MANN
FLOW CONTROLS, INC

Butterfly Valves

Installation, Operation & Maintenance Manual

Index: General Instructions

1. INTRODUCTION

1.1 General Introduction

This Manual has been prepared by **MFC's** engineers, designers, R&D and Technical personnel to assist you in obtaining many years of satisfactory service from your Butterfly Valves. It will assist you in restoring your valve to best working condition with minimum of time and expense.

MFC Valves are designed and manufactured based on many years of research and product development and are constantly being improved, Before beginning any major works, we recommend that you read this booklet carefully at least once to understand the valve's physical condition.

Please note that if you do not understand the reason for the service problem, we suggest that you get in touch with your local **MFC's** representative or call our **MFC's** head office for technical assistance.

Before beginning any major work, we recommend that you carefully check the nameplates of the valve and record the figure number and the tag number to identify the type and size of valve.

1.2 Types Of Butterfly Valves

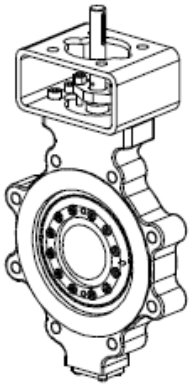
MFC butterfly valves cover a range of size and pressure classes. Each of them is built in Five basic body styles:

1. Lug Type
2. Wafer Type
3. Double Flanged "Short Pattern"
4. Double Flanged "Long Pattern"
5. Butt Weld Type

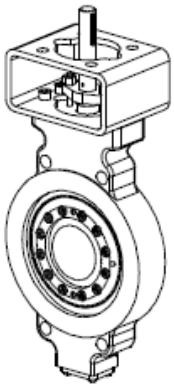
· Double Flanged type which can be installed between two flanges using gaskets and fasteners

· Wafer Type which can be installed between two flanges.

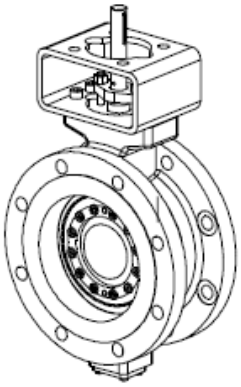
· Lug Type which can installed between two flanges and or bolted to either flange



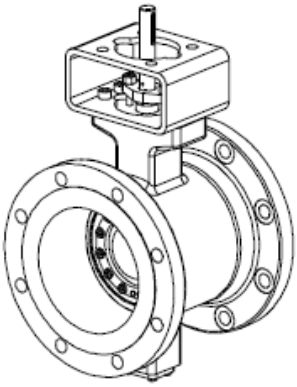
LUG TYPE



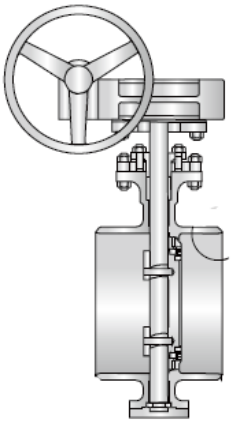
WAFER TYPE



SHORT PATTERN



LONG PATTERN



BUTT WELD TYPE

1.3 Hydrotest Procedure (Reference from API 598 / API 6D / EN 12266)

A) Cleaning the valve inside bore and outside surface without any dirty which will be affected of the testing

B) Move the valve install on the testing bench

Process of Testing

a) Lock the valve with blind valve in the test bench
b) Open the stem/disc on 20 degree
c) Inject the hydro water and hydro pressure up to 1.5 time higher than design pressure
d) Hold the hydro pressure for minutes (duration time according to API 598 / API 6D request), inspection with any leaks or not from the body/packing.
e) Release hydro pressure, closed the disc until 100% fully closed. Inject the hydro water and hydro pressure up to 1.1 times higher than design pressure
f) Hold the hydro pressure for minutes (duration time according to API 598 / API 6D request), inspection with any leaks or not from the seat

g) Release hydro pressure, bring some clean water on the disc. Inject clean air under the seat up to 0.6 Mpa
h) Hold the air pressure for minutes (duration time according to API 598 / API 6D request), inspection with any leaks/bubble or not from the seat
i) After testing, clean the valve, and move to storage area with plastic covers on the double flanges connection

