



Apollo Top Entry Ball Valves Installation, Operation, & Maintenance Guide

Introduction

This manual presents guidelines for the Installation, Operation and Maintenance of Apollo Top Entry Ball Valves. Review the entire manual before beginning any work.

Storage & Protection

Valves should be stored in original shipping containers until installation with protective means in place to prevent any damaging effects from the environment or other potentially damaging influences. Valves should be properly supported and secured before moving to prevent possible damage to property or harm to personnel.

Limitations

- Conditions supporting no greater than European Pressure Equipment Directive (PED) Category III valves. Valves are not to be used in safety functions such as safety loops or separating incompatible fluids.
- For gases and liquids in European Pressure Equipment Directive (PED) Groups 1 & 2.
- Service to be compatible with the materials of construction. Prior to selection it is the user's responsibility to determine that the valve is appropriate for the intended application. Applications should not allow corrosion $>.002$ "/year (.05mm/year).
- The possibility of material deterioration in service and need for periodic inspections is the responsibility of the user.
- For carbon steel valves, complete valve replacement will be necessary after 10 years of continuous service above 800°F (426°C).
- Mechanical supports are not to be welded directly to the valve; however, they may be fitted to the associated piping.

- It is the piping system designer's responsibility to implement appropriate protection measures to minimize reaction forces and moments which result from supports, attachments, piping, etc.
- Laws of the state must be observed as they apply.
- In-service inspections may be required by national authorities of the country where the valve is installed.
- Some national or local authorities may require periodic hydrostatic testing.
- Only use Conbraco replacement parts.
- Valves are intended for on-off service only and should not to be used for throttling applications.
- Valves are primarily intended for industrial use.
- Level of training, experience or ability of users should be at least that of trained and skilled maintenance personnel or technicians.

Installation

Proper valve selection is the first step in any successful installation. Refer to an "Apollo Industrial Applications Guide" catalog for application guidance or contact your distributor or the factory for more detailed assistance. **WARNING: All installations shall be provided with pressure relief devices in accordance with the requirements of the Pressure Equipment Directive 97/23/EC. Proper installation prior to initial operation is the user's responsibility. Furthermore, where an additional hazard can occur due to valve exposure to fire or other unexpected external heat source, a supplemental pressure relief device shall be installed to protect against excessive pressure. This device shall prevent the pressure from rising more than 21% above the maximum allowable working pressure. Means must also be provided to monitor valve filling to prevent over pressurization and instability.**

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Pre-Installation Inspection

Inspect the piping system prior to valve installation whenever possible, to ensure that it has been properly flushed and cleared of construction and fabrication debris. The seating surfaces in soft seated valves are particularly susceptible to weld slag and sand blasting grit. Pipe scale, metal chips and other foreign materials should be removed.

Just prior to installation, remove each valve from its packing and remove any end covers. Examine the flow bore for debris. All Apollo ball valves are shipped in the open position to prevent damage to the ball surface. Any grit or foreign matter must be removed. Scratched or dented balls must be replaced. Do not install a damaged valve.

It is also important to check for valve operation clearances. With the exception of special directional valves, installation is acceptable in any position using standard pipe fitting practices.

Flanged-End Installation

Flanged-End installation shall be done in accordance with the applicable Code or regulation covering the system into which the valve is being installed. It is the end-user's responsibility to select the Code Section(s) that apply to a proposed piping installation. The end-user is fully responsible for assuring safe piping for the proposed installation, including all additional necessary supplementary requirements.

Weld-End Valve Installation

Installation welding shall be done in accordance with the applicable Code or regulation covering the system into which the valve is being installed. Both butt-weld and socket-weld valves require special consideration for installation. In addition to the general cautions already discussed, the heat of welding may damage seats and seals. A warning label is included with all weld end valves. To avoid this concern, the bonnet, seal, stem, ball and seats can be removed. The design of Apollo Top Entry ball valves makes the process of removing these components almost effortless. This procedure is included in the "Disassembly" section of this manual.

Once the body has been welded into the piping system, using an appropriate welding procedure, it should be allowed to cool and thoroughly cleaned before reinstalling the internal components. Damage to sealing surfaces should be avoided.

Threaded-End Valve Installation

After removing the valve from its packing, inspect the NPT threads for damage. Occasionally threads may require chasing prior to installation to remove burrs or other minor imperfections. Apply pipe sealant compound or PTFE tape to the male pipeline threads only. Do not use sealant on the female threads because excess compound may be forced into the valve body. This could cause sticking of the ball or encourage the accumulation of dirt and debris that could prevent positive valve shutoff.

Operation

Apollo valves are shipped with a securely fastened nameplate and attached warning tags. Most Apollo ball valves are non-directional. However, valves may be ordered with the vented body option which safe guards against excessive pressure build-up in the body cavity. This option renders the valves directional. Valves with this feature are identified by a special tag permanently affixed to the valve body with the word "Flow" and an arrow showing the required orientation of the valve shown in red.

Although each valve is thoroughly tested and inspected before it leaves the factory, nameplates and/or warning tags could be lost or destroyed during shipment or while in storage. If either is missing or not legible, contact your distributor or the factory for assistance before placing the valve in service.

Ball valves are intended to be on-off devices operating through 90° of stem rotation. Operation is clockwise to close.

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The most common service failures not related to the installation and start-up processes are:

- Exceeding the operating temperature or pressure limits of the valve due to a process upset condition.
- A chemical attack on valve components due to either misapplication or changes in the service.

Violating temperature and pressure limits can result in immediate valve failure where chemical attack or corrosion generally occurs gradually.

