Newco / OIC / Cooper Forged Valves

Operation & Maintenance

Manual

Revision 2, 9 May 2007

1. INTRODUCTION AND SAFETY INFORMATION

1.1. Introduction

This manual has been prepared to serve as a guide to insure continuous satisfactory service and assist in restoring of a valve to proper working condition.

It covers 'NEWCO' Forged Class 150 through 2500, bolted/welded bonnet, outside screw and yoke, flanged /threaded /socket welded, carbon steel, stainless steel and alloy steel valves. The installation, storage, operation, disassembly / reassembly inspection and repair, service problems, maintenance and preventive maintenance covering these valves are also included in this manual.

Prior to performing any work on these valves, it would be useful to have a general understanding of their construction. Chapter 4 shows the valve's basic construction.

1.2. Safety Information

The following general safety notices supplement the specific warnings and cautions appearing elsewhere in this manual. They are recommended precautions that must be understood and applied during operation and maintenance of the equipment covered herein.

a. To avoid injury, never attempt disassembly while there are pressures either upstream or downstream. Even when replacing packing rings caution is necessary to avoid possible injury.

b. Do not attempt to disassemble a valve while there is pressure in the line. Make sure both upstream and downstream pressures are removed before disassembly. Disassemble with caution in the event that all pressures have not been relieved.

c. Prior to replacing packing rings, remove all pressure from the valve. The packing can also be replaced while there is pressure <u>BUT</u> the valve must be tightly backseated. This will not insure complete safety and it is not recommended. If the backseat faces have been damaged by foreign material the backseat may leak into the packing chamber.

2. STORAGE, PREPARATION AND INSTALLATION

2.1. Storage.

2.1.1. Temporary Storage.

If valves are to be stored before installation, the following should be observed:

a. Keep the valves wrapped and protected as shipped from the manufacturer.
b. Do not remove the protective end covering until the valve is ready for installation. This will reduce the possibility of foreign material damaging internal valve components.
c. Valves stored outdoors should be positioned such that water does not accumulate in the valve body.

2.1.2. Long Term Storage.

If the valves are to be stored in excess of one year, they should be prepared in the following manner:

a. Remove the packing and apply a preservative to the packing chamber.
b. Do not remove the protective end covering.
c. Valve which will remain in storage for an excessive period of time should have a preservative applied to the external surface.
d. Do not store the valves outdoors.

2.2. Preparation.

a. Remove the valve end protection.
b. Prior to shipment from the manufacturer, a preservative may have been applied to the inner body of the valve. This preservative may be removed with a solvent.
c. The inside of the valve should be inspected and blown out with compressed air. Adjacent piping must be clean and free from debris to prevent damage to the valve.
d. Make sure the valve is positioned such that there is sufficient space so that the handwheel is easily and safely reached and there is enough clearance for the stem when the valve is open.
e. Install the valve according to the flow indicator on the valve body. Note gate valves can be installed in any position without regard for the direction of the flow, unless marked with the flow direction.
f. Gate valves and globe valves are not designed for throttling and should be kept in the fully open or closed position. Should the valve be used in a partially open or closed position, the bottom of the wedge and the seat may become eroded in a very short time. This may also cause a chatter noise in the line.

2.3. Installation

2.3.1. Flanged Valves.

Bolting and gasket material should be compatible with the valve's body material and pressure class. Care should be taken that flanges are straight and parallel. Bolts should be evenly tightened in a star pattern. This will ensure a uniform gasket loading.

2.3.2. Socket and Threaded Valves.

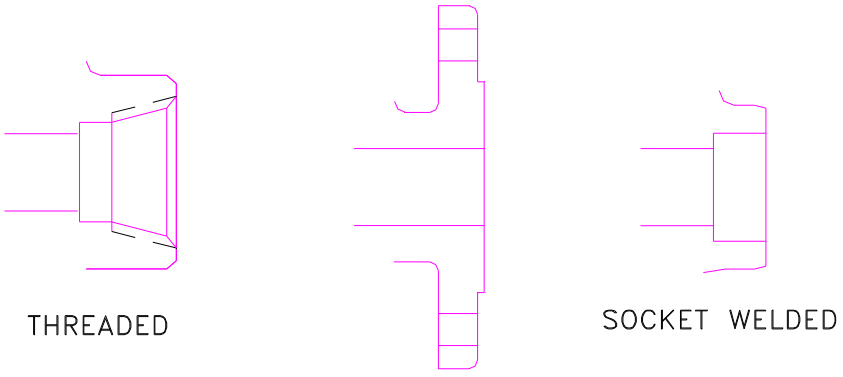
Ensure that the socket/threaded connection is clean and free from any foreign debris or burrs. For any welding required, check that body material (as specified on nameplate), and pipe materials are compatible for weld procedure.