2. RECEIVING AND PREPARATION FOR INSTALLATION

2.1 Receiving Inspection

All valves must be examined for signs of damage that may have occurred during handling and transportation. Any damage should be analyzed and a report should be issued. Serious damage should be reported to your local **MFC** representative or to **MFC** head office Customer Service Manager and also to the Transport Carrier so that a suitable arrangement for repairs can be made without delay

2.2 Quality Control Documentation

For valves purchased with Quality Control (QC) certification, documents must verify the package of documents to see that the Quality Control documents are completed as per the purchase order

2.3 Storage

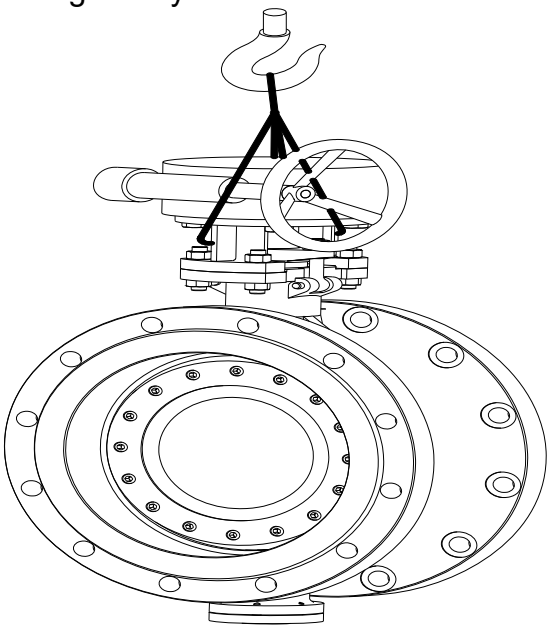
Valves must be stored in a suitable sheltered place to prevent contamination by weather, dirt or dampness. The valve is shipped with end protectors on the inlet and outlet which should remain on the valve until it is ready for installation.

NOTE: If actuators are involved, please refer to the applicable manufacturer's instructions for storage.

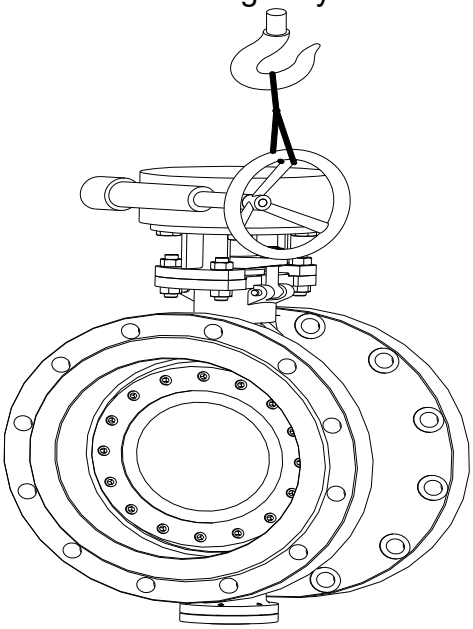
2.4 Handling and Preparation

On large valves, a hoist is needed to assist installation. A nylon sling should be placed under the valve body so that the unit can be lifted vertically to its final destination. Ends protectors must be removed from all types of valves prior to installation and connections must be checked for cleanliness. Any visible foreign matter must be removed from end connections of the valve. The flanges must be cleaned properly with suitable solvent such as acetone or alcohol. Do not use solvents containing chloride or fluoride.

Right Way



Wrong Way



2.5 Special Instructions For Butterfly Valves

2.5.1 Inspection

Carefully remove the valve from the shipping package to avoid any damage to the valve and components or, in the case of automated valves to the electric, pneumatic / hydraulic actuator or instrumentation.

Prior to installation, clean the inside of the valve.

Ensure that there are no solid objects such as bits of wood, plastic or packaging material within the valve or on the valve seat

Inspect the seal ring to ensure that it was not damaged during transportation and handling. This is especially important in the event of valves with “fail-open” actuators.

