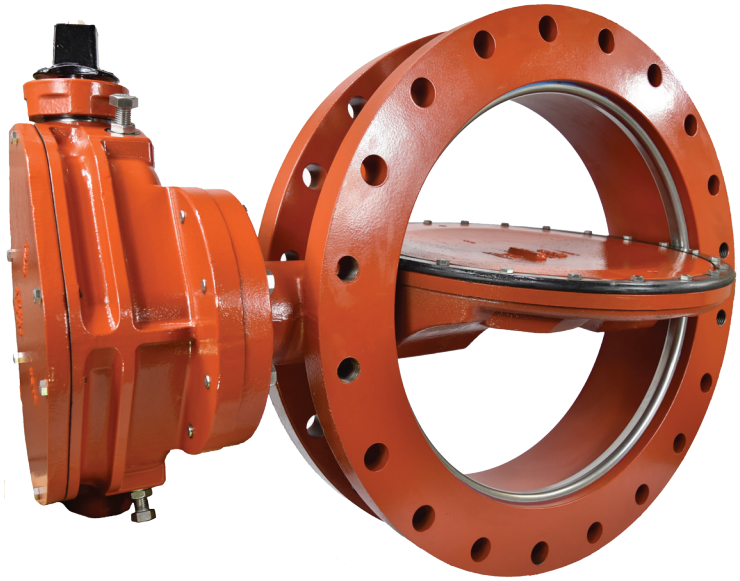
MPI MCWANE PLANT & INDUSTRIAL

# SEAT-ON-DISC
# BUTTERFLY VALVE
## 3"-54" AWWA C504

## INSTALLATION & OPERATION MANUAL



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# INTRODUCTION

Butterfly Valves are commonly used in water transmission and distribution. This manual will provide you with the information needed to properly install, operate, and maintain the valve and to provide long service life.The rubber seat provides a 'zero leakage' alternative to the metal-seated valves. BFVs offer flow control advantages and economy vs. gate valves, which become increasingly more significant with larger sizes.

For pump station and treatment plant applications, BFVs offer flow control advantages (such as throttling) over gate valves. BFVs are manufactured in accordance with the current version of the American Water Works Association (AWWA) C504 standard. BFVs are constructed of ductile iron, stainless steel, rubber seats & seals. The strength of ductile iron along with stainless steel components provide corrosion resistance for buried service applications.

# RECEIVING & STORAGE

Inspect valves upon receipt to ensure correct material, quantity, and any optional equipment has been received. Also inspect all received equipment for any damage which may have occurred during shipment. Contact the McWane Plant & Industrial sales team to report any issues with materials received.

Unload all valves safely to protect both the materials and workers. For valves 36" and larger, use forklifts or slings under skids. For smaller valves, do not lift valves with slings or chains around the operating shaft, operator, or through waterway. Lift these valves with eyebolts or rods through the flange holes.

Protect the valve and operators from weather and the accumulation of dirt, rocks, and debris. Store valves indoors with the valve in the fully closed position to prevent damage to the seating surface by foreign material. When valves fitted with power operators and controls are stored, energize electric operators or otherwise protect electrical control equipment to prevent corrosion of electrical contacts due to condensation resulting from temperature variation. If outdoor storage is required valves need to be protected from weather and foreign materials.

# INSTALLATION

**WARNING:** IInstallation of valves should be performed by experienced installers. Valves should never be used as structural supports and movement into place. Valves are heavy and may include accessories or bolt on pieces which should be handled with caution.

**NOTE: BEFORE INSTALLING THE VALVE:**

1. Prior to installation check that the valve and end joints are clean. Check for damage to the valve.
2. Open and close the valve to insure proper operation.
3. The Inside Diameter (ID) of the mating of thepiping system should be considered BEFORE installing the valve. When BFVs open, the vane will extend into the mating piping system.

It is recommended that valves be installed into piping system in accordance with AWWA M-11 to prevent any undue piping stress, deflection or bending that may affect the performance of the valve.