2.3.3. Valve Installation by Welding.

Unless the valve contains PTFE packing and/or gasket, leave valves assembled and in the lightly closed position during installation, welding and post-weld heat treatment. This will prevent the valve seat from floating or warping during the process. After welding completion, open the valve and flush the line to clean out any foreign matter.

Valves containing PTFE packing and/or gasket must be disassembled for installation as the welding temperature can adversely affect the PTFE components. Match mark each component during disassembly for proper reassembly.

The responsibility for welding of the valves into piping systems is that of those performing the welding. Refer to ASME B31.1, B31.3, etc. Written welding procedures covering all attributes of the process and materials to be welded shall be in accordance with Section IX of the ASME Boiler and Pressure Vessel Code and any additional requirements from the applicable piping code including any possible necessary localized PWHT depending on material specifications.



VALVE END CONNECTIONS

3. MAINTENANCE AND REPAIR

3.1. Inspection and Maintenance

A periodic inspection and maintenance schedule should be established for each valve. The time frame given for the implementation of these schedules are to be used as a guide only in establishing routine inspection and maintenance schedules. Exact time periods for performing these procedures cannot be provided due to the unknown nature of the service conditions each valve is in.

3.1.1. Periodic Inspection.

A periodic inspection should be performed on each unit. As mentioned previously, this time frame should be adjusted depending on usage and service conditions. An infrequently used unit may have a longer time period between the performance of a periodic inspection. If, on the other hand, a valve is in constant service a shorter time period between inspections would be appropriate.

The inspection is used as a means to identify a problem before it can cause a shutdown of the system. A periodic inspection should include the following:

a. Examine the valve stem for cleanliness and lubrication. The stem threads should be coated with a clean grease lubricant.
b. Some valves have a grease fitting in the bonnet or yoke. If it is dry, lubricate with a hand grease gun.
c. Open and close the valve. The actions should be smooth without any binding of the stem through full travel.
d. If valve is in service and under pressure:
   - **i) Examine the body to bonnet connection for leakage through the gasket. If leakage is found, tighten the bonnet nuts evenly in a star pattern until the leakage stops. Do not exceed the maximum torque values in Table A. If the leakage persists, see section 3.2. (NOTE: this does not apply to welded bonnets)**
   - **ii) Check the stem packing for any leakage during the opening and closing action. If a leak is found, tighten the gland nuts alternately with no more than a quarter turn on each nut until the leak stops. If the leakage persists, see section 3.2.**
   - **iii) Inspect the exterior of the valves for cleanliness. Remove any dirt, grime or oil from the valve body and bonnet.**

3.1.2. Post Inspection.

After completion of this periodic inspection, valves that are providing satisfactory service require no further disassembly or inspection. Should a valve be found which is not performing satisfactorily, see section 3.2 "Troubleshooting".

3.1.3. Maintenance.

Other than periodic inspection, no routine maintenance is required. Routine replacement of parts, such as gasket and packing is not usually performed until these parts fail. Once in service, it may become apparent that these and other parts require repair or replacement due to usage and service conditions. A maintenance schedule should be developed taking these conditions into consideration to replace parts which have a tendency to wear within a given time frame. These can then be replaced during a routine overhaul prior to any failure.

3.2. Trouble-shooting

The following chart will cover the various problems that are common to most valves. It will provide information that will aid in isolating and correcting these problems.

Table 3-2 Valve Troubleshooting

PROBLEM	PROBABLE CAUSE	SOLUTION
Leakage through the stem packing	a. Gland nuts are loose	a. Tighten gland bolting.
	b. Gland is binding against the stem or packing chamberwall	b. Check to insure gland is centered and evenly tightened
	c. Inadequate amount of packing rings	c. Install additional packing rings see section 3.3
	d. Packing is hard and dry	d. Replace with new packing see section 3.3
	e. Packing was not properly cut and staggered	e. Replace with new packing see section 3.3
	f. Stem is damaged	f. Repair or replace as required
Problems in operating valve	g. Stem binding during travel	g. Remove dirt and lubricate stem with grease
	h. Stem packing is exerting excessive force on the stem	h. Check torque on gland nuts.
	i. Stem is damaged	i. Examine stem through full open and close action. Repair or replace as required
	j. Internal components may be damaged	j. Disassemble the valve. Inspect and repair as needed.
Bonnet Leakage	k. Bonnet nuts are loose	k. Tighten to values listed in Table A.
	l. Gasket is damaged	l. Disassemble and install a new gasket.
	m. Flange faces are damaged	m. Repair and install a new gasket
Seat Leakage	n. Valve not properly seated	n. Check to see if valve is tightly closed
	o. Internal components are damaged or worn	o. Inspect internal components and repair as required (for detailed repair consult Newmans representative).

