

M&H VALVE COMPANY
AWWA C504-00
CLASS 150, 200, & 250
BUTTERFLY VALVES

August 2002 / C504-00 / BFV

Operation and Maintenance Manual Table Of Contents
M&H Style #4500 / #1450 Butterfly Valves

Section 1 **General Information**

Page 1-2	Table of Contents
Page 3-6	Butterfly Valves for Water Works Applications A Summary of Design, Applications, and Maintenance

Section 2 **General Literature**

Page 7	Automation Information Form
--------	-----------------------------

Section 3 **Installation & Testing**

Page 8-10	Installation of AWWA Butterfly Valves
Page 11-12	Pressure Testing of AWWA Butterfly Valves
Page 13	Minimum Mating ID for Butterfly Valve Installations
Page 14	Mechanical Joint End Assembly
Page 15	Flange End Assembly
Page 16	Tapped Holes & Threaded Studs for Flange Ends

Section 4 **Operation**

Page 17-18	Operation, with Traveling Nut Actuators
Page 19	Turns to Operate, Traveling Nut Actuator

Section 5 **Maintenance, Valve**

Page 20-22	4" thru 24", #4500 Disassembly & Assembly
Page 23-25	30" thru 48", #1450 Disassembly & Assembly
Page 26	Seat Adjustment
Page 27-28	Seat Replacement
Page 29	Shaft Seal Replacement, #4500

Page 30-32	General Service & Troubleshooting, Traveling Nut Actuator
Page 33	Shaft & Key Dimensions
Page 34	Handwheel / Op nut Cross Reference Chart (RSGV)
---	4" #65 Actuator Disassembly & Assembly (Contact Factory For Additional Information)
---	6" #150 Actuator Disassembly & Assembly (Contact Factory For Additional Information)
---	8" #250 Actuator Disassembly & Assembly (Contact Factory For Additional Information)
Page 35-36	10"-12" #510 Actuator Disassembly & Assembly
Page 37-38	14"-20" #1250 Actuator Disassembly & Assembly
Page 39-40	24"-36" #2200 Actuator Disassembly & Assembly
---	36"-42" #4350 Actuator Disassembly & Assembly (Contact Factory For Additional Information)
Page 41	Actuator Adjustment, Traveling Nut, External Stop
Page 42	Actuator Adjustment, Traveling Nut, Actuator Shift
Page 43	Field Installation of Position indicator
Page 44-45	Opening Directional Conversion

Section 7 Maintenance, Automated Actuators

Page 46	Automation, General
---	Cylinder Actuators (Contact Factory For Additional Information)
Page 47-48	Cylinder Actuator, General Maintenance (Contact Factory For Additional Information)
---	Motor Actuators (Contact Factory For Additional Information)

Section 8 Coatings

Page 49	Protective Coatings for BFV, General
Page 50	Use of Two Part Epoxy

Butterfly Valves for Water Works Applications

A Summary of Design, Applications, and Maintenance

GENERAL

Butterfly valves (BFV) are commonly used in water transmission and distribution for sizes 12" and larger. For pump station and treatment plant applications BFV's offer flow control advantages over gate valves.

Butterfly Valves for water works applications are constructed of cast and/or ductile iron, stainless steel, rubber seats & seals, and teflon trim. Corrosion resistance of cast & ductile iron makes this a very suitable material for buried service. Stainless steel components provide corrosion resistance as required for water service applications.

AWWA SPECIFICATION

Butterfly valves are addressed in the American Water Works Association (AWWA) standard C504-00. 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 AWWA C504-00 standard covers pressure ratings from 25 to 250 psi with velocities from 8 to 16 fps (sec.1.1.1.2, sec 1.1.1.4, & 1.1.2). If the commonly used 150-psi rating with the maximum velocity is the intent of the application, be sure to specify AWWA C504, Class 150B.

Since BFV's produced for Class 250B service may require larger actuators and higher seat tension, it is suggested to specify 250B only when required for anticipated operating conditions. ANSI Class 125 flanges are suitable for 250 psi, cold-water pressure, nonshock. An ANSI class 250-flange pattern is available for higher shell pressures.

Valve body material and related wall thickness is specified in AWWA C504-00, Table 1. The wall thickness required for CL 250B and CL 150B valves is the same, when the 250B body material is ductile iron.

APPLICATIONS

Upon the introduction of the BFV for water works applications, a common application was as a distribution system valve up to 12 inch. This provided a zero leakage valve in place of the allowable leakage of a double disc gate valve (DDGV). With the current nearly universal use of the resilient seat gate valve (RSGV), zero leakage for 10" and smaller applications is now economically achieved with this valve.

Butterfly valves are generally used for larger size distribution or transmission applications - starting at 12". This is due in part to dimensional considerations relating to minimizing trench depths. Additional safety requirements may apply to work in 4 ft. or deeper trenches. The side mounted BFV operator permits its use in a 4 ft trench. A 12" gate valve, being 39" +/- tall, leaves little flexibility for grade adjustments.

For larger transmission line applications, a BFV is typically specified. From a construction standpoint a BFV is more efficient to install due to its size and weight as compared to 12" & larger gate valves. There is also a corresponding BFV price advantage for the 14" plus sizes, which becomes progressively more significant with larger sizes.

AWWA BFV's are desirable for use in municipal water treatment applications - absent of concentrations of corrosive industrial process. A 'Corrosion Guide' can provide information regarding compatibility for materials of construction with specific line content. Air service is acceptable to 25 psi. Rubber component alternatives are available when required for temperatures up to 225 degrees.

Throttling operation that generates velocities up to 16 feet per second (fps) is acceptable as 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.

The minimum mating inside diameter (ID) of the piping system should be considered. With thick wall & smaller ID plastic piping systems there exist a potential for disc operation interference. This situation may apply to all AWWA BFV's, barring a substantially undersized disc. (AWWA C504 Appendix A sec. 5.8 and the manufacturers minimum mating ID chart)

SEAT DESIGN

Seat testing is required at "pressure equal to the valve class" (C504-00, section 5.2.2.1). AWWA addresses a maximum pressure setting of the seats to 250 psi.

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.

In AWWA C504, section 4.5.5.2.1, it is stated "Rubber seats shall be applied to the body or the disc". For valves 30" and larger, AWWA (4.5.5.2) requires "a design that permits removal and replacement at the site of the installation". A mechanically retained rubber seat, which is offset from the shaft, is commonly used due to its reliability and field serviceability.

Seat service is further referenced in Appendix A-9 of AWWA C504-00 - noting, "in some instances, valve design permits field adjustment or replacement of rubber seats". Configurations having mechanical retention and seat accessibility without disassembly of the shaft & disc assembly comply with this maintenance reference.

SHAFT & DISC DESIGN

AWWA covers the use of either a thru or stub shaft. A thru shaft is common for the 4" thru 12" sizes. For 14" & larger sizes, a stub shaft is common. Stub shafts allow enhanced flow characteristics by use of a recessed disc back design and/or open disc structure. For excellent corrosion resistance in fresh water applications, valve shafts are generally type 304 stainless steel, as per AWWA C504, Sec 4.4.2.4. (For CL 250B valves, 630 stainless steel is used.)

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

Maintenance free shaft seals are an essential consideration for inaccessible applications - such as buried service. O-rings are considered excellent for close tolerance applications and do not require periodic adjustment to compensate for wear or compression. For further seal application information, reference Parker Seals O-Ring Handbook - taking note of table A1-1, Comparison of Seal Types.

ACTUATION

The most common mechanical operator provided is a traveling nut actuator. This incorporates the benefit of slowing as it closes at the same input speed - serving to minimize water hammer. This actuator will hold its place in any intermediate position due to built in operational inefficiencies that prohibit flow from back driving the disc. Many traveling nut operators provide overload protection, allowing for input torques 1.5 times the requirement of the AWWA C504 standard.

For 36" and larger valves (or as required), worm gear mechanical operators can be supplied. Worm gear operators designed to the AWWA C504 standard must be capable of accepting 300 ft-lb of input torque on wrench nuts.

An important service note - Do not remove a BFV actuator while under flow and pressure. Lacking an actuator a BFV wants to close in the presence of flow and can create a hazardous water hammer situation. Also the actuator may serve to retain shaft seals, which could be ejected without the actuator mounted on the valve.

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

The Class specification of a BFV is also critical relating to the operator sizing, such as Class 150B. This is heavy enough for 150-psi service at a velocity of 16 fps. Lighter duty operators designed to meet the 25A (25 psi service at a velocity of 8 fps) are not suitable for 150-psi / 16 fps service. Proper actuator selection includes safety factors that are calculated to allow closure in high velocity line break conditions.

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 will provide automation to suit virtually all control needs having very application specific design criteria. When specifying, pricing, or ordering automated valves, required information 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 upon request.

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

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

COATINGS

For buried service, an asphalt varnish or a two-part liquid epoxy coating is available. Epoxy coatings are the two-part epoxy system specified within AWWA C550, Protective Epoxy Interior Coatings for Valves and Hydrants. Due to the manner in which rubber components are incorporated into BFV design and assembly, the heat fusion epoxy system used for resilient seat gate valves is not available for BFV's.

For flanged end above ground valves, a primer coating (with handwheel) is standard. This allows for finish exterior painting in treatment plant or pump station applications. If a buried service coating is required (and/or 2" op nut), this must be specified at the time of the order.

SERVICE ACCESS AND SAFETY

If it is determined that valve servicing is required, full access to the valve and operator must be provided to permit an efficient and effective repair. In the process of providing adequate access, note the information as follows:

- a. Prior to any excavation of buried service valves, 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.
- b. For buried service valves, furnish excavation that provides protection from trench wall cave in by proper sloping, shoring or other means in accordance with OSHA* Regulation CFR 1926, Subpart P, Excavations.
- c. For valves located in manholes or vaults, 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.

