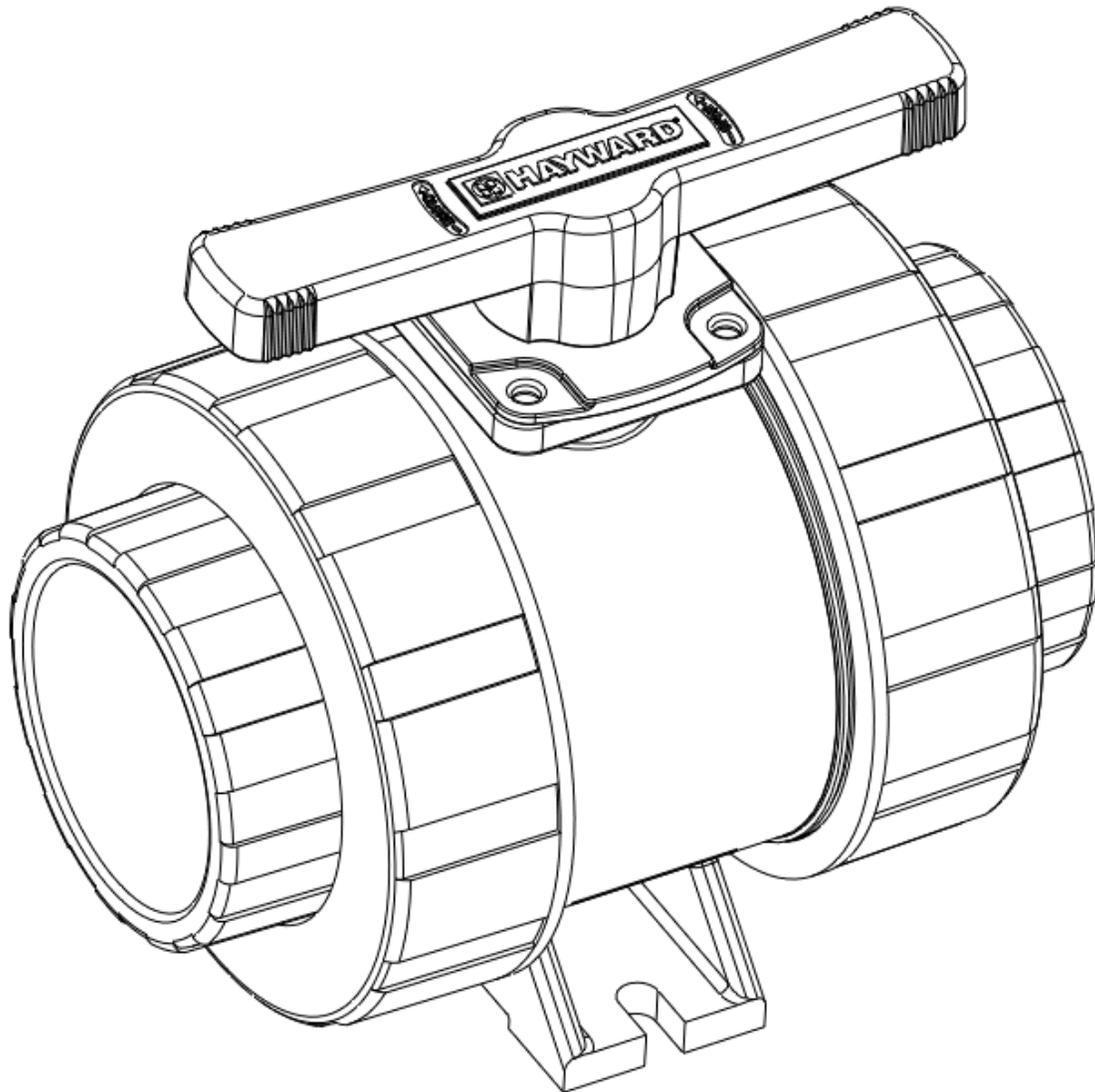


HAYWARD FLOW CONTROL
2-1/2" – 6" TBH SERIES & CVH SERIES TRUE UNION BALL VALVE
INSTALLATION, OPERATION AND MAINTENANCE INSTRUCTIONS



PLEASE READ THE FOLLOWING INFORMATION PRIOR TO INSTALLING AND USING HAYWARD TBH SERIES BALL VALVES. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN PRODUCT DAMAGE, PROPERTY DAMAGE, PERSONAL INJURY, OR EVEN DEATH.

