HAYWARD®

FLOW CONTROL

Industrial Product Guide

define
design
deliver

QUALITY | SERVICE | INTEGRITY

WELCOME TO HAYWARD FLOW CONTROL

Hayward® Flow Control, a division of Hayward Industries, Inc., and based in Clemmons, NC, USA, has been a leading manufacturer of industrial thermoplastic valves and process control products for more than 60 years. In fact, Hayward was one of the originators of the first thermoplastic ball valves. Since then, we have remained committed to producing the highest quality products while providing outstanding service that exceeds customer expectations. Hayward has earned an unsurpassed reputation for product design, manufacturing precision, quality assurance, experience and know-how, and a total commitment to customer satisfaction and support. We serve a multitude of markets and industries worldwide with our products.

Founded in 1923 by Irving M. Hayward, Hayward Industries was a small company located in Brooklyn, NY, making specialty metal valves and industrial flow control products. When Mr. Hayward retired in 1964, new management acquired the company and a new period of growth and diversification began, one that continues to this day. Management realized an opportunity existed for thermoplastic, rather than metal, swimming pool filters and accessories, and diversified into the swimming pool market. Rapid growth in the pool business resulted in the creation of Hayward Pool Products, Inc. At the same time, through a combination of acquisitions, modernization of the manufacturing facilities and product innovations, the industrial thermoplastic flow control business grew as well—and became Hayward Flow Control.

RELIABLE BY DESIGN

Reliable by design, Hayward valves are designed using the latest state-of-the-art equipment. Our Computer Aided Design (CAD) system, linked to finite element software, provides accurate and essential stress analysis. Hayward valves are designed to be strong, with material where it counts allowing years of service. Hayward Flow Control products are backed up by our industry leading Two-Year Warranty.

WORLD CLASS QUALITY

As an ISO 9001:2008 certified company, Hayward Flow Control adheres to the strictest guidelines relative to component manufacture, assembly and testing. We employ the latest manufacturing technologies and continue to invest in new equipment and tooling. Our reputation for quality and reliability is unmatched. In addition to a tradition of quality and expertise, Hayward's highly qualified field sales organization also provides customer assistance, training and field support. We strive to provide our customers with products specific to their application criteria.

COMMITMENT TO THE FUTURE

Hayward remains dedicated to new product development and innovative process technology that produces high quality, reliable products and ultimately, total customer satisfaction. We will continue to advance fluid process technology as the leading American manufacturer of industrial thermoplastic flow control products.

LLOYD'S REGISTER · LRQA
ISO 9001

QUALITY ASSURED 2 YEAR HAYWARD WARRANTY

BACKED BY HAYWARD FLOW CONTROL'S EXCLUSIVE TWO YEAR WARRANTY

ABS FOUNDED 1862

THE BENEFITS OF HAYWARD THERMOPLASTIC FLOW CONTROL PRODUCTS:

Since the introduction of PVC in the U.S. during the 1940s, thermoplastic valves, pipes and fittings have gained broad acceptance. Thermoplastic valves, pipes and fittings are often the material of choice for systems that were traditionally designed in metal. Unlike metal, thermoplastic valves and piping components have a high resistance to corrosion, will not scale or rust and will not contaminate sensitive fluids.

Hayward manufactures products from compounds of PVC, CPVC, natural PP, Glass Filled PP (GFPP), PVDF, Eastar® and Polyetherimide. These materials are nonconductors and, as such, are immune to electrolytic and galvanic corrosion. Equally important, they contain nothing to leach out and contaminate sensitive fluids. Benefits of Hayward thermoplastic valves and flow control products include:

NONTOXIC

Hayward PVC and CPVC products are suitable for use with potable water and are consistent with National Sanitation Foundation (NSF). Where applicable, Hayward products are made to ASTM and ANSI standards. See specific products in this catalog for NSF / ANSI 61 and 372 compliance.