*Individual states may have more stringent regulations. Contact the appropriate state agency before entering any trench or valve vault.

BFV PRODUCTION

Over the past several years, there has been extensive consolidation within the valve manufacturing industry. This has been driven in part by new machining technologies, which has required extensive capital investments. Implementation of new CNC machining capabilities has improved availability, cost efficiency, and assures very consistent tolerances and quality.

Consolidation has resulted in some types of AWWA butterfly valves being discontinued and others have been combined under existing or revised trade names. Butterfly valve specifications should be reviewed to assure the named manufacturers and models are reflective of current production.

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 / Kennedy Valve will warrant valves with automation installed as per AWWA C504-00, Section 5.21 and 5.22.

David G. Acomb, M&H / Kennedy Valve, 888-902-7520

F-2.95, 6/01

**M&H / Kennedy Valve
Installation of AWWA Butterfly Valves
M&H #4500 / # 1450**

INTRODUCTION

The M&H / Dresser butterfly valve (BFV) was introduced in 1965 for clean water applications. The rubber seat provided a ‘zero leakage’ alternative for metal-seated valves common at that time. Today, BFV’s offers flow control advantages and economy vs. gate valves, which becomes progressively more significant in larger sizes.

M&H produces butterfly valves in accordance with the American Water Works Association (AWWA) C504-00 standard. Much of the following installation information is based on Appendix “A” of this standard, being restated or modified within the “General”, “Unloading”, “Storage”, “Inspection”, and “Installation” sections of this document.

INSTALLATION SAFETY

Any employee entering a trench, more than 5 feet in depth, must be protected by proper sloping, shoring or other means in accordance with OSHA regulation CFR 1926, Subpart P “Excavations”.

All entry into confined spaces, including trenches, which may contain hazardous atmospheres or other hazards is regulated by OSHA regulation CFR 1910.146 “Confined Spaces”.

Individual states may have more stringent regulations. Contact the appropriate state agency before entering any trench or valve vault.

APPLICATIONS

Rubber seated butterfly valves are designed to provide a 100% shut off at operating pressures in accordance with AWWA C504. The current AWWA C504-00 standard covers pressure ratings from 25 to 250 psi with velocities from 8 to 16 fps (sec.1.1.1.2, sec 1.1.1.4, & 1.1.2). If the commonly used 150 psi rating with the maximum velocity is the intent of the application, be sure to specify “AWWA C504, Class 150B”.

AWWA BFV’s are desirable for use in municipal water treatment applications - absent of concentrations of corrosive industrial process. A “Corrosion Guide” can provide information regarding compatibility for materials of construction with specific line content. Air service is acceptable to 25 psi. Rubber component alternatives are available when required for temperatures up to 225 degrees F.

Confirm that gear actuator supplied is suitable for operating pressures of the specific application. Quarter turn lever operators are available for 8” and smaller sizes where the maximum unseating pressure is 25 psi or less. For automated valves, see specific installation information furnished by the actuator manufacturer.

GENERAL

Butterfly valves are a significant component 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, costly unearthing operations to correct or eliminate the problem. Many problems with butterfly valves can be traced to improper installation, operation, or maintenance procedures.

UNLOADING

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 larger than 36 inch, use forklifts or slings under skids. On smaller valves, do not lift valves with slings or chains around the operating shaft, actuator, 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.

STORAGE

Protect the valve and actuators from weather and the accumulation of dirt, rocks, and debris. When valves fitted with power actuators and controls are stored, energize electric actuators or otherwise protect electrical control equipment to prevent corrosion of electrical contacts due to condensation resulting from temperature variation. Do not expose rubber seats to sunlight or ozone for an extended period.

INSPECTION PRIOR TO INSTALLATION

Make sure flange faces, joint sealing surfaces, body seats, and disc are clean. Check bolting attaching actuator for loosening in transit and handling. If loose, tighten firmly. Open and close valve to make sure it operates properly and that stops or limit switches are correctly set so the valve fully closes and seats. Close the valve before installing.

For dry operation prior to installation, it is suggested that a NSF lubricant such as Dow #111 be applied to the rubber seat.

INSTALLATION

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

M&H butterfly valves are rated for the designated operating pressure with flow in either direction. The mechanically retained seat on the disc provides for adjustment or replacement with relative ease. It is recommended that CL150B valves 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.

Make sure the valve disc, when opened will not contact the pipe port. The M&H Butterfly Valve was designed to be compatible with water distribution pipe sizes standard to our industry in 1965. Thicker wall plastic piping systems introduced since that time have a smaller inside diameter, which may interfere with the operation of a butterfly valve disc. See the document "Minimum Mating Inside Diameter for M&H Butterfly Valves" for clearances, which apply to M&H BFV's.

PIPE CONNECTION

Do not deflect the pipe to valve joint. Do not use as a jack to pull into alignment. The weight of the valve should be supported independent of the pipe connection.

Mechanical joint bolting torques must not exceed 75 to 90 lbf-ft for 4" thru 24" valves (appendix to AWWA C-111). A food grade pipe lubricant is recommended to minimize gasket to pipe binding. 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 as many as five repetitions of tightening to assure even torque stress.

Flanged ends must be flush and clear of debris, which may impair gasket sealing.

Bolt torques for flanged valves should be based on the yield strength of the bolt. Consult the "Tightening Torque Guide" for the SAE grade bolts being supplied.

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 during design 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 actuator as a result of shifting soil or traffic load.

TESTING

In new construction, obstructions within the water line are generally the cause of improper seating. Flushing the water line is a recommended procedure to evacuate debris from the line and prevent damage to the seating surfaces. Avoid attempts to overcome seating obstructions with high input torques.

Confirm that the seat test pressures required do not exceed the pressure or velocity rating of the valve (AWWA C600, sec 4.1.1).

See the document "Pressure Testing of AWWA Butterfly Valves" for detailed testing information.

RECORDS

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

OPERATION

Do not operate valves at pressures, which exceed the rated pressure of the valve. Closing of valves must be performed slowly to minimize the potential for water hammer. If air encountered during operation, stand clear of all equipment until the air flow ceases - and do not close valve while blowing off air.

See the document "Operation of AWWA Butterfly Valves" for detailed operational information.

Pressure Testing of AWWA Butterfly Valves

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) standards C600 "Installation of Ductile Iron Water Mains and their Appurtenances", AWWA C504 "Rubber Seated Butterfly Valves" and Appendix "A", "Installation, Operation, and Maintenance of Rubber Seated Butterfly Valves".

Valve manufacturing issues are rarely the cause of testing failures. In the majority of cases, 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/Kennedy Valve distributor or representative for complete service information. Note that a BFV actuator should not be removed with the waterline under flow or pressure.

MECHANICAL ISSUES

Within the AWWA C600 specification, waterline hydrostatic testing is addressed. Section 3.9 "Flushing" recognizes that "foreign material left in pipeline during installation often results in valve or hydrant leakage during pressure testing". This remains the most prevalent cause of testing failure relating to valves & hydrants. Care during construction and thorough flushing is recommended prior to pressure testing. This can avoid the presence of - or facilitate the removal of - construction debris in the waterline.

Performing an inspection of the valve prior to installation - as noted in AWWA C504-00, Appendix A, - can also avert testing problems. This includes (in part) checking for shipping damage, verify bolt tightness, and operation through one complete open - closing cycle.

In normal service, seat lubrication is achieved by water in the line. Thus, before testing, operating the valves to achieve full wetting of seating surfaces will facilitate better testing results. An FDA approved water works lubricant can provide lubrication for dry testing prior to 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.

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 (AWWA C504-00, sec 4.5.8.5.2). The range of disc travel can generally be revised by an external actuator adjustment. Reference maintenance information for adjustment procedures specific to the actuator type supplied.

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, sec 4.1.3 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, section 4.1.2 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.

HYDROSTATIC TEST

The seat test pressures should not exceed the rated pressure of the valve (C600, sec 4.1.1). 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.

LEAK DETECTION & LISTENING DEVICES

Suspect joints, valves, or hydrants are often excavated prematurely in attempt to locate a source of line leakage. Barring an obvious situation, this can be a time wasting effort.

Correlater leak detection systems can provide a conclusive method to locate piping system leakage. For effective use of correlater leak detection equipment, it is suggested that exposed contact points be available every 300 to 500 feet. Multiple listening points become more critical for larger size pipelines, which provide less leak sound.

In Appendix "A" of AWWA C504, Sec A.6.1, "it is recommended that excavations for buried valves not be backfilled until after pressure test have been made". It is recognized that other construction considerations may make full adherence to this impractical. However, providing valve contact points allows use of listening devices - Being either a correlater leak detection system or a basic screwdriver.

SERVICE SUPPORT

If a testing problem persist 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 with the valve in line vs removal.

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.

Minimum Mating Pipe Inside Diameter for Butterfly Valves

The M&H / Dresser AWWA Butterfly Valve was designed in 1965 to be compatible with water distribution pipe sizes standard to our industry at that time. Many thicker wall piping systems introduced over the past 34 years have a smaller inside diameter, which may interfere with the operation of a butterfly valve disc.

A remedy for this situation, short of choosing an alternate piping system, is to use iron fitting adapters with the butterfly valve. It may also be possible to slightly taper the interior 90-degree edge of the pipe to allow for disc clearance. However it is advised to check with pipe manufacturer to verify the viability of this solution.

While alternate BFV sources may differ in their specific minimum mating ID, all other AWWA manufactures are affected by this situation barring a substantially undersized disc.

This issue is also covered in the AWWA C504-00 standard, Appendix A sec. 5.8, which states; "Make sure the valve disc, when opened, will not contact the pipe port".