1. Hayward Flow Control (Hayward), a division of Hayward Industries, guarantees its products against defective material and workmanship only. Hayward assumes no responsibility for property damage or personal injury resulting from improper installation, misapplication, or abuse of any product.
2. Hayward assumes no responsibility for property damage or personal injury resulting from chemical incompatibility between its products and the process fluids to which they are exposed. Determining whether a particular PVC, CPVC, or PP product is suitable for an application is the responsibility of the user. Chemical compatibility charts provided in Hayward literature are based on ambient temperatures of 70°F and are for reference only.
3. Hayward products are designed for use with non-compressible liquids.

WARNING

Hayward PVC and CPVC products should NEVER be used or tested with compressible fluids such as compressed air or nitrogen. Use of PVC and CPVC products in compressible fluid applications may result in product damage, property damage, personal injury, or even death.

WARNING

The TBH Series Ball Valve is intended for use in liquid service only. Do not attempt to use this valve for controlling air or gases. Use of this product in air or gas service may result in product damage, property damage, personal injury, or even death.

4. The maximum recommended fluid velocity through any Hayward product is eight feet per second (8 ft/s). Higher fluid velocity can result in damage due to the water hammer effect.
5. Piping systems must be designed and supported to prevent excess mechanical loading on Hayward products due to system misalignment, weight, shock, vibration, and the effects of thermal expansion and contraction.
6. The effect of temperature on plastic piping systems must be considered when the systems are initially designed. The pressure rating of plastic systems must be reduced with increasing temperature. Maximum operating pressure is dependent upon material selection as well as operating temperature. Before installing any Hayward product, consult Hayward product literature for pressure vs. temperature curves to determine any operating pressure or temperature limitations.
7. PVC and CPVC plastic products become brittle below 40°F. Use caution in their installation and operation below this temperature.

WARNING

Hayward PVC and CPVC products should not be used in services with operating temperature below 34°F.

8. Due to differential thermal expansion rates between metal and plastic, transmittal of pipe vibration and pipe loading forces, **DIRECT INSTALLATION OF PLASTIC VALVES INTO METAL PIPING SYSTEMS IS NOT RECOMMENDED.** Wherever installation of plastic valves into metal piping systems is necessary, it is recommended that at least 10 pipe diameters in length of plastic pipe be installed upstream and downstream of the plastic valve to compensate for the factors mentioned above.
9. Published operating requirements are based on testing of new valves using clean water at 70°F. Valve performance is affected by many factors including fluid chemistry, viscosity, specific gravity, flow rate, and temperature. These should be considered when sizing Hayward products.
10. Systems should always be depressurized and drained prior to installing or maintaining any Hayward product.

WARNING

Failure to depressurize and drain system prior to installing or maintaining valve may result in product damage, property damage, personal injury, or even death.

11. Always follow your site and/or company procedures for any safety training and/or site specific precautions or warnings in addition to those in this document.

1. INSTALLATION:

1.1. Transporting the Valve:

- 1.1.1. Valve should be stored inside factory packaging until product is ready to be installed. Packaged valve should be stored indoors, at room temperature, and out of direct sunlight. Avoid storing packaged valve in location where packaging may become wet. Valve should be moved as close to installation site as possible prior to removing from packaging. Do not cut through tape on box any more than necessary to avoid damaging valve. After removing valve from carton, care must be taken not to damage valve or to allow debris to enter valve.

WARNING

System must be depressurized and drained prior to installing valve or performing maintenance. Failure to depressurize and drain system prior to installing or maintaining valve may result in product damage, property damage, personal injury, or even death.