Verify that the materials of construction listed on the valve nameplates are appropriate for the service intended and are as specified.

Locate the “Flow Arrow” marking on the body which defines the preferred mounting orientation in respect to the pressure. In most cases the valve is properly installed when the actuator fluid flow or high pressure is acting on the shaft side of the disc when the valve is closed.

Ensure that the packing flange bolting nuts against the packing flange cannot be rotated by hand.

2.5.2 Installation.

MFC recommends that all common safety practices be followed during installation of the valve into the line.

Recommended installation orientation is with valve shaft horizontal or inclined from vertical.

This will minimize any problems associated with solid particles present in the process that otherwise could deposit in the lower bearing.

Unless recommended otherwise by **MFC,** mount the valve in preferred direction, with the “Flow Arrow” marking pointing to the lower pressure side so that the shaft side of the disc will be upstream when the valve is in closed position.

WARNING: The use of impact wrench to install & assemble **MFC Valve** is not permitted. Use of such tools can cause valve body seat to deform, and the change in shape may result in leaks or internal bleeding.

For operating temperatures above 400℃, thermal insulation of body is recommended.

The depth of the tapped holes in the bodies of all wafer valves is specified in the technical literature supplied with the valve. Failure to use correct (size & grade) cap screws/studs may result in damage to the valve.

The valve should be installed in the closed position to ensure that the laminated seal in the disc is not damaged during installation.

Particular care should be taken with those valves equipped with “Fail-open” actuators.

If the pipe is lined, confirm that the disc does not contact the lining during the opening stroke, especially in water and short patter body styles, Failure to confirm that the disc rotation does not contact the lining may result in damage to the valve.

2.5.2.1 Double Flange: Long and Short Pattern

Orient the valve with the “Flow Arrow” marking (preferred side) in the proper position.

Insert the valve between the two flanges until the two bottom holes in the valve body align with the two lower flange holes. Or, as an alternative, insert studs of one half to two times the correct length in the lowest four flange holes. This will allow the valve to rest loosely for the installation of the flange gasket.

Install the flange gasket and remaining flange bolts/studs along with anti-seize compound on the treads.

Using the bolt tightening sequence cross over method, tighten all nuts.

NOTE: Cap screws will be necessary for the top and bottom alignment tapped holes. The studs should be used in the through-holes.

2.5.2.2 Wafer Type

Orient the valve with “Flow Arrow” marking (preferred side) in the proper position.

Insert the valve between the two pipe flanges until the alignment holes at either side of the valve match and align the corresponding holes in the flanges (assuming horizontal position). Do not use the valve to align mis-aligned piping.

Insert a long cap screw or stud through the flange and thread it into the body/flange. This will allow the valve to center and align itself properly for the installation of the flange gasket.

Install the flange gasket and the remaining flange cap screws/studs/nuts etc.

Remove the long cap screws/studs from the lower alignment holes and replace with the correct fasteners.

Using the cap screw tightening sequence, tighten all flange screws, incrementally. Maintaining uniform clearance around studs and flange holes.

Seat the flanges by tightening the flanges cap screws/studs, little at a time until flanges face seats.

During this operation it is recommended to continuously check the distance between the flange faces and select the tightening sequence to maintain the parallelism of the both mating flanges.

Complete the final torque of the flange in 3 to 4 increments to the recommended torque valve.

2.5.2.3 Lug Type

Locate the “HP” marking on the body which defines the preferred mounting orientation in respect to the pressure. In most cases the valve is properly installed when the actuator fluid flow or high pressure is acting on the shaft side of the disc when the valve is closed

Orient the valve with the “Flow Arrow” marking (preferred side) in the proper position.

Insert the valve between the two flanges until the two bottom holes of the valve align with the two lower flange holes.

Insert cap screw or stud through the flange and screw it into valve body holes. This will allow the valve to center and align properly for the installation of the flange gasket.

The connecting flange face may not be more than 1/4” away from the valve flange face.

Do not use the valve to align mis-aligned piping.

Install the flange gasket and the remaining flange cap screws.