Minimum Mating ID for Pipe Adjoining M&H #4500 & #1450 BFV

SIZE	MECH. JOINT	FLANGED	WAFER
4"	3.375	0	3.5
6"	5.6875	3.8125	5.8125
8"	7.75	5.75	7.875
10"	9.4375	6.6875	9.875

12"	11.5625	9.6875	11.875
14"	12.875	11.375	13.125
16"	14.9375	13.75	15.1875

18"	16.9375	16.25	17.0625
20"	18.9375	18.25	19.0625
24"	22.875	22.75	

30"	26.5	26.625	
36"	33.125	33.25	
42"	39.125	39.25	

Installation of Mechanical Joint Follower Glands

M&H / Kennedy Valve Product Engineering has done numerous lab test of mechanical joint glands and offers the following general installation guidelines.

- a. The use of a food grade pipe 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 as many as five repetitions of tightening to assure even torque stress.
- c. Torques in excess of 200 ft. - lbs. have the potential to damage AWWA C504 Butterfly valves. It is important to note that previous follower glands were manufactured of cast iron, which would fail during an inappropriate installation process. With the mechanical joint glands produced today, torques in excess of suggested guidelines transfers damage potential from the gland to the valve.
- d. Nut torques of 80 ft - lbs. are almost always sufficient to insure a good seal of a mechanical joint gland. Nut torque of approximately 120 ft. - lbs. is always sufficient to effect a good seal of a mechanical joint gland.

AWWA recommends in the appendix to AWWA C-111 the following torques for mechanical joint bolting:

3"	45 to 60 lbf-ft
4"-24"	75 to 90 lbf-ft
30"-36"	100 to 120 lbf-ft
42"-48"	120 to 150 lbf-ft

Flanged End Connection for AWWA Valves

GENERAL

Standard flanged ends for M&H / Kennedy butterfly valves (BFV) are Class 125-B flanges as per ANSI B16.1 (1989). Hydrostatic Shell Test Pressures for Class 125-B flanges are stipulated in Table 2 of this specification.

For 100-degree water, ANSI Class 125-B 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 Kennedy Valve recommends a maximum of 250 psi for 14” and larger Class 125B flanges.

ANSI Class 250-B flanges are an available option for M&H / Kennedy BFV, having hydrostatic shell test pressure rating of 450 psi for cold water service.

Since a variety lay of lengths are available for flanged end valves, Confirm lay length when ordering valves for new or replacement installations. All bolting patterns should also be confirmed.

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.

Bolt torques for flanged valves should be based on the yield strength of the bolt. Consult the “Tightening Torque Guide” for the SAE grade bolts being supplied.

Tapped Holes & Threaded Studs for Flanged End Butterfly Valves

Most sizes of M&H 4500-02 and 1450-02 butterfly valves use 4 tapped holes in the flange end. These are located to allow the use of a threaded stud (or rod) at locations where the actuator or end cover assembly may interfere with the installation of standard bolts & nuts.

The dimensional drawings show the "S" dimension which indicates the depth of the tapped holes. 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.

<u>Valve size</u>	<u>"S" = Depth of tapped holes</u>	<u>"AB" = Size of tap</u>
4	15/16"	5/8 - 11
6	1"	3/4 - 10
8	1 1/8"	3/4 - 10
10	N/A	
12	N/A	
14	1 3/8"	1 - 8
16	1 7/16"	1 - 8
18	1 9/16"	1 1/8 - 7
20	1 11/16"	1 1/8 - 7
24	1 7/8"	1 1/4 - 7

M&H in the past has published the required stud length for commonly used flanges. However due to the variety of flanged fittings & thickness now available this dimension may not apply in all cases.

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.

Operation of M&H Butterfly Valves with Traveling Nut Actuators

GENERAL

Operational criteria for rubber seated Butterfly Valves (BFV) is covered in Appendix “A”, section A.8, of the American Water Works Association (AWWA) C504. Briefly stated, this information covers:

1. (A.8.1) “Do not permit operation of any valve at pressures above the rated pressure of the valve.”
2. (A.8.2) “Do not exceed 300 ft-lb input torque on actuators with wrench nuts and do not exceed 200 lb rim pull for handwheel or chainwheels”.
3. (A.8.3) “If a valve is stuck in some intermediate position between open and closed, check first for jamming in the actuator” - and “do not force the disc open or closed” which can severely damage internal parts.

INPUT TORQUES

Many traveling nut actuators provide for overload protection that can withstand input torques beyond the recommendations of section A.8.2. (300 ft-lb on wrench nuts and 200 lb-ft rim pull on handwheels). However this safety factor is less prevalent with worm gear actuators. Since all maintenance personnel may not be fully aware of what type of actuator is used, it is considered good practice to utilize the above stated input torques as an operational guideline.

THROTTLING

The M&H traveling nut actuator is designed hold in place at any intermediate position and not allowing line flow to back drive the disc. Throttling operation that generates velocities up to 16 feet per second (fps) is acceptable as 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.

WATER HAMMER

When closing valves, consideration must be given to the potential for water hammer as a result of closing a valve too rapidly.

The M&H traveling nut actuator generally has a number of turns equal to approximately 2 to 3 times the valve size. Note that BFV may be equipped with an alternate manual actuator to meet needs of a specific application. See the related chart for the number of turns specific to actuator used. Turns to operate worm gear actuators may greatly vary from the turn range of traveling nut actuators.

A traveling nut actuator incorporates the benefit of slowing as it closes at the same input speed - which serves to minimize the potential for water hammer. Despite anti-water hammer characteristics, it is 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.

Service note;

Do not remove a BFV actuator while under flow and pressure. Lacking an actuator, a BFV wants to close in the presence of flow and will thus create a hazardous water hammer situation. Also the actuator may serve to retain shaft seals, which could be ejected lacking the actuator mounted on the valve.

Turns to Operate M&H #4500 / #1450 Butterfly Valves

M&H Valve traveling nut actuators for the #4500 / #1450 butterfly valves (BFV) are sized to meet requirements of American Water Works Association C504 for class 150B except as noted. Standard applications utilize the following actuators.

<u>SIZE</u>	<u>MODEL</u>	<u>TURNS</u>
4"	#65	16 1/2
6"	#150	16 1/2
8"	#250	24
10"	#510	36
12"	#510	36
14"	#1250	48
16"	#1250	48
18"	#1250	48
20"	#1250	48
24"	#2200	72
30"	#2200	72
36"	#2200 (150B only)	72
36"	#4350 (250B)	90
42"	#4350 (150B and 250B)	90
48"	Auma GS200 (Worm) (150B and 250B)	58

Note that butterfly valves may be equipped with an alternate manual actuator to meet needs of a specific application. See the related chart for the number of turns specific to actuator used. Turns to operate traveling nut actuators may greatly vary from the number of turns required for worm gear type actuators.

M&H Style 4500 Butterfly Valve Disassembly & Assembly Procedures Sizes 4" thru 24"

GENERAL

All rubber sealing components for M&H butterfly valves (BFV) can be replaced without removal of the shaft & disc, thus, the need for a complete valve disassembly is virtually non-existent. M&H BFV's comply with the related maintenance reference in AWWA C504-00, Appendix A.9, noting a design that "permits field adjustment or replacement of rubber seats."

The following information reviews the valve disassembly and reassembly process. Additional service memos are available with more detailed information concerning replacement of rubber sealing components and actuator adjustments.

DISASSEMBLY

1. Depressurize and drain line. Place valve in closed position before removing from the line and prior to disassembly.
2. Remove the hex nuts that retain the traveling nut actuator to the valve body. Pull actuator from the shaft. Due to tight tolerances, leverage may be required to work it free from the keyed portion of the shaft. Recover key from shaft or actuator bore. (For valves with worm gear and/or automated actuators, see information specific to the manufacturer and model.)
3. Remove end cover from valve body
4. To remove the rubber seat, place vane in a near closed position and remove seat retention screws. Open valve 20 degrees and lift the seat edge up from the vane recess area. If required, tap lightly on the seat edge to bump the seat away from the recess on the opposite side of the disc. Gently work the rubber seat free.
5. Re-close valve and mark operator shaft & thrust shaft to indicate shaft to vane relationship to aid in reassembly. Number parts to insure reassembly in their respective location.
6. Using a fine blade screwdriver or other sharp tool, work seal cartridge out of valve body and pull off of shaft.
7. Remove stainless steel torque plugs and/or pins, which retain vane to the valve shaft.
8. Pull operator shaft from vane & valve body. Remove thrust shaft from vane & valve body.
9. Recover Teflon sleeve bushings from shaft bore in valve body.

EXAMINATION & REASSEMBLY

1. Wipe parts clean and check for excessive wear, burrs, or cut rubber-sealing components. Replace rubber seals, seat ring, and sleeve bushings, if necessary.
2. Lubricate bushings with NO-OX-ID and insert in bores of both ends of body.
3. Lubricate and install O-ring seals on operator shaft. Insert shafts into body & bushings, being careful not to damage seal. Note the location of shaft to vane alignment marks made prior to disassembly.
4. Insert vane into body from side opposite stainless body seat ring. Push shafts into vane bores. Use care to insure alignment for torque plug and/or pin installation.
5. Coat torque plugs with Permatex and thread into vane.
6. Lubricate end cover gasket & install end cover and tighten the cap screws.
7. Lubricate metal seal ring with silicone and slide over shaft on actuator end. Remove any burrs on key and install in keyway.
8. Install actuator over shaft with key. If installation alignment with the key in place is not easily achieved, install the actuator without key. Leave mounting nuts loose. Remove actuator cover. (Note that actuator is 90% grease filled and provisions should be made to capture and reinstall grease). Align shaft and lever keyway, and drive key into place.
9. Level the vane in relation to the body seat ring. Tighten actuator mounting nuts and cycle to check operation.
10. Install vane seat ring as per the following:
 - a) Close valve to within 10 degrees of full closure
 - b) Lubricate replacement seat with a FDA approved grease or pipe lubricant. Lay seat onto disc and slide into place. Gentle tapping on the seat ring can assist in setting into place. Once seat is located in seat recess, it can be rotated for retention screw alignment. Start self-locking seat adjusting screws by hand and continue to spin into place using a socket with a vertical drive only.
 - c) Fully close valve and inspect vane for level position corresponding to a centered position within the stainless steel body seat ring. (If seat is not level, refer to actuator adjustment information to level vane.)
 - d) Tighten seat screws until a .002 feeler gage is snug when placed between the rubber seat and the stainless steel body seat adjacent to the adjusting screw. With minimal force on maximum 5" wrench leverage, evenly snug the seat screws one-third turn more working in a circular pattern. Re check all screws to assure that they are tight. (180 to 200 inch lbs for 14" thru 24" BFV)
 - e) Test valve as per AWWA C504 sec. 5.2.2.2 prior to installation.

