the bolts, open the valve fully and inspect the Vane Ring for any mechanical damage to the rubber (a cut or tear or similar damage).
3. Once confirmed that the Vane Ring is in good condition, be sure to make sure that the seating area is clean and free from any debris.
4. Move the vane to the fully closed position and confirm that the vane is level with the stainless-steel seat in the valve body. NOTE: Make sure that the seating area has been lubricated with an NSF61 approved lubricant. If the vane is not level with the seat is not level:
 - a If an M&H Traveling Nut Operator is being used, skip to Section 5.5 – Vane Level Adjustment.
 - b If a third-party operator is being used, consult the Operator Manual for how to adjust the end stops of the operator.
5. After Steps 2, 3 & 4 have been verified, if there is still water leaking in the seat area, determine the location of the leakage.
 - a Using a Torque wrench (wrench should be in “in-lb” readings), determine the approximate torque of the bolts around the leak.

- b Using the measured torque amount, increase the torque wrench setting by 20in-lbs.
- c Re-torque 3 to 5 of the bolts around the leak. Repressure test the valve.
- d If the valve still leaks, this step can be done once more.
- e If the valve still leaks after the second attempt, the Vane Seat Ring may need replacement.

Valve Sizes	Vane Ring Bolt Wrench Size	Max Vane Ring Torque
3" thru 12"	7/16" Hex Head Bolt	150in-lbs
14" thru 24"	9/16" Hex Head Bolt	220in-lbs
30" thru 54"	7/32 Allen Key Bolt	220in-lbs
60" thru 72"	9/16" Hex Head Bolt	220in-lbs

SECTION 5.3 – VANE SEAT RING REPLACEMENT

M&H BFV’s design complies with the AWWA C504 Appendix guidance that “permits field adjustment or replacement of rubber seats when leakage occurs past the disc.” So, if an M&H rubber seat becomes damaged or badly worn, field replacement of the rubber seat can be accomplished with relative ease. The rubber seat can be replaced without removal of the shaft & vane assembly. This can be accomplished at the installation site for all valve sizes with standard tools. Assuming the maintenance staff can safely access the Vane Seat Ring side of the valve, this can be done with the valve still in the line.

Section 5.3.1.1 – 3” thru 24” REMOVAL OF EXISTING VANE SEAT RING

1. With vane in the closed position, remove seat retention screws.
2. Open valve approximately 20 degrees to remove the seat. NOTE: For 3” thru 24” valves, the Vane Ring Rubber is molded to the stainless-steel insert. They are one unit and can only be removed from the valve as one piece.
3. Lift the near side seat edge up from the seat recess area and, using a rubber mallet or hammer & block of wood, tap lightly on the seat edge to bump the Vane Seat Ring away from the recess area of the vane.
4. Gently work the Vane Seat Ring free, keeping in mind that resistance may be encountered at areas of contact near the shaft locations. (Forcible removal may damage the seat and prohibit reuse, if desired.)
5. Clean any debris, grease, or coating material from seat recess on vane and from stainless steel seating surface in the valve body.

Section 5.3.1.2 – 3” thru 24” INSTALLATION OF NEW SEAT

1. With the existing vane seat ring removed and the seating area cleaned of any debris and raised (or rough) surfaces smoothed, move the vane to the close position. Make sure the vane is level in the valve body. (If vane is not level, refer to Section 5.5 – VANE LEVEL ADJUSTMENT)
2. Fully lubricate the stainless-steel body seat with an NSF61 approved grease or pipe lubricant. Use extra lubricant at contact area near the shaft locations. Fully lubricate the rubber portion of the new Vane Seat Ring. Lay the Vane Seat Ring on vane, aligning the vane ring bolt holes in the vane and seat

ring as best as possible. Gently tap the seat ring with a rubber mallet or with a block of wood to push the ring into place.

3. Once the Vane Seat Ring is located in the seat recess, the bolts holes can be further aligned. Using self-locking seat adjusting screws, place screws in all the seat vane ring bolt holes. By hand, make sure that the screws are threaded into the holes to secure the seat to the vane. Do not begin compression of the rubber seat at this point.

4. For 3" thru 12" BFVs,
 - a. Set the torque wrench to 90in-lbs, torque all of the bolts down to 90in-lbs in an alternating star pattern as shown in the picture below.
 - b. Increase the setting on the torque wrench to 110in-lbs and repeat the process.
 - c. Pressure test the valve. If the valve holds the rated pressure, then the process is done.
 - d. If the valve does not hold the rated pressure, then increase the setting on the torque wrench to 130in-lbs and repeat the pressure test. Again, if the valve holds the rated pressure, then the process is done.
 - e. If the valve does not hold, increase the setting on the torque wrench to 150in-lbs, and a repeat the process.
 - f. If the valve holds the rated pressure, then the process is done. If the valve still does not hold pressure, then consult the factory.