CAUTIONS

**Do not install valve directly to pump outlet. Allow a length of at least 5 pipe diameters between pump outlet and valve.
Do not install valve directly after a reducer / expansion fitting. Install at least 5 pipe diameters from an expansion or reducing fitting.
Pipe must be supported upstream and downstream of the valve. Sound piping system design principles should be applied when installing this valve.
Do not install valve directly into a metal system. Wherever installation of thermoplastic valves into metal piping systems is necessary, it is recommended that at least 10 pipe diameters in length of thermoplastic pipe be installed upstream and downstream of the thermoplastic valve.
When lifting valve do not lift by the handle.**

1.2. Mounting the Valve to a Skid or Panel:

- 1.2.1. Hayward TBH Series ball valves are equipped with a footpad suitable for mounting the valve to a skid or panel. When mounting, a hex head cap screw should be used with the head of the screw placed inside the footpad with a washer. With the screw threads facing away from the valve use nuts and washers on the opposite side of the skid / panel. The nuts should be torqued to 5 in-lb.

CAUTION

Do not allow valve to support weight of pipe or other system components. Footpad is intended only to locate valve and should not be used in place of pipe hangers or other pipe supports.

1.3. Installing the Valve into a System:

NOTES

**Hayward TBH Series ball valves with standard balls are bi-directional. There are no direction arrows or specific orientation requirements for proper operation.
Hayward TBH & TBH-Z Series ball valves with vented balls are uni-directional. There is a flow arrow marked on the valve to indicate proper flow direction.**

- 1.3.1. Remove valve from packaging.
1.3.2. Verify that product is defect free and meets specifications.
1.3.3. Remove the nut and end connector by rotating the nuts counter clockwise. Verify end connector o-rings are installed in their respective grooves.
1.3.4. Place nut over pipe end so that it can engage the end connector once the end connector is connected to the pipe end.
1.3.4.1. Threaded End Connectors:
1.3.4.1.1. Wrap male threads of pipe end with PTFE tape. Proper application of PTFE tape will provide a sufficient seal for PVC and CPVC threaded joints.

WARNING

Do not use “pipe dope”, liquid sealant, or thread sealant on any PVC or CPVC threaded connections. Pipe dope and thread sealants may react with the PVC or CPVC, weakening the material and potentially resulting in failure of the joint, product damage, property damage, personal injury, or even death.

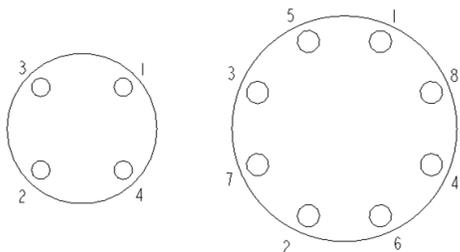
- 1.3.4.1.2. Thread the end connector onto the threaded pipe end until “hand tight”. Using a strap wrench only (never use a pipe wrench), tighten the end connector onto the pipe only to the point required to form a seal between the end connector and pipe thread; 1/2 turn past hand tight is typically sufficient to form a seal. (**Caution: Tightening beyond this point may introduce excessive stress that could cause failure of the end connector or the threaded end of the pipe.**)
1.3.4.2. Solvent-Weld End Connectors (PVC and CPVC only):

CAUTION

Valve center cartridge must be disassembled from nuts and end connectors prior to solvent cementing end connections into system. Avoid exposing valve cartridge and end connector o-rings to primer, solvent cement, or their fumes, as damage to the valve could result.

- 1.3.4.2.1. Refer to solvent-cement manufacturer’s instructions and cure times.
1.3.4.2.2. **Do not install valve cartridge until solvent cement has fully cured.** Reinstall end connectors by threading nuts onto body by rotating in a clockwise direction.
1.3.4.3. Flange Connections:
1.3.4.3.1. NOTE: When provided with flanges, TBH Series True Union Ball Valves are provided with an end connection sub-assembly, consisting of an end connector, solvent cemented to a flange, with an assembly nut for connection to the valve.
1.3.4.3.2. Flange bolts should be tight enough to compress the gasket and make a good seal, without distorting or putting excessive stress on the flanges. Suitable washers should be used between the bolt head and flange and the nut and flange. Bolts should be tightened in alternating sequence (Figure 1). See Table 1 for recommended torque.