CORROSION RESISTANCE

Hayward thermoplastic flow control products are resistant to corrosion in applications where metal valves may corrode. They are dielectric, meaning they will not support a charge, and will remain free from the ionization and corrosion that may occur with metal valves.

EXTENDED SERVICE LIFE

Hayward thermoplastic valves will outlast most metal valves and are not affected by normal weather conditions. They will provide years of maintenance-free service.

LOW THERMAL CONDUCTIVITY

Hayward thermoplastic products have much less thermal conductivity than metal valves so that heat gain or loss is greatly reduced. Pipe insulation is rarely required for thermoplastic piping systems.

IMPROVED FLOW RATES

Hayward thermoplastic valves have a high flow coefficient and, as compared to metal, will not pit, rust or corrode. Their interior walls are molded with an ultra-smooth finish that will remain smooth throughout the valve's service life—resulting in a more consistent flow rate over time.

HIGH TEMPERATURE SERVICE

Hayward flow control products are capable of handling corrosive chemicals at elevated temperatures—up to 240°F with Glass Filled PP (GFPP).

EASY INSTALLATION

Hayward thermoplastic flow control products are generally 1/3 to 1/2 the weight of similar size and type metal valves. They are simple to install and result in reduced handling, labor and installation costs.

ECONOMICS

When evaluating the economics of Hayward thermoplastic flow control products over metal equals, consider not only the initial cost savings, but the reduced freight, lower installation and maintenance costs and the extended service life of the valves. Hayward thermoplastic flow controls are a cost effective alternative to metal products.

Table of Contents

Disclaimer: Products and Dimensional data are subject to change without notice. Consult factory for possible updates.

LHB Series
Manual Limit Switch

FOR BALL VALVES UP TO 6" AND
BUTTERFLY VALVES UP TO 8"

KEY FEATURES

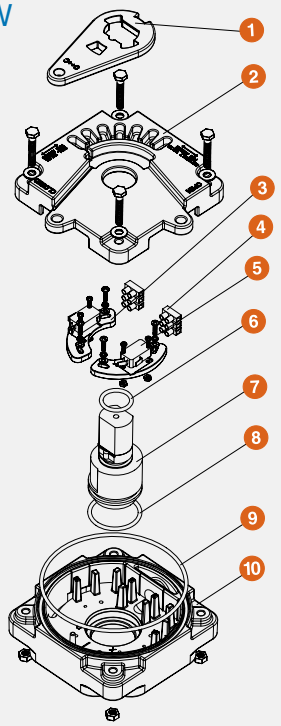
- Remote Monitoring of Critical Services
- Retrofits to Existing Valves
- Robust GFPP Body, Cover and Plate
- 304 Stainless Steel Stem and FPM Seals
- Fits All Hayward® Ball Valves up to 6" and Butterfly Valves up to 8"
- Available with "Dead-Man" Spring Return Handle or Handlever (LHB-SR)
- Two Adjustable SPDT 10 Amp at 120 VAC Switches (Open/Close Position)
- 1/2" Conduit Port
- Terminal Blocks for Ease of Wiring
- Meets ISO5211, F05, F07 and F10 Patterns
- NEMA 4X
- Switches CSA Listed

OPTIONS

- Additional Two Switches
- Optional Handles – Lever or T-Handle

TECHNICAL INFORMATION

EXPLODED VIEW



SELECTION CHART

MANUAL LIMIT SWITCH MODEL	VALVE SIZE/SERIES
LHB-1	1/2" – 2" TB / TBH (DN15 – DN50) 1-1/2" – 4" BYV (DN40 – DN100)
LHB-2	2-1/2" – 6" TB / TBH (DN65 – DN150) 6" – 8" BYV (DN150 – DN200)
LHB-1-SR	1/2" – 2" TB (DN15 – DN50)
LHB-2-SR	2-1/2" – 6" TB (DN65 – DN150)