Use Anti-seize compound around fastener threads.

Remove the two extra long cap screws/studs from the lower alignment holes and replace them with correct sized cap screws/studs.

Tighten all flange cap screws/studs as per tightening sequence in 3 to 4 increments, to the recommended torque.

2.5.2.5 Butt Weld Type

Orient the valve with the “Flow Arrow” marking (preferred side) in the proper position.

Insert the valve between the two welded neck flanges/pipe.

Cleaning all four welding ends, ensure there is not solid objects such as bits of wood, plastic or packaging material on the welding ends.

Valve should be coaxial with pipeline, welding ends with 2-3mm gap.

Inside welding pad ring should be support when welding.

Cleaning welding slag from the inside valve and pipeline

2.5.3 Valve Verification

Tightening the packing flange as per torque table to prevent stem leakage. Over-tightening will decrease packing lift and increase operating torque (rim pull) equipment.

Check the operation of the valve by stroking to “100% open” to “100% close”. To determine the orientation of the disc, the index marking on the shaft is aligned with the corresponding marking on the body in closed position

The valve disc travels clockwise to close/counter clockwise to open.

For automated valves, set the air pressure/electric voltage for at least the minimum given to select the actuator. For pneumatic actuators, do not apply more than 1.25 times the pressure for which the actuator was designed.(Work with the sizing sheet from engineering)

NOTE: for springs return actuators with positioners, overpressure will cause excessive time delay in obtaining a spring movement for the valve disc to pen or close.

The use of impact wrenches to install a **MFC** valve is not permitted, use of the impact wrenches can cause body seat to change the geometry of valve body and internal component (shape), increasing the possibility of valve leakage or internal grinding.

3. SAFETY WARNINGS III

FOR SAFETY REASONS,

It is important to take these precautions before removing a valve from a line.

- Personel marking adjustments to the valve should wear safety equipment normally used to work with fluid in the line where the valve is installed.
- Before removing a valve from a line, line pressure must be relieved with no exception. Failure to do so may cause serious personal injury and/or equipment damage.
- MFC valves can be equipped with a variety of manual gear, electric, hydraulic or pneumatic actuators.
  Generally, all pressure must be relieved from both sides of the valve (inlet & outlet) before the actuators are removed/disassembled.
- The packing rings must be replaced under no pressure.
  noval of the packing with the valve under pressure is at the owner's risk.

Warning on NACE Conversions

It is extremely important to ensure that valves, when converted to NACE trims in the field are done by **MFC** authorized service shops. Unauthorized conversions can result in failure to carry out post-weld heat treatment and result in severe stress cracks in non-stress relieved areas.

4 GENERAL MAINTENANCE

4.1 Operation

4.1.1 General

MFC Butterfly Valve have been designed to require a minimum of maintenance; all valves require examination before being put into service/operation.

Additionally, valves should be inspected regularly during operation and should receive prompt attention when troubles arise.

As a general rule, valves should be subjected to scheduled maintenance.

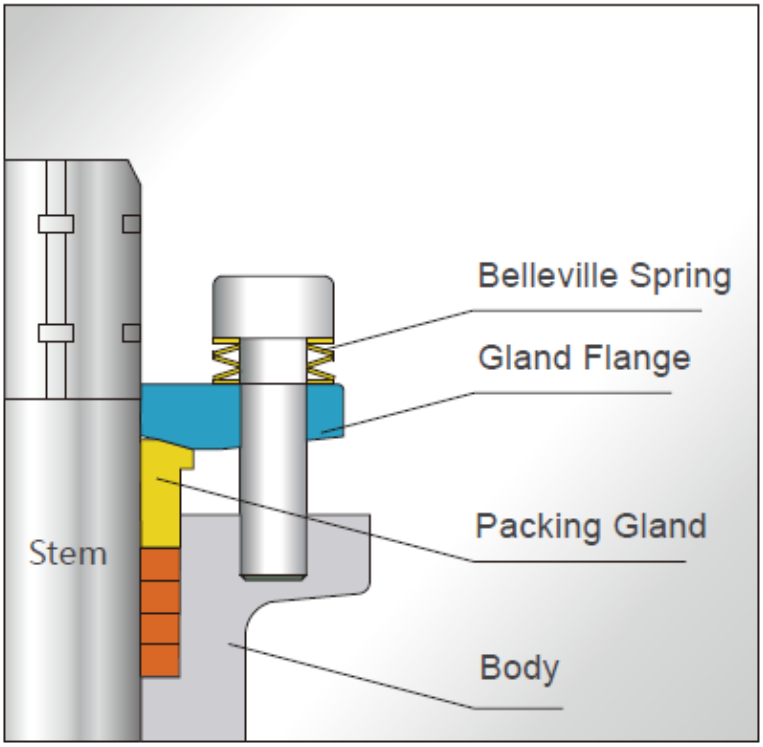
Generally only maintenance on the packing box is required. If shaft leakage is observed through the packing box, tighten the gland nuts to the torque table.