5. For 14" thru 24" BFVs,
 - a. Set the torque wrench to 160in-lbs, torque all of the bolts down to 160in-lbs in an alternating star pattern as shown in the picture below.
 - b. Increase the setting on the torque wrench to 180in-lbs and repeat the process.
 - c. Pressure test the valve. If the valve holds the rated pressure, then the process is done.
 - d. If the valve does not hold the rated pressure, then increase the setting on the torque wrench to 200in-lbs and repeat the pressure test. Again, if the valve holds the rated pressure, then the process is done.
 - e. If the valve does not hold, increase the setting on the torque wrench to 220in-lbs, and a repeat the process.
 - f. If the valve holds the rated pressure, then the process is done. If the valve still does not hold pressure, then consult the factory.

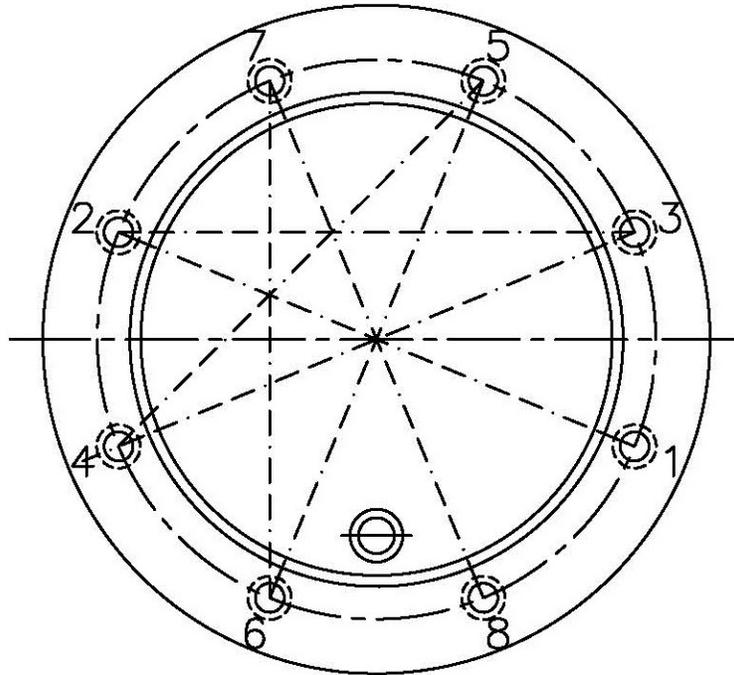
6. Retest the valve as necessary in accordance with AWWA C504 sec. 5.2.2.2.

Section 5.3.1.3 – 3" thru 24" SERVICE DETAILS

1. PARTS REQUIRED
 - a. Vane Seat Ring
 - b. Seat Ring retention screws - with pre applied 'nylock'
 - c. NSF61 approved Lubricant,
2. TOOLS REQUIRED
 - a. 7/16" socket for valve sizes 3" thru 12",
9/16" socket for valve sizes 14" thru 24"
 - b. An adjustable torque wrench with in-lb settings up to 250in-lbs
NOTE: It is not recommended to use a torque wrench with ft-lbs increments.
 - c. Screwdriver
 - d. Rubber mallet or hammer with wood block.
3. ESTIMATED SERVICE TIME
 - a. Approximately 30 minutes for 4" – 12" valves

- b. Approximately 45 minutes for 14" – 24" valves.

Alternating Star Pattern for Vane Ring Bolt Tightening



Section 5.3.2.1 – 30" thru 72" REMOVAL OF EXISTING SEAT

1. With vane in the closed position, remove seat ring retention screws.
2. Remove the stainless-steel clamp ring segments from the valve. For 30" and larger valves, these are not bonded to the rubber Vane Seat Ring.
3. Open valve approximately 20 degrees to remove the rubber Vane Seat Ring.
4. Lift the near side seat edge up from the vane recess area and, using a rubber mallet or hammer & block of wood, tap lightly on the seat edge to bump the Vane Seat Ring away from the recess area of the vane.
5. Gently work the Vane Seat Ring free, keeping in mind that resistance may be encountered at areas of contact near the shaft locations. (Forcible removal may damage the seat and prohibit reuse, if desired.)
6. Clean any debris, grease, or coating material from seat recess on vane and from stainless steel seating surface in the valve body.