Pat. No's.: 9,010,721; and 9,0101, 722; 9, 702,480

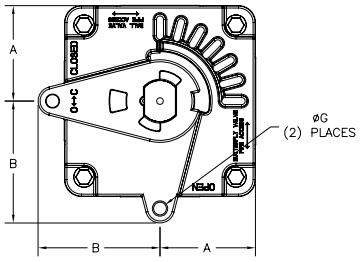
LHB Series
Manual Limit Switch

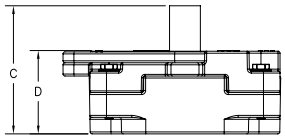
FOR BALL VALVES UP TO 6" AND BUTTERFLY VALVES UP TO 8"

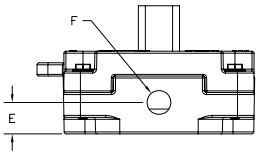
TECHNICAL INFORMATION, *CONTINUED*

PARTS LIST

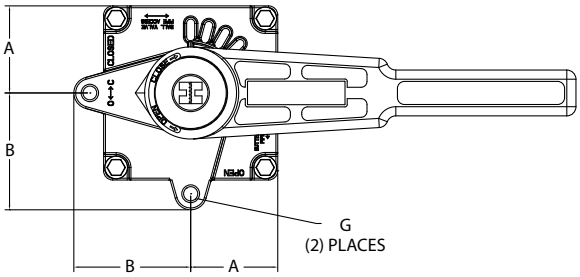
1. Lock Plate
2. Cover
3. Adjustment Plate
4. Terminal Block
5. Switch
6. Upper Shaft O-Ring
7. Shaft
8. Lower Shaft O-Ring
9. Body O-Ring
10. Body

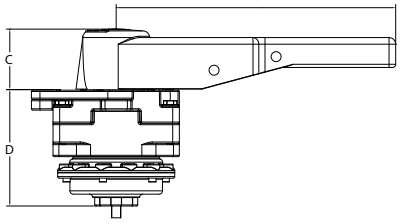


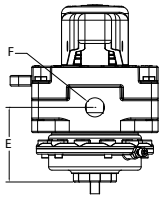




LHB







LHB-SR

DIMENSIONS

MANUAL LIMIT SWITCH MODEL	VALVE SIZE/SERIES	A in / mm	B in / mm	C in / mm	D in / mm	E in / mm	F in	G in / mm
LHB-1	1/2" – 2" TB / TBH 1-1/2" – 4" BYV	2.38 / 60	3.19 / 81	3.88 / 99	2.52 / 64	.95 / 24	1/2" NPT	.38 / 10
LHB-2	2 -1/2" – 6" TB / TBH 6" and 8" BYV	2.89 / 73	3.69 / 94	3.88 / 99	2.52 / 64	.95 / 24	1/2" NPT	.38 / 10
LHB1-SR	1/2" – 2" TB / TBH	2.38 / 61	3.19 / 81	2.28 / 60	4.38 / 112	2.81 / 71	1/2" NPT	.38 / 10
LHB2-SR	2-1/2" – 6" TB / TBH	2.89 / 73	3.69 / 94	2.28 / 60	2.52 / 64	112 / 71	1/2" NPT	.38 / 10

Dimensions are subject to change without notice – consult factory for installation information

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SV Series True Union Solenoid Valves

1/4" TO 1" PVC AND CPVC

KEY FEATURES

- Available in PVC and CPVC
- Corrosion-Resistant Polyester Coil
- No Pressure Differential Required for Operation
- Both 1/2" Conduit or SJ-Type Cord Electrical Connection
- 110 VAC Standard
- Normally Closed Design

OPTIONS

- 12 VAC, 24 VAC, 220 VAC, 12 VDC, 24 VDC

OPERATING PARAMETERS

For optimum valve performance, inlet pressure must not exceed 120 PSI. Flow velocity must not exceed 5 ft. per second. Units are not to be operated on continuously. Maximum back pressure 25psi.