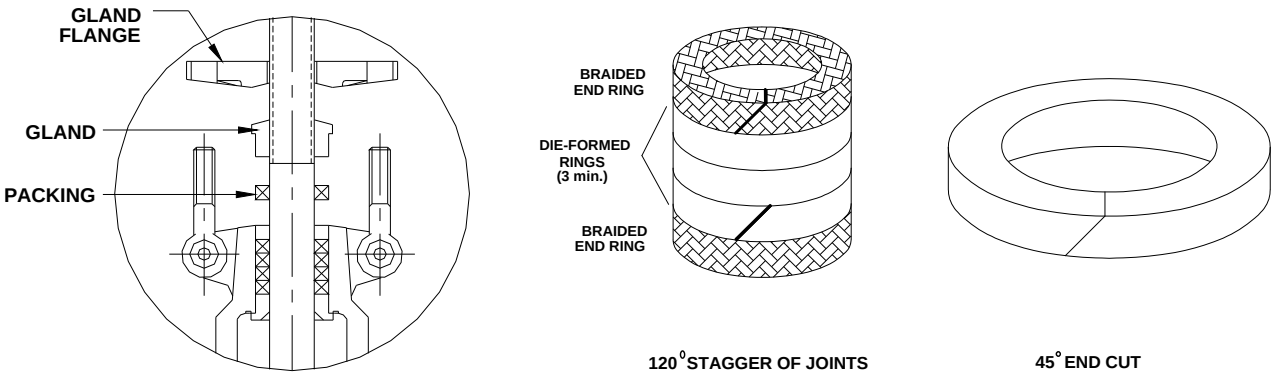
3.3. Stem Packing Replacement

WARNING

To prevent injury ensure that all pressure is removed from the valve both upstream and downstream before disassembly.

a. Check original tightness of valve operation. Remove gland nuts. Lift the gland up the stem clear of the packing chamber.
b. Remove the existing or defective packing rings with a sharp tool or packing remover. Do not scratch or score the machined surfaces of the stem or packing chamber.
c. Examine the machined surface of the stem in the packing chamber. Remove any scratches, scoring or burrs with emery cloth or hand filing. Clean the stem with a solvent soaked cloth.
d. Count original number of rings and measure x-section thickness. If original packing cannot be counted or measured, follow the steps below:
    1.) Measure the stem diameter (OD), stuffing box diameter (ID) and stuffing box depth (d).
    2.) Packing x-section (R) = (ID - OD)/2
    3.) #rings = (1.25 x d)/R
e. Install new packing. Cut each ring at a 45-degree angle and stagger the joints at 120 degrees, every fourth joint will be in the same position as the first. Install rings individually using a split ring spacer, compressing each ring by hand tightening = 1/4 turns on each gland nut.
f. When packing chamber becomes filled with packing, reassemble gland and gland flange. Alternate tightening gland flange nuts 1/4 turn at a time until eye bolts begin to get tight. (If gland travels more than the height of one packing ring into the packing chamber, insert one more ring and repeat step F until chamber is filled.
g. Compare valve operation to original tightness. If valve operation is considerably tighter than original operating tightness, back off 1/4 turn on each gland nut and recheck tightness.
h. Several hours after a repacked valve has been returned to service, inspect the area to ensure full compression, tight bolting and no leakage. Should leakage occur, tighten gland nuts at 1/4-turn increments until leakage stops.

Figure 3.1.3-1 (a) Valve Stuffing Box Assembly (b) Packing Detail



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4. NEWCO FORGED STEEL VALVES

4.1. Bolted/Welded Bonnet Gate and Globe Valves

4.1.1. Operation

By turning the handwheel counter-clockwise, the stem, to which the wedge (or disc) is attached at the base, is drawn up through the yokesleeve. By turning the handwheel clockwise, the action is reversed and the wedge (or disc) is lowered into the closed position.

4.1.2. Disassembly

WARNING

To prevent injury ensure that all pressure is removed from the valve both upstream and downstream before disassembly.