SEAT ADJUSTMENT

1. Be sure that seating area is free from debris.
2. Fully close valve and confirm level position corresponding to a centered position within the stainless steel body seat ring. If seat is not level, refer to service document "M&H #4500 Butterfly Valve Traveling Nut Actuator, External Travel Stop Adjustment" (or information specific to the actuator being used).
3. If seat leakage is occurring, determine the location where leakage is occurring and adjust corresponding seat screws. Recheck all screws as noted in section 10-d above
4. Test valve in accordance with AWWA C504 section 5.2.2.2.

LUBRICANTS

1. NO-OX-ID, a special WW rust preventative as manufactured by Dearborn Chemical Division, WR Grace & Co., Chicago, IL, or equal.
2. No. 111 Silicone Compound as manufactured by Engineering Products Division, Dow Corning Corp., Midland, MI, or equal.

M&H Style 4500 Butterfly Valve Disassembly & Assembly Procedures Sizes 30" thru 48"

GENERAL

All rubber sealing components for M&H butterfly valves (BFV) can be replaced without removal of the shaft & disc, thus, the need for a complete valve disassembly is virtually non-existent. M&H BFV's comply with the related maintenance reference in AWWA C504-00, Appendix A.9, noting a design that "permits field adjustment or replacement of rubber seats."

The following information reviews the general valve disassembly and reassembly process. Additional service memos are available with more detailed information concerning field replacement of rubber sealing components and actuator maintenance.

DISASSEMBLY

1. Depressurize and drain line. Place valve in closed position before removing from the line and prior to disassembly.
2. Remove the hex nuts that retain the traveling nut actuator to the valve body. Pull actuator from the shaft. Due to tight tolerances, leverage may be required to work it free from the keyed portion of the shaft. Recover key from shaft or actuator bore. (For valves with worm gear and/or automated actuators, see information specific to the manufacturer and model.)
3. Remove end cover from valve body
4. To remove the rubber seat, place vane in a near closed position and remove seat retention screws. Open valve 20 +/- degrees and lift the seat edge up from the vane recess area. Gently work the rubber seat free.
5. Re-close valve and mark operator shaft & thrust shaft to indicate shaft to vane relationship to aid in reassembly. Number parts to insure reassembly in their respective location.
6. Using a fine blade screwdriver or other sharp tool, work seal cartridge out of valve body and pull off of shaft. Do not remove thrust bearing.
7. Remove stainless steel torque plugs and/or pins, which retain vane to the valve shaft.
8. Pull operator shaft from vane & valve body. Remove thrust shaft from vane & valve body.
9. Recover Teflon sleeve bushings from shaft bore in valve body.

EXAMINATION & REASSEMBLY

1. Wipe parts clean and check for excessive wear, burrs, or cut rubber-sealing components. Replace rubber seals, seat ring, and sleeve bushings, if necessary.
2. Lubricate bushings with NO-OX-ID and insert in bores of both ends of body.
3. Lubricate and install O-ring seals on operator shaft. Insert shafts into body & bushings, being careful not to damage seal. Note the location of shaft to vane alignment marks made prior to disassembly.
4. Insert vane into body from side opposite stainless body seat ring. Push shafts into vane bores. Use care to insure alignment for torque plug and/or pin installation.
5. Coat taper pins with Permatex and insert into original holes in vane as marked. Drive pins solidly into place. Coat fasteners with Permatex and tighten securely.
6. Lubricate end cover gasket & install end cover and tighten the cap screws.
7. Check centering of vane by measuring from vane to edge of body. Make any adjustment using proper screws in thrust bearing.
8. Lubricate metal seal ring with silicone and slide over shaft on actuator end. Remove any burrs on key and install in keyway.
9. Install actuator over shaft with key. If installation alignment with the key in place is not easily achieved, install the actuator without key. Leave mounting nuts loose. Remove actuator cover. (Note that actuator is 90% grease filled and provisions should be made to capture and reinstall grease). Align shaft and lever keyway, and drive key into place.
10. Level the vane in relation to the body seat ring. Tighten actuator mounting nuts and cycle to check operation.
11. Install vane seat ring as per the following:
 - a) Close valve to within 10 degrees of full closure
 - b) Lubricate replacement seat with a FDA approved grease or pipe lubricant. Lay seat onto disc and slide into place. Gentle tapping on the seat ring can assist in setting into place. Once seat is located in seat recess, it can be rotated for retention screw alignment. Start self-locking seat adjusting screws by hand and continue to spin into place using a socket with a vertical drive only.
 - c) Fully close valve and inspect vane for level position corresponding to a centered position within the stainless steel body seat ring. (If seat is not level, refer to actuator adjustment information to level vane.)
 - d) Tighten seat screws until a .002 feeler gage is snug when placed between the rubber seat and the stainless steel body seat adjacent to the adjusting screw. Working in a circular pattern, evenly snug the seat screws to 90 inch pounds. Tighten all screws to 150 inch pounds (for CL150B valves).
 - e) Test valve as per AWWA C504 sec. 5.2.2.2 prior to installation.

SEAT ADJUSTMENT

1. Be sure that seating area is free from debris.
2. Fully close valve and confirm level position corresponding to a centered position within the stainless steel body seat ring. If seat is not level, refer to service document "M&H #4500 Butterfly Valve Traveling Nut Actuator, External Travel Stop Adjustment" (or information specific to the actuator being used).
3. If seat leakage is occurring, determine the location where leakage is occurring and adjust corresponding seat screws. Re-check all screws as noted in section 11-d above
4. Test valve in accordance with AWWA C504 section 5.2.2.2.

LUBRICANTS

1. NO-OX-ID, a special WW rust preventative as manufactured by Dearborn Chemical Division, WR Grace & Co., Chicago, IL, or equal.
2. No. 111 Silicone Compound as manufactured by Engineering Products Division, Dow Corning Corp., Midland, MI, or equal.

Seat Adjustment for M&H #4500 / # 1450 Butterfly Valves

M&H Butterfly Valves utilize a seat design that provides for end user maintainability with tools & skills common to maintenance staff. Where safe access is provided, this can be achieved with the valve in line.

If it is determined that there exist leakage past the seat, utilize the following procedure to verify the source of leakage and adjust the seat if required.

1. Be sure that seating area is free from debris.
2. Fully close valve and confirm level position corresponding to a centered position within the stainless steel body seat ring. (If seat is not level, refer to actuator adjustment information to level vane.)
3. Determine the location where leakage is occurring and adjust seat screws with minimal 'three finger force' on maximum 5" wrench handle. This will compress the rubber seat - pressing it outward to seal against the stainless steel body seat ring. Re check remaining seat screws to assure that they are tight, working in a circular pattern. (180 to 200 inch lbs for 14" thru 24" BFV)
4. Test valve in accordance with AWWA C504 section 5.2.2.2.

Field Seat Replacement for M&H #4500 Butterfly Valves

GENERAL

The dependability of the M&H mechanically retained seat on the disc butterfly valve (BFV) design has been well established over the past 38 years, with thousands of our AWWA C504 valves service. Field replacement of the rubber seat can be accomplished with comparative ease. However, sales records of repair parts indicate this remains close to a non-existent service need.

In the event that seat replacement is required, it usually as a result of objects becoming lodged in the seat area and seat damage occurred in attempts to achieve closure.

M&H BFV's are designed with rubber seats that can be replaced without removal of the shaft & disc assembly. This can be accomplished at the site of installation for all sizes with tools and skills common to maintenance staff. Where safe access is provided, this can be achieved with the valve in line.

M&H BFV's comply with the related maintenance reference in AWWA C504-00, Appendix A.9, noting a design that "permits field adjustment or replacement of rubber seats."

REMOVAL OF EXISTING SEAT

1. With disc in substantially closed position, remove seat retention screws.
2. Open valve 20 degrees to remove the seat.
3. Lift the near side seat edge up from the disc recess area and, using a rubber mallet or hammer & block of wood, tap lightly on the seat edge to bump the seat away from the recess on the opposite side of the disc.
4. Gently work the disc 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 disc and from stainless steel seating surface in the valve body.