MATERIALS

- PVC Cell Class 12454 per ASTM D1784
- CPVC Cell Class 23447 per ASTM D1784
- FPM and EPDM O-Ring Seals

TECHNICAL INFORMATION

SELECTION CHART

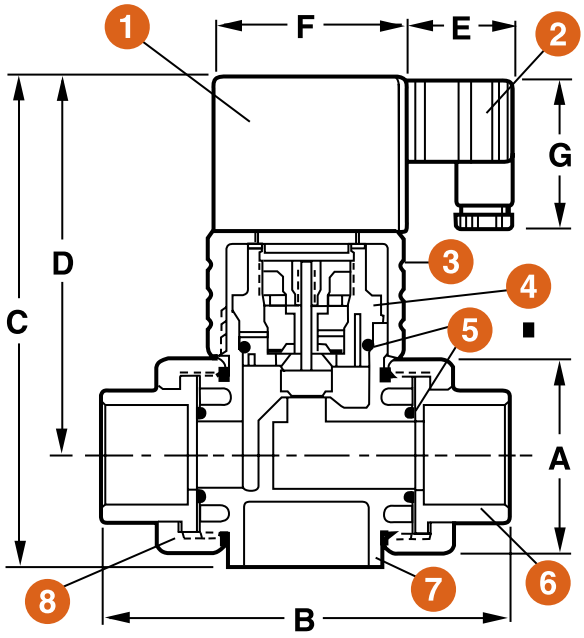
SIZE	MATERIAL	END CONNECTION	SEALS	PRESSURE RATING
1/4" – 1" * (DN8 – DN25)	PVC or CPVC	Socket and Threaded	FPM or EPDM	150 PSI @ 70°F 10 Bar @ 21°C Non-Shock

* PVC and CPVC socket ends available to ISO 727-1 and threaded ends to BS21.

TECHNICAL INFORMATION, *CONTINUED*

PARTS LIST

1. Solenoid Coil
2. Electrical Connector
3. Bonnet Nut
4. Seal Cartridge
5. O-Rings
6. End Connector
7. Body
8. Union Nut



DIMENSIONS

SIZE in / DN	A in / mm	B in / mm	C in / mm	D in / mm	E in / mm	F in / mm	G in / mm	WEIGHT lbs / kg
1/4 / 8	2.25 / 57	5.30 / 135	6.30 / 160	4.60 / 117	1.60 / 41	2.60 / 66	2.00 / 51	2.79 / 1.27
1/2 / 15*	2.25 / 57	5.30 / 135	6.30 / 160	4.60 / 117	1.60 / 41	2.60 / 66	2.00 / 51	2.81 / 1.27
3/4 / 20*	2.63 / 67	5.50 / 140	6.60 / 168	5.10 / 130	1.60 / 41	2.60 / 66	2.00 / 51	3.01 / 1.37
1 / 25*	2.63 / 67	5.50 / 140	6.60 / 168	5.10 / 130	1.60 / 41	2.60 / 66	2.00 / 51	3.03 / 1.37

Dimensions are subject to change without notice – consult factory for installation information

* Metric End Connections Available In: BSP – Straight Thread, BSP TR – Tapered Thread and Metric Socket

Cv VALUES

SIZE in / DN	Cv VALUES	SIZE in / DN	Cv VALUES
1/4 / 8	1.3	3/4 / 20	3.2
1/2 / 15	2.3	1 / 25	3.8

PRESSURE LOSS CALCULATION FORMULA

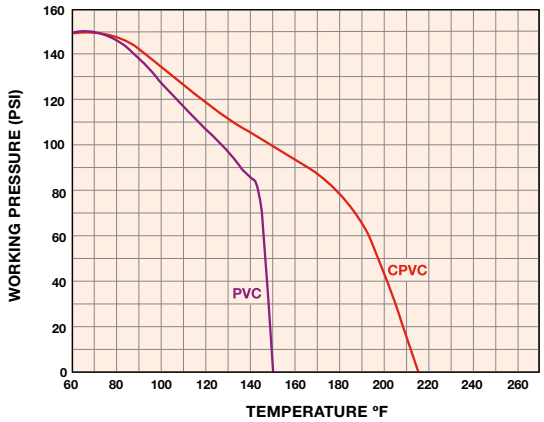
$$\Delta P = \left[\frac{Q}{Cv}\right]^2$$