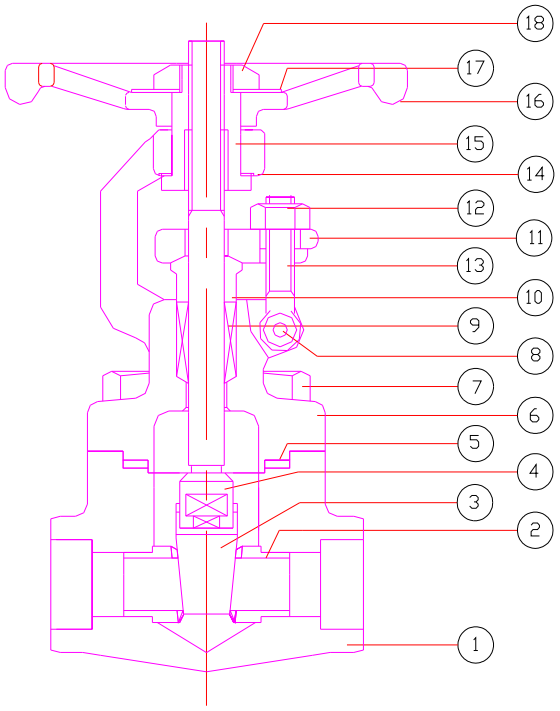
NOTE: Welded bonnet valves can be disassembled but is not justifiable due to the amount of time required to do this.

a. Close the valve and then open, two full handwheel turns. Match or mark flange with metal tool or paint to clearly show the original position for reassembly.
b. Caution should be taken when loosening body-bonnet bolting, as pressure may still be present in bonnet.
c. Once assured there is no more pressure in the line, remove the bonnet bolting. Lift the bonnet-stem-wedge (or disc) assembly out of the body, taking care not to scratch the seating surface. For gate valves, as the assembly is drawn out of the body, match or mark the wedge so that it can be replaced in the same position.
d. Remove the bonnet gasket from the valve body flange.
e. For **gate valves**, remove the wedge from the stem "T" head, carefully protecting the seating surface. . For **globe valves**, remove the disc from the stem by cutting tackwelds and unthreading the disc nut or bushing.
f. Unfasten the handwheel nut. Remove the handwheel from the valve.
g. To remove the valve stem, loosen the gland bolting and gland. Disengage the stem from the yokesleeve by rotating it counterclockwise and pulling from below until the stem is free of the packing chamber. Be careful not to score or scratch the stem machined surface or the threads**.**

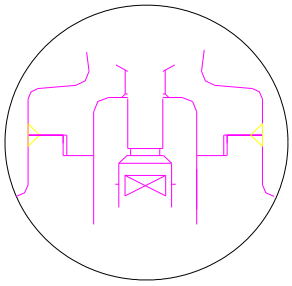
4.1.3. Reassembly

a. Thoroughly clean the valve interior, body and bonnet flange surfaces and all components. Remove all scale, oil, grease or other foreign material. Wipe the seating surface of the wedge (or disc) and valve seat with a solvent soaked cloth.
b. Install the stem carefully, sliding it through the packing and gland until the threads are engaged with the yokesleeve. Slowly rotate the stem clockwise until it extends beyond the bonnet.
c. Place handwheel in position atop the valve, stem nut for gate valves and stem for globe valves. Secure with handwheel nut.
d. Position a new gasket on the body flange aligned with the bolt holes. The gasket should not extend over the open body cavity. The gasket may be coated with a light oil.
e. For gate valves, install the wedge to the "T" head of the stem connection. For globe valves, install the disc and secure it with the bushing or disc nut to the stem and tackweld.
f. Lift the bonnet-stem-wedge assembly up and over the body. Check the location marks on the body, bonnet flange and wedge. Carefully lower the assembly until the body and bonnet flanges and the location marks meet. Again, caution must be used to prevent scoring or scratching of the seating surfaces. Keeping the bonnet stationary, open the valve a few turns to ensure the wedge (or disc) is not touching the seat.
g. Line up the body and bonnet holes. Make sure the gasket does not extend into any of the bolt holes. Install the bonnet bolting and tighten in a star pattern to evenly load the gasket to the torque values listed in Table A.
h. Install new packing as per section 3.3.
i. Align and center the gland in the packing chamber. Evenly tighten the gland nuts until snug, then alternate tightening with no more than a quarter turn on each.
j. Open and close the valve using the handwheel. The action should be smooth and regular through full stem travel.