1. Place valve into position carefully to avoid impact with trench walls or vault walls.
2. When connecting pipe to the BFV, do not deflect the pipe to connect the valve. Do not use as a jack to pull into alignment. As much as reasonably possible, the BFV should be in an "unconstrained" position with the weight of the valve being supported independently of the pipe connection. Pipe connections can put undue stress on the valve pulling the valve body out of shapeand causing it not to seal properly. This becomes increasingly important as the piping size gets larger.

**MECHANICAL JOINT INSTALLATION:**

When connecting BFV mechanical joints (MJs) bolting torques should not exceed the recommended torque limits in the appendix of AWWA C-111.

A. The use of an NSF61 approved pipe grade lubricantis recommended to minimize gasket to pipe binding.

B. The most important factor is pulling the gland down uniformly so that the face of the gland follower remains parallel to the face of the valve flange throughout the tightening cycle. The torque on the nuts should be uniform, utilizing an alternating star pattern with as many as five repetitions of tightening to assure even torque stress.

C. The MJ bolts should be torqued in accordance with the AWWA C111 specification. See the chart below for a quick reference. Torques in excess of the recommendations below may damage the BFV, the mechanical joint gland or both.

| Valve Size | Bolt Size | | Range of Torque | |
|---|---|---|---|---|
| | in. | mm | lbf-ft | N-m |
| 3" | 5/8 | 15.9 | 45-60 | 61-81 |
| 4"-24" | 3/4 | 19.1 | 75-90 | 102-122 |
| 30"-36" | 1 | 25.4 | 100-120 | 136-163 |
| 42"-54" | 1-1/4 | 31.8 | 120-150 | 163-203 |

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

**FLANGED ENDS INSTALLATION:**

1. The weight of the valve should be supported independent of the pipe connection. Provisions for thrust restraint must be adequate to absorb closing thrust.
2. Prior to assembly, flange faces must be cleaned to remove rust, paint runs, or other impediments to smooth surfaces.
3. All bolting patterns are in accordance with ANSI B16.1. Bolt torques for flanged valves should be based on the yield strength of the bolt. Due to size and casting restrictions, BFV sizes 14" and larger have some tapped holes (instead of thru holes) in the flanges. These are located around the operator or thrust ends. The chart below shows thread depth / flange thickness, thread size, and # of threaded holes per flange for sizes 14" and larger. NOTE: To determine the total required length of the stud, add this dimension to the thickness of the adjoining flange plus the thickness of the appropriate nut.

| Valve Size | Thread Depth/ Flange Thickness | Thread Size | # of Threaded Holes per Flange |
|---|---|---|---|
| 14" | 1-3/8" | 1"-8 UNC | 4 |
| 16" | 1-7/16" | 1"-8 UNC | 4 |
| 18" | 1-9/16" | 1-1/8"-7 UNC | 4 |
| 20" | 1-11/16" | 1-1/8"-7 UNC | 4 |
| 24" | 1-7/8" | 1 1/4"-7 UNC | 4 |
| 30" | 2-1/8" | 1 1/4"-7 UNC | 8 |
| 36" | 2-3/8" | 1 1/2"-6 UNC | 4 |
| 42" | 2-5/8" | 1 1/2"-6 UNC | 4 |
| 48" | 2-3/4" | 1 1/2"-6 UNC | 8 |
| 54" | 3" | 1 3/4"-5 UNC | 12 |

4. 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). Check the adjoining fitting and flange clearances to confirm there is enough room to swing the bolt into place.

**NOTE**: Butterfly valves should not be installed at adead end or near a bend in a pipeline without proper & adequate restraint to support the valve and prevent it from blowing off the end of the line.It is good engineering practice to consider whether thrust blocks, restrained joints, or other means of restraint are needed on or adjacent to valves on pipelines and/or where unusual conditions exist, such as high internal pressures, adjacent fittings, or unsuitable soils. Buried valves installed with valve boxes shall be installed so that the valve box does not transmit shock or stress to the valve operator as a result of shifting soil or traffic load.