Section 5.3.2.2 – 30" thru 72" INSTALLATION OF NEW SEAT

1. With the existing Vane Seat Ring removed and the seating area cleaned of any debris and any raised (or rough) surfaces smoothed, move the vane to the close position. Make sure the vane is level in the valve body. (If the vane is not level, refer to Section 5.5 – VANE LEVEL ADJUSTMENT)
2. Fully lubricate the stainless-steel body ring and the new rubber seat ring with an NSF61 approved lubricant. Use extra lubricant at contact area near the shaft locations. Lay the new rubber Vane Seat

Ring on vane, aligning the vane ring bolt holes as best as possible. It is recommended to push the rubber Vane Seat Ring into place by hand.

3. Once the rubber seat ring is in place, put the clamp ring segments can be put into place, aligning the bolt holes in the clamp ring with the bolt holes rubber vane ring.
4. Using self-locking seat adjusting screws, install the screws through the clamp ring, through the Vane Seat Ring and into the threaded holes in the vane. This should be done by hand to make sure that the bolts are in the threaded holes and are not cross-threaded. Do not begin compression of the rubber seat at this point.
5. To tighten the Vane Sear Ring vane ring down:
 - a. Set the torque wrench to 160in-lbs, torque all of the bolts down to 160in-lbs in an alternating star pattern as shown in the picture above.
 - b. Increase the setting on the torque wrench to 180in-lbs and repeat the process.
 - c. Pressure test the valve. If the valve holds the rated pressure, then the process is done.
 - d. If the valve does not hold the rated pressure, then increase the setting on the torque wrench to 200in-lbs and repeat the pressure test. Again, if the valve holds the rated pressure, then the process is done.
 - e. If the valve does not hold, increase the setting on the torque wrench to 220in-lbs, and a repeat the process.
 - f. If the valve holds the rated pressure, then the process is done. If the valve still does not hold pressure, then consult the factory.
6. Retest the valve as necessary in accordance with AWWA C504 sec. 5.2.2.2.

Section 5.3.1.3 – 30” thru 72” SERVICE DETAILS

1. PARTS REQUIRED
 - a. Vane Seat Ring
 - b. Seat Ring retention screws - with pre applied ‘nylock’
 - c. NSF61 approved Lubricant
2. TOOLS REQUIRED
 - a. 7/32” Allen Key socket for valve sizes 30” thru 54”
 - b. 9/16” socket for valve sizes 60” thru 72”
 - c. An adjustable torque wrench, with in-lb settings up to 250in-lbs
NOTE: It is not recommended to use a torque wrench with ft-lbs increments
 - d. Screwdriver
 - e. Rubber mallet or hammer with wood block
3. ESTIMATED SERVICE TIME
 - a. Approximately 1 hour for 30” thru 54” valves
 - b. Approximately 1.5 hours for 60” thru 72” valves

SECTION 5.4 – M&H BFV Traveling Nut Operator

Section 5.4.1 – GENERAL

Traveling nut operators are standard equipment for all manually operated M&H BFVs sizes 3” thru 42”. Standard production operators are sized as per AWWA C504 for Class 150B service and for Class 250B service as required.

When servicing buried operators, make sure that all standard safety protocols are followed for any trenching or confined space work that must be done.

NOTE: Never attempt to service any BFV operator while the line is following or under pressure. Prior to servicing, properly identify the BFV model and its operator and obtain the correct service information. Also, confirm the opening direction. See SECTION 4.5 – TURNS TO OPERATE determine the number of turns to operate from full open to close that applies to each valve size and/or pressure class.

An internal obstruction of the vane is the most likely cause trouble operating the BFV. However, an internal obstruction is the most difficult of all scenarios to correct since it normally requires the removal of the valve from the line.

So, it is good practice to evaluate all of the other possible causes, before removing the valve from the line. A detailed description of the possible valve movement problems is listed in the following sections. It is also good to note:

- Is the valve open or closed?
- Will the operator move at all or is it just difficult to move?
- Are there areas in the movement that there is more resistance?
- Does the operator stop short of Fully Open or Fully Closed?

This information will help to determine if the obstruction is: 1) External, 2) Internal to the Operator, or 3) Internal to the Valve.

Section 5.4.2 – External Obstruction

1. Check operating nut clearances in buried service valve boxes and/or binding of operational accessories such as, extension stems, stem guides, and chain wheels.
2. Check for operating nut to thrust plate interference due to backfill material becoming wedged between the op nut and thrust plate. Binding can be checked by removing (or loosening) the operating nut.
3. An improperly fitted operating nut may cause it to lean to the point of contacting the thrust plate. Loosening the op nut can confirm this possibility.
4. Confirm the thrust plate is securely mounted on the operator housing. If the thrust plate has become loose, fully thread the input shaft into the operator housing and re-tighten by turning to the left (backwards). Take provisions to lock threads to prevent future loosening.