Fig. 1: Bolt Tightening Sequence



Flange Size	Bolt Dia. (in.)	Torque (ft. lbs.)
2-1/2"	5/8"	15 – 25
3"	5/8"	20 – 25
4"	5/8"	20 – 25
6"	3/4"	30 – 40

- 1.3.5. Install valve cartridge between end connectors, match nuts to body threads and turn nut clockwise to thread onto body. Using a strap wrench only (never use a pipe wrench), nut can be tightened ¼ - ½ turn past hand-tight, as needed.
- 1.3.5.1. Never install valve into system where assembly nuts have to be used to pull system together. This will apply undue loading on the valve body and assembly nuts. Piping system should be properly aligned prior to valve installation.
- 1.3.5.2. Never install valve into system that must be forcibly separated in order to allow space for body. This will apply undue loading on the valve body.
- 1.3.6. Valve with actuator:
 - 1.3.6.1. If the valve was provided with an actuator from the factory, the actuator stops will already be set by the factory during assembly.
 - 1.3.6.2. Support weight of actuator as necessary.
 - 1.3.6.3. Do not allow valve to support the weight of the pipe.
 - 1.3.6.4. When using pneumatic or electric actuators, additional support directly to the actuator is recommended. When large actuation is used, weight of the actuator needs to be supported independent of the support given by the mounting flange of the valve.
 - 1.3.6.5. Refer to IOM provided with actuator for wiring / plumbing and operating instructions.

2. STARTUP AND OPERATION:

WARNINGS

Hayward PVC and CPVC products should NEVER be used or tested with compressible fluids such as compressed air or nitrogen. Use of PVC and CPVC products in compressible fluid applications may result in product damage, property damage, personal injury, or even death.

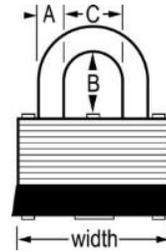
The TBH Series Ball Valve is intended for use in liquid service only. Do not attempt to use this valve for controlling air or gases. Use of this product in air or gas service may result in product damage, property damage, personal injury, or even death.

Hayward PVC and CPVC products should not be used in services with operating temperature below 34°F.

- 2.1. Operate valve to 45° (i.e. ½ open) position.
- 2.2. Slowly purge air from system as line fills with liquid
- 2.3. Look for leaks around valve handle, stem, and end connections and check for proper valve operation. If any leaks are present, or valve does not perform properly, refer to troubleshooting guide. Depressurize and drain system prior to performing any maintenance.
- 2.4. Periodically check valve for leaks or external damage.
- 2.5. Periodically check true union nuts and / or flange connections.
- 2.6. Operation of valve to full closed:
 - 2.6.1. Rotate the handle clockwise about stem axis to close. Lock plate will engage stop on body when valve is in fully closed position.
 - 2.6.1.1. When fully closed, handle will be perpendicular to pipe axis / centerline.
- 2.7. Operation of valve to full open:
 - 2.7.1. Rotate the handle counter clockwise about stem axis to open. Lock plate will engage stop on body when valve is in fully open position.
 - 2.7.1.1. When fully open, handle will be parallel to pipe axis / centerline.
- 2.8. Locking valve in position:
 - 2.8.1. The lock plate on the TBH Series True Union Ball Valve incorporates four holes suitable for locking the valve in the fully open or the fully closed position. (See Figure 2).
 - 2.8.2. To lock a valve in position, pass the shackle of a lock through the aligned holes on the lock plate and body top flange and latch the lock. Confirm that a suitably tight fit exists between the lock plate, valve body, and lock in order to prevent valve from being operated.
 - 2.8.2.1. See Table 2 for suggested shackle diameters and lock sizes. Other suitable locks can be used.
 - 2.8.3. Once lock is installed, verify that valve cannot be operated.
 - 2.8.4. **Do not install lock in lock plate if valve is not fully open or fully closed.**
- 2.9. Periodic Operation
 - 2.9.1. Where possible, for valves that are installed in locations where they are not operated frequently, it is recommended that valves are operated according to a routine maintenance schedule at least once every six months.