Maintenance

Preventive Maintenance Schedule

A regularly scheduled and documented preventive maintenance program needs to be established to achieve maximum useful valve life at the lowest cost. Initially, it is recommended that valves be inspected monthly for smooth operation and leak free performance.

For manual valves After an initial break-in period of approximately 500 cycles, stem packings may require adjustment. In most applications, inspection and or adjustments twice a year will be sufficient to assure reasonable valve life.

For automated valves After an initial break-in period of approximately 5,000 cycles, stem packings may require adjustment. Monthly adjustments (approximately 20,000 cycles) should be sufficient thereafter. Valves may be ordered with a “live-loading” feature. The “live loading” feature has design allowances for compaction and wear of the stem packing. It also makes allowance for thermal expansion and contraction as the valve goes through temperature cycles. See Appendix B for “live loading” configurations.

Valve Adjustments

At some point in the service life of the valve, leakage may occur. This should be noted in the maintenance history log of the valve. The stem

packing and bonnet gasket were adjusted at the factory to provide a leak tight seal when the valve was new, but compaction can occur within these seals that may make re-adjustment necessary. Stem packing leakage should be stopped as soon as it is detected. On actuated valves, most mounting hardware allows access to the packing adjustment screws. If this is not the case, it may be necessary to remove the actuator to gain adequate access to make the packing adjustment. Packing adjustment can be accomplished by turning the stem packing adjustment screws clockwise to the maximum torque shown in Table 1. **Caution: Never back off the stem packing adjustment screws when the valve is under pressure.**

Table 1: Stem Packing Adjustment Torque

Nominal Valve Size		Port Size ⁽¹⁾	Pressure Class	Torque ⁽²⁾		-EF Option Torque	
(in)	(mm)			(N·m)	(in·lb)	(N·m)	(in·lb)
½" - 1"	15 - 25	SP	150/300	2.0	18	3.62	32
1-½"	40	SP	150/300	5.1	45	8.37	74
2"	50	SP	150/300	9.9	88	16.95	150
3" - 4"	80 - 100	SP	150/300	17.4	154	29.72	263
6" - 8"	150 - 200	SP	150/300	48.1	426	80.22	710
10" - 12"	250 - 300	SP	150/300	86.1	762	146.66	1298
1"	15 - 25	FP	150/300	5.1	45	8.37	74
1-½"	40	FP	150/300	9.9	88	16.95	150
2" - 3"	50 - 80	FP	150/300	17.4	154	29.72	263
4" - 6"	100 - 150	FP	150/300	48.1	426	80.22	710
8"	200	FP	150/300	86.1	762	146.66	1298
10" - 12"	250 - 300	FP	150/300	164.7	1458	280.32	2481
½" - 1"	15 - 25	SP	600	5.1	45	8.37	74
1-½" - 2"	40 - 50	SP	600	9.9	88	16.95	150
3" - 4"	80 - 100	SP	600	17.4	154	29.72	263
6" - 8"	150 - 200	SP	600	48.1	426	80.22	710
1" - 1-½"	15 - 40	FP	600	9.9	88	16.95	150
2" - 3"	50 - 80	FP	600	17.4	154	29.72	263
4" - 6"	100 - 150	FP	600	48.1	426	80.22	710
8"	200	FP	600	86.1	762	146.66	1298

(1) SP = Standard Port, FP = Full Port

(2) Increase adjustment screw torque's by 25% for valves with graphite stem packing (-24 option)

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Do not over tighten the adjustment screws. Over-tightening will result in excessive operating torque and shorten the packing's service life. If stem leakage continues, or operating torque becomes excessive, valve overhaul may be required.

Bonnet leakage, like stem leakage, must be stopped as soon as it is detected. In addition to the obvious hazards of a leak, allowed to go unchecked, the gasket sealing surface on the body or bonnet may be eroded requiring the replacement of one of these major components. Tighten bonnet bolts to the maximum torque shown in Table 2. Follow the appropriate pattern shown in Figure 1. It is advisable to bring the fasteners up to the specified torque level in two equal steps. When doing the final torque check, torque adjacent bolts clockwise around the pattern. If the bonnet leak continues, de-pressurize the valve and replace the bonnet gasket. When installing a new spiral wound gasket always place the last rings tie-in spot-weld directly under the #1 fastener.

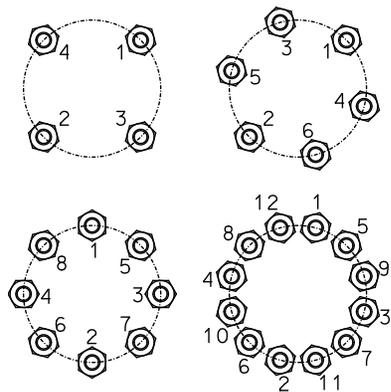


Figure 1

Table 2: Maximum Bonnet Torque

Nominal Valve Size		Classes 150 & 300				Class 600			
		SP		FP		SP		FP	
(in)	(mm)	ft-lb	N·m	ft-lb	N·m	ft-lb	N·m	ft-lb	N·m
1/2"	15	8	11	--	--	20	27	--	--
3/4"	20	8	11	--	--	20	27	--	--
1"	25	8	11	12	16	20	27	20	27
1-1/2"	40	12	16	30	41	20	27	30	41
2"	50	30	41	60	81	30	41	60	81
3"	80	60	81	45	61	60	81	100	136
4"	100	45	61	100	136	100	136	160	217
6"	150	100	136	245	332	160	217	245	332
8"	200	245	332	355	481	245	332	800	1085
10"	250	245	332	500	678	--	--	--	--
12"	300	355	481	680	922	--	--	--	--

Valves with high operating torque, not resulting from stem seal over-tightening, or valves which have leakage by the seats, may have damaged seats or ball surfaces. These valves should be depressurized, disassembled, and inspected for damage.