ΔP = Pressure Drop

Q = Flow in GPM

Cv = Flow Coefficient

OPERATING TEMPERATURE/PRESSURE



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EA Series Automated True Union Ball Valves

1/2" TO 2" PVC AND CPVC

VALVE FEATURES

- Available in PVC and CPVC
- EPDM Seals
- PTFE Seats
- Full Port Design
- Fully Serviceable
- Double O-Ring Stem Seals

ACTUATOR FEATURES

- UL/CSA Listed Motor
- Thermoplastic NEMA 4 / 4X enclosure
- 2.5 Second, 90° Cycle Time
- Thermal Overload Protection
- Permanently Lubricated Gear Train
- Actuator Brake
- No Need for Manual Adjustments
- Blind Leads Connection
- Standard 120 VAC
- Unidirectional, Not Reversing

MATERIALS

- PVC Cell Class 12454 per ASTM D1784
- CPVC Cell Class 23447 per ASTM D1784
- EPDM O-Ring Seals

TECHNICAL INFORMATION

SELECTION CHART

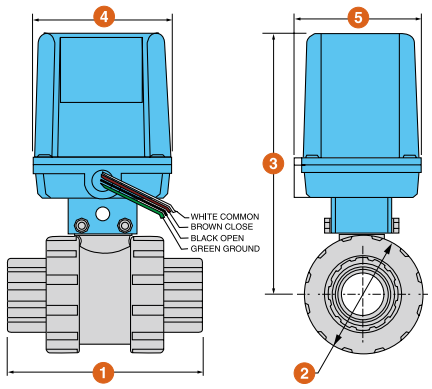
SIZE	VALVE MATERIAL	END CONNECTION	VALVE SEALS	VALVE PRESSURE RATING
1/2" – 2" (DN15 – DN50)	PVC or CPVC	Socket and Threaded	EPDM	250 PSI @ 70°F 16 Bar @ 21°C Non-Shock

* PVC and CPVC socket ends available to ISO 727-1 and threaded ends to BS21. Not for use with "Z" Ball.

TECHNICAL INFORMATION, *CONTINUED*

DIMENSIONS

SIZE in / DN	1 in / mm	2 in / mm	3 in / mm	4 in / mm	5 in / mm	WEIGHT lbs / kg
1/2 / 15	4.63 / 118	2.25 / 57	8.30 / 211	4.75 / 121	4.34 / 110	6.80 / 3.08
3/4 / 20	4.75 / 121	2.63 / 67	8.46 / 215	4.75 / 121	4.34 / 110	6.80 / 3.08
1 / 25	5.25 / 133	3.00 / 76	8.73 / 222	4.75 / 121	4.34 / 110	7.10 / 3.22
1-1/4 / 32	6.30 / 160	4.00 / 102	9.50 / 241	4.75 / 121	4.34 / 110	8.00 / 3.63
1-1/2 / 40	6.75 / 171	4.00 / 102	9.15 / 232	4.75 / 121	4.34 / 110	8.10 / 3.67
2 / 50	8.00 / 203	4.75 / 121	9.65 / 245	4.75 / 121	4.34 / 110	9.80 / 4.45



Dimensions are subject to change without notice – consult factory for installation information

ACTUATOR SPECIFICATIONS

MODEL	EA
Torque Output (in-lbs)	120
Standard Voltage	120 VAC
Duty Cycle	25%
Thermal Overload	Standard
Cycle Time (secs @ 90°)	2.5
Conduit Entry	1/2" NPT
Enclosure	NEMA 4 / 4X
Enclosure Material	Polypropylene
Max Current Amps @ 115 VAC	1.8