NOTE: Do not over-tighten packing box gland nuts. Over-tightening will increase the torque require to operate the valve. When tightening the gland nuts, use half-turn increments until leakage has stopped.

4.1.2 Live Loaded Gland Flange

Live loading gland flange provide gland load retention, compensating for expected in-service consolidation of the packing.

A set of Belleville-Spring washers are used on each gland stud to help exert a continuous compressive force on the gland and therefore fugitive emissions from the stem packing is available.



Live loaded Gland Flange

4.1.3 Seat Tightness – Closing Torque

Even with a brand new valve, seat tightness will only be achieved when sufficient load has been applied to the disc.

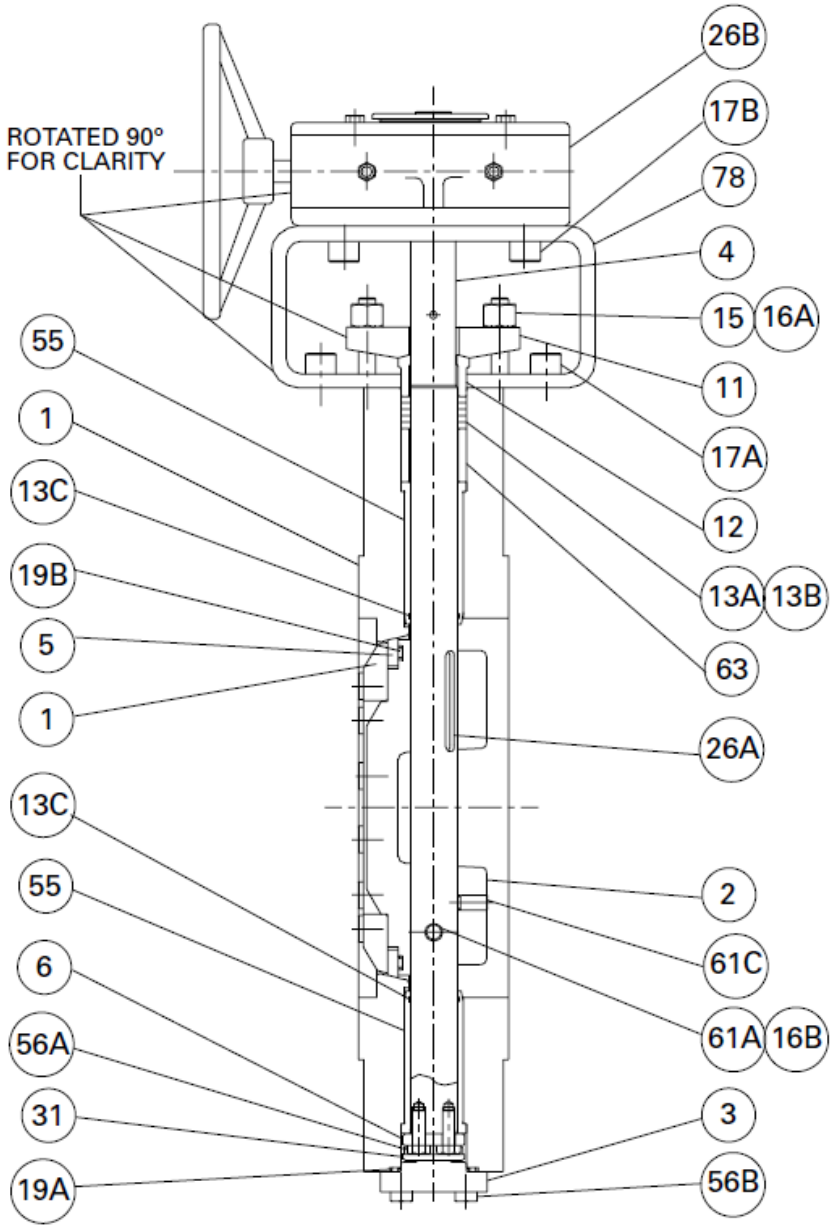
This load varies with the pressure differential against which the valve has to be closed or opened.