# OPERATION

Operational criteria for rubber seated BFV are covered in the appendix section of AWWA C504. DO NOT operate any valve at pressures above the rated pressure of the valve. DO NOT exceed 300 ft-lbs input torque on operation with wrench nuts and do not exceed 200 lb. rim pull for hand-wheel or chainwheels against the open or closed stops.

Do not remove a BFV operator while under flow and pressure. Without an operator in place holding the vane, a BFV will try to close in the presence of flow and can create a hazardous water hammer situation. BFVs can be operated manually by rotating the handwheel, chainwheel, or nut. Do not force the handwheel, chainwheel, or nut to close faster. This can cause damage to the gearing.

BFV traveling nut operators are designed to open and close the valve at LESS THAN 150ft-lbs. of input torque. Torque in excess of these limits may damage the valve or operator or both. Maintenance personnel should be aware of the type of operators being used before actuating the valves.

Cylinder operators are base mounted and operated automatically by pneumatic or hydraulic pressure to either side of the power cylinder. Cylinder operators use solenoid valves to direct fluid to the cylinder ports based on electrical power signals.

Motor actuators are designed to open and close the valve through its ¼ turn of rotation. They contain gearing that slowly moves the valve from open to close position. Electrical controls are included in the motor actuator for local electrical control. The positioning of the valve disc will be done by limit switches in the motor actuator. Instructions for adjustment of limit switches or mechanical stops can be found in the motor manual.

BFVs can be automated to suit virtually all control even those with very specific design criteria.

# MAINTENANCE

Before any maintenance or service work is conducted on a BFV, whether above or below ground, all potential safety issues should be considered. Prior to maintenance, properly identify the BFV model and its operator then obtain the correct service information.

Annual maintenance of the BFV includes the following:

1. Cycle the valve to verify operation and no interference in line.
2. Close the valve and check for any leaks

**VANE SEAT RING ADJUSTMENT Sizes 3”-54”:**

1. If there is a small leak at a specific location around the circumference of the vane, this may be corrected by adjusting the vane ring bolts on the vane.
2. Before attempting to adjust the bolts, open the valve fully and inspect the vane ring for any mechanical damage to the rubber (a cut or tear or similar damage).
3. Once confirmed that the vane ring is in good condition, be sure to make sure that the seating area is clean and free from any debris.
4. Move the vane to the fully closed position and confirm that the vane is level with the stainless-steel seat in the valve body. **NOTE**: Make sure that the seating area has been lubricated with an NSF61 approved lubricant. If the vane is not level with the seat is not level:
   A. If a travelingnut operator is being used, skip to section – vane level adjustment.
   B. If a third-party operator is being used, consult the operator manual for how to adjust the end stops of the operator.
5. After Steps 2, 3 & 4 have been verified, if there is still water leaking in the seat area, determine the location of the leakage.
   A. Using a torque wrench (wrench should be in “in-lb.” readings), determine the approximate torque of the bolts around the leak.
   B. Using a measured torque amount, increase the torque wrench setting by 20in-lbs.
   C. Re-torque 3 to 5 of the bolts around the leak. Repressure test the valve.
   D. If the valve still leaks, this step can be done once more.
   E. If the valve still leaks after the second attempt, the vane seat ring may need replacement.

| Valve Size | Vane Ring Bolt Wrench Size | Max Vane Ring Torque |
|---|---|---|
| 3”-12” | 7/16” Hex Head Bolt | 150in-lbs. |
| 14”-24” | 9/16” Hex Head Bolt | 220in-lbs. |
| 30”-54” | 7/32” Allen Key Bolt | 220in-lbs. |