VALVE SPECIFICATIONS

VALVE TYPE	TRUE UNION
Material of Construction	PVC, CPVC
Seals	FPM/EPDM
Seats	PTFE
End Connections	Socket or Threaded
Sizes	1/2", 3/4", 1", 1-1/4", 1-1/2" and 2"
Pressure Rating	250 PSI @ 70°F non-shock
Design	Full Port

Cv VALUES

SIZE in / DN	Cv VALUES	SIZE in / DN	Cv VALUES
1/2 / 15	8.0	1-1/4 / 32	75.0
3/4 / 20	15.0	1-1/2 / 40	90.0
1 / 25	29.0	2 / 50	140.0

PRESSURE LOSS CALCULATION FORMULA

$$\Delta P = \left[\frac{Q}{Cv}\right]^2$$

ΔP = Pressure Drop

Q = Flow in GPM

Cv = Flow Coefficient

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EAU Series Automated True Union Ball Valves

1/2" TO 2" PVC AND CPVC

VALVE FEATURES

- Available in PVC and CPVC
- FPM or EPDM Seals
- PTFE Seats
- Full Port Design
- Fully Serviceable
- Double O-Ring Stem Seals

ACTUATOR FEATURES

- UL/CSA Listed Motor
- Thermoplastic NEMA 4 / 4X Enclosure
- 2.5 Second, 90° Cycle Time
- Permanently Lubricated Gear Train
- Actuator Brake
- 90 or 180° Operation
- Unidirectional, Not Reversing
- Terminal Block Connections
- Standard 120 VAC
- End of Travel Dry Contact Limit Switch
- Thermal Overload Protection
- Lightweight, Compact and Inexpensive

OPTIONS

- 24VAC / VDC
- 230 VAC

MATERIALS

- PVC Cell Class 12454 per ASTM D1784
- CPVC Cell Class 23447 per ASTM D1784
- FPM and EPDM Seals

TECHNICAL INFORMATION

SELECTION CHART

SIZE	VALVE MATERIAL	END CONNECTION	VALVE SEALS	VALVE PRESSURE RATING
1/2" – 2" (DN15 – DN50)	PVC or CPVC	Socket and Threaded	FPM or EPDM	250 PSI @ 70°F 16 Bar @ 21°C Non-Shock

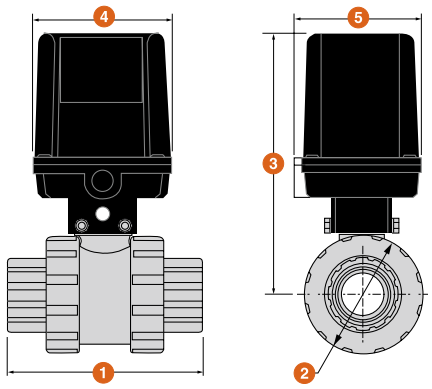
* PVC and CPVC socket ends available to ISO 727-1 and threaded ends to BS21. Not for use with "Z" Ball.

EAU Series
Automated True Union Ball Valves
1/2" TO 2" PVC AND CPVC

TECHNICAL INFORMATION, *CONTINUED*

DIMENSIONS

SIZE in / DN	1 in / mm	2 in / mm	3 in / mm	4 in / mm	5 in / mm	WEIGHT lbs / kg
1/2 / 15	4.63 / 118	2.25 / 57	8.40 / 213	4.88 / 124	4.13 / 105	6.80 / 3.08
3/4 / 20	4.75 / 121	2.63 / 67	8.60 / 218	4.88 / 124	4.13 / 105	6.80 / 3.08
1 / 25	5.25 / 133	3.00 / 76	9.10 / 231	4.88 / 124	4.13 / 105	7.10 / 3.22
1-1/4 / 32	6.30 / 160	4.00 / 102	9.50 / 241	4.88 / 124	4.13 / 105	8.00 / 3.63
1-1/2 / 40	6.75 / 171	4.00 / 102	9.50 / 241	4.88 / 124	4.13 / 105	8.10 / 3.67
2 / 50	8.00 / 203	4.75 / 121	10.10 / 257	4.88 / 124	4.13 / 105	9.80 / 4.45