Figure 4.1-1 Bolted Bonnet Gate Valve with Welded Bonnet

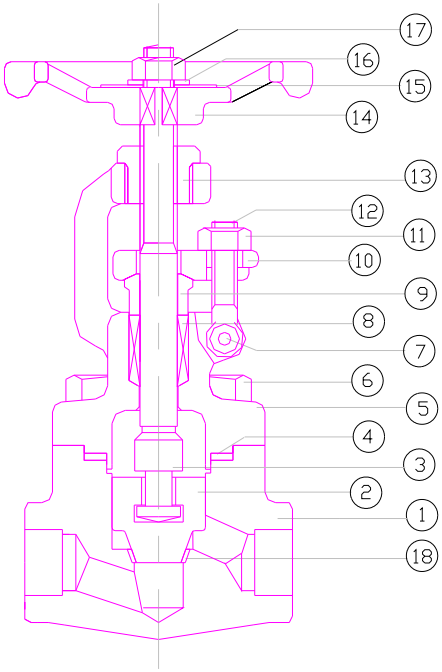


18	HAND WHEEL NUT
17	NAME PLATE
16	HAND WHEEL
15	SLEEVE
14	SLEEVE WASHER
13	EYE BOLT
12	EYE BOLT NUT
11	GLAND FLANGE
10	GLAND
09	PACKING
08	EYE BOLT PIN
07	BONNET BOLT
06	BONNET
05	GASKET
04	STEM
03	WEDGE
02	SEAT RING
01	BODY

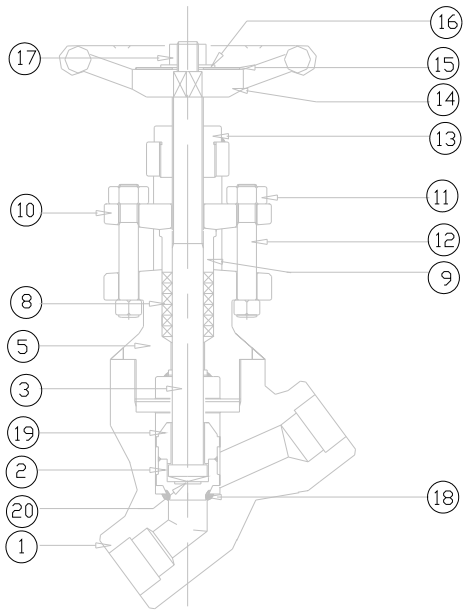


WELDED BONNET DETAIL

Figure 4.1-2 Bolted Bonnet Globe Valve With Welded Bonnet Y-Pattern Globe



20*	SEAT RING
19*	DISC NUT
18	SEAT RING
17	NUT
16	WASHER
15	NAME PLATE
14	HANDWHEEL
13	STEM NUT
12*	EYE BOLT/STUD
11	EYE BOLT NUT
10	GLAND FLANGE
09	GLAND
08	GLAND PACKING
07*	EYE BOLT PIN
06*	BONNET BOLT
05	BONNET
04*	GASKET
03	STEM
02	DICK
01	BODY



* MAY VARY WITH DESIGN

4.2. Bolted/Welded Cap Swing-Type Check Valves

4.2.1. Operation

The Swing Check valve's operation is automatic and requires no assistance. When the flow exerts sufficient pressure against the disc to overcome the disc's weight, the disc, which is set on a hinge, lifts allowing the flow to continue through the piping system. As the pressure decreases, the disc lowers until its own weight forces it to seat. This prevents the possibility of a reversal in the flow.

4.2.2. Disassembly

WARNING

To prevent injury ensure that all pressure is removed from the valve both upstream and downstream before disassembly.

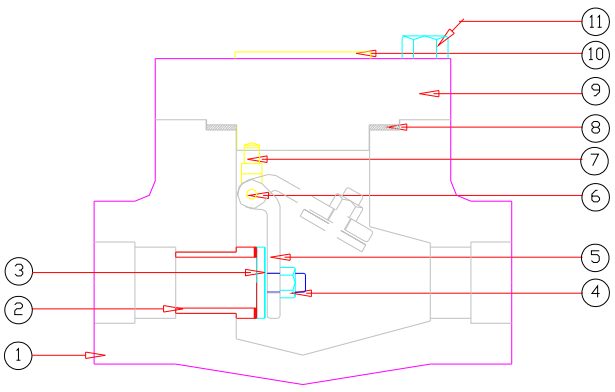
NOTE: Welded cap valves can be disassembled but is not justifiable due to the amount of time required to do this.