SEAT REPLACEMENT

1. Close valve to within 10 degrees of full closure
2. Fully lubricate seat edge with a FDA approved grease or pipe lubricant. Use extra lubricant at contact area near the shaft locations. Lay seat on disc and slide into place. Gentle tapping on the seat ring with a rubber mallet or via a block of wood can assist in setting into place. Once seat is located in seat recess, it can be rotated for retention screw alignment. Start self-locking seat adjusting screws by hand then snug evenly to secure the seat to the disc. Do not begin compression of the rubber seat at this point.
3. Fully close valve and inspect vane for level position corresponding to a centered position within the stainless steel body seat ring. (If seat is not level, refer to actuator adjustment information to level vane.)
4. Tighten seat screws until a .002 feeler gage is snug when placed between the rubber seat and the stainless steel body seat adjacent to the adjusting screw. With minimal force on maximum 5" wrench handle, evenly snug the seat screws approximately one-third turn more working in a circular pattern. Re check all screws to assure that they are tight. (180 to 200 inch lbs for 14" thru 24" BFV)

5. Test in accordance with AWWA C504 sec. 5.2.2.2 prior to installation.

Lay valve flat with seat down and place a test flange on the non-seat side of the valve. Completely fill valve with water and connect test pump. Gradually introduce water pressure to valve up to the specified working pressure. If necessary, reposition and secure valve on its side and re-adjust seat retention screws.

PARTS REQUIRED

1. Seat ring
2. Seat retention screws - with pre applied 'nylock'.
3. Lubricant (Dow #111 or equal).

TOOLS REQUIRED

1. 7/16" socket, 4" thru 12" sizes - or 9/16" socket, 14 thru 24" sizes.
2. Adjustable angle socket wrench or open-end wrench, 5" length.
3. Screw driver.
4. Rubber mallet or hammer with wood block.
5. Feeler gauge, .002

ESTIMATED SERVICE TIME

Approximately 30 minutes for 4" – 12" valve, and 45 minutes for 14" – 24" valve.

Replacement of O-Ring Shaft Seals for M&H 4500 Butterfly Valves

GENERAL

M&H butterfly valves are equipped with O-ring shaft seals, which do not require periodic adjustment. Generally, replacement of shaft seal O-rings are only required as a result of prolonged service in modulating applications.

To obtain the correct replacement seals, identify the valve model, size, and year of manufacture. M&H / Dresser butterfly valves produced prior to 1990 used a hex shaft seals rather than the round shaft & seals currently used.

Replacement O-ring shaft seals should be performed in the absence of flow and pressure. The valve should be in the closed position.

The following details the procedure to replace the shaft seal located at the actuator.

REMOVAL OF EXISTING SHAFT SEAL

1. Depressurize line and close valve.
2. Remove first the housing cover cap screws and cover plate only.
3. Remove grease from actuator. Since the housing is 90% grease filled, have a bucket and scoop tool available to collect the grease.
4. Mark the actuator position in relation to the valve body for reassembly.
5. Remove mounting nuts and pull actuator from body and off of keyed shaft.
6. Using a fine blade screwdriver or other sharp tool, work seal cartridge out of valve body and pull off of shaft.
7. Inspect the seal cartridge and O-rings for damage and replace as required.

REPLACEMENT OF SHAFT SEAL

1. Inspect all machined surfaces for any irregularities that may allow leakage.
2. Lubricate and install O-ring seal cartridge. All bearing and machined surfaces must be free of dirt, burrs and foreign elements.
3. Replace the actuator housing. Align keyway and drive key into place.
4. Use alignment marks made prior to disassembly to position actuator in relation to the valve body. Fully close valve and firmly tighten mounting nuts.
5. Operate valve from full closed to full open to full close. Observe that crosshead travels to the recess of lever at both ends of travel and there is no binding throughout travel of crosshead.
6. Replace lubricant into actuator.
7. Use Permatex to seal cover plate and replace to actuator casing.
8. Adjust actuator position as per service information covering Actuator Adjustment for M&H #4500 Butterfly Valves.

NOTE: Lubricant used - EP grease - (Lithium-Moly-Grease) - Beacon Q2, as manufactured by Humble Oil & Refining Co, Houston, Texas 77001.

M&H Butterfly Valve Traveling Nut Actuator Troubleshooting & General Service Information

GENERAL

Traveling nut actuators are standard equipment for all manually operated M&H / Kennedy Butterfly Valves (BFV) thru 42" in size. Standard production operators are sized as per American Waterworks Association (AWWA) C504 for Class 150B service - or for Class 250B service as required.

Instances of major mechanical failure are virtually non-existent for M&H traveling nut actuators. This is due to simplicity of the direct drive lever design - and the ability to withstand input torques exceeding the requirement of AWWA C504.

When servicing buried actuators, excavations must provide sufficient access for the repair process. Adequate shoring of trench walls must protect the work area. This is especially critical when servicing side-mounted actuators. When working in confined spaces such as manholes, vaults, or trenches, proper ventilation must be supplied.

An important service note - Do not remove a BFV actuator while under flow and pressure. Lacking an actuator in the presence of flow and pressure, the BFV may slam closed creating a hazardous water hammer situation. The actuator may also serve to retain shaft seals and bearings, which could be ejected by line pressure without the actuator mounted on the valve.

Prior to servicing, properly identify the BFV model and its actuator and obtain the correct service information. Also, confirm the opening direction.

The most likely cause for an operating resistance problem would be an internal obstruction, which is impeding movement of the valve disc. However, an internal obstruction can be the most difficult of all possible scenarios to remedy, since this may require removal of the valve from the line.

A detailed description of the exact nature of operating resistance can provide a good indication as to the source of the problem. Is the valve open or closed, fully locked, or is resistance encountered after some number of turns short of full operation? This information will help to determine if the obstruction is: 1) External, 2) Internal to the Actuator, or 3) Internal to the Valve.

See M&H BFV memo regarding 'Butterfly Valve Actuator Sizing' to determine the number of turns to operate from full open to close that applies to each valve size and/or pressure class.

1) External Obstruction

- a) Check operating nut clearances in buried service valve boxes and/or binding of operational accessories such as, extension stems, stem guides, and chain wheels.
- b) 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.
- c) An improperly fitted operating nut may cause leaning to the point of contacting the thrust plate. Loosening the op nut can confirm this possibility.
- d) Confirm the thrust plate is securely mounted on the actuator housing. If the thrust plate has become loose, fully thread the input shaft into the actuator housing and re-tighten by turning to the left (backwards). Take provisions to lock threads to prevent future loosening.

2) Obstruction, Internal to the Actuator

- a) If the actuator is locked, it is possible that machining shavings or other debris is binding the internal input shaft to crosshead nut threading. Try operation by sharply shaking from the open to close position in attempt to dislodge any obstructions.

If the above fails to resolve the problem, excavate to expose the actuator and provide ample service access (use appropriate trench shoring measures). In advance of removing the cover plate, have a bucket and scoop tool available to remove & retain the grease - which 90% fills the actuator housing. Once the mechanical actuator components are exposed, there exists an opportunity to visually detect obstructions related to the input shaft, crosshead nut, and lever.

- b) Check for binding between the thrust cap to the input shaft by loosening the thrust cap (thread off to right). If this allows the valve to operate, a tolerance problem in this area may exist.
- c) If the input shaft is moderately bent, limited operation may be achievable with operation gradually becoming stiff.
- d) If the lever machining relationship is improper between the lever bore and lever forks, again limited operation may be achievable - gradually becoming stiffer at midrange turns.

To aid in confirmation of issues #c and #d, relieve line pressure and loosen the actuator mounting bolts. This may serve to minimize binding between the disc shaft and actuator assembly. If the input shaft is bent or a machining relationship problem exists - the loosened mounting bolts can allow for operation - but the housing will wobble. If binding of this nature is detected, the actuator should be replaced. (Obtain service memo regarding disassembly & assembly.)

3) Obstruction, Internal to the Valve

- a) Minimum Mating Inside Diameter- The ID of the adjoining pipe may interfere with disc opening. This is generally a consideration only when using thick wall piping systems with mechanical joint end valves. Consult the 'Minimum Mating ID Chart' for specific data.

This situation may allow disc/actuator movement to be normal from the closed toward open for up to 8 +/- turns. As the disc begins to contact the pipe wall, operation would become stiff for a few turns and then stop - or break free as the disc is forced past the pipe interference.

If the ID chart data and operating conditions point to disc interference as the problem, the valve must be removed and appropriate piping modifications completed. Inspect the seat for damage prior to reinstalling valve.

- b) An internal obstruction is always to be considered among the most likely scenarios, however, it can be the most difficult to remedy since valve removal is generally required.

Remove the actuator - but only in the absence of line pressure & flow with the valve in a substantially closed position. Use a pipe wrench and attempt to turn the shaft. Provisions should be taken to minimize damage to the shaft by the wrench. Prior to reassembly, use a file to remove burrs created by the wrench.

Failing to turn the shaft with low input torque, remove the valve from the line and clear obstructions. Prior to re-installation, inspect the rubber seat and replace if necessary.

4) Mechanical Failure

Any major mechanical failure of the valve or the manual actuator are likely be caused by factors related to the application, installation, or improper operation. Contact M&H / Kennedy Valve to review operating conditions and related service needs.

SERVICE INFORMATION

This information is substantially structured toward identification of the source of an actuator problem. If its determined to disassemble, remove, and/or replace the actuator, contact M&H / Kennedy Valve to obtain more specific service information concerning disassembly, repairs, and re-assembly.

M&H Butterfly Valves, Shaft and Keyway Sizing for Actuator Adaptation

Model#	Size	Shaft Ext	Shaft Diameter* (round)	STD KEY
65	4	4 5/8	5/8	3/16 sq x 3 3/8"
150	6	4 5/8	1	1/4 sq x 3 1/2
250	8	4 5/8	1 1/8	1/4 sq x 3 1/2
510	10	5 1/2	1 1/2	3/8 sq x 3 5/8"
510	12	5 1/2	1 1/2	3/8 sq x 3 5/8"
1250	14	7 5/16	2	1/2 sq x 4 3/4
1250	16	7 5/16	2	1/2 sq x 4 3/4
1250	18	7 5/16	2	1/2 sq x 4 3/4
1250	20	7 5/16	2	1/2 sq x 4 3/4
2200	24	7 7/8	3.248	3/4 sq x 5 1/4
2200	30	8 7/8	3.248	3/4 sq x 5 1/4
2200	36	8 7/8	3.248	3/4 sq x 5 1/4
4350	42	7 7/8	3.25	3/4 sq x 5 3/4
GS200	48	8 5/16	4.986	1 1/4 sq x 6

*Shaft Diameters are +/- .003

* Full size shaft in body of valve is the same or greater than required AWWA C504 minimum diameters.