Valve Overhaul

As part of planned maintenance or as a result of a problem that cannot be adjusted away, a valve may require a complete overhaul. Because of the uncomplicated design of Apollo Top Entry ball valves, this can be accomplished with the valve in line. The first step is to contact your distributor to acquire an appropriate rebuild kit. These kits typically contain a complete set of seats, seals, and gaskets. If seat or ball damage is suspected, it is wise to order a new ball when the seal kit is purchased. To properly order spare parts, you will need the valve model number as shown on the permanent nameplate. A list of recommended spare parts to hold as maintenance items are shown in Appendix "A". This list is generic, as the severity of the service and availability of some exotic alloys can also affect recommended spare parts stocking levels.

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Disassembly

- Once the spare parts are on hand, the first step in the valve disassembly is to isolate the valve from line pressure.
WARNING: Do not attempt to work on any valve under pressure. Depending on the service, valve surface temperature may be hot. Use proper protective gear to protect against burns and any possible uncontrolled release of fluid.
- Begin the disassembly process by operating the valve to the open position. This can be accomplished using the valve lever, or a properly sized adjustable wrench. Be careful not to damage the stem when using an adjustable wrench. Most valves 6" and larger require operation using gear operators or actuators. These units should be used to place the valve in the open position prior to removal. Manufacturer's instructions should be used for removal of actuators, gear operators and mounting kits.
- For manually operated valves, bend the locking tab of the star washer down to permit the removal of the lever nut, lever and grounding spring.
- **Caution:** The ball cannot be removed from the body if it is in the closed position!
- Back off each of the bonnet fasteners ½ turn only initially. This will release the bonnet gasket and assure that there is no pressure trapped within the valve.
- Loosen the stem packing adjustment bolts and remove the bonnet nuts and bolts as applicable. It is not necessary to remove the bonnet studs from the body. Lift off the bonnet assembly and spring after removing the nuts and/or bolts as applicable.
- Remove the stem, gland plate bolts, gland plate and packing gland. The stem design incorporates a blow-out proof feature and must be removed from the bottom side of the bonnet.
- Remove the stem seals from the bonnet using care not to scratch the bore surfaces.
- Insert a large screwdriver or similar tool into the oval slot in the top of the ball, as illustrated in Figure 2. Resting the screwdriver on the valve body, pry the ball and seats loose and upward by pushing down on the screwdriver's handle. Use care not to damage the bonnet gasket sealing surface.

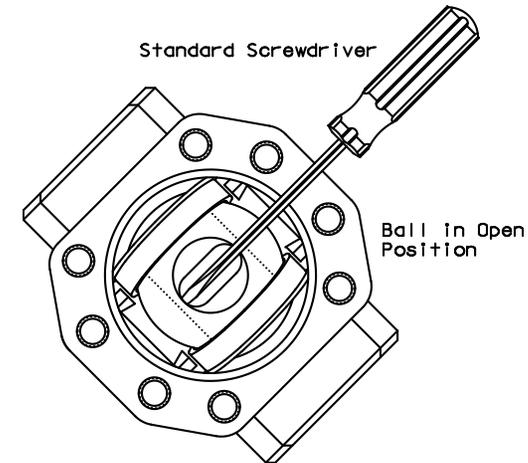


Figure 2

Inspection

- Thoroughly clean all the components in preparation for inspection.
- Examine the flat seating surfaces within the body cavity. See Figure 3. If these surfaces are pitted or scratched the body must be replaced. A scratch is anything you can feel with your fingernail. Machining marks may be present and will not interfere with sealing. Scratches that can be seen but not felt may be polished out using #120 grit emery cloth or finer.
- Inspect the bonnet gasket surface on the body and bonnet. If they are pitted or scratched, then those components must be replaced.
- Examine the packing gland surfaces. Polish these surfaces with #120 (or finer) grit emery cloth and inspect for pits and scratches. Deep scratches running down the side of the packing gland will necessitate the replacement of the valve bonnet.
- If the ball has pits or scratches as described above it should be replaced.
- If the seats are worn or scratched, push the inserts out of the metal seat rings and replace the inserts with new ones. Keep the metal rings.

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- Inspect remainder of body & bonnet interior for pitting or corrosion, replace either if excessive.
- Inspect all parts for wear due to erosion or abrasion and replace if excessive.

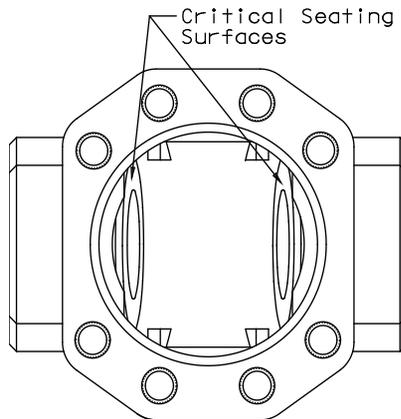


Figure 3

Re-assembly

- When installing new seat inserts in the metal rings, be certain that the sealing surface on the back of the seat protrudes uniformly beyond the metal seat ring(s). It is essential that the seat insert clear both the inner (if provided) and outer seat rings.
- Lightly lubricate the stem packing and bonnet gasket with a lubricant compatible with the intended service⁽³⁾. Slide the thrust bearing over the stem and insert the stem into the bonnet. Slide the stem packing set one at a time over the stem. Use the packing gland ring to push each packing into its final installed position in the bonnet counter-bore.

