Introduction to Chemtrol

With more than 55 years of experience in industrial thermoplastics, Chemtrol offers dependable products that work in the most demanding environments.

The premium line of quality Chemtrol® valves are lightweight, corrosion-resistant, and maintenance-free – saving you time and money.

For specific recommendations of chemical compatibility, see the *Chem-Guide*. For engineering data related to plastic piping system design and installation and maintenance instructions, see the *Chemtrol Thermoplastic Piping Technical Manual*. All Chemtrol publications are available for download on www.chemtrol.com in PDF format.

True Union

True Union 3-Way

True Union Flanged

True Union Ball Valves

The True Union feature, a Chemtrol introduction, an exclusive Chemtrol introduction, so revolutionized the industrial plastic valve industry that it has become the standard followed by all major manufacturers. The purpose of the design is to permit the valve cartridge, i.e., the body containing all operational components, to be easily lifted from the piping system for servicing/replacement when the union nuts are backed off. Easy repair/replacement, interchangeability, distribution availability, technical service, and reliable quality are the synergistic rationale many plants and original equipment manufacturers have embraced while standardizing on Chemtrol® True Union Ball and Check Valves.

The laying length of the body and the heavy-duty modified-acme threads in the union connections to the body have not changed in the four distinct models' 40-year history of the valve. This permits fouled valve replacement with a new body cartridge, which will fit the old union nuts. No change in piping length is required.

The distinctive orange handle indicates "open/close" and direction of flow at a distance. And molded-in arrows on top of the handle dictate rotational direction to personnel for easy operation within 90° stops. For applications requiring handle removal, the D-ring stem flats indicate "open/close" and a molded-in arrow on top of the stem indicates flow direction.

The Evolution of Chemtrol® Ball Valves

As a result of continuous testing and improvements since the inception of the True Union Ball Valve, three distinct model changes have occurred. The original True Union Model A design had a seat-carrier that slid into the smooth bore of the valve body, held in place by the external nut and end connector. Tightening the external nut adjusted the compression of the PTFE seat onto the ball.

The first major evolution to the True Union Ball Valve, Model B, introduced the Tru-Bloc concept, a functional safety feature. With this design a separate threaded retainer locked the seat-carrier into the body and prevented the seat-carrier from being extruded out of the valve body when the external nut was removed. This change is intended to prevent pressure on the other side of the valve from ejecting the internal components and fluid medium out of the open valve end and to further prevent possible injury to persons or property.

The Model C seat-carrier design was modified to include an external thread which mated into the valve body threads, eliminating the separate retainer. This modification also eliminated the adjustment of the seat-carrier by the external nut and end connector, resulting in a sealing envelope that was independent of external forces. An energized O-ring was added under the PTFE seat that provided automatic adjustment to compensate for seat wear. This design modification continued the Tru-Bloc feature, preventing the seat carrier from being extruded out of the valve body when the external valve nut was removed.

Manufactured in PVC and CPVC through 2", the current Model D ball valve's seat-carrier internal threads and the external union nut threads were strengthened to provide an increased pressure rating of 250 psi at 73°F and improved the pressure ratings at higher temperatures. The end connector design was modified to provide wrench flats. The union nut OD was changed to provide improved gripping for strap wrenches. The Model D design continued the sealing envelope that was independent of external forces with an energized O-ring under the PTFE seat that provided automatic adjustment to compensate for seat wear. The Tru-Bloc® feature was also retained.

WARNING: DO NOT USE OR TEST THE PRODUCTS IN THIS CATALOG WITH COMPRESSED AIR OR OTHER GASES. FAILURE TO FOLLOW THIS WARNING CAN RESULT IN PERSONAL INJURY OR DAMAGE TO PROPERTY.

Materials

PVC

(Polyvinyl Chloride) PVC conforming to ASTM D1784, Classification 12454, formerly designated Type I, Grade 1, is the most frequently specified of all thermoplastic piping materials. It has been used successfully for more than 55 years in such diverse areas as chemical processing, industrial plating, chemical drainage, fresh and wastewater treatment, chilled and tower cooling water, deionized water manufacture and distribution, and irrigation sprinkler systems. PVC is characterized by high physical properties and resistance to chemical attack by strong acids and other oxidizers, alkalis, salt solutions, some organic chemical solutions, and many other chemicals. However, it is attacked by non-ionic surfactants, some vegetable oils (e.g., peanut), and many organic chemicals such as polar solvents (e.g., ketones), aromatics (i.e., benzene ring structure), and chlorinated hydrocarbons. The maximum service temperature of PVC is 140°F. With a design stress of 2,000 psi at 73°F, the long-term hydrostatic strength of PVC is as high as any of the major thermoplastic materials being used for solid piping systems. PVC is joined by solvent cementing, threading, or flanging.