Table 2: Suggested Shackle Diameters and Lock Sizes

Valve Size	Shackle Diameter (A)	Shackle Height (B)	Shackle Width (C)	Width	Master Lock® Number
2-1/2"	.28"	.75"	.63"	1.56"	3
3"	.28"	.75"	.63"	1.56"	3
4"	.28"	.75"	.63"	1.56"	3
6"	.28"	.75"	.63"	1.56"	3


Fig. 2: Valve with Lock Installed

Fig. 3: Lock

3. MAINTENANCE:

WARNINGS

System must be depressurized and drained prior to installing valve or performing maintenance. Failure to depressurize and drain system prior to installing or maintaining valve may result in product damage, property damage, personal injury, or even death. Make sure operator or actuator, if any, has no stored energy and is in its' fail position if applicable. For valves supplied with electric actuators, follow lock out/tag out procedures and remove all power from device before performing maintenance. Valve must only be removed from line when handle is in partially, but not fully, open position (i.e. 45° position) and when line is fully depressurized and drained. Valves that are in fully open or fully closed positions could have trapped cavity pressure.

3.1. Removing Handle and Lock Plate:

- 3.1.1. Depressurize and drain system with valve handle in partially, but not fully, open position (i.e. handle at 45° position).
- 3.1.2. Handle can be removed from lock plate by inserting a flat blade screwdriver between handle and lock plate and gently prying upwards against handle. Rocking handle back and forth in relation to lock plate will ease removal
- 3.1.3. Lock plate can be removed from valve by inserting flat blade screwdriver between lock plate and body top flange and gently prying upwards against lock plate.

3.2. Replacing End Connector O-Rings:

- 3.2.1. Depressurize and drain system with valve handle in partially, but not fully, open position (i.e. handle at 45° position).
- 3.2.2. Remove assembly nuts from valve body by rotating counterclockwise.
- 3.2.3. Remove valve body from system.
- 3.2.4. Using a plastic pick, carefully remove the old seals. NOTE: Be very careful not to damage the o-ring grooves or valve body.
- 3.2.5. Clean o-ring grooves with a soft brush or cloth.
- 3.2.6. Install new o-rings by gently pressing o-ring into groove until o-ring is fully seated.
- 3.2.7. Install valve cartridge between end connectors, match nuts to body threads and turn nut clockwise to thread onto body. Using a strap wrench only (never use a pipe wrench), nut can be tightened ¼ - ½ turn past hand-tight, as needed.
 - 3.2.7.1. Never install valve into system where assembly nuts have to be used to pull system together. This will apply undue loading on the valve body and assembly nuts. Piping system should be properly aligned prior to valve installation.
 - 3.2.7.2. Never install valve into system that must be forcibly separated in order to allow space for body. This will apply undue loading on the valve body

3.3. Replacing Internal Seats and Seals:

- 3.3.1. Depressurize and drain system with valve handle in partially, but not fully open position (i.e. handle at 45° position).
- 3.3.2. Remove assembly nuts from valve body by rotating counterclockwise.
- 3.3.3. Remove valve body from system.
- 3.3.4. Rotate handle so valve is in fully closed position.
- 3.3.5. Remove handle and lock plate (See Section 3.1)
- 3.3.6. Remove seal retainer from body by engaging slots on seal retainer and rotating counter-clockwise. An optional wrench is available from Hayward Flow Control and is needed to engage the slots.
- 3.3.7. Remove ball from body by reaching inside closed end bore of body and pushing ball towards open end of valve body.
- 3.3.8. Remove stem from body by pressing on top of stem and forcing stem into body, then pulling stem out of body.
- 3.3.9. Using a plastic pick, remove seats from the body and from the seal retainer.
- 3.3.10. Using a plastic pick, remove the o-rings from the stem, body, and seal retainer. Note o-ring size for each location.
- 3.3.11. Clean o-ring grooves and seat pockets with a soft brush or cloth.
- 3.3.12. Install and lightly lubricate new o-rings on stem, seal retainer (one on OD and one at seat pocket), and body. Be careful not to roll or damage o-rings during installation.
 - 3.3.12.1. Hayward recommends lubricating o-rings with Krytox™ GPL203.
- 3.3.13. Install a seat into the body on top of the seat o-ring.
 - 3.3.13.1. NOTE: Seat is reversible and can be installed with either side facing towards the ball.