For -EF Packing Option Do not lubricate the stem packing. Lightly lubricate the stem with a lubricant compatible with the intended service (MorOil FLO 1150 ⁽⁴⁾ is recommended). *Do not perform on valves requiring dry assembly or special cleaning for chlorine services ⁽³⁾. Only install the first two rings of the -EF option packing, by sliding them one at a time over the stem; offset packing rings such that each consecutive ring has 180° of separation between the skive cuts in the packing rings.

- Install the packing gland ring, gland plate and stem packing adjustment screws. Hand-tighten the stem packing adjustment screws.

For -EF Packing Option Do not install the packing retention system (packing gland ring, gland plate, and stem packing adjustment screws/studs and nuts) at this time.

- Wipe any foreign particles from the flat seating surfaces within the body. Wipe the seats and ball clean. Apply a small amount of lubricant compatible with the intended service to both sides of the seats and ball, which will allow them to temporarily “stick” together⁽³⁾.
- With the ball between the seats in the open position, insert the ball and seats simultaneously into the valve body. The oval slot in the ball should be near 90° to the pipeline. The slot must be facing the bonnet opening. The seats and ball are lined up with the pipe centerline by four lugs in the valve body. The amount of spacing between the seats and the lugs should be equally distributed on both sides so that the ball is aligned with the centerline of the valve. A large screwdriver can be used to gently adjust the alignment if necessary.
- Put a new bonnet gasket in place on the bonnet. When installing the new spiral wound gasket always place the last ring’s tie-in spot weld directly in line with the #1 fastener.
- Line the stem tang up with what corresponds to the open position. Test fit the bonnet assembly. Position the bonnet over the bonnet opening in such a manner that the stem slides into the ball slot. After proper alignment is achieved, remove the bonnet assembly and slide the larger spring over the stem tang and reposition the bonnet assembly on the body.
- Press the bonnet assembly down against the valve body using care not to damage the bonnet gasket. Apply a small amount of anti-seize compound to all fasteners. Insert the bonnet bolts or studs and nuts and torque to the value shown in Table 2 using the appropriate pattern illustrated in Figure 1.

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- Tighten the stem packing adjustment screws to the value shown in Table 1.

For -EF Packing Option Packing shall be pre-compressed two rings at a time (for packing sets that have an odd number of packing rings: the final packing pre-compression will be compressing a single ring). The first two rings of the -EF option packing should already be installed and offset by 180° of separation between the skive cuts in the packing rings. Use the appropriate compression spacers, listed in Table 3, and the valve's packing retention system as the means for packing pre-compression. Carefully insert the appropriate compression spacer into the stuffing box; avoid scratching the stuffing box or compressing the packing by hand. For valves that use two compression spacers, the spacer indicated as spacer #1 in Table 3 shall be used for the first pre-compression of the packing and spacer #2 shall be used for the second pre-compression of the packing. Lubricate the stem packing adjustment screws. Install the packing gland ring, gland plate, and stem packing adjustment screws in the order given. Ensure the gland and gland plate remain parallel to the valve body and centered about the valve stem. Torque the stem packing adjustment screws to the applicable value specified in Table 1. Ensure that the gland plate does not make contact with the valve's mounting pad or anything that could prevent desired compression of the stem packing. Remove the packing retention system and compression spacer. Repeat the packing installation and packing pre-compression process as listed above until the entire packing set has been pre-compressed. If the final pre-compression does not require a compression spacer, then the packing retention system does not have to be removed after the final pre-compression has been performed.

- Cycle the valve from open to close at least five (5) times to verify free operation and re-torque the stem packing adjustment screws to the applicable value specified in Table 1.
- For manual valves, place the grounding spring over the stem, install the handle, star lock washer and handle nut.
- Bend one tab of the lock washer up against the handle nut on a flat that most nearly aligns with one of the tabs.
- The valve is now ready for testing and use.

(3) **Warning: For Chlorine, Oxygen and other like services, assemble without lubricants.**

(4) MorOil FLO 1150 is a manufactured product of MorOil Technologies.