Dimensions are subject to change without notice – consult factory for installation information

ACTUATOR SPECIFICATIONS

MODEL	EAU
Torque Output (in-lbs)	120
Standard Voltage	120 VAC
Duty Cycle	25%
Thermal Overload	Standard
Cycle Time (secs*)	2.5 / 5.0
Conduit Entry	1/2" NPT
Enclosure	NEMA 4 / 4X
Enclosure Material	Polypropylene
Max Current Amps @ 115 VAC	1.8 (60 Hz), 2.8 (50 Hz)

* EAU28 = 180° (5.0 sec), , EAU29 = 90° (2.5 sec.)

VALVE SPECIFICATIONS

VALVE TYPE	TRUE UNION
Material of Construction	PVC, CPVC
Seals	FPM/EPDM
Seats	PTFE
End Connections	Socket or Threaded
Sizes	1/2", 3/4", 1", 1-1/4" 1-1/2" and 2"
Pressure Rating	250 PSI @ 70°F non-shock
Design	Full Port

Cv VALUES

SIZE in / DN	Cv VALUES	SIZE in / DN	Cv VALUES
1/2 / 15	8.0	1-1/4 / 32	75.0
3/4 / 20	15.0	1-1/2 / 40	90.0
1 / 25	29.0	2 / 50	140.0

PRESSURE LOSS CALCULATION FORMULA

$$\Delta P = \left[\frac{Q}{Cv}\right]^2$$

ΔP = Pressure Drop

Q = Flow in GPM

Cv = Flow Coefficient

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PM Series Automated TBH True Union Ball Valves

1/2" TO 2" PVC AND CPVC

VALVE FEATURES

- System2™ Sealing Technology provides longer cycle life
- 250 PSI / 16 Bar, non-shock at 70°F / 23°C full pressure rating
- Consistent operating torque with adjustment-free design
- Lockout/Tagout mechanism that secures directly to valve body for enhanced safety
- Ergonomic handle for improved grip and comfort
- ISO mounting flange simplifies actuation
- Permanent markings, eliminates labels
- Integral footpad for skid or panel mount
- FPM or EPDM seals
- Double O-Ring stem seals
- Reversible PTFE seats – Standard
- Easy replacement for existing Hayward TB Series
- NSF / ANSI 61 and NSF / ANSI 372 Listed

ACTUATOR FEATURES

- Corrosion-Resistant Thermoplastic Housing
- Permanently Lubricated Gear Train
- Manual Override
- Two-Piston Rack and Pinion Design
- Namur Compliant Accessory Mount
- Position Indicator
- Lightweight
- Air-to-Air (Double Acting) or Spring Return (Single Acting)

MATERIALS

- PVC Cell Class 12454 per ASTM D1784
- CPVC Cell Class 23447 per ASTM D1784
- FPM and EPDM O-Ring Seals

TECHNICAL INFORMATION

SPECIFICATIONS

SIZE	MATERIAL	END CONNECTION	SEALS	PRESSURE RATING
1/2" – 2" (DN15 – DN50)	PVC or CPVC	Socket and Threaded	FPM or EPDM	250 PSI @ 70°F 16 Bar @ 21°C Non-Shock