- 3.3.14. Install stem into stem bore by rotating stem inside valve body until center axis of stem is aligned with stem bore, then pressing gently and evenly on stem until stem has “bottomed” against stem counter bore.
- 3.3.15. While continuing to hold the stem in place, install lock plate and handle onto stem. The lock plate “snaps” to stem. The handle “snaps” to the lock plate.
- 3.3.16. Make certain that the handle / stem / lock plate assembly is rotated to the closed position.
- 3.3.17. Install ball into body in closed position. Make certain ball slot engages the bottom of the stem boss.
- 3.3.18. Install a seat into the seal retainer on top of the seat o-ring.
- 3.3.19. Reassemble the seal retainer sub-assembly to the valve body by engaging the mating threads and rotating the seal retainer in the counterclockwise direction.
- 3.3.20. Using a torque wrench, measure the torque at the valve stem required to rotate the ball 90°. See the following table for the proper stem torque.

Valve Size	Stem Torque (in*lbs.)	Valve Size (in)	Stem Torque (in*lbs.)
2-1/2", DN65	140	4", DN100	170
3", DN80	140	6", DN150	170

- 3.3.21. Adjust the seal retainer in either the counterclockwise (tighten), or clockwise (loosen), direction until the proper stem torque is achieved.
- 3.3.22. Push the handle or lock plate/handle back onto the valve if it was removed for the above steps. Turn the ball to the open position.
- 3.3.23. Install new end connector o-rings into body and seal retainer by gently pressing o-ring into groove until o-ring is fully seated.
- 3.3.24. Reinstall valve body into system per Section 1.3.5.
- 3.3.25. Restart system per Section 2.0 (while following any site required safety practices and procedures).

4. **PRODUCT SPECIFICATIONS:**

Maximum Pressure: 235 psi @ 70°F (see Chart 1 for operating pressures at elevated temperatures), 150 psi @ 70°F for flanged products.

Operating Temperature:

Material	Min. Operating Temperature	Max. Operating Temperature
PVC	34°F (1.1°C)	140°F (60.0°C)
CPVC	34°F (1.1°C)	190°F (82.2°C)

Max. System Flow Velocity: 8 ft/s (2.4 m/s) for thermoplastic piping systems

Flow Coefficient Cv, **TBH**:

Opening Angle	2-1/2"	3"	4"	6"X4"
90°	340	490	600	550

Flow Coefficient Cv, **CVH**
(Slow Open / Fast Open):