CPVC (Corzan®)

(Chlorinated Polyvinyl Chloride) CPVC conforming to ASTM D1784, Classification 23447, is a resin created by the post-chlorination of a PVC polymer. The material's resistance to chemical attack is almost identical to that of PVC. And the physical properties of CPVC are very similar to those of PVC at 73°F, but the additional chlorine in the CPVC polymer extends its maximum service temperature to 210°F. For example, the design stress for CPVC is 2,000 psi at 73°F, identical to that of PVC. But its strength is only reduced to 500 psi at 180°F, as compared to 440 psi for PVC at 140°F. For more than 35 years, CPVC has proven to be an excellent material for hot corrosive liquids, hot and cold water distribution, and similar applications above the useful temperature range for PVC. CPVC may even be chosen over PVC in the 110°F to 140°F temperature range because its higher strength-at-temperature, requiring less frequent piping supports, can translate to a more favorable overall installed cost than PVC. CPVC is joined by solvent cementing, threading, or flanging.

PVDF (Kynar®)

(Polyvinylidene Fluoride) PVDF homopolymer conforming to ASTM D3222, Type I, Grade 2, is a tough, abrasion-resistant fluorocarbon material that has a design stress of 1,360 psi at 73°F and a maximum service temperature of 280°F. It has versatile chemical resistance to salts, strong acids, dilute bases, and many organic solvents, such as the aromatics (i.e., benzene ring structure), the aliphatics (i.e., paraffin, olefin, and acetylene hydrocarbons), and the chlorinated groups. And PVDF is ideally suited for handling wet or dry chlorine, bromine, and other halogens. However strong bases and some organic chemicals such as polar solvents (e.g., ketones) and esters attack it. No other solid thermoplastic piping material can approach the combined strength, working temperature, and chemical resistance characteristics of PVDF. It is joined by the thermo-sealing socket fusion process, threading, or flanging.

PVDF, absent of any color pigment, is transparent to ultraviolet light. So while PVDF is one of the few plastic materials that is not degraded by UV radiation, exposure of the fluid medium inside a piping system to direct sunlight can frequently adversely affect its stability. Therefore, all PVDF piping components that Chemtrol produces for general chemical service, contain an FDA-approved red pigment to mask the penetration of UV rays.

Natural Kynar® PVDF Type I (polymerized in emulsion) homopolymer is notably free of metallic ions and foreign organic compounds. And since the resin does not require processing or other external additives to aid manufacturing or long-term stability, the hard-polish surface of components will remain intact, so that piping systems will not release particulate to the fluid medium. Further, there will be no surface micropores to encourage biological growth. Natural Kynar® systems are intended for ultra high pure water and chemical services, such as electronics, pharmaceuticals, and processed foods and beverages.

PP

(Polypropylene) PP as specified by ASTM D4101, is a member of the polyolefin family of pure hydrocarbon plastics. Although PP has half the strength of PVC and CPVC, with a design stress of 1,000 psi at 73°F, it may have the most versatile chemical resistance of the thermoplastic materials identified as the sentinels of industrial piping. Consider the fact that there are no known solvents for PP. As a result, it has been the material of choice for drainage of mixed industrial chemicals for over 40 years. As pressure piping, PP has no peers for concentrated acetic acid or hydroxides. It is also suitable for milder solutions of most acids, alkalis, salts, and many organic chemicals, including solvents. The nemeses for PP are strong oxidizers, such as the hypochlorites and higher concentrations of sulfuric, nitric, and hydrofluoric acids. They are Environmental Stress Cracking (ESC) agents for PP, meaning that time-to-failure is a function of the combined variables of concentration and temperature of the fluid and stress. Although PP is not recommended for some organic chemicals, such as polar and chlorinated solvents and the aromatics, the concern is permeation through rather than catastrophic damage of the molecular chain.

Black PP used in Chemtrol products is formulated with a minimum 2.5% carbon black. The plastic pipe industry recognizes PP formulated with this level of carbon black as suitable for long-term outdoor service.

Chem-Pure® Natural PP utilized to produce Chemtrol® piping products was selected because of its extremely low content of metals, organic compounds other than naturally pure propylene, and free ions. No pigments or other adulterants (natural) are added to the plastic resin. Chem-Pure® systems are intended for high purity chemicals or DI water. Chem-Pure systems are intended as an economic alternative to the ultra high purity PVDF systems typically found in the highly sophisticated electronic semi-conductor industry.