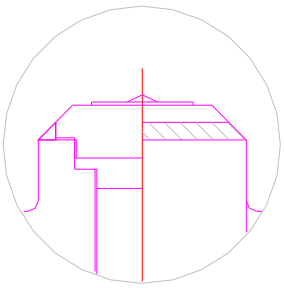
a. Match or mark cover and body with metal tool or paint to clearly show the original position for reassembly.
b. Caution should be taken when loosening body-cover bolting, as pressure may still be present.
c. Once assured there is no more pressure in the line, remove the cover bolting and lift the cover off the body.
d. Remove the gasket from the valve body flange.
e. If so equipped remove any tackwelds.
f. Remove the hinge pin from support arms in cap. It may be necessary to use a punch, as pin may have been penned over.
g. To remove the disc from swing arm, remove the cotter pin and unfasten the disc nut.

4.2.3. Reassembly

a. Thoroughly clean the valve interior and all components. Remove all scale, oil, grease, or other foreign material. Wipe the seating surface of the disc and valve seat with a solvent soaked cloth. Clean the body and cover flange surfaces and all bolting.
b. Install the disc and secure it to the arm with the disc nut. Insert and secure a new pin (peen over if required). Do not use the old pin unless a new one is unavailable.
c. Place the disc-arm assembly in the valve and insert the hinge pin.
d. Replace any tackwelds as required.
e. Open the valve by lifting the arm. The action should be smooth and regular through full hinge pin rotation.
f. Position a new gasket on the body flange aligned with the bolt holes. The gasket should not extend over the open body cavity. Do not reuse a gasket. The gasket may be coated with a light oil.
g. Line up the body and cover holes. Make sure the gasket does not extend into any of the bolt holes. Install the cover bolting and tighten in a star pattern to evenly load the gasket to the torque values listed in Table A.

Figure 4.2-1 Bolted/Welded Cap Swing-Type Check Valve





11	COVER BOLT
10	NAME PLATE
9	COVER
8	GASKET
7	SUPPORTER
6	SUPPORTER PIN
5	HINGE
4	RETAINING NUT
3	DISC
2	SEAT RING
1	BODY

WELDED BONNET DETAIL

4.3. Bolted/Welded Cap Lift Check Valves

4.3.1. Operation

The Lift Check valve's operation is automatic and requires no assistance. When the flow exerts sufficient pressure against the plug/ball to overcome the plug/ball weight, the plug/ball, lifts allowing the flow to continue through the piping system. As the pressure decreases, the plug/ball lowers until its own weight forces it to seat. This prevents the possibility of a reversal in the flow.

4.3.2. Disassembly

WARNING

To prevent injury ensure that all pressure is removed from the valve both upstream and downstream before disassembly.

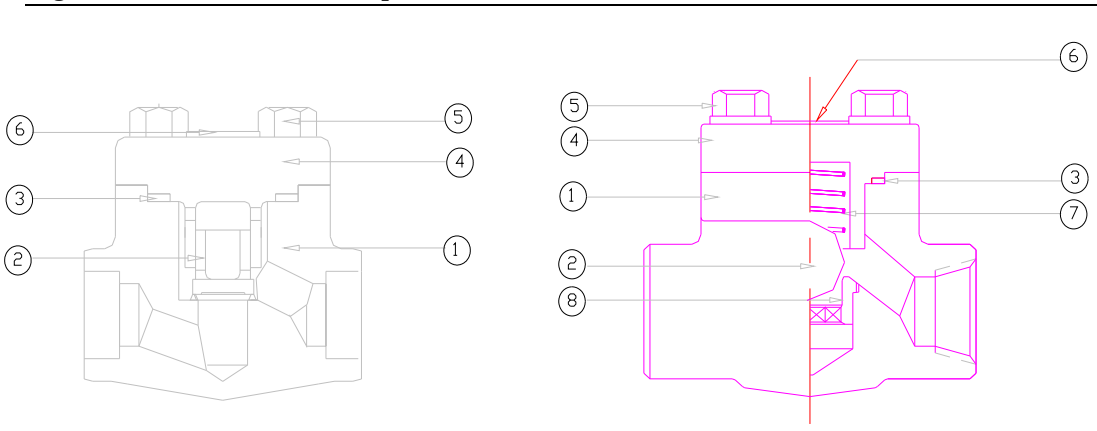
NOTE: Welded cap valves can be disassembled but is not justifiable due to the amount of time required to do this.

a. Match or mark cover and body with metal tool or paint to clearly show the original position for reassembly.
b. Caution should be taken when loosening body-cover bolting as pressure may still be present.
c. Once assured there is no more pressure in the line, remove the cover bolting and lift the cover off the body.
d. Remove the gasket from the valve body flange.
g. For ball type valves remove spring (if so equipped) before sliding out the ball. For plug type, simply slide out the plug.