When ordering butterfly valves for field actuator adaptation, obtain the specific data concerning shaft size, shaft extension, keyway, and mounting pattern required.

The above noted M&H shaft dimensions are subject to change. Confirm these dimensions when ordering BFV's for field actuator adaptation.

M&H Butterfly Valve Handwheel Cross Reference to RSGV

Traveling nut actuators for the M&H #4500 / #1450 BFV now have input shaft sizing that allows for use of handwheels or operating nuts utilized for our 4000 / 7000 series RSGV. However, these do not cross over size to size. The following cross-reference chart identifies which RSGV handwheel or op nut adapts to each BFV actuator size.

M&H Actuator	Model M&H BFV Size		RSGV Hdw/Op Size	Part # (left) (Hdw/op nut)
65	4"	=	8"	Hdw LH226387 op nut LH226374
150	6"	=	8"	LH226387 LH226374
250	8"	=	8"	LH226387 LH226374
510	10"-12"	=	8"	LH226387 LH226374
1250	14"-20"	=	10"-12"	LH226389 LH226376
2200	24"-36"	=	10"-12"	LH226389 LH226376
4350	36"-42"		NA	

Note that shaft sizing was modified to accommodate interchangeability in 2000. This cross-reference chart does not apply to valves / actuators dated 1999 or earlier. Contact M&H Valve for shaft size data for prior production actuators.

Procedure for Field Disassembly / Assembly M&H Manual Actuator Model #510 (10" and 12")

GENERAL

M&H butterfly valves are generally equipped with a manual traveling nut actuator. Due to the reliability of the M&H direct drive lever design - disassembly is rarely required. To access shaft seals, the actuator may be removed as a unit – in the absence of flow and pressure.

DISASSEMBLY (Open Left Valves)

1. Depressurize line and close valve.
2. Remove housing cover cap screws and cover plate. Remove grease from actuator. Have a bucket & scoop tool available to collect the grease, which 90% fills the housing.
3. Remove operating nut or handwheel. Remove thrust cap - which threads off by turning right.
4. Remove input shaft by turning out of crosshead.
5. Pull lever with crosshead assembly off of shaft. Remove key from shaft or lever. Do not turn shaft. NOTE: If lever and crosshead assembly binds between shaft and/or housing, loosen housing mounting nuts slightly to help with removal of lever assembly.

EXAMINATION AND ASSEMBLY

1. For assembly: Note that all bearing and machine surfaces are free of dirt, burrs and foreign elements. Check O-rings for damage and replace as required.
2. Lubricate machined surfaces of crosshead & lever with EP grease. Lubricate crosshead sleeves (if applicable) and install on crosshead - locking them in place with retaining rings. Install crosshead in lever.
3. Lubricate valve shaft and install lever assembly in closed position on shaft. Push lever into housing, aligning threaded hole in crosshead toward input shaft bore in housing. Install key.
4. Clean key and keyway in shaft and lever. File lead edge of key and lubricate to reduce binding during installation. Align key ways and install key by lightly tapping with a small hammer.
5. Lubricate entire input shaft with EP grease. Clean thrust collar area of any chips, dirt, or foreign elements. Turn input shaft through crosshead until crosshead or lever is snug against stop in housing and thrust collar is drawn tight into counterbore of housing.
 - a. For open right actuators, back off input shaft at least two (2) full turns. This will allow the input shaft to seat against the counter bore of housing.
(Failure to do this will cause the thrust cap to tighten falsely against the input shaft thrust collar in a raised position.)
 - b. On actuators with thrust washers, lubricate spacer and thrust washers with EP grease. Insert spacer (1/32" thick), then thrust washer (1/8" thick) prior to inserting input shaft. After installing shaft, install remaining 1/8" thick thrust washer so that it rests on collar face and in housing counter bore. (NOTE: No spacer is used above thrust washer.)
 - c. On older actuators with needle bearings, lubricate needle thrust bearings and thrust races. Insert thrust race (1/32" thick) then needle thrust bearing, then another thrust race (1/32" thick) prior to inserting input shaft. After inserting input shaft install another set of thrust bearings as above.

6. Remove excess lubricant from top of thrust washer.
7. Apply a light film of EP grease to internal machined surfaces of thrust cap. Install O-rings and slide over input shaft. Screw thrust cap onto housing and tighten with 450-foot pounds torque.
8. If mounting nuts were loosened during disassembly, fully close valve and tighten firmly.
9. Operate valve from full closed to full open to close. Observe that crosshead nestles in recess of housing at both ends of travel and there is no binding throughout travel of crosshead.
10. Reinstall grease and replace cover - replacing position indicator if applicable. Attach nut or handwheel. Use Permatex #2 to seal the cover plate to the casing.
11. Return line to service and confirm full closure of valve. If required, closure stop may be adjusted as covered in the appropriate M&H 'Actuator Adjustment' service memo.

NOTE: Lubricant used - EP grease - (Lithium-Moly-Grease) - Beacon - Q-2, as manufactured by Humble Oil & Refining Co, Houston, Texas 77001.

Procedure for Field Disassembly / Assembly M&H Manual Actuator Model #1250 (14" thru 20")

GENERAL

M&H butterfly valves are generally equipped with a manual traveling nut actuator. Due to the reliability of the M&H direct drive lever design - disassembly is rarely required. To access shaft seals, the actuator may be removed as a unit – in the absence of flow and pressure.

DISASSEMBLY (Open Left Valves)

1. Depressurize line and close valve.
2. Remove housing cover cap screws and cover plate. Remove grease from actuator. Have a bucket & scoop tool available to collect the grease, which 90% fills the housing.
3. Remove operating nut or handwheel. Remove thrust cap - which threads off by turning right.
4. Remove input shaft by turning out of crosshead.
5. Pull lever with crosshead assembly off of shaft. Remove key from shaft or lever. Do not turn shaft. NOTE: If lever and crosshead assembly binds between shaft and/or housing, loosen housing mounting nuts slightly to help with removal of lever assembly.

EXAMINATION AND ASSEMBLY

1. For assembly: Note that all bearing and machine surfaces are free of dirt, burrs and foreign elements. Check O-rings for damage and replace as required.
2. Lubricate machined surfaces of crosshead & lever with EP grease. Lubricate crosshead sleeves (if applicable) and install on crosshead - locking them in place with retaining rings. Install crosshead in lever.
3. Lubricate valve shaft and install lever assembly in closed position on shaft. Push lever into housing, aligning threaded hole in crosshead toward input shaft bore in housing. Install key.
4. Clean key and keyway in shaft and lever. File lead edge of key and lubricate to reduce binding during installation. Align key ways and install key by lightly tapping with a small hammer.
5. Lubricate entire input shaft with EP grease. Clean thrust collar area of any chips, dirt, or foreign elements. Turn input shaft through crosshead until crosshead or lever is snug against stop in housing and thrust collar is drawn tight into counterbore of housing.
 - a. For open right actuators, back off input shaft at least two (2) full turns. This will allow the input shaft to seat against the counter bore of housing. (Failure to do this will cause the thrust cap to tighten falsely against the input shaft thrust collar in a raised position.)
 - b. On actuators with thrust washers, lubricate spacer and thrust washers with EP grease. Insert spacer (1/32" thick), then thrust washer (1/8" thick) prior to inserting input shaft. After installing shaft, install remaining 1/8" thick thrust washer so that it rests on collar face and in housing counter bore. (NOTE: No spacer is used above thrust washer.)
 - c. On older actuators with needle bearings, lubricate needle thrust bearings and thrust races. Insert thrust race (1/32" thick) then needle thrust bearing, then another thrust race (1/32" thick) prior to inserting input shaft. After inserting input shaft install another set of thrust bearings as above.

6. Remove excess lubricant from top of thrust washer.
7. Apply a light film of EP grease to internal machined surfaces of thrust cap. Install O-rings and slide over input shaft. Screw thrust cap onto housing and tighten with 450-foot pounds torque.
8. If mounting nuts were loosened during disassembly, fully close valve and tighten firmly.
9. Operate valve from full closed to full open to close. Observe that crosshead nestles in recess of housing at both ends of travel and there is no binding throughout travel of crosshead.
10. Reinstall grease and replace cover - replacing position indicator if applicable. Attach nut or handwheel. Use Permatex #2 to seal the cover plate to the casing.
11. Return line to service and confirm full closure of valve. If required, closure stop may be adjusted as covered in the appropriate M&H 'Actuator Adjustment' service memo.

NOTE: Lubricant used - EP grease - (Lithium-Moly-Grease) - Beacon - Q-2, as manufactured by Humble Oil & Refining Co, Houston, Texas 77001.

**Procedure for Field Disassembly / Assembly
M&H Manual Actuator Model #2200 (24" thru 36")**

GENERAL

M&H butterfly valves are generally equipped with a manual traveling nut actuator. Due to the reliability of the M&H direct drive lever design - disassembly is rarely required. To access shaft seals, the actuator may be removed as a unit – in the absence of flow and pressure.

DISASSEMBLY (Open Left Valves)

1. Depressurize line and close valve.
2. Remove housing cover cap screws and cover plate. Remove grease from actuator. Have a bucket & scoop tool available to collect the grease, which 90% fills the housing.
3. Remove operating nut or handwheel. Remove thrust cap - which threads off by turning right.
4. Remove input shaft by turning out of crosshead.
5. Pull lever with crosshead assembly off of shaft. Remove key from shaft or lever. Do not turn shaft. NOTE: If lever and crosshead assembly binds between shaft and/or housing, loosen housing mounting nuts slightly to help with removal of lever assembly.