FKM

(Fluoroelastomer) FKM is compatible with a broad spectrum of chemicals. Because of this extensive chemical compatibility, spanning wide ranges of concentration and temperature, FKM has gained wide acceptance as a material of construction for valve o-rings and seats. These fluoroelastomers can be used in most applications involving mineral acids (with the exception of HCl), salt solutions, chlorinated hydrocarbons, and petroleum oils. FKM is not recommended for most strong alkali solutions.

EPDM

(Ethylene-propylene-diene monomer) EPDM is a terpolymer elastomer that has good abrasion and tear resistance and offers excellent chemical resistance to a variety of salt, acidic, and organic chemical solutions. It is the best material for most alkali solutions and hydrochloric acid, but is not recommended for applications involving petroleum oils or most strong acids.

PTFE

(Polytetrafluoroethylene) PTFE has outstanding resistance to chemical attack by most chemicals and solvents. PTFE has a temperature rating of -200°F to +500°F. It is a self-lubricating material used as a seat and/or bearing material in most Chemtrol® valves.

Chemical Resistance

While thermoplastic piping systems are useful in general water service because they are light-weight, easy to install, and cost-effective, they excel in corrosive environments, such as water and wastewater treatment, food and pharmaceuticals, chemical processing, mining, power plants, oil refineries and more. Choosing the proper material for corrosive fluids can be handled by consulting NIBCO's chemical resistance guide and understanding the effect that temperature will have upon plastic materials' strength.

Chemical resistance is the ability for a particular plastic material to maintain properties in contact with a chemical. To ensure comprehensive chemical compatibility, a piping system must take into consideration the chemical resistance of all system components, including, but not limited to, plastic components, solvent cements or thread pastes (if applicable), elastomeric seals, all valve components and lubricants. Testing under field conditions may be the best way to ensure selected materials will work in a particular application.

		Polyvinyl Chloride (PVC) 	Chlorinated Polyvinyl Chloride (Corzan® CPVC) 
Typical Applications		Chemical processing, industrial plating, chilled water distribution, chemical drainage, and irrigation systems	Systems for hot corrosive liquids, hot and cold water distribution, chemical processing, industrial plating, deionized water lines, chemical drainage, waste water treatment systems, and similar applications above the temperature range of PVC
Joining Methods		Solvent cementing, threading, or flanging	Solvent cementing, threading, or flanging
Max. Service Temperature		140° F/60° C	200° F/93° C
Fittings	Schedule 80	Socket– 1/2" through 12" Threaded– 1/4" through 4"	Socket– 1/4" through 12" Threaded– 1/4" through 4"
	Large diameter	10" and 12" couplings, tees, 90° and 45° elbows, reducer bushings, and Van Stone flanges	10" and 12" couplings, tees, 90° and 45° elbows, reducer bushings
Valves	Tru-Bloc®/True Union ball valves*	1/2" through 6" socket, threaded, and flanged connections	1/2" through 6" socket, threaded, and flanged connections
	Tru-Bloc®/True Union ball check valves	1/2" through 4" with socket, threaded, or flanged ends	1/2" through 4" with socket, threaded, or flanged ends
	Butterfly valves*	EPDM and FKM liner	EPDM and FKM liner 3" only
	Multiport valves*	True Union 3-way/3-position; 1/2" through 2" with socket, threaded, or flanged ends	True Union 3-way/3-position; 1/2" through 2" with socket, threaded, or flanged ends
	Specialty valves	Angle and Y pattern: 1/4" through 1" threaded Needle and Chemcock®: 1/4" threaded	
Pipe			

*For pneumatic or electric actuation.

Refer to Chemtrol Technical Manuals for pressure ratings at various temperatures.

Corzan® is a registered trademark of The Lubrizol Corporation.

WARNING: DO NOT USE OR TEST THE PRODUCTS IN THIS CATALOG WITH COMPRESSED AIR OR OTHER GASES. FAILURE TO FOLLOW THIS WARNING CAN RESULT IN PERSONAL INJURY OR DAMAGE TO PROPERTY.