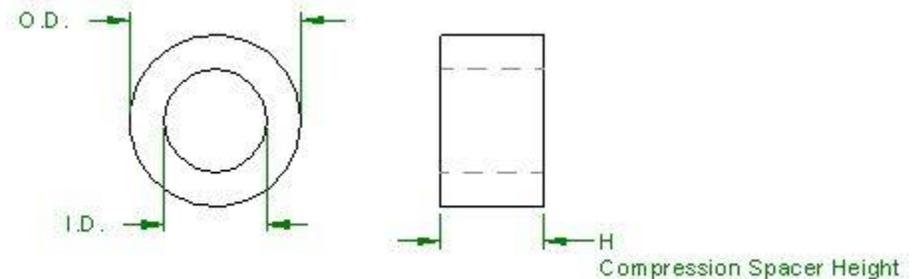


Figure 4: -EF Packing Option Compression Spacer

**Table 3: -EF Packing Option Compression Spacers
(Data presented is in reference to Figure 4)**

Used On	Compression Spacer Part #	Spacer #	I.D. [in]	O.D. [in]	H [in]	-EF Packing Part #
1/2" SP, 3/4" SP, 1" SP 150#/300# TEV	E306006	1	0.510 ± 0.003	0.745 ± 0.003	0.185 ± 0.003	D557000
1" FP, 1-1/2" SP 150#/300# TEV	E306106	1	0.635 ± 0.003	0.995 ± 0.003	0.416 ± 0.003	D567000
1/2" SP, 3/4" SP, 1" SP 600# TEV	E306306	1	0.760 ± 0.003	1.245 ± 0.003	0.543 ± 0.003	D560200
1-1/2" FP, 2" SP 150#/300# TEV	E306606	1	1.260 ± 0.003	1.750 ± 0.003	0.731 ± 0.003	D556600
1" FP, 1-1/2" SP, 1-1/2" FP, 2" SP 600# TEV	E306706	2	1.260 ± 0.003	1.750 ± 0.003	0.350 ± 0.003	
2" FP, 3" SP, 3" FP, 4" SP 150#/300# TEV	E307006	1	2.010 ± 0.003	2.625 ± 0.003	1.136 ± 0.003	D560300
2" FP, 3" SP, 3" FP, 4" SP 600# TEV	E307106	2	2.010 ± 0.003	2.625 ± 0.003	0.600 ± 0.003	
8" FP, 10" SP, 12" SP 150#/300# TEV	E307206	1	2.500 ± 0.003	3.240 ± 0.003	1.400 ± 0.003	D567200
8" FP 600# TEV	E307306	2	2.500 ± 0.003	3.240 ± 0.003	0.778 ± 0.003	
10" FP, 12" FP 150#/300# TEV	E307606	1	3.750 ± 0.003	4.490 ± 0.003	1.200 ± 0.003	D567400
	E307706	2	3.750 ± 0.003	4.490 ± 0.003	0.600 ± 0.003	

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Final Adjustments

Occasionally after testing or initial start-up, a minor stem packing leak may occur. Adjust the stem packing as appropriate and as described in the section entitled “Valve Adjustments”.

Special Application Valves: Ball Stops

Valves designed for high temperature applications (above 500°F) and valves using ceramic balls and seats may come equipped with an adjustable ball stop. Should the valve to be serviced have this feature, characterized by the extra components installed in the bottom of the valve body, as illustrated in Figure 5, several specialized steps are required to successfully complete the overhaul.

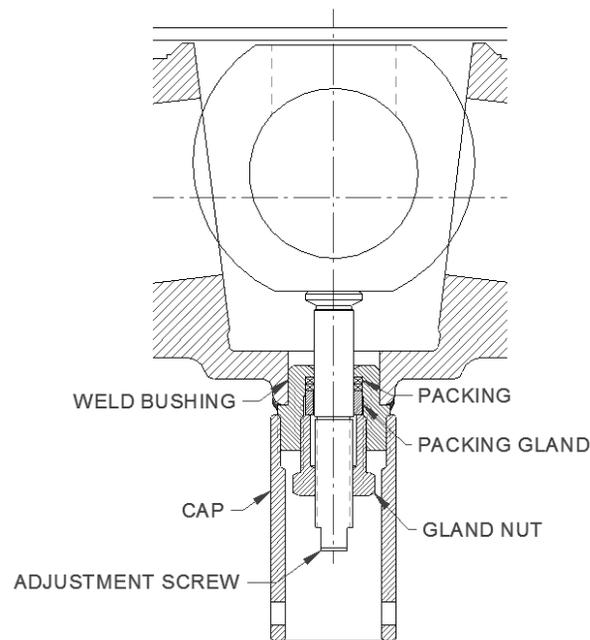


Figure 5

Disassembly Process Changes

Because of the presence of the ball stop it should not be necessary to pry the ball and seats out of these valves; no force should be required to disengage them. Once the ball and seats are removed, the ball stop should be disassembled in the following order:

- First, remove the cap, gland nut and packing gland from outside the valve.
- Then, unscrew the adjustment screw from inside the valve. The packing can then be removed from the outside.
- All parts are then to be cleaned and new packing ordered with the seal kit. No scratches or pits are permissible on the seat faces in the body. Simple polishing is not adequate. These surfaces are match lapped to the seats. They must be truly flat and flawless. These surfaces cannot be repaired. If there is damage, the body must be replaced.

Re-assembly Process Changes

Note: Before installing ball and seats, first insert the adjustment screw from inside the valve (see Figure 5).

When reinstalling used high temperature carbon-graphite seats or metal to metal seats, the seats must be matched lapped to the ball and lapped to the seat faces in the body. If a “final fitting” lap seems necessary, use a small amount of lapping fluid (very fine abrasives mixed with a light oil or even water) in conjunction with the seats to lap these surfaces smooth. New carbon-graphite and ceramic sets are lap matched at the factory. No additional attention prior to installation is required.

If the seating surfaces are good, wipe them clean and apply a small amount of a lubricant compatible with the service. They can be installed dry if necessary, but handling does become more difficult. Install the ball and seats as directed in the standard re-assembly procedure.

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Ball Stop Installation

- Completely assemble the valve as described in the body of this manual before proceeding.
- Apply a small amount of anti-seize compound to all threads. PTFE pipe sealant may be substituted for the anti-seize but do not use PTFE tape.
- Carefully slide the new packing over the adjustment screw and push into place at bottom of weld bushing and slide packing gland against packing.
- Thread the gland nut onto the adjustment screw and hand-tighten. Back out the adjusting screw while holding the nut stationary, until it bottoms against the back seating feature. Slowly turn the adjusting screw clockwise until it just contacts the ball. You will be able to feel it when it meets this resistance. Hold this adjustment and tighten the gland nut to the torques specified in Table 4.
- On all seat styles except the ceramic seats, the adjustment screw should be backed out about ¼ to ½ turn, do not back out the ball stop on valves with ceramic seats.