Torque required to open or close a valve against a given differential pressure.

The torque shown is that torque which has to be applied directly to the valve stem to achieve tight shut off and does not take into account any mechanical advantage such as that achieved with a gear actuator, cheater bar, etc.

4.2 General Assembly Information

1 - Valve body, Seat
2 - Disc
3 - Bottom cover
4 - Shaft
5 - Laminated seal
6 - Thrust bearing
11 - Packing flange
12 - Gland bushing
13A - Packing ring
13B - Packing ring
13C - Bearing protector o-ring
15 - Gland stud
16A - Gland heavy hex nut
16B - Taper pin hex nut (crimped)
17A - Actuator bracket hex. socket cap screw
17B - Retainer hex. socket cap screw
19A - Bottom cover spiral wound gasket
19B - Disc spiral wound gasket
26 - Key
31 - Locking plate
55 - Stem bearing
56A - Thrust bearing hex. head cap screw
56B - Cover heavy hex. headcap screw
61A - Taper pin
61B - Centering pin
61C - Assembly set screw
63 - Packing spacer
78 - Actuator bracket



4.2.1 Butterfly Valve Assembly Drawing

The most important factor to be considered is the cleanliness of all components of valve. All rust and dirt should be removed from all components.

NOTE: the body seat and laminated seal should never be in contact with any abrasive material. Although in some cases, minor scratches can be removed from the seat by polishing with grade 800 or finer paper.

All threaded fasteners (cap, screws, nuts, studs) must be well re-lubricated. All components and particularly the stem should be free of old grease before a new application of grease is applied.

Repair or replacement components must be inspected to verify that all repair procedures have been carried out and that all replacement components (e.g. packing, gasket) have been inspected for size and quality so that they will fit into the valve being serviced.

All orientation match marks assigned during disassembly must be observed during re assembly so that correct orientations is maintained.

CAUTION: Do not allow disc to strike against body seat, as this may result in valve damage and seat leakage.

4.4 General Fasteners / Max Torque Values

Maximum torque for all fasteners other than Retaining Ring fasteners or gland nuts.

Torque Values -
General Fasteners ft•lbs (Nm)

SIZE	B7/B16	B8M cl.2	B8M cl.1
1/4-20UNC	5(7)	5(7)	4(6)
5/16-18UNC	10(14)	10(14)	8(11)
3/8-16UNC	20(27)	20(27)	15(21)
1/2-13UNC	50(68)	45(62)	35(47)
5/8-11UNC	100(136)	85(116)	70(95)
3/4-10UNC	170(231)	150(203)	125(170)
7/8-9UNC	270(366)	200(271)	200(271)
1-8UNC	400(542)	350(475)	300(407)
1 1/8-8UN	600(814)	450(610)	450(610)
1 1/4-8UN	850(1153)	650(881)	650(881)
1 3/8-8UN	1200(1627)	900(1200)	900(1200)
1 1/2-8UN	1500(2034)	1200(1627)	1200(1627)
1 5/8-8UN	2000(2712)	-	1500(2034)
1 3/4-8UN	2500(3390)	-	1900(2576)
1 7/8-8UN	3100(4200)	-	2300(3119)
2-8UN	3800(5150)	-	2800(3797)

