



Worcester Controls

06959-G

1/2"-2" CL94 Three-Piece Chlorine Ball Valves 1/2"-4" CL94 150/300 Flanged One-Piece Chlorine Ball Valves Installation, Operation and Maintenance Instructions

CAUTION: Flowserve recommends that all product which must be stored prior to installation be stored indoors, in an environment suitable for human occupancy. Do not store product in areas where exposure to relative humidity above 85%, acid or alkali fumes, radiation above normal background, ultraviolet light, or temperatures above 120°F or below 40° F may occur. Do not store within 50 feet of any source of ozone.

INSTALLATION

- A. Standard CL94 Series three-piece and flanged one-piece valves may be installed for flow or vacuum in either direction. Use care to exclude pipe sealants from the valve cavity. The Chlorine Institute recommends that the relief hole in the ball be upstream, towards the pressure source. An arrow stamped on the body or on a metal tag welded to the body indicates preferred flow direction. The valve will seal in either direction. Note that the maximum pressure rating is 300 psi for three-piece valves and ANSI Class 300 one-piece valves, and 150 psi for ANSI 150 one-piece valves per the Chlorine Institute.
- B. When installing CL94 flanged one-piece valves, use standard gaskets suitable for the specific service. Tighten flange bolts or studs evenly. Follow ANSI standards for flange bolt torque.
- C. For Weld End Valves (SW, BW):

NOTE: Prior to welding, THOROUGHLY CLEAN ALL JOINT SURFACES to prevent contamination.

1. Tack weld the valve in place.
2. Remove three body bolts, loosen the fourth, and swing out the body with valve open. Close valves. Remove the ball and one-piece seat/body seals.
3. Swing body in and secure it with one additional body bolt diagonally from first.
4. Weld pipe ends. When gas welding, DO NOT play flame on the valve body.

- 5. Allow the valve to cool. Reassemble the valve.
- 6. Tighten and torque the body bolts of the valve evenly and diagonally opposite each other, alternating in a criss-cross pattern. Use the torque figures shown:

Carbon Steel Bolts		
Bolt. Dia.	In.-Lbs.	Ft.-Lbs.
1/4"	96-120	8-10
5/16"	120-144	10-12
3/8"	216-264	18-22
7/16"	480-540	40-45
1/2"	720-780	60-65

Stainless Steel and Alloy 20 Bolts		
Bolt. Dia.	In.-Lbs.	Ft.-Lbs.
1/4"	72-94	6-8
5/16"	120-144	10-12
3/8"	192-216	16-18
7/16"	336-384	28-32
1/2"	504-552	42-46

- D. CAUTION**
The fluoropolymer body seal makes an excellent seal. However, some points of caution in its use need emphasizing:
1. No fluoropolymer part (except a seat) is reusable. Upon disassembly of the valve, they should be discarded and replaced with new parts.
 2. Care must be taken to avoid scratching or damaging the fluoropolymer during installation. Light lubrication of these seals can help to prevent damage.

NOTE: Only three-piece valves use a one-piece seat/body seal.

OPERATION

- A. The operation consists of turning the stem (by manual or automated means) ¼ turn clockwise to lose and ¼ turn counter-clockwise to open. When the handle (if used) and/or stem flats or groove are in-line with the pipeline, the valve is open.
- B. 94 Series valves will provide bubble-tight shutoff when used in accordance with Worcester's published pressure/temperature chart.
- C. Do not leave the ball partly open (throttling operation) without having the first determined whether the pressure drop and/or flow rate are detrimental to the valve seats. These conditions should be checked with Worcester's Control Valve Manual or the factory.
- D. Torque Requirements: Operating torque requirements will vary depending on the length of time between cycles, media in the system, and line pressure. The figures in the following table are based on laboratory tests with clean tap water as the media. They are measured at WOG rated pressure, 70°F, after 24 hours. For a more detailed analysis of valve torque requirements, see Worcester's Actuator Sizing Manual.

Valve Size	Maximum Expected Breakaway Torque (In.-Lbs.)
½"	50
¾"	75
1"	125
1½"	450
2"	600
3"	1200
4"	2000

MAINTENANCE

For maximum stem seal life, proper packing adjustment procedure must be followed.