The valve is now ready for testing and use. As with standard valves, some final adjustments may be necessary. Refer to the “Valve Adjustments” section of this manual.

Table 4: Ball Stop Gland Nut Torque

Nominal Valve Size	Ball Stop Gland Nut Torque (ft-lb)	
	Std. Port	Full Port
½”	5	5
¾”	5	5
1”	5	5
1-½”	5	5
2”	5	15
3”	15	15
4”	15	15
6”	15	35
8”	35	35
10”	35	35
12”	35	35

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Name Plate/Hand Tag Information

One of three possible identification tags may be attached to the valve. ASME/ANSI qualified valves feature a stainless nameplate secured to the side of the body. On qualified 1-1/4" and larger designs, the stainless tag features the CE logo.

ASME/ANSI NAMEPLATE
MODEL
MANUFACTURING DATE
DESIGN CODE
BALL/STEM
SEAT/PACKING
DN – SIZE
PS – MAXIMUM ALLOWABLE PRESSURE @ 38°C
CWP @ 100°F
CONBRACO IND., INC. Made In U.S.A.

CE NAMEPLATE
CE MARK
NOBO NO.
MODEL
MANUFACTURING DATE
DESIGN CODE
BALL/STEM
SEAT/PACKING
DN – SIZE
PS – MAXIMUM ALLOWABLE PRESSURE @ 38°C
CWP @ 100°F
CONBRACO IND., INC. Made In U.S.A.

WARNING TAG

Carefully read the applicable Installation, Operation, & Maintenance Manual in its entirety before removing valve from shipping container. To obtain manual, download from <http://www.conbraco.com/iom>.
DO NOT REMOVE TAG.



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Appendix A

Recommended Spare Parts for Initial Start-Up and 1 Year of Service

Item	Number of Valves to be Supported				
	1 to 10	11 to 25	26 to 50	51 to 100	101 Plus
Seal Kits*	1	2	4	8	10
Stem	0	1	2	4	5
Ball	0	1	2	4	5
Spare Valve(s)**	0	0	1	2	3

Recommended Spare Parts for 2 Years of Service

Item	Number of Valves to be Supported				
	1 to 10	11 to 25	26 to 50	51 to 100	101 Plus
Seal Kits*	2	4	8	16	20
Stem	1	2	4	8	10
Ball	1	2	4	8	10
Spare Valve(s)**	0	1	2	3	4

Recommended Spare Parts for 3 Years of Service

Item	Number of Valves to be Supported				
	1 to 10	11 to 25	26 to 50	51 to 100	101 Plus
Seal Kits*	3	6	12	24	30
Stem	1	3	6	12	15
Ball	1	3	6	12	15
Spare Valve(s)**	1	2	3	4	5

*Seal kits consist of stem packing set, bonnet gasket and seats (compression spacer kits are available for purchase for the -EF option packing)