NOTE: 1. Torque tolerance +/- 10%
2. For temperatures above 750°F (400°C) use 75% of the torque values

5. DETAILED MAINTENANCE

5.1 Trouble Shooting Chart

Trouble Shooting

SYMPTOM	PROBLEMS CAUSE	SOLUTION
VALVE SHAFT WON'T ROTATE	Actuator has failed	Replace or Repair actuator
	Valve packed with debris	Flush or clean valve to remove debris
	Shaft key has sheared	Determine cause of shearing and correct, replace shaft key
SHAFT PACKING LEAKING	Gland fasteners loose	Tighten gland nuts
	Packing rings damaged	Depressurize valve and replace pacing rings
	Packing is worn out	Replace packing as per procedure
	Stem damaged	Repair or replace stem
BOTTOM FLANGE GASKET LEAKING	Bottom flange bolting loose	Tighten bottom flange bolting to the torque table & tightening of sequence
	Spiral wound gasket damage	Remove valve from service and replace gasket
VALVE LEAKING	Valve not fully closed	Close valve 100%
	Debris trapped in valve	Cycle and flush to remove debris
	Seal damaged	Remove valve from service and replace seal
	Seat damaged	Remove valve from service and get in touch with your Velan representative
	Actuator mechanical closure stops adjusted improperly	Adjust the stop for closure
OPENING & CLOSING TORQUE IS EXCESSIVE	Packing too tight	Loosen packing to hand tight to the torque table, cycle valve, retighten
	Shaft seals are dirty or worn out	Clean or replace components as per assembly-disassembly procedure
	Shaft bent	Replace shaft
JERKY OPERATION	Actuator/shaft adapter mis-aligned	Remove actuator mounting and realign
	Over tightened packing	Loosen packing to hand tight to the torque table, cycle valve, retighten
	Air supply inadequate	Increase air supply pressure

5.2 Seat Leakage

An indication of a valve leak is pressure loss in high-pressure line side after a valve has been properly closed. In the case of hot water or steam lines, note whether the downstream pipe remains hot beyond the usual length of mine.

This type of leak may be the result of:

1. Serious damage to seat or seal sealing surfaces.
2. The stress relieving temperatures that may have been used during installation; e.g. if a valve has been in excessively high temperature service for extensive period of time against our recommendation.
3. Valve not fully closed
4. An erosion of laminated seal
5. A laminated seal damaged during closed/open operation OR if debris were trapped between seal and disc.

Valve, which leak, should be repaired as quickly as possible to prevent greater damage caused by high velocity and erosion.

5.3 Packing Chamber Leakage

If moisture or dripping occurs around the stem and into the packing chamber, the following points must be investigated before removing the packing:

1. Check if the packing flange is torqued down to the correct torque.
2. Check if the live-loading arrangement is in correct order as per drawing and compare valve live-loading arrangement confirmed with drawing: if it is incorrect reassembly live loading arrangement is correct order, then re-torque packing flange to correct torque.
3. After re-tightening cycle the valve three to five times and re-tighten packing flanges nuts to original torque value. Slacken the nuts slightly if torque is too high. If above steps do not stop leakage, proceed with the removal and replacement of the packing rings.
4. Packing ring removal on line.

Torque Values for Packing Gland Nuts.

Valve NPS	Class	Nut Size (16A)	Torque	
			Ft•lbs	Nm
3	150	3/8	5	7
	300	3/8	5	7
4	150	3/8	6	8
	300	3/8	6	8
6	150	3/8	8	11
	300	3/8	9	12
8	150	3/8	9	12
	300	1/2	14	19
10	150	1/2	13	18
	300	1/2	23	31
12	150	1/2	14	19
	300	5/8	32	44
14	150	1/2	23	31
	300	5/8	36	50
16	150	5/8	32	44
	300	3/4	48	65
18	150	5/8	36	50
	300	3/4	53	72
20	150	3/4	48	65
	300	7/8	104	142
24	150	7/8	104	142
	300	1	137	188
30	150	1	137	188
	300	1 1/8	185	253
36	150	1 1/8	185	253
	300	1 1/2	282	386

NOTE: 1. Torque tolerance +/- 10%
2. Torque values are the minimum required for the hydro test of the body.