Polypropylene (PP) 		Polyvinylidene Fluoride (KYNAR® PVDF) 	
Black Polypropylene: Clean chemical processes, hot corrosive liquids, industrial plating, waste treatment systems	**Natural Polypropylene:** Deionized water systems, clean chemical processes, pharmaceutical operations, food processing	**Red KYNAR®** PVDF, which protects fluid medium from UV exposure, is an excellent material for general industrial applications, especially outdoor installations.	**Natural KYNAR®** (Unpigmented) PVDF is ideal for industries such as electronics, pharmaceuticals, and processed foods or beverages.
Thermo-seal fusion, threading, or flanging	Thermo-seal fusion, threading, or flanging	Socket heat fusion, threading, or flanging	Socket heat fusion, threading, or flanging
180° F/82° C	180° F/82° C	280° F/138° C	280° F/138° C
IPS socket type– 1/2" through 6" Threaded– 1/2" through 4"	Socket ends– 1/2" through 4" Threaded– 1/2" through 4"	IPS socket type– 1/2" through 6" Threaded– 1/2" through 2"	IPS socket type– 1/2" through 6" Threaded– 1/2" through 2"
1/2" through 4" with socket, threaded, or flanged ends	1/2" through 4" with socket ends	1/2" through 4" with socket, threaded, or flanged ends	1/2" through 4" with socket, threaded, or flanged ends
1/2" through 4" with socket, threaded, or flanged ends		1/2" through 4" with socket, threaded, or flanged ends	1/2" through 4" with socket, threaded, or flanged ends
	1/2" through 4" with metric spigot, IPS socket, or ANSI flanged ends.		1/2" through 4" with metric spigot, IPS socket, or ANSI flanged ends.
Schedule 40 and 80 wall thicknesses		Schedule 80 wall thicknesses	

WARNING: DO NOT USE OR TEST THE PRODUCTS IN THIS CATALOG WITH COMPRESSED AIR OR OTHER GASES. FAILURE TO FOLLOW THIS WARNING CAN RESULT IN PERSONAL INJURY OR DAMAGE TO PROPERTY.

Key to Chemtrol Valve Figure Number System

X XX XX - X - XX - SIZE
(1) (2) (3) (4) (5) (6)

(1) End Configurations

S	Socket
F	Flanged
T	Threaded (female)
M	Threaded (male)
A	Hose x Male Threaded
W	Wafer Style Butterfly
U	Universal (socket and threaded)

(2) Body Material

45	PVC Schedule 80
51	CPVC Schedule 80
61	Black Polypropylene (PP)
62	Chem-Pure® Natural Polypropylene (PP)
65	Red Kynar® PVDF
66	Natural Kynar® PVDF

(3) Types of Valves

AC	Angle
BC	Ball Check
BF	Butterfly (Model B)
BG	Butterfly (Model C)
CC	Chemcock®
CN	Needle
D2	Diverter (3-Way, 2-Position)
FV	Ball Foot
M3	Multiport (3-Way, 3 Position)
TB	Tru-Bloc® True Union Ball Valve
YP	Y-Pattern

(4) O-Ring Material

E	EPDM
V	FKM

(5) Operating Mechanisms

NO	None
LH	Lever Handle, Manual
RH	Round Safety Handle, Manual
GO	Gear Operator, Manual

(6) Size

State Valve Size

WARNING: DO NOT USE OR TEST THE PRODUCTS IN THIS CATALOG WITH COMPRESSED AIR OR OTHER GASES. FAILURE TO FOLLOW THIS WARNING CAN RESULT IN PERSONAL INJURY OR DAMAGE TO PROPERTY.

PVC and CPVC True Union Ball Check, Foot, and Vent Valves

Chemtrol Figure Numbers

Type Valve	End Conn	Elastomeric Trim	Materials	
			PVC	CPVC
Ball Check Valve	Soc.	FKM EPDM	U45BC-V[1] U45BC-E[1]	U51BC-V[1] U51BC-E[1]
	Thd.	FKM EPDM	U45BC-V[1] U45BC-E[1]	U51BC-V[1] U51BC-E[1]
	Flgd.	FKM EPDM	F45BC-V F45BC-E	F51BC-V F51BC-E

1 1/2"–2" PVC and CPVC TU ball check figures are supplied with universal connection components (i.e., a set of both socket and threaded end connectors). For 3" and 4" sizes of PVC and CPVC BC valves, replace U in the figure no. with S or T for socket or threaded units respectively.

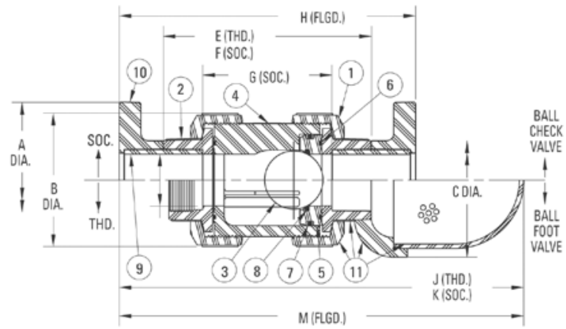
Features

- Rated at 150 psi with non-shock service at 73°F.
- Gravity ball check may be converted for air or gas venting by replacement of standard ball with natural polypropylene floater ball. Then install valve upside down for fluid to lift ball into seat.
- For foot valve, replace inlet end connection with a foot valve screen housing assembly.
- Free oscillation of ball in guide ribs facilitates full port flow with minimum turbulence and chatter.
- Equally effective in checking back flows from head pressure on the discharge or suction sides of pump.