**Recommended if order quantities do not already include spare valves

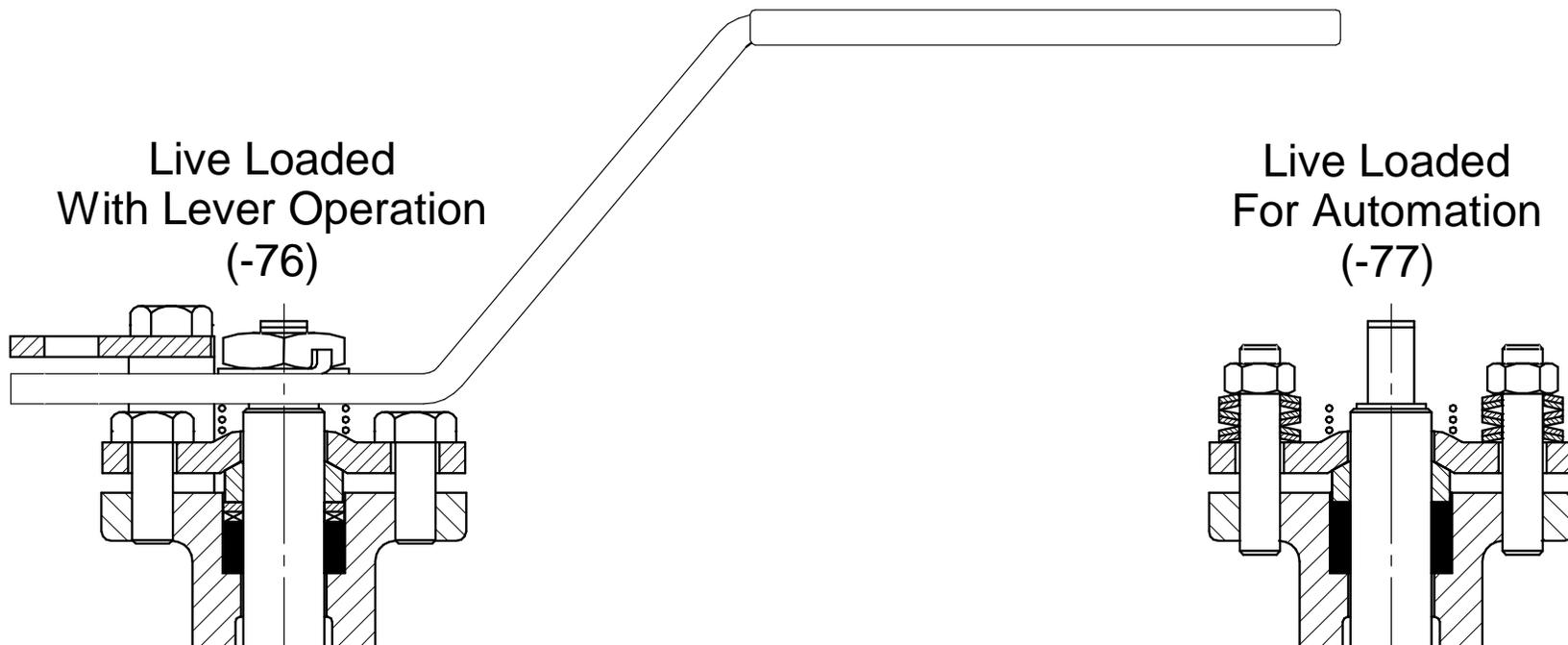


Apollo Top Entry Ball Valves Installation, Operation, & Maintenance Guide

Appendix B

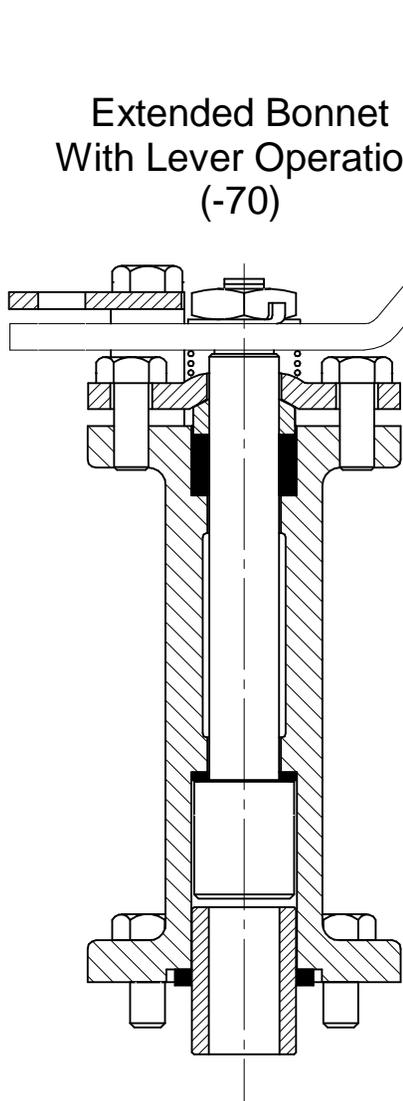
Optional Bonnet Configurations

Apollo Top Entry Ball Valves can be ordered with a wide variety of optional bonnet configurations. Options include live-loaded standard bonnets, extended bonnets, live-loaded extended bonnets, double packed extended bonnets and live-loaded double packed extended bonnets with monitoring port. Many of these options can be combined to meet a wide range of application requirements. Several options are shown below.