Section 5.4.3 – Internal to the Operator Obstruction

1. If the operator locked, it is possible that some debris in the threaded components of the operator is causing it to bind. Try working the Input shaft in the Open then Closed direction several times. This should move or dislodge the debris. If this fix is working the amount of turns of the Input shaft should increase until full travel is permitted.
2. If the above fails to resolve the problem, the cover of the operator can be removed to inspect the internal components. NOTE: Before opening the operator, it is recommended to have a bucket, a scoop tool, and gloves available to remove & retain the grease in the operator housing. Depending on the operator, there are approximately five pounds of grease in the operator.
3. Once the mechanical operator components are exposed, inspect the input shaft, crosshead nut, and lever for obstructions that may be causing the binding issue.
4. If the input shaft is damaged, limited movement of the operator may be possible. The operator will bind as the damaged area comes into contact with the crosshead.

5. If the lever/crosshead interface is damaged, again, there may be some limited movement of the operator before the binding occurs.
6. Check for binding between the thrust cap to the input shaft by loosening the thrust cap (thread off to right).

Section 5.4.4 – Internal to the Valve Obstruction

1. Minimum Mating Inside Diameter – The Inside Diameter of the adjoining pipe may interfere with vane opening. This is generally a consideration only when using thick wall (non-metal) piping systems with mechanical joint end valves. Consult the ‘Minimum Mating ID Chart’ for specific dimensions needed for vane clearance.
2. If the Pipe ID is too small, the vane will have normal movement from the closed position for approximately 1/3 the number of turns of the operator. Once the vane contacts the pipe wall, movement will stop. The valve will “free up” as the vane is moved back to the closed position. NOTE: Impact with the pipe wall will normally cut the rubber vane ring and the valve will now leak in the closed position.
3. If the Minimum Mating ID Chart and operating conditions point to vane interference as the problem, the valve must be removed from the line and appropriate piping modifications completed. Inspect the seat for damage prior to reinstalling valve.
4. If the valve has good movement from the Open position but binds as it approaches the Closed Position, it is likely that there is an obstruction in the line preventing the valve from fully closing.
5. The only way to verify an internal obstruction to gain access to the inside of the piping system to BFV vane.
6. If there is an internal obstruction, the vane must be accessed to physically remove the obstruction.

Section 5.5 – Vane Level Adjustment

M&H BFVs, 3” thru 42”, are generally equipped with a mechanical traveling nut operator. The operator lever adjustment is set during the production/testing process and the valve pressure tested in both directions for proper sealing at full closure. As a result, field adjustment is rarely required.