- A. Tighten packing gland bolts to the torque values in the tables below. Alternate between the two gland bolts when tightening to maintain the alignment of the gland plate with the top of the valve body. Some rocking of the gland plate can be tolerated; however, excessive misalignment may cause premature failure of the stem packing.

Valve Size	Gland Bolt Torque (In.-Lbs.) "T" Packing
½"-¾"	40-45
1"	65-70
1½"-2"	85-95
3"-4"	175-200

NOTE: After adjustment, packing creep will occur over several hours. Bolt torque measured then will be lower.

REBUILDING

This manual contains exploded views of the valves covered by the text. They have been included to aid in the rebuilding of the valves. Please refer to them when following the written instructions.

▲ WARNING: BALL VALVES CAN TRAP PRESSURIZED FLUIDS IN THE BALL CAVITY WHEN CLOSED.

The valve must be decontaminated before disassembly. It is recommended that the following steps be taken for safe removal and disassembly:

- Relieve the line pressure. Operate the valve prior to attempting removal from line.
 - Place the valve in half-open position and flush the line to remove any hazardous material from the valve. Refer to Chlorine Institute Pamphlet 6 procedure for flushing and drying.
 - All persons involved in the removal and disassembly of the valve should wear the proper protective clothing such as face shield, gloves, apron, etc.
 - Refer to Chlorine Institute Pamphlet 6 for additional information on precautions and cleaning.
- A. A standard repair kit can be ordered for the CL94 Series valve containing all the necessary parts for standard valve rebuilding; seats, split thrust bearing, split ring, all non-metallic stem packing parts, and Belleville washers. To order, specify the valve size and series, the material of the seats, and the "R" number (Revision Number) or for non-standard valve, the "P" number, "T" number, "C" number, or similar number. This information is found on the nameplate on the valve body.

Repair Kit Ordering Examples:

1" CL RK 94 T R1 or

2" CL RK 94 RT R1

2" CL RK 94 RT T0726

CAUTION: If the seats and seals installed differ from those removed, the valve nameplate or stop MUST be replaced or remarked to indicate the altered materials and ratings or valve tagged to so indicate.

B. TO DISASSEMBLE ½"-2" THREE-PIECE CL94 VALVES:

1. Place valve in open position. Remove three body bolts and nuts and loosen fourth to swing the center section out from between the pipe ends, or remove all four bolts to remove the valve from the line; whichever is more convenient.
2. Close the valve. Remove the seats and ball.
3. Remove the handle (if any), gland bolts, Bellevilles, gland plate and follower(s) (1 or 2 pieces) from the top of the valve.

4. Remove the stem and packing from the valve:
 - a. Push the stem down into the body cavity.
 - b. Remove the split ring and split thrust bearing from the recessed diameter above the stem tang.
 - c. Remove the stem from the top of the body. This may require considerable force. The flats on the stem can be clamped in a vise or other fixture to aid in removal. Avoid damaging the stem flats. The packing will be removed with the stem by the shoulder on the end of the stem.

CAUTION: Use care to avoid scratching the surface of the stem and packing chamber.

- d. Remove the packing from the stem.

TO DISASSEMBLE ½"-2" FLANGED ONE-PIECE CL94 VALVES:

5. Place valve in closed position.
6. Unscrew end plug and remove. If required, end plug disassembly tools are available from your supplier or from Flowserve Corporation.
7. Remove body seal, ball and seats.
8. Remove the handle (if any), gland bolts, Belleville washers, gland plate, and follower(s) (1 or 2 pieces) from the top of the valve.
9. Remove the stem and packing from valve.
 - a. Push the stem down into the body cavity.
 - b. Remove the split ring and split thrust bearing from the recessed diameter above the stem tang.
 - c. Remove the stem from the top of the body. This may require considerable force. The flats on the stem can be clamped in a vise or other fixture to aid in removal. Avoid damaging the stem flats. The packing will be removed with the stem by the shoulder on the end of the stem.

CAUTION: Use care to avoid scratching the surface of the stem and packing chamber.

- d. Remove the packing from the stem.