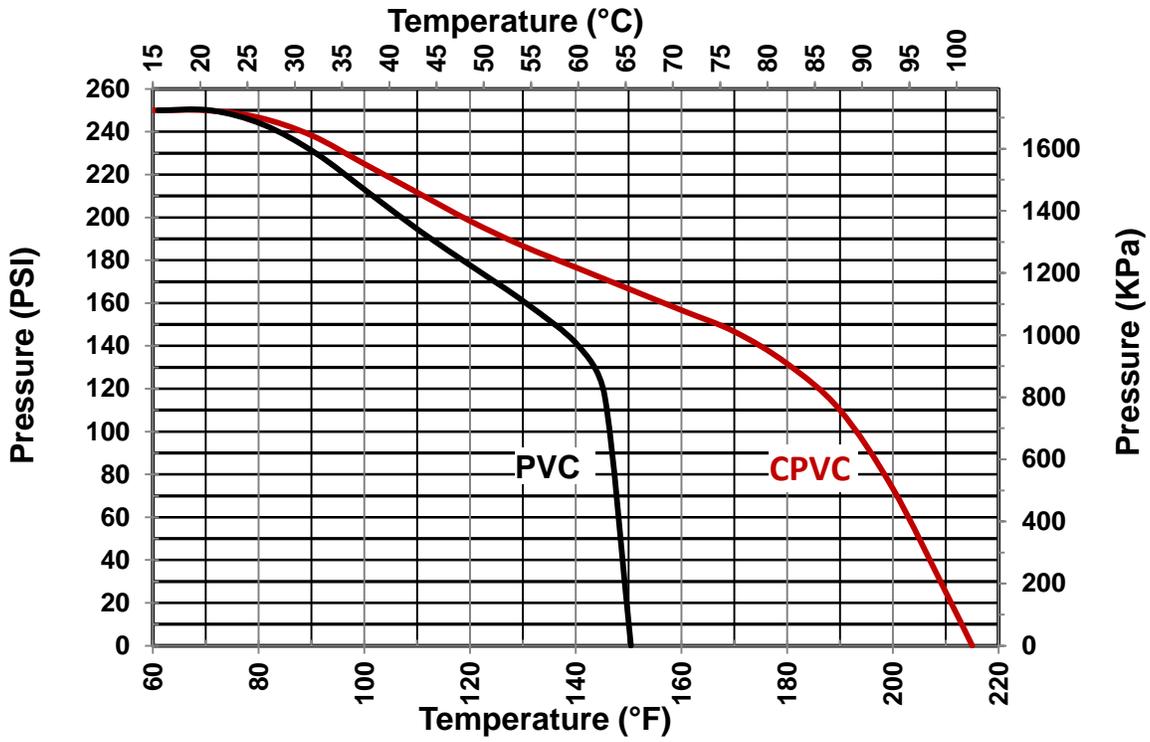
Opening Angle	3"	4"
15°	3 / 10	5 / 18
30°	12 / 26	30 / 55
45°	30 / 50	65 / 114
60°	60 / 79	120 / 183
75°	89 / 112	185 / 200
90°	128 / 128	215 / 215

WARNING

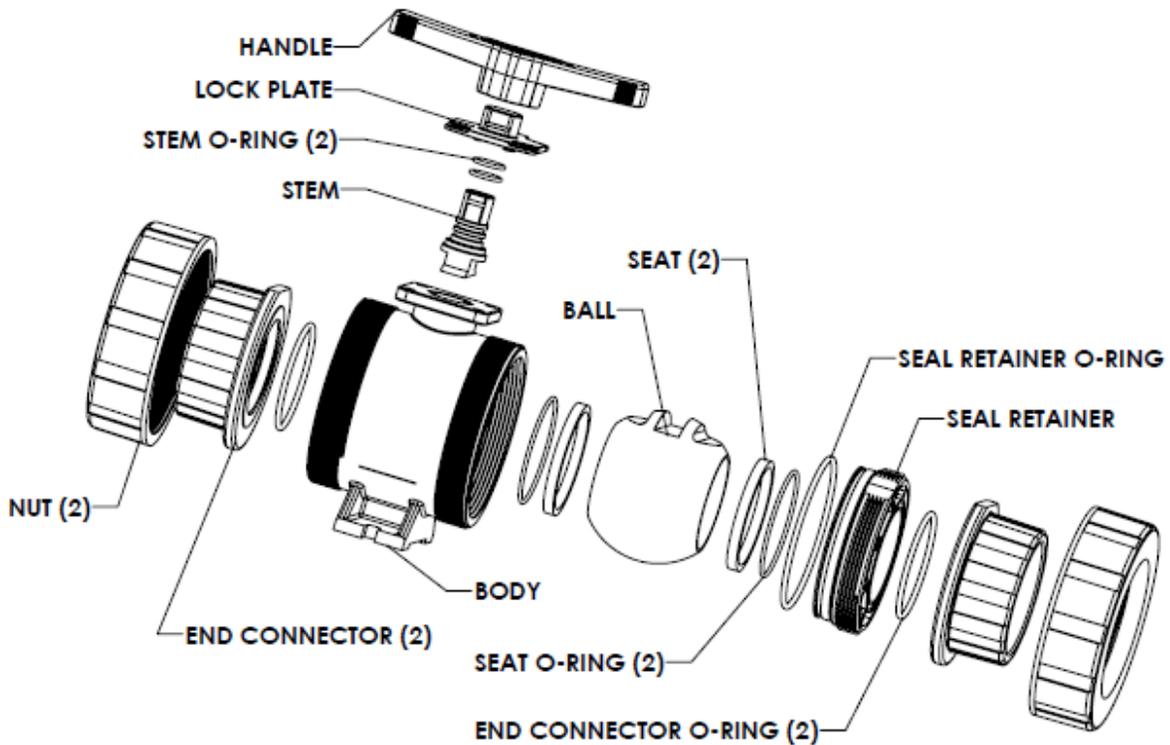
The maximum recommended fluid velocity through any plastic piping system is eight feet per second (8 ft/s). Higher fluid velocity can create excess water hammer effect, resulting in property damage, personal injury, or even death.