EXAMINATION AND ASSEMBLY

1. For assembly: Note that all bearing and machine surfaces are free of dirt, burrs and foreign elements. Check O-rings for damage and replace as required.
2. Lubricate machined surfaces of crosshead & lever with EP grease. Lubricate crosshead sleeves (if applicable) and install on crosshead - locking them in place with retaining rings. Install crosshead in lever.
3. Lubricate valve shaft and install lever assembly in closed position on shaft. Push lever into housing, aligning threaded hole in crosshead toward input shaft bore in housing. Install key.
4. Clean key and keyway in shaft and lever. File lead edge of key and lubricate to reduce binding during installation. Align key ways and install key by lightly tapping with a small hammer.
5. Lubricate entire input shaft with EP grease. Clean thrust collar area of any chips, dirt, or foreign elements. Turn input shaft through crosshead until crosshead or lever is snug against stop in housing and thrust collar is drawn tight into counterbore of housing.
 - a. For open right actuators, back off input shaft at least two (2) full turns. This will allow the input shaft to seat against the counter bore of housing. (Failure to do this will cause the thrust cap to tighten falsely against the input shaft thrust collar in a raised position.)
 - b. On actuators with thrust washers, lubricate spacer and thrust washers with EP grease. Insert spacer (1/32" thick), then thrust washer (1/8" thick) prior to inserting input shaft. After installing shaft, install remaining 1/8" thick thrust washer so that it rests on collar face and in housing counter bore. (NOTE: No spacer is used above thrust washer.)
 - c. On older actuators with needle bearings, lubricate needle thrust bearings and thrust races. Insert thrust race (1/32" thick) then needle thrust bearing, then another thrust race (1/32" thick) prior to inserting input shaft. After inserting input shaft install another set of thrust bearings as above.

6. Remove excess lubricant from top of thrust washer.
7. Apply a light film of EP grease to internal machined surfaces of thrust cap. Install O-rings and slide over input shaft. Screw thrust cap onto housing and tighten with 450-foot pounds torque.
8. If mounting nuts were loosened during disassembly, fully close valve and tighten firmly.
9. Operate valve from full closed to full open to close. Observe that crosshead nestles in recess of housing at both ends of travel and there is no binding throughout travel of crosshead.
10. Reinstall grease and replace cover - replacing position indicator if applicable. Attach nut or handwheel. Use Permatex #2 to seal the cover plate to the casing.
11. Return line to service and confirm full closure of valve. If required, closure stop may be adjusted as covered in the appropriate M&H 'Actuator Adjustment' service memo.

NOTE: Lubricant used - EP grease - (Lithium-Moly-Grease) - Beacon - Q-2, as manufactured by Humble Oil & Refining Co, Houston, Texas 77001.

M&H #4500 Butterfly Valve Traveling Nut Actuator External Travel Stop Adjustment

GENERAL

M&H #4500 Butterfly Valves (BFV), 3" thru 36", are generally equipped a mechanical traveling nut actuator. This actuator serves to minimize water hammer by slowing of the disc as it arrives at final closure at the same input speed. A traveling nut actuator will hold in any intermediate position - prohibiting flow from back driving the disc.

The actuator lever adjustment is set during production and corresponding seating is tested at full closure. As a result, field adjustment is rarely required.

Instances of BFV leakage are infrequent and generally related to new construction rather than long-term use. Leakage past the seat is, in most cases, due to material becoming lodged in the seat area or resulting damage to the seating surfaces. Through flushing of the water system is recommended as a remedy for this situation.

ADJUSTMENT PROCEDURE (For external locking set screw adjuster)

An external locking setscrew adjustment feature was added to M&H BFV's in 1998. (For M&H BFV's without a setscrew adjustment, see service memo regarding 'Operator Shift Adjustment'.)

1. Loosen the jam nut (1 1/8") retaining the allen head set screw. (For open left valves, the closure adjustment is located near the op nut or handwheel)
2. Back off the allen head (3/8") lever stop setscrew.
3. Operate valve in a closing direction to locate the point at which leakage stops and/or the vane is level within the stainless steel body seat ring.
4. If step #3 causes leakage to increase, the disc has over-traveled. Turn in the open direction to locate the point at which leakage stops and/or the vane is level within the stainless steel body seat ring.
5. Fully tighten the lever stop set screw.
6. Tighten jam nut to retain setscrew position.

(Service note - Do not remove a BFV actuator while valve is under flow and pressure.)

M&H #4500 Butterfly Valve Traveling Nut Actuator / Actuator Shift Adjustment

GENERAL

M&H #4500 Butterfly Valves (BFV), 3" thru 36", are generally equipped a mechanical traveling nut actuator. This actuator serves to minimize water hammer by slowing of the disc as it arrives at final closure at the same input speed. A traveling nut actuator will hold in any intermediate position - prohibiting flow from back driving the disc.

The actuator lever adjustment is set during production and corresponding seating is tested at full closure. As a result, field adjustment is rarely required.

Instances of BFV leakage are infrequent and generally related to new construction rather than long-term use. Leakage past the seat is, in most cases, due to material becoming lodged in the seat area. Through flushing of the water system is recommended as a remedy for this situation.

Prior to removal of the valve from the water line it is suggested to consider the following procedure to level the vane.

ADJUSTMENT PROCEDURE (For actuators without external set screw adjuster)

(For M&H BFV's having a setscrew adjustment, see service memo regarding 'External Travel Stop Adjustment'.)

1. Check for disc over-travel (past the closed position) by operating from full closed to slightly open. If leakage stops, adjust to compensate for over-travel by rotating the actuator counter clockwise in step #6.
2. For best results, relieve line pressure
3. Mark the existing operator to valve position to provide indication of subsequent adjustment.
4. Close valve and then open approximately 6 to 8 turns - then turn the valve in the closing direction 2 to 3 turns.
5. Loosen operator-mounting nuts. (Do not remove nuts or actuator)
6. For open left valves, shift operator in a clockwise rotation and tighten bottom nut first and then top nut. (Open right valves shift operator counter clockwise rotation and tighten top nut first.)
7. Close valve and check for positive shut off of flow.

PARTS REQUIRED

None

TOOLS REQUIRED

Open end wrench, 7/8" for 4" thru 8" valve

or

Open end wrench, 1 1/4" for 10", 12", & 14" valve

or

Open end wrench, 1 5/8" for 16" thru 36" valve

ESTIMATED SERVICE TIME

30 minutes

If the actuator adjustment does not successfully resolve the seating issue, it may be necessary to gain access to the seat to determine and resolve the seating question. See service information regarding 'Seat Replacement' to adjust or replace seat.

Service note* - Do not remove a BFV actuator while under flow and/or pressure. Lacking an actuator, a BFV wants to close in the presence of flow and can create a hazardous water hammer situation. Also the actuator may serve to retain shaft seals, which could be ejected without the actuator mounted on the valve.

Procedure for Field Installation of Position Indicator for M&H Traveling Nut Actuators

GENERAL

M&H #4500 butterfly valves (BFV), having our traveling nut actuator, are provided with an actuator mounted position indicator when the order specifies “handwheel” or “above ground service”. BFV’s with a 2” operating nut are typically for buried service and are not equipped with a position indicator – unless otherwise noted on the purchase order.

PARTS REQUIRED

Required parts for adding a position indicator to a non-indicating BFV in the field are shown on M&H drawing #99-0135 and noted below. When purchasing parts, specify the valve size and/or actuator model number and the year of manufacture.

1 ea	#2	Cover, Housing (Specify a drilled cover to accept indicator)
1 ea	#15	Indicator
1 ea	#16	Nut, Hex
1 ea	#17	O-ring
1 ea	#18	Pin, Indicator
		<i>Permatex #2</i>

FIELD INSTALLATION OF POSITION INDICATOR

1. Depressurize line and close valve.
2. Remove the small housing cover cap screws (#14) and #2 cover plate. Have a bucket & scoop tool available to collect the grease, which 90% fills the housing.
3. Install the #17 O-ring on the #18 pin.
4. Place the pin into the lever recess at the shaft location.
5. Replace lubricant and install cover plate (#2), which is drilled for indicator pin. Use *Permatex #2* to seal the cover plate to the housing. Loosely install the cover plate screws and confirm proper operation. Snug all cover plate screws.
6. Install the #15 indicator. Retain indicator with the #16 nut.

Opening Direction Conversion Procedure for M&H Traveling Nut Actuators

GENERAL

M&H butterfly valves are produced to allow flexibility for standard open left operation or provide for open right operation. This is accomplished by providing a shaft with double keyway options for actuator lever attachment. Conversion to the opposite opening direction is accomplished by relocating the key in the alternate position.

OPENING DIRECTION CONVERSION

1. Depressurize line and close valve
2. Remove housing cover cap screws and cover plate. Remove grease from actuator. Have a bucket and scoop tool available to collect the grease, which 90% fills the housing.
3. With the valve in a substantially closed position remove the square key as noted below. The op nut / input shaft may be rotated to relieve stresses against key, however a full closed or near full closed disc position should be reestablished to provide for key installation.
 - a. If the key provides extension out of the shaft, use vise grips to attempt to pull out of shaft & lever if tolerance permits.
 - b. If the key is flush with the shaft & lever assembly, drilling and tapping key and inserting a screw may permit pulling of the key.
 - c. Back off the actuator mounting nuts and pull actuator. This may carry out the key, which may remain accessible as the actuator is pushed back to the valve body - or - it may be necessary to fully remove actuator to access key and/or overcome a tight tolerance fit.
4. Reinstall actuator on to shaft and mounting studs - with mounting nuts threaded loosely to mounting studs.
5. **a.** For conversion from open left to open right operation, turn the op nut / input shaft to the left until the lever assembly is at the lower position in the housing and the lever keyway aligns with the alternate keyed position on the shaft.
5. **b.** For conversion from open right to open left operation, turn the op nut / input shaft to the right until the lever assembly rises to the top position in the housing and the lever keyway aligns with the alternate keyed position on the shaft.
6. Drive key into the keyway. It is suggested to touch up of the lead end of the key with a file to avoid binding.
7. Fully tighten mounting nuts. If valve is properly seated, proceed to step #9.
8. Adjust actuator / seat position as per service information covering Actuator Adjustment for M&H #4500 Butterfly Valves. (This can be done after step #9 if desired)
9. Replace lubricant and replace cover plate using Permatex #2 to seal the cover plate to the casing.