TO DISASSEMBLE 3"-4" FLANGED ONE-PIECE CL94 VALVES:

10. Place valve in closed position. Remove end plug retaining screws.
11. Remove end plug. If necessary, drive end plug from valve, using wooden drift applied to face of ball. Be certain the ball is fully closed.
12. Remove body seal, ball and seats.
13. Remove the handle assembly, spacer, and stop (if any), gland bolts, Belleville washers, gland plate, and follower(s) (1 or 2 pieces) from the top of the valve.
14. Push the stem down into the body cavity and remove.

15. Remove the thrust bearing and stem packing from the body.

CAUTION: Use care to avoid scratching the surface of the stem and packing chamber.

C. VISUAL INSPECTION:

1. The ball and surfaces against which the seats and seals are installed should be undamaged, clean and free of pit marks and scratches. Light marring from the action of the ball against the seats is normal and will not affect the operation of the valve. Flaws that can be seen, but barely detected with fingertips, are acceptable.
2. The stem and body surfaces that the stem seals and thrust bearing contact must be undamaged, clean and free of pit marks and scratches.

D. REASSEMBLY:

NOTE: It is recommended that the valve be installed with the ball relief hole upstream to ensure that cavity relief is upstream as suggested in Chlorine Institute Pamphlet 6. An arrow pointing downstream is stamped on the body or on a metal tag welded to the body.

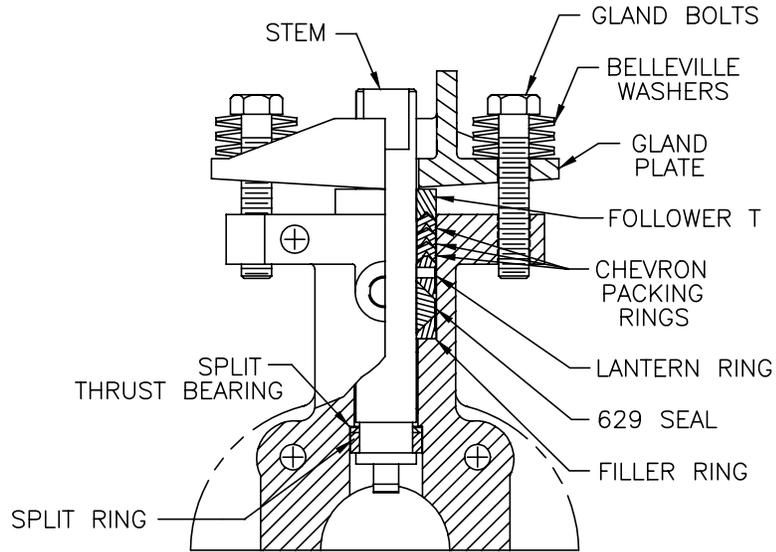
Clean all sealing surfaces of the valve including the ball.

Lightly lubricate the ball, seats, body seal(s), split thrust bearing and split ring or one-piece thrust bearing and stem seals with a PTFE-based lubricant such as Fluorolube S-30 or equivalent.

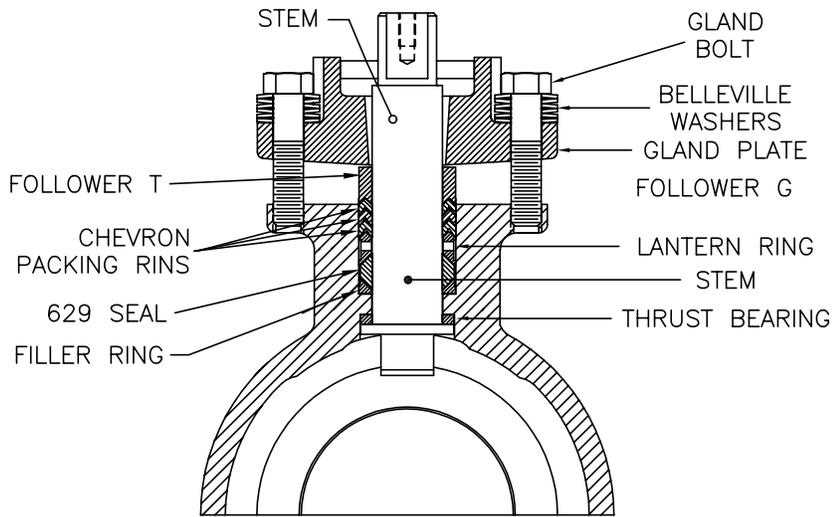
TO REASSEMBLE ½"-2" THREE-PIECE CL94 VALVES:

1. Insert the stem down through the bonnet and into the body.
2. Place the split thrust bearing in the recessed diameter above the stem tang. Place the split ring in the same recessed diameter, under the split thrust bearing (refer to exploded view).
3. Pull the stem up so that the split thrust bearing and split ring are drawn into the stem hole recess in the ball cavity. See instructions 21 through 26 for stem packing and gland plate assembly.
4. With the valve in the closed position (stem flats going across pipeline), replace the ball and one-piece seat/body seals. Open the ball.
5. Place the center section between the pipe ends being careful not to scratch any sealing surfaces. Replace the four body bolts and nuts. Tighten finger-tight.

“T” Packing Detail



1/2" - 2" THREE-PIECE AND FLANGED ONE-PIECE VALVES



3" - 4" FLANGED ONE-PIECE VALVES

TO REASSEMBLE ½"-2" FLANGED ONE-PIECE CL94 VALVES:

6. On all sizes except the ½", place the far seat in the body cavity.
7. Insert the stem down through the bonnet and into the body.
8. Place the split thrust bearing in the recessed diameter above the stem tang. Place the split ring in the same recessed diameter, under the split thrust bearing (refer to exploded view).
9. Pull the stem up so that the split thrust bearing and split ring are drawn into the stem hole recess in the ball cavity. See instructions 21 through 26 for stem packing and gland plate assembly.
10. Install far seat (½" valves only). With the valve in the closed position (stem flats going across pipeline), insert the ball into the body so that the stem slot engages the tang on the stem.
11. Install the body seal. Be certain that the body seal rests squarely on the sealing surface in the body.
12. Insert the other seat into the cavity in the end plug.
13. Install the end plug into the body and tighten until the body and end plug make metal-to-metal contact. The end plug may project up to .009" beyond the surrounding serrated surface. End plug must be fully tightened against machined step in body. If in doubt, assemble end plug without seat and seal, make a witness mark, then reassemble the full assembly.

TO REASSEMBLE 3"-4" FLANGED ONE-PIECE CL94 VALVES:

14. Place the thrust bearing on the stem.
15. Insert the stem and thrust bearing into the body through the ball cavity. See instructions 21 through 26 for stem packing and gland plate assembly.
16. Place one of the seats in the body cavity.
17. With the valve in the close position (stem groove going across pipeline), insert the ball into the body so that the stem slot engages the tang on the stem.
18. Install the body seal. Be certain that the body seal rests squarely on the sealing surface in the body.

CAUTION: If the body seal is installed on the end plug, it will be damaged.

19. Insert the other seat into the cavity in the end plug.
20. Assemble the end plug into the body as far as it will go. Secure with end plug retaining screws tightening each one firmly. The end plug screws only retain the end plug. Flange bolt force is required to compress the body seal and seat the end plug. Proper installation will allow not more than .010" protrusion of the end plug beyond the valve body.

Upon reinstallation of the valve in the line, retighten the end plug retaining screws after the flange bolts are fully torqued.

THE FOLLOWING INSTRUCTIONS ARE FOR ALL CL94 VALVES:

21. **NOTE:** Be certain that the stem seals are lubricated per *Rebuilding, section D, prior to assembly.*

Install the following parts over the stem and into the packing chamber in this order (refer to packing assembly drawing):

Filler ring, 629 seal, lantern ring-T, three Chevron packing rings (for ½"-2" three-piece and one-piece valves only, one Chevron ring is of carbon-filled fluoropolymer material and black in color and must be positioned as the top ring), follower-T, follower-G or one-piece follower-T.
22. Install gland plate over stem.
23. Place three sets of two Belleville washers on each gland bolt. Each set consists of two Bellevilles opposing each other with their O.D.s touching.
24. Lubricate the gland bolt threads with an anti-galling agent, such as Christo-Lube MCG-111. Install gland bolt/Bellevilles through the gland plate and thread them into the body. Tighten the gland bolt per Maintenance, A. Be certain that the bolts do not bind — this can result in improper packing loading.