Construction Materials

Components[1]	PVC	CPVC
1. Union Nut	PVC	CPVC
2. End Connector	PVC	CPVC
3.Ball	PVC	CPVC
– Standard for Check or Foot Valve	Natural PP Floater Ball	
– Floater Ball for Vent Valve[2]		
4. Body[1]	PVC	CPVC
5. C.V. Seat-Carrier	PVC	CPVC
6. O-ring[3] Body & Carrier; End Seal	FKM or EPDM	
7. O-ring[3] Seat-Carrier, OD Seal	FKM or EPDM	
8. O-ring[3] Seat Seal	FKM or EPDM	
9. Plain End Pipe Nipple for Flanged Valve	PVC	CPVC
10. Flange–Socket for Flanged Valve	PVC	CPVC
11. Foot Valve Screen Housing Assembly[4]	PVC	CPVC

1 All components except valve bodies are available as replacement parts.
2 Gravity ball check valves are converted to vent valves by replacing the standard ball with a floater ball and inverting the valve at installation–with seat up.
3 Each replacement O-ring kit contains all the O-rings required to refurbish any True Union Check or Ball Valve (regardless of model or style), or a minimum of two pipe unions.
4 Gravity ball check valves are converted to foot valves by replacing the union nut and end connector on the receiving end – seat end – of the body with an F.V. screen housing assembly.



Dimensions[1]–Weights[3]–Fluid Flow Coefficients

Valve Size	Ball Check/Foot A	B	C	D	Ball Check Valve E Thd.	F Soc.	G Soc.	H Flgd.	Approx.[2] Wt. Lbs.	Ball Foot Valve J Thd.	K Soc.	M Flgd.	Approx.[3] Wt. Lbs	Seating Head Ft – H_2O Vert.	Horiz.	Fluid Flow Coefficient C_V[3]
1/2	3.50	1.98	2.63	0.50	3.94	4.13	2.36	6.27	0.42	6.13	6.19	7.25	0.23	6	7	5
3/4	3.88	2.44	2.63	0.75	4.65	5.02	3.00	7.38	0.72	6.88	7.13	8.25	0.29	6	7	10
1	4.26	2.83	3.63	1.00	5.08	5.40	3.12	7.99	1.05	8.13	8.25	9.63	0.37	4	5	19
1 1/4	4.62	4.08	5.50	1.25	6.38	6.75	4.22	9.65	2.46	11.13	11.25	12.75	1.34	4	5	37
1 1/2	5.00	4.08	5.50	1.50	6.38	6.99	4.21	10.18	2.62	11.13	11.50	13.13	1.34	4	5	56
2	6.00	5.23	5.50	2.00	7.36	8.02	4.99	11.45	4.76	11.75	12.13	13.75	1.88	4	5	101
3	7.50	7.17	5.50	3.00	9.98	9.98	6.17	14.22	9.21	13.38	13.38	15.63	3.00	3	4	251
4[4]	9.00	7.17	5.50	3.00	20.76	20.76	16.20	16.14	14.18	18.50	18.50	16.25	3.00	3	4	251

1 Foot valve screen housing assemblies are available for the field conversion of PVC and CPVC TU ball check valves in sizes 1/2" - 4".
2 Weights shown for ball valve figures are PVC threaded models. For an approximation of CPVC check valve weights, the PVC weight may be multiplied by factor of 1.123. Weights shown for foot valves are actually those for PVC F.V. screen housing assemblies. So, the weight for a CPVC F.V. screen housing assy. may be found by multiplying the PVC weight by the 1.123 factor. These must be added to check valve weight for full foot valve weight.
3 C_v values are based on the basic valve laying length (G).
4 The 4" PVC and CPVC check valves are fabricated by solvent cementing either reducing flanges or reducing couplings onto the ends of a 3" valve with plain-end nipples.

WARNING: DO NOT USE OR TEST THE PRODUCTS IN THIS CATALOG WITH COMPRESSED AIR OR OTHER GASES. FAILURE TO FOLLOW THIS WARNING CAN RESULT IN PERSONAL INJURY OR DAMAGE TO PROPERTY.