Hardware Sizing Chart

Valve Size	Actuator Model#	Mounting Nut Wrench Size	Key Size
4	150	7/8	1/4 sq x 3 3/8
6	150	7/8	1/4 sq x 3 1/2
8	150	7/8	1/4 sq x 3 1/2
10	510	1 1/4	3/8 sq x 3 5/8
12	510	1 1/4	3/8 sq x 3 5/8
14	510	1 1/4	3/8 sq x 3 5/8
16	1250	1 5/8	1/2 sq x 5 1/8
18	1250	1 5/8	1/2 sq x 5 1/8
20	1250	1 5/8	1/2 sq x 5 1/8
24	2200	1 5/8	5/8 sq x 5
30	2200	1 5/8	5/8 sq x 5
36	2200	1 5/8	5/8 sq x 5

Automation of M&H Butterfly Valves General Information

GENERAL

M&H Valve Co offers automation of the #4500 / #1450 butterfly valves for control requirements of frequent operation, remote operation, hazardous locations, or other applications as required. Automation equipment and related electronic controls are as produced by outside manufacturers with adaptation provided at M&H Valve Co.

APPLICATIONS

Automated valve control systems are very 'application specific'. Torque rating of actuators, motor sizing, control equipment, and weatherproof enclosures are among the specific issues that must be addressed to assure proper application. To assure proper function, all equipment must be fully specified at the time of order. See the 'Automation Valve Information Form' as a guide for furnishing application criteria.

Existing butterfly valves can be retrofitted with automation at the site of installation. The actuator manufacturers local rep can provide assistance for these applications.

INSTALLATION, START UP

A representative of the actuator manufacturer generally provides 'Start up' service. A fee schedule may apply to start up which is separate from the purchase price of the valve. This is based, in part, on the scope of the start up, job site location, and the amount of advance notification provided.

MAINTENANCE

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

As with all equipment, full identification of all mechanical or electronic equipment is required to assure an effective and efficient service response. Data relating to the manufacturer and the electrical current will be indicated on the valve.

When servicing automated valves located in manholes or vaults, 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".

Procedure for Field Disassembly and Assembly M&H Cylinder Actuators

DISASSEMBLY

1. Depressurize line and close valve.
2. Remove one set of tie rod nuts and bland end cylinder head, also tail rod guard and housing cover.
3. Remove cylinder barrel.
4. Remove piston cup by holding onto wrench flats of tail rod and remove hex piston nut.
5. Loosen cylinder connecting nut and remove rod end cylinder head. NOTE: Right hand thread on cylinder head and left hand thread on housing.
6. Remove cartridge with rod seal and tail rod from piston rod.
7. If lever and crosshead assembly appear in a bind between shaft and housing, loosen stud nuts slightly to release lever assembly.

ASSEMBLY

1. For assembly, note that all bearing and machined surfaces are free of dirt, burrs and foreign elements.
2. Lubricate machined surfaces of crosshead, lever and crosshead sleeves with EP grease. Install sleeves on crosshead, locking them in place with retaining rings prior to sliding into lever. Install crosshead in lever and slide on hex shaft. NOTE: Closed position.
3. Lubricate the inside of tail rod bushing with EP grease and install in housing as shown on sub-assembly drawing.
4. Lubricate piston rod seal cartridge with DC-111 and install O-ring and rod seal in cartridge. Be sure that rod seal is installed as shown on sub-assembly drawing (with O-ring packed to the outside).
5. Lubricate piston rod with DC-111 and push through piston rod seal cartridge gently, using care to avoid damaging rod seal. Insert piston rod seal cartridge with piston rod in end of housing, being certain that seals are located as shown on sub-assembly drawing. Push piston rod into bore of crosshead.
6. Lubricate tail rod thoroughly with grease and slide through tail rod bushing and into crosshead. Screw tail rod into piston rod hand-tight (this connection will be fully tightened later - Step 16).
7. Lubricate threads of cylinder connecting nut and mating threads on housing with grease. Screw cylinder-connecting nut onto housing, allowing approximately 1/8" clearance between face of nut and machined shoulder on housing. (NOTE: LEFT-HAND THREAD.)
8. Lubricate threads of rod end cylinder head with grease. Screw into cylinder connecting nut until cylinder head contacts housing. Then loosen connection by turning cylinder-connecting nut slightly, and locate pipe taps on cylinder head in position shown on sub-assembly drawing, or as desired. Hold cylinder head in this position and tighten connecting nut to approximately 250-foot pounds torque. Apply Loctite plastic gasket in groove in each cylinder head.

9. Lubricate O-rings (piston half) with DC-111. Assemble piston halves, O-rings and piston cup on piston rod as shown on sub-assembly drawing and securely tighten both nut and tail-rod-piston-rod connection simultaneously to approximately the torques listed below (hold tail rod with wrench on flats):

4" thru 12" valves	70 ft-lbs
14" thru 20" valves	300 ft-lbs

10. Lubricate entire piston cup rubber outside diameter with DC-111. Slide cylinder barrel over piston cup, registering in groove in cylinder head (rod end).
11. Install cylinder head (blank end) on cylinder barrel so that pipe taps on cylinder head are located in position shown on sub-assembly drawing, or as desired. Insert cylinder tie rods and tighten nuts evenly and securely to approximately the torques listed below:

4" thru 8" valves	30 ft-lbs
10" thru 20" valves	75 ft-lbs

12. Lubricate threads of tail rod guard with grease. Screw tail rod guard into housing, seating firmly on shoulder of tail rod bushing. Tighten to approximately the torques listed below:

4" thru 12" valves	55 ft-lbs
14" thru 20" valves	100 ft-lbs

13. With crosshead tight against end of housing pull stud nuts up tight to approximately the torques listed below:

4", 6", 8" valves	55 ft-lbs
10", 12" valves	150 ft-lbs
14" thru 20" valves	300 ft-lbs

14. Refer to operator changeover sheet. Install housing cover with indicator and tighten cap screws. NOTE: Closing position of indicator.
15. Operate valve one complete cycle from closed to open to closed again to be certain that the entire assembly functions freely and properly, and that indicator shows vane position correctly. NOTE: Operator changeover sheet for helpful hints.

NOTE: Lubricants and chemicals to use:

DC-111 - #111 Silicone Compound - as manufactured by Engineering Products Division, Dow Corning Corp.; Midland, Michigan 48640

Loctite Safety Solvent, and Loctite Plastic Gasket are manufactured by Loctite Corp, Newington, Connecticut 06111.

EP Grease - Beacon Q-2, as manufactured by Humble Oil & Refining Co, Houston, Texas 77001.

Protective Coatings for Butterfly Valves

M&H Valve Co. generally provides one of the following 3 coatings for butterfly valves.

- a. For buried service valves - a 'two part liquid epoxy coating', which complies with American Water Works Association C-550 "Protective Interior Coatings for Valves and Hydrants". This has evolved to the most commonly requested coating system due to the quality of corrosion protection and its field serviceability
- b. An asphalt varnish coating remains an available coating for buried service valves upon request. This also accommodates field touch up if scarred by shipping and handling.
- c. For flanged end BFV with handwheel, a primer coating is standard. This is best suited for finish exterior painting in treatment plant or pump station applications. If a buried service coating is required for a flanged BFV with handwheel, this must be specified at the time of the order.

Note that the heat fusion bonded epoxy coating process (such as used for resilient seat gate valves) is not provided for BFV. Production sequences require installation of rubber components at machined locations prior to coating. As a result, the heat fusion process could subject these rubber components to heat damage.

General Information Regarding the Use of Pota Pox Two Part Epoxy

For buried service butterfly valves, M&H Valve Co. provides a 'two-part liquid epoxy coating' which is in compliance with American Water Works Association C550 "Protective Interior Coatings for Valves and Hydrants."

A two-part epoxy coating system permits field re-coating or touch up to remedy shipping or installation abrasions. The following are to be considered as general guidelines for use of this epoxy system (note item #10).

1. Wear eye protection when removing can closure clips.
2. Wear gloves and eye protection when mixing or applying.
3. Fully mix equal portions of Part #1 Resin and Part #2 hardener.
4. Keep both mixed and unmixed epoxy or components sealed when not in use.
5. Shelf life of mixed epoxy is 4 to 10 hours, depending on the exact mixture and/or temperature.
6. Provide for ventilation when using or mixing.
7. Allow a minimum of 30 minute between coats.
8. Allow 10 hours of drying time before handling or packing for shipment.
9. Vent and allow mixed epoxy to harden before disposal.
10. Epoxy coating products contain solvents and/or other chemical ingredients. Adequate health and safety precautions should be observed during storage, handling, application and curing. For information regarding the potential hazards associated with this product, please refer to the container label or refer to the Material Safety Data Sheet available from the manufacturer.
11. Due to shipping constraints relating to volatile liquids, contact the area 'Tnemec' distributor to obtain 'Pota Pox N140' epoxy coating.