CAUTION: Tightening the gland bolts can cause the stem to be pushed into the ball cavity. The stem must either be fixtured to prevent this, or be worked back into position when assembling the ball and seats in to the body.

25. Tighten the body bolts per Installation Section C.6. (½"-2" three-piece valves only).
26. Add handle (if any) and tighten the handle set screws.

For 3"-4" flanged one-piece valves, add stop, spacer, and handle assembly (if used) and tighten handle retaining bolt.

Note: The spacer is to be used only if one was removed with the handle assembly and stop.

RECOMMENDED SPARES

When ordering parts, please provide the part name and all the valve code information found on the nameplate on the body: valve size, style, materials, ends, and "R" number (Revision Number).

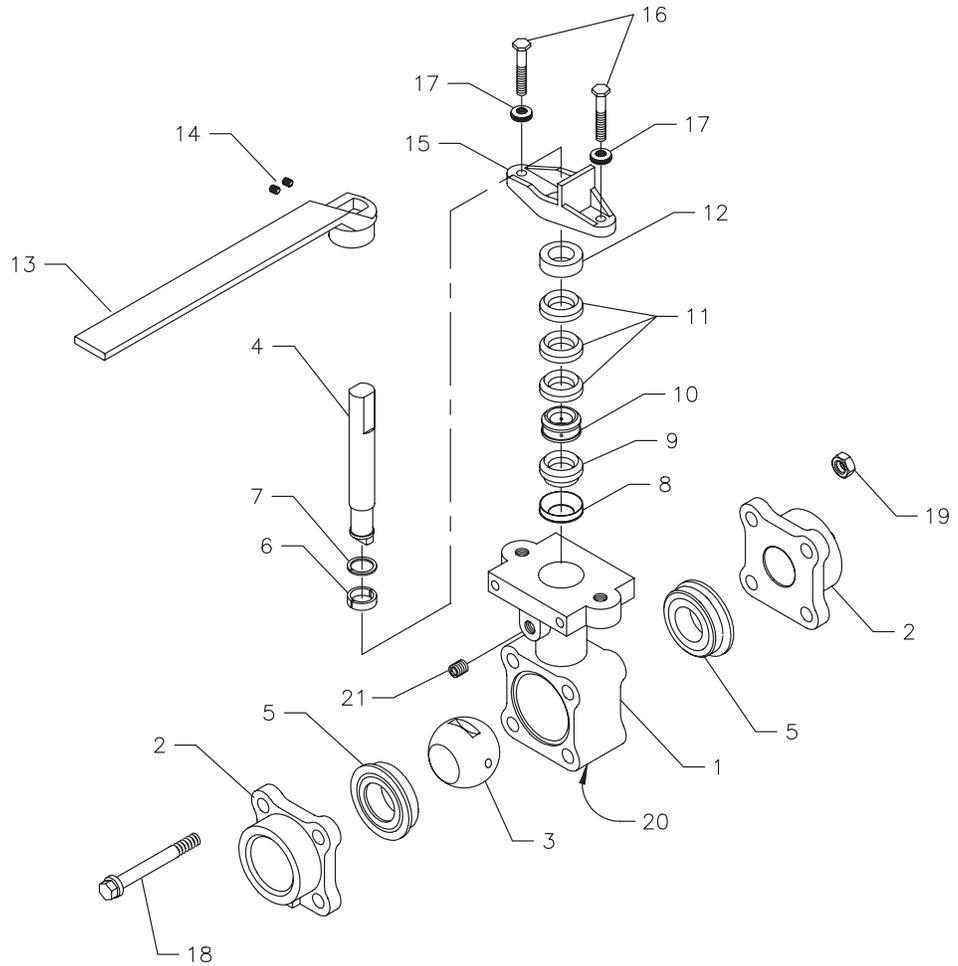
Example: 1" CL94 4C T SE R1 Ball or
3" CL94 4C RT300 RO Stem

Valves may also be marked with additional "P", "T", "C", or similar number. These numbers designate non-standard products and must be specified along with the valve code.