**VALVE SEAT RING REPLACEMENT:**

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

**Removal of Existing Seat Ring - Sizes 3"-24":**

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

**Installation of New Seat - Sizes 3"-24":**

1. With the existing vane seat ring removed and the seating area cleaned of any debris and raised (or rough) surfaces smoothed, move the vane to the close position. Make sure the vane is level in the valve body. (If vane is not level, refer to– VANE LEVEL ADJUSTMENT)
2. Fully lubricate the stainless-steel body seat with an NSF61 approved grease or pipe lubricant. Use extra lubricant at contact area near the shaft locations. Fully lubricate the rubber portion of the new vane seat ring. Lay the vane seat ring on vane, aligning the vane ring bolt holes in the vane and seat ring as best as possible. Gently tap the seat ring with a rubber mallet or with a block of wood to push the ring into place.
3. Once the vane seat ring is in the seat recess, the bolts holes can be further aligned. Using self-locking seat adjusting screws, place screws in all the seat vane ring bolt holes. By hand, make sure that the screws are threaded into the holes to secure the seat to the vane. Do not begin compression of the rubber seat at this point.

**4. For 3" thru 12" BFVs:**

A. Set the torque wrench to 90in-lbs, torque all of the bolts down to 90in-lbs in an alternating star pattern as shown in the picture below.

B. Increase the setting on the torque wrench to 110in-lbs and repeat the process.

C. Pressure test the valve. If the valve holds the rated pressure, then the process is done.

D. If the valve does not hold the rated pressure, then increase the setting on the torque wrench to 130in-lbs and repeat the pressure test. Again, if the valve holds the rated pressure, then the process is done.

E. If the valve does not hold, increase the setting on the torque wrench to 150in-lbs, and a repeat the process.

F. If the valve holds the rated pressure, then the process is done. If the valve still does not hold pressure, then consult the factory.

**5. For 14" thru 24" BFVs:**

A. Set the torque wrench to 160in-lbs, torque all of the bolts down to 160in-lbs in an alternating star pattern.

B. Increase the setting on the torque wrench to 180in-lbs and repeat the process.

C. Pressure test the valve. If the valve holds the rated pressure, then the process is done.

D. If the valve does not hold the rated pressure, then increase the setting on the torque wrench to 200in-lbs and repeat the pressure test. Again, if the valve holds the rated pressure, then the process is done.

E. If the valve does not hold, increase the setting on the torque wrench to 220in-lbs, and repeat the process.

F. If the valve holds the rated pressure, then the process is done. If the valve still does not hold pressure, then consult the factory.

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

**3" thru 24" Service Details**

1. Parts Required:

   A. Vane Seat Ring

   B. Seat Ring retention screws- with pre-applied 'nylock'

   C. NSF61 approved Lubricant

2. Tools Required:
   A. 7/16" socket for valve sizes 3" thru 12", 9/16" socket for valve sizes 14" thru 24"
   B. An adjustable torque wrench with in-lb settings up to 250in-lbs NOTE: It is not recommended to use a torque wrench with ft-lbs increments.
   C. Screwdriver
   D. Rubber mallet or hammer with wood block.

**30" thru 54" Service Details**

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

**30" thru 54" Installation of New Seat**

1. With the existing vane seat ring removed and the seating area cleaned of any debris and any raised (or rough) surfaces smoothed, move the vane to the close position. Make sure the vane is level in the valve body. (If the vane is not level, refer to VANE LEVEL ADJUSTMENT)
2. Fully lubricate the stainless-steel body ring and the new rubber seat ring with an NSF61 approved lubricant. Use extra lubricant at contact area near the shaft locations. Lay the new rubber Vane Seat Ring on vane, aligning the vane ring bolt holes. It is recommended to push the rubber vane seat ring into place by hand.
3. Once the rubber seat ring is in place, put the clamp ring segments can be put into place, aligning the bolt holes in the clamp ring with the bolt holes rubber vane ring.
4. Using self-locking seat adjusting screws, install the screws through the clamp ring, through the vane seat Ring and into the threaded holes in the vane. This should be done by hand to make sure that the bolts are in the threaded holes and are not cross-threaded. Do not begin compression of the rubber seat at this point.
5. To tighten the Vane Sear Ring vane ring down:
   A. Set the torque wrench to 160in-lbs, torque all the bolts down to 160in-lbs. in an alternating star pattern.
   B. Increase the setting on the torque wrench to 180in-lbs and repeat the process.
   C. Pressure test the valve. If the valve holds the rated pressure, then the process is done.
   D. If the valve does not hold the rated pressure, then increase the setting on the torque wrench to 200in-lbs and repeat the pressure test. Again, if the valve holds the rated pressure, then the process is done.
   E. If the valve does not hold, increase the setting on the torque wrench to 220in-lbs, and a repeat the process.
   F. If the valve holds the rated pressure, then the process is done. If the valve still does not hold pressure, then consult the factory.
6. Retest the valve as necessary in accordance with AWWA C504 sec. 5.2.2.2.