4.3.3. Reassembly

a. Thoroughly clean the valve interior and all components. Remove all scale, oil, grease, or other foreign material. Wipe the seating surface of the plug/ball and valve seat with a solvent soaked cloth. Clean the body and cover flange surfaces and all bolting.
d. Replace ball/plug by sliding it back into the body. If so equipped place spring in following ball.
e. Open the valve by sliding plug/ball up and down. The action should be smooth and regular through full plug/ball travel.
f. Position a new gasket on the body flange aligned with the bolt holes. The gasket should not extend over the open body cavity. Do not reuse a gasket. The gasket may be coated with a light oil.
g. Line up the body and cover holes. Make sure the gasket does not extend into any of the bolt holes. Install the cover bolting and tighten in a star pattern to evenly load the gasket to the torque values listed in Table A.

Figure 4.3-1 Bolted/Welded Cap Lift Check Valve



8*	GASKET
7*	SUPPORTER
6	SUPPORTER PIN
5	HINGE
4	RETAINING NUT
3	DISC
2*	SEAT RING
1	BODY

* VARIES WITH DESIGN

5. ABOUT NEWCO VALVES

5.1. Identifying Newco Figure Numbers

Newco valves can be identified by a distinct figure number on the identification plate. This plate is located either on the body/bonnet flange or on the bonnet yoke. The figure number gives all the necessary information for identifying valve type, material, end connections, pressure rating, etc. Listed below is the basic set-up.

Type	Pressure Class	End Connections	Trim Material
1 = Gate, OS&Y	1 = 150	F = Flanged	1 = CR13
2 = Globe, OS&Y	2 = 125	W = Butt Weld	2 = CR13/HF**
3 = Swing Check	3 = 300	J = RTJ	3 = HF/HF**
4 = Lift Check	4 = 400	S = Socket Weld	4 = 316
5 = Ball	5 = 250	T = Threaded	5 = NI CU (Monel***)
6 = Gate, NRS	6 = 600	B = Wafer	6 = Alloy 20
7 = Angle, OS&Y	8 = 800	X = Special (Customer to specify)	7 = Bronze
8 = Plug	9 = 900		8 = Iron
9 = Butterfly	15 = 1500		9 = Special (Customer to specify)
	25 = 2500		
	45 = 4500		

FIG. 11F-CB2*

BODY/BONNET MATERIAL

CB	= ASTM A216, WCB	= Cast Carbon Steel
C5	= ASTM A217, C5	= Cast Alloy Steel (5% Chrome, ½% Moly)
C6	= ASTM A217, WC6	= Cast Alloy Steel (1¼% Chrome, ½% Moly)
C9	= ASTM A217, WC9	= Cast Alloy Steel (2¼% Chrome, 1% Moly)
C12	= ASTM A217, C12	= Cast Alloy Steel (9% Chrome, 1% Moly)
LCB	= ASTM A352, LCB	= Cast Low Temperature Carbon Steel
LC3	= ASTM A352, LC3	= Cast Low Temperature 3½% Nickel Steel
CF8	= ASTM A351, CF8	= Cast 304 Stainless Steel
C8M	= ASTM A351, CF8M	= Cast 316 Stainless Steel
A20	= ASTM A351, CN7M	= Cast Alloy 20
MO	= ASTM A296, M35	= Cast NI CU (Monel***)
FS	= ASTM A105	= Forged Carbon Steel
F5	= ASTM A182, F5	= Forged Alloy Steel (5% Chrome, ½% Moly)
LF-2	= ASTM A350, LF2	= Forged Low Temperature Carbon Steel
F11	= ASTM A182, F11	= Forged Alloy Steel (1¼% Chrome, ½% Moly)
F22	= ASTM A182, F22	= Forged Alloy Steel (2¼% Chrome, 1% Moly)
F8M	= ASTM A182, F316	= Forged 316 Stainless Steel
F8	= ASTM A182, F304	= Forged 304 Stainless Steel
F8C	= ASTM A182, F321	= Forged 321 Stainless Steel
DI	= ASTM A395	= Cast Ductile Iron
IB	= ASTM A126, CLB	= Cast Iron
BR	= ASTM B61	= Bronze
SPL	= Special (Customer to specify)	

For End Connections, Body Materials and Trims not listed, please specify.