Example: 1" CL94 4C T SE P-2933 Ball or
½" CL94 4C RT150 T-1340 Stem

SERIES 94 (1/2"-2" THREE-PIECE)

Part No.	Part Name	Qty. Per Valve
1	Body	1
2	Pipe End	2
3	Ball	1
4	Stem	1
5	Seat/Body Seal	2
6	Split Ring	1
7	Thrust Bearing	1
8	Filler Ring	1
9	629 Seal	1
10	Lantern Ring T	1
11	Chevron Ring	3
12	Follower T	1
13	Handle	1
14	Set Screw	2
15	Gland Plate	1
16	Gland Bolt	2
17	Belleville Washer	12
18	Body Bolt	4
19	Body Nut	4
20	Nameplate	1
21	1/8" NPT Pipe Plug	1

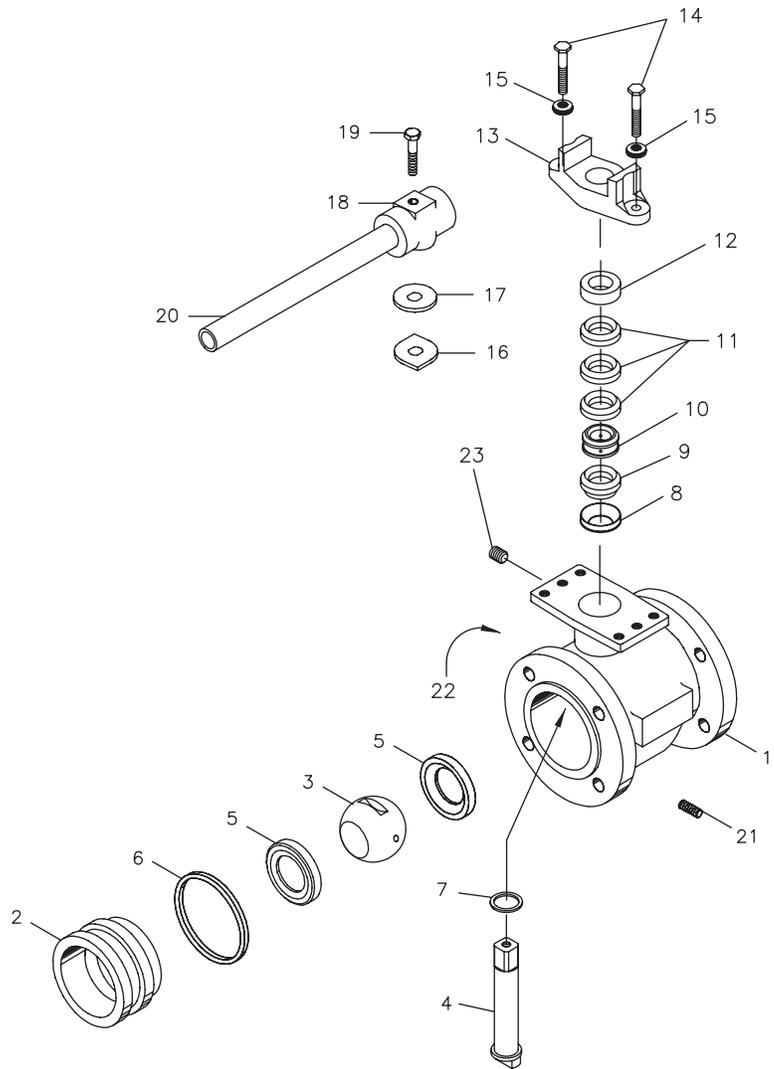


Note: Handle is optional and ordered separately from valve.