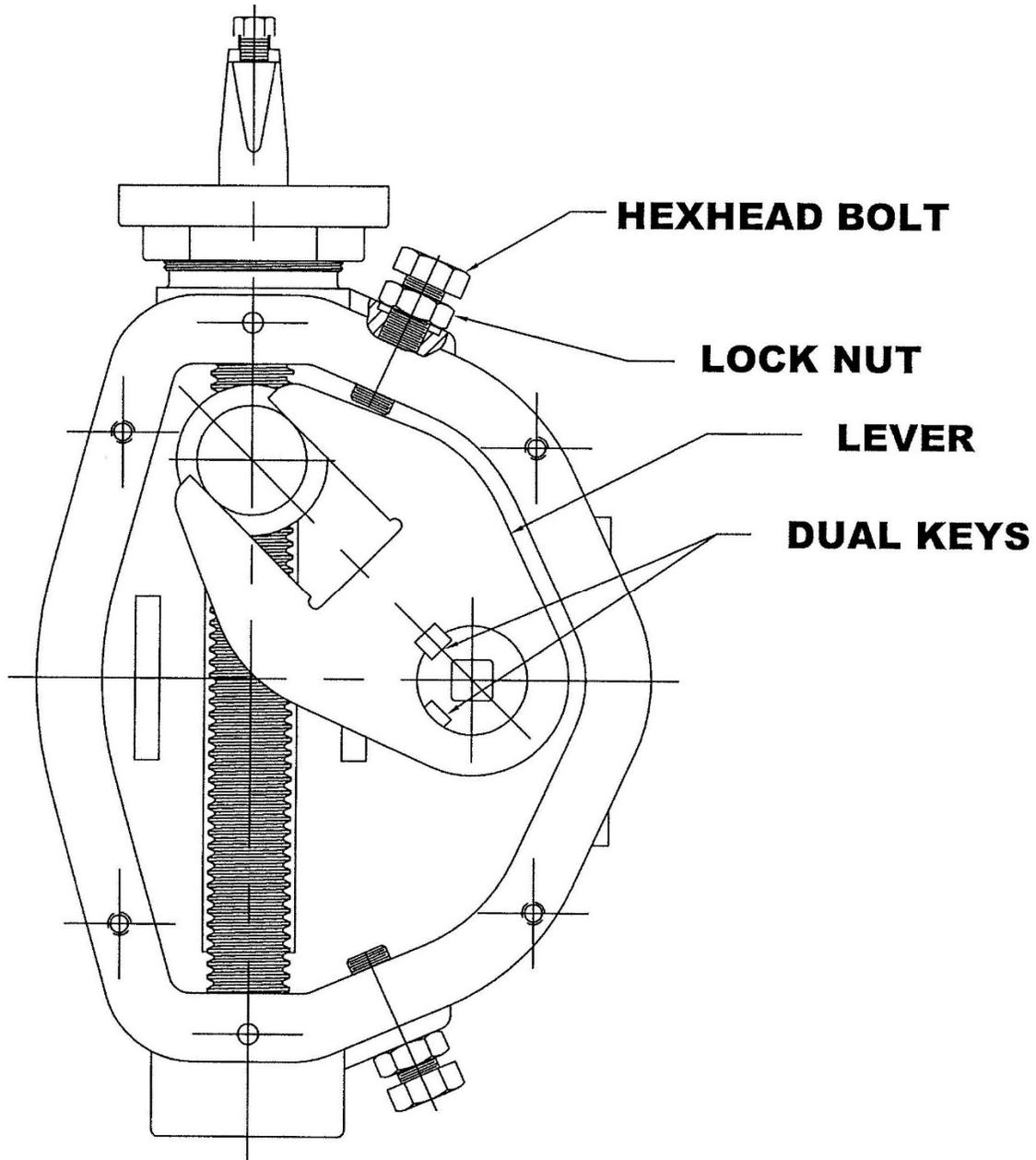
Section 5.5.1 – Vane Level Adjustment Procedure for 3” thru 12” BFVs

Call your customer service representative for the current procedure.

Section 5.5.2 – Vane Level Adjustment Procedure for 14” thru 42” BFVs

An external locking bolt adjustment feature was added to M&H BFVs in 1998.

1. Loosen the Lock Nut retaining the Hex Head Bolt. (For open left valves, the closure adjustment is located near the op nut or handwheel)
2. Turn the Hex Head Bolt so that it moves outward from the Operator Housing. Do not unthread the Hex Head Bolt to where it comes out of the housing. Normally, 1 to 3 turns is sufficient.
3. Using the Op Nut or Handwheel, level the valve as needed. Assuming the valve itself is level, a small Carpenter’s level can be placed on the vane to set the level.



4. Once the vane is level, turn the Hex Head Bolt inward until it firmly contacts the Lever.
5. Holding the Hex Head Bolt with a wrench (so that it does not move), tighten Lock Nut against the Housing to lock the Hex Head Bolt in place.
6. Move the vane out of the seat area and then back into the seat to confirm that the adjustment leveled the vane.

Section 5.5.3 – Vane Level Adjustment Procedure for 48” thru 72” BFVs

M&H does not manufacture a traveling nut operator for valves this size. Third-party worm gears are normally provided for valves of this size. For maintenance and adjustment procedures for these types of operators, please contact the manufacturer of the gear.

Section 5.6 – Protective Coatings

M&H Valve Co. generally provides one of two coatings for butterfly valves.

1. The primary coating used for M&H BFVs is fusion bond epoxy (FBE). NSF61 and UL certified, meeting the requirements of AWWA C550 “Protective Interior Coatings for Valves and Hydrants”. This coating provides excellent corrosion protection for the valve in both buried and above ground service. For above ground use, it is easily painted over to match customer piping paint schemes.
2. In some instances, M&H will use TNEMEC Pota-Pox N141 two-part epoxy. N141 is NSF61 and UL approved and meeting the requirements of AWWA C550. N141 can be used for field coating and touch up uses. It adheres well to the FBE used above. When field applying N141, make sure to follow all of the manufacturer’s recommend application, safety and environmental guidelines.
3. For small touch-up needs, M&H can supply matching touch-up paint in an easy to use spray-can. Contact you customer service representative for more information related to this.