*SUFFIX LETTERS

PS	= Pressure Seal Bonnet
SO	= Safe-O-Seal Bonnet
WB	= Welded Bonnet
UB	= Union Bonnet
HP	= Horizontal Piston Check
HB	= Horizontal Ball Check
VB	= Vertical Ball Check
TD	= Tilting Disc Check
FP	= Full Port
RP	= Regular Port
TF	= Teflon* Insert
VT	= Viton* Insert
SC	= Stop-Check
NR	= Non-Return
SG	= Solid Wedge, Gate
N1	= Material to NACE MR-01-75
HL	= High Lift
FS	= Firesafe
PT	= PTFE Seats
GO	= Gear Operator
MO	= Motor Operator
PO	= Pneumatic Operator
HO	= Hydraulic Operator
CR	= Cryogenic Service
OL	= Outside Weight & Lever
VP	= V-Port Disc
BP	= By-Pass
OX	= Oxygen Service
CL	= Chlorine Service
GI	= Grease Injection
BS	= Bellows Seal
VG	= Venturi Gate
ST	= Socket Weld x Threaded
SL	= Special Lining

* = Viton and Teflon are registered trademarks of DuPont Company.
** HF = Hardfaced - AWS 5.13 Class C_oC_RA
*** Monel is a registered trademark of International Nickel Company.

Please order by size, figure number (which specifies type), pressure class, end connections, materials and special features, as shown above.

5.2. Ordering Parts

Although valves have many parts common to one another, they are not interchangeable, other that with those of identical material, size and pattern. All the valve's parts can be replaced, but with proper care and maintenance, they will provide continuous satisfactory service. Should a part require replacement, please provide the following information:

Valve Size
Newco Figure
Two Digit Foundry Code (on body)
Part Description
Drawing No. (If known)
Item No. (If known)

It is recommended that a spare gasket and set of packing for the various valves be kept in stock.

5.3. Identifying Cooper Valves

Cooper Valves are all special order and built per a myriad of customer requirements to perform under various special conditions. Every Cooper Valve and its components are fully traceable through a unique serial number assigned and attached to each valve. Also found on the valve tag is the part number.

5.4. Ordering Cooper Parts

Please use the valve serial number when contacting the factory for parts as well as the part number.

6. REVISION HISTORY

Revision	Description	Approval and Date
1	Initial Release	Undated, Unsigned
2	Added Cooper Product line to document. Added approval and revision information to document body. Other minor formatting improvements.	9 May 2007, maw for Shu-Ping Chow

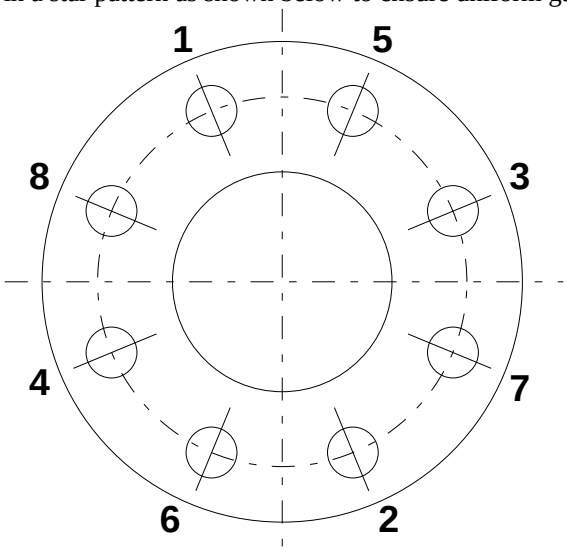
APPENDIX A

Table A -- Torque Values for Bonnet Bolting

Bolt Nominal Diameter (in.)	Torque (ft-lb)	(N-M)	Bolt Nominal Diameter (in.)	Torque (ft-lb)	(N-M)
1/4	4	5	1	200	271
5/6	8	11	1-1/8	375	509
3/8	12	16	1-1/4	525	712
7/16	20	27	1-3/8	715	970
1/2	30	41	1-1/2	925	1254
9/16	45	61	1-5/8	1200	1627
5/8	60	81	1-3/4	1500	2034
3/4	110	149	1-7/8	1850	2509
7/8	170	231	2	2260	3064

Notes:

1. Values are for B7 bolting only. For other bolting material, please consult your local Newco representative.
2. Values above are based on 30,000 psi (206.85 Mpa) bolting stress and lubricated with a heavy graphite and oil mixture. Non-lubricated bolts have and efficiency of 50% of the values stated.
3. Do not exceed by more than 25% of values stated when emergency torquing is required.
4. All bolts shall be torqued in a star pattern as shown below to ensure uniform gasket loading.



Bolt torquing sequence. 1-2-3-4-5-6-7-8