CAUTION

Published operating requirements are based on testing of new valves using clean water at 70°F. Valve performance is affected by many factors including fluid chemistry, viscosity, specific gravity, flow rate, and temperature. These should be considered when sizing systems using Hayward products.



5. PARTS LIST



6. TROUBLESHOOTING:

Problem	Cause	Solution
Leak between body and end connector.	Missing end connector o-ring	Replace end connector o-ring
	Damaged end connector o-ring	Replace end connector o-ring
	Assembly nuts too loose	Tighten assembly nut per Section 1.3
Leak between ball and seat.	Valve not fully closed	Fully close valve
	Damaged ball	Repair or replace valve
	Damaged seat	Repair or replace valve
	Damaged seat carrier seals	Repair or replace valve
Valve difficult to operate.	Solids in system.	Install a strainer upstream of valve to prevent damage to valve.
	Crystallized media in valve.	Consider using valve with vented ball (Series TBH-Z).
	Piping system not properly aligned and / or supported.	Properly align and support piping, especially adjacent to valve.
Damaged ball or seats.	Excessive valve cycles.	Replace seats and seals. Inspect ball, stem, handle, and lock plate. Replace if warranted.
	Water Hammer	Maximum line velocities of 8 ft/sec. recommended for plastic piping systems. Resize system or valve. Reduce line velocity. Reduce speed of operation (i.e. closure) of valve.
	Detrimental solids in process media.	Install a strainer upstream of valve to prevent damage to valve.
	Cavitation in line.	Maximum line velocities of to 8 ft/sec. exceeded. Valve should be installed at least 5 pipe diameters from the nearest pump or fitting. Resize system or valve.
	Process conditions.	Check chemical compatibility of ball and seat material with fluids in system.
		Check that valve was not in service or operated at temperatures above or below recommended operating temperature.
Leakage through top of valve at actuator mounting flange.	Failed stem o-rings	Replace o-rings. Inspect stem and replace if needed.
	Actuator is not properly supported, transferring weight and stress to valve.	Add supports to system so that actuator is independently supported.

7.0 WARRANTY TERMS AND CONDITIONS:

THREE YEAR WARRANTY: All products manufactured by Hayward are warranted against defects in material or workmanship for a period of three years from date of shipment. Our sole obligation under this warranty is to repair or replace, at our option, any product or any part or parts thereof found to be defective. HAYWARD MAKES NO OTHER REPRESENTATION OR WARRANTY, EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. The warranty set forth above is the only warranty applicable to Hayward products and in no event shall Hayward be liable for any delay, work stoppage, cartage, shipping, loss of use of equipment, loss of time, inconvenience, loss of profits of any direct or indirect incidental resulting from or attributable to a breach of warranty. The remedies under this warranty shall be the only remedies available. OUR MAXIMUM LIABILITY SHALL NOT IN ANY EVENT EXCEED THE CONTRACT PRICE FOR THE PRODUCT.

Notes:

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