Flow Coefficient / CV Value.

CLASS 150LB

Size		Disc Opening Angle								
Inch	mm	10°	20°	30°	40°	50°	60°	70°	80°	90°
3"	80	5	11	17	22	33	50	72	99	110
4"	100	12	25	38	50	76	113	164	227	252
6"	150	44	96	143	191	287	430	621	860	956
8"	200	75	163	244	326	488	733	1058	1465	1628
10"	250	124	270	405	541	811	1216	1757	2433	2703
12"	300	249	542	813	1084	1627	2440	3524	4880	5422
14"	350	287	624	936	1247	1871	2807	4054	5613	6237
16"	400	380	826	1239	1652	2478	3717	5368	7433	8259
18"	450	482	1049	1573	2097	3146	4719	6817	9438	10487
20"	500	556	1209	1814	2419	3628	5442	7860	10884	12093
24"	600	839	1825	2737	3650	5474	8212	11861	16423	18248
28"	700	1371	2980	4470	5960	8940	13410	19370	26820	29800
30"	750	1642	3570	5355	7140	10710	16065	23205	32130	35700
32"	800	1886	4100	6150	8200	12300	18450	26650	36900	41000
36"	900	2466	5360	8040	10720	16080	24120	34840	48240	53600
40"	1000	3031	6590	9885	13180	19770	29655	42835	59310	65900
42"	1050	3307	7190	10785	14380	21570	32355	46735	64710	71900
48"	1200	4476	9730	14595	19460	29190	43785	63245	87570	97300

Flow Coefficient / CV Value.

CLASS 300LB

Size		Disc Opening Angle								
Inch	mm	10°	20°	30°	40°	50°	60°	70°	80°	90°
3"	80	5	11	17	22	33	50	72	99	110
4"	100	12	25	38	50	76	113	164	227	252
6"	150	44	96	143	191	287	430	621	860	956
8"	200	75	163	244	326	488	733	1058	1465	1628
10"	250	124	270	405	541	811	1216	1757	2433	2703
12"	300	249	542	813	1084	1627	2440	3524	4880	5422
14"	350	287	624	936	1247	1871	2807	4054	5613	6237
16"	400	380	826	1239	1652	2478	3717	5368	7433	8259
18"	450	482	1049	1573	2097	3146	4719	6817	9438	10487
20"	500	556	1209	1814	2419	3628	5442	7860	10884	12093
24"	600	839	1825	2737	3650	5474	8212	11861	16423	18248
28"	700	1371	2980	4470	5960	8940	13410	19370	26820	29800
30"	750	1642	3570	5355	7140	10710	16065	23205	32130	35700
32"	800	1886	4100	6150	8200	12300	18450	26650	36900	41000
36"	900	2466	5360	8040	10720	16080	24120	34840	48240	53600
40"	1000	3031	6590	9885	13180	19770	29655	42835	59310	65900
42"	1050	3307	7190	10785	14380	21570	32355	46735	64710	71900

Flow Coefficient / CV Value.

CLASS 600LB

Size		Disc Opening Angle								
Inch	mm	10°	20°	30°	40°	50°	60°	70°	80°	90°
3"	80	4	9	14	19	28	42	61	85	94
4"	100	10	22	33	44	66	99	144	199	221
6"	150	31	67	101	134	202	302	437	605	672
8"	200	49	105	158	211	216	475	685	949	1054
10"	250	81	177	266	354	531	797	1151	1593	1770
12"	300	132	287	430	573	860	1290	1863	2580	2867
14"	350	188	409	614	818	1227	1841	2659	3681	4090
16"	400	260	566	849	1132	1699	2548	3680	5096	5662
18"	450	362	788	1182	1576	2363	3545	5121	7090	7878
20"	500	461	1003	1504	2005	3008	4512	6518	9024	10027
24"	600	695	1510	2265	3020	4530	6795	9815	13590	15100