**30" thru 54" Service Details**

1. Parts Required:
   A. Vane Seat Ring
   B. Seat Ring retention screws- with pre-applied 'nylock'
   C. NSF61 approved Lubricant
2. Tools Required:
   A. 7/32" socket for valve sizes 30" thru 54"
   B. 9/16" socket for valves sizes 60" thru 72"
   C. An adjustable torque wrench, with in-lb settings up to 250in-lbs. NOTE: It is not recommended to use a torque wrench with ft-lbs increments.
   D. Screwdriver
   E. Rubber mallet or hammer with wood block.

### VALVE LEVEL ADJUSTMENT:

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

**Vane Level Adjustment Procedure -**

**Sizes 3"-12" BFV's:** Call your MPI inside sales representative for the current procedure.

**Sizes 14"-42" BFV's:** An external locking bolt adjustment feature was added to BFVs in 1998.

1. Loosen the lock nut retaining the hex head bolt. (For open left valves, the closure adjustment is located near the op nut or handwheel)
2. Turn the hex head bolt so that it moves outward from the operator housing. Do not unthread the hex head bolt to where it comes out of the housing. Normally, 1 to 3 turns are sufficient.
3. Using the op nut or handwheel, level the valve as needed. Assuming the valve itself is level, a small carpenter's level can be placed on the vane to set the level.
4. Once the vane is level, turn the hex head bolt inward until it firmly contacts the lever.
5. Holding the hex head bolt with a wrench (so that it does not move), tighten lock nut against the housing to lock the hex head bolt in place.
6. Move the vane out of the seat area and then back into the seat to confirm that the adjustment leveled the vane.

**Vane Level Adjustment Procedure -Sizes 48"-54" BFV's**

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

## TROUBLESHOOTING

| PROBLEM | CAUSE | SOLUTION |
|---|---|---|
| Valve leaks when closed | Disc not fully closed or past fully closed | Adjust actuator closed position stop |
| | Disc edge wear or damage | Clean and/or replace disc edge |
| | Rubber seat wear or damage | Adjust or replace valve seat |
| Chainwheel jam | Poorly fitting chain | Replace with correct chain |
| Valve hard to operate | Foreign material in valve | Remove obstructions |
| | Corroded actuator parts | Clean and grease actuator |
| | Loose Actuator | Apply locking compound and tighten bolts |
| Internal operator obstruction | Debris in threaded components | Work Input shaft in the open or closed direction several times until full travel is permitted |
| Internal to the Valve Obstruction | Vane interference | Remove valve from line to modify mating pipe ID |
| | Internal obstruction | Access vane and physically remove obstruction |
| External Obstruction | Op. nut interference | Check Op. Nut clearances in buried service valve boxes |
| | Binding of operational accessories | Adjust as needed to resolve binding |
| | Thrust plate not mounted securely | Fully thread the input shaft into the operator housing and tighten |

## PARTS & SERVICE

Parts and service are available from your local representative or the factory. For availability and pricing of spare parts please contact the MPI sales team:

**McWane Plant & Industrial**
www.mcwanepi.com
Phone: 866-924-8674
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