SERIES 94-150 and 94-300 (1/2"-2" FLANGED)

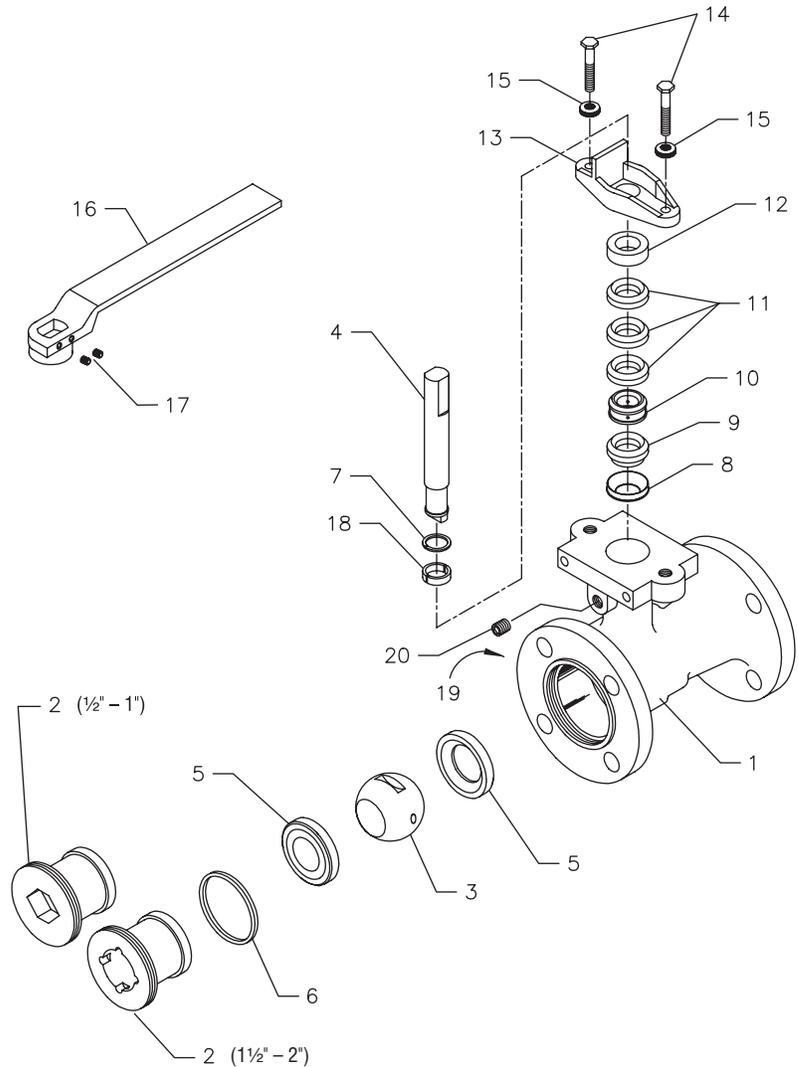
Part No.	Part Name	Qty. Per Valve
1	Body	1
2	End Plug	1
3	Ball	1
4	Stem	1
5	Seat	2
6	Body Seal	1
7	Thrust Bearing	1
8	Filler Ring	1
9	629 Seal	1
10	Lantern Ring T	1
11	Chevron Ring	3
12	Follower T	1
13	Gland Plate	1
14	Gland Bolt	1
15	Belleville Washer	12
16	Handle	1
17	Handle Set Screw	2
18	Split Ring	1
19	Nameplate	1
20	1/8" NPT Pipe Plug	1

Note: Handle is optional and ordered separately from valve.



SERIES 94-150 and 94-300 (3"-4" FLANGED)

Part No.	Part Name	Qty. Per Valve
1	Body	1
2	End Plug	1
3	Ball	1
4	Stem	1
5	Seat	2
6	Body Seal	1
7	Thrust Bearing	1
8	Filler Ring	1
9	629 Seal	1
10	Lantern Ring T	1
11	Chevron Ring	3
12	Follower T	1
13	Gland Plate	1
14	Gland Bolt	1
15	Belleville Washer	12
16	Stop	1
17	Spacer (See Below)	1
18	Handle	1
19	Hex Head Bolt	1
20	Wrench Extension	1
21	End Plug Screw	4-8
22	Name Plate	1
23	1/8" NPT Pipe Plug	1



NOTE: Spacer not always present. Wrench assembly and stop are optional and ordered separately from valve.

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For more information about Flowserve Corporation, contact www.flowserve.com or call USA 1-800-225-6989.

FLOWSERVE CORPORATION
FLOW CONTROL DIVISION
 1978 Foreman Drive
 Cookeville, Tennessee 38501 USA
 Phone: 931 432 4021
 Facsimile: 931 432 3105
www.flowserve.com