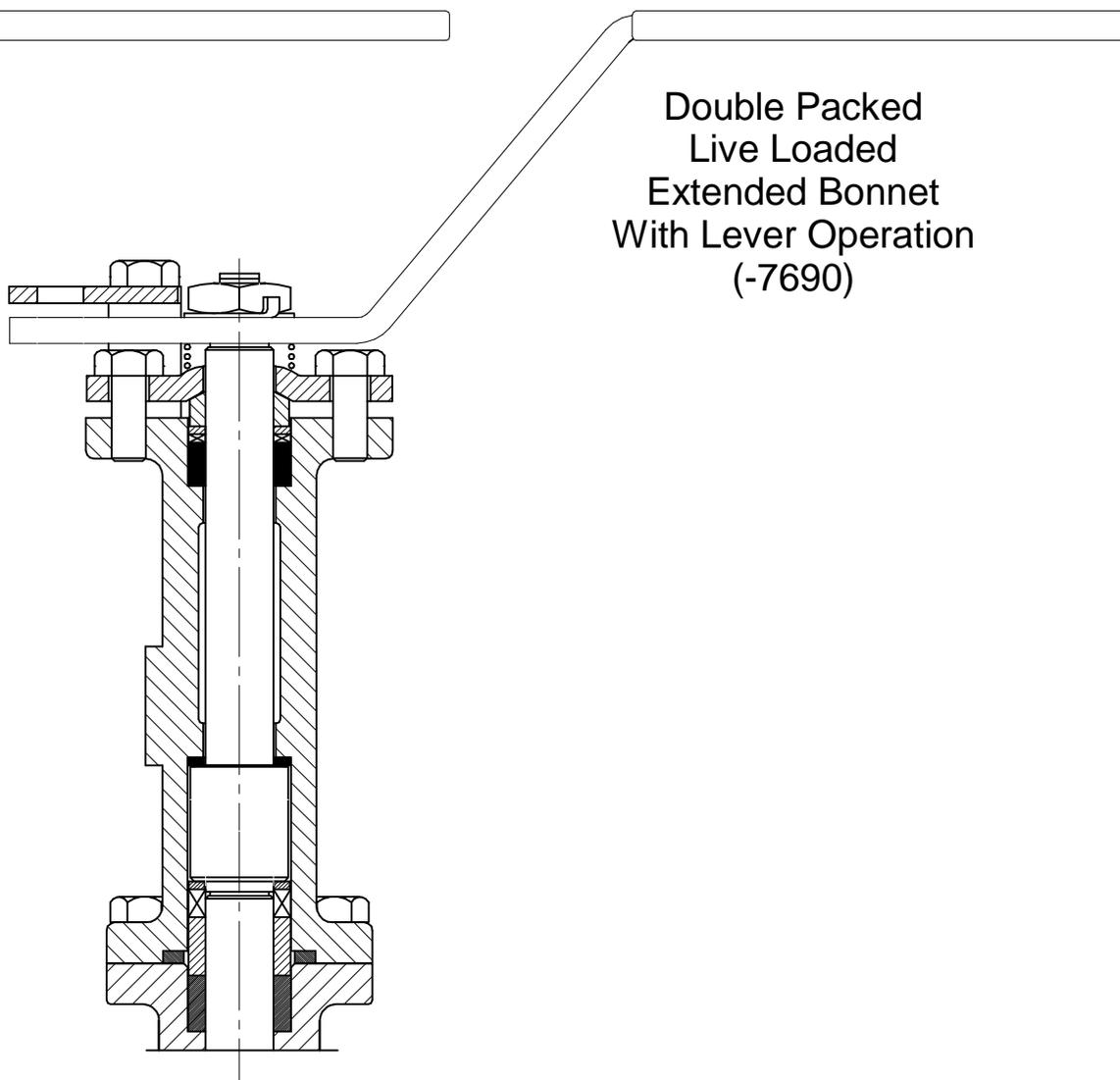


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Extended Bonnet
With Lever Operation
(-70)

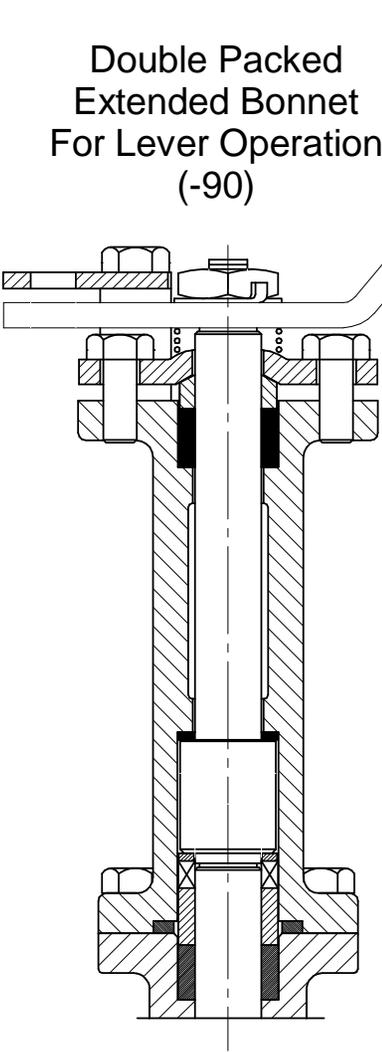


Double Packed
Live Loaded
Extended Bonnet
With Lever Operation
(-7690)

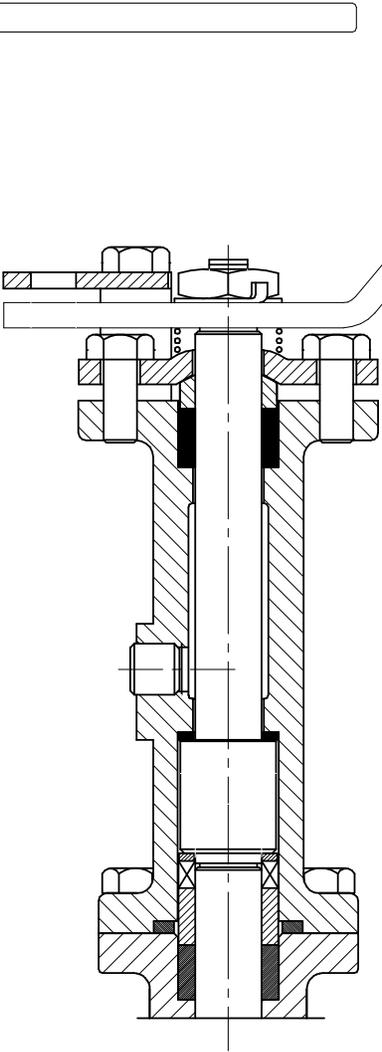


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Double Packed
Extended Bonnet
For Lever Operation
(-90)

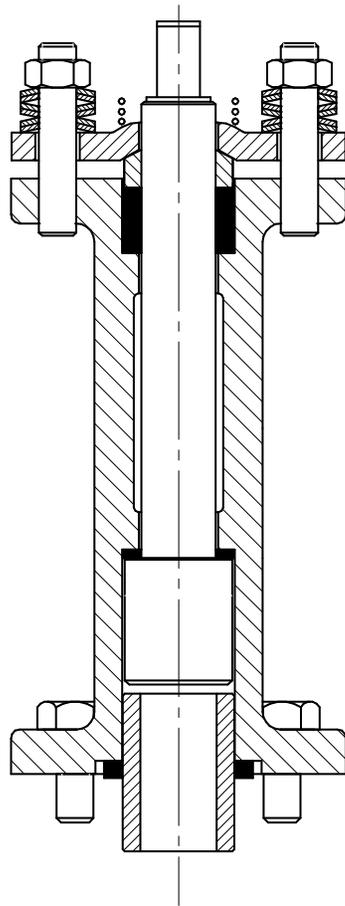


Double Packed
Extended Bonnet
With Purge Port
For Lever Operation
(-9P)



Apollo Top Entry Ball Valves Installation, Operation, & Maintenance Guide

Live Loaded
Extended Bonnet
For Automation
(-7077)



Live Loaded
Double Packed
Extended Bonnet
For Automation
(-7790)