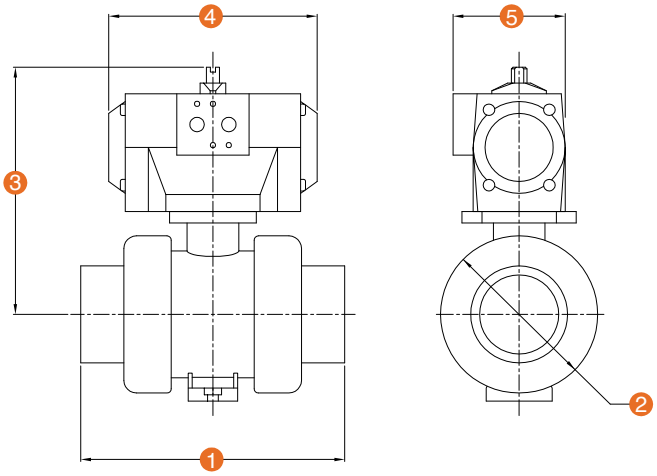
* PVC and CPVC socket ends available to ISO 727-1 and threaded ends to BS21.

TECHNICAL INFORMATION, *CONTINUED*

DIMENSIONS

SIZE in / DN	1 in / mm	2 in / mm	3 in / mm	4 in / mm	5 in / mm
SPRING RETURN (PMS)					
1/2 / 15	4.65 / 118	2.25 / 57	6.13 / 156	6.30 / 160	3.39 / 86
3/4 / 20	4.79 / 122	2.63 / 67	6.29 / 160	6.30 / 160	3.39 / 86
1 / 25	5.39 / 136	3.00 / 76	6.55 / 167	6.30 / 160	3.39 / 86
1-1/4 / 32	6.83 / 174	4.00 / 102	6.98 / 178	6.30 / 160	3.39 / 86
1-1/2 / 40	7.39/ 188	4.00 / 102	6.98 / 178	6.30 / 160	3.39 / 86
2 / 50	8.00 / 203	4.75 / 121	7.98 / 190	6.30 / 160	3.39 / 86
DOUBLE ACTING (PMD)					
1/2 / 15	4.65 / 118	2.25 / 57	5.39 / 136	4.69 / 119	2.64 / 67
3/4 / 20	4.79 / 122	2.63 / 67	5.50 / 140	4.69 / 119	2.64 / 67
1 / 25	5.39 / 136	3.00 / 76	5.76 / 147	4.69 / 119	2.64 / 67
1-1/4 / 32	6.83 / 174	4.00 / 102	6.19 / 158	4.69 / 119	2.64 / 67
1-1/2 / 40	7.39/ 188	4.00 / 102	6.19 / 158	4.69 / 119	2.64 / 67
2 / 50	8.00 / 203	4.75 / 121	6.69 / 170	4.69 / 119	2.64 / 67

Dimensions are subject to change without notice – consult factory for installation information



ACTUATOR SPECIFICATIONS

MODEL	PMD15	MODEL	PMS15
Torque Output (in-lbs) @ 80 PSI	275	Torque Output (in-lbs) @ End of Spring Return	107
Enclosure Material	Polyamide	Enclosure Material	Polyamide
Output Shaft	Carbon Steel	Output Shaft	Carbon Steel
Air Port Connections	1/4" NPT	Air Port Connections	1/4" NPT
Air Consumption (cu. in.)	13.5	Air Consumption (cu. in.)	10.8
Air Transfer	Internal	Air Transfer	Internal
Stroke Time (seconds)	.5	Stroke Time (seconds)	.5
Cycle Time	1/2 Second	Cycle Time	1/2 Second
Minimum Air Pressure	80 PSI	Minimum Air Pressure	80 PSI
Maximum Air Pressure	120 PSI	Maximum Air Pressure	120 PSI
Operation	Rack and Pinion	Operation	Rack and Pinion
Weight (lbs / kg)	1.15 / .52	Weight (lbs / kg)	3.1 / 1.4

Cv VALUES

SIZE in / DN	Cv VALUES	SIZE in / DN	Cv VALUES
1/2 / 15	8.0	1-1/4 / 32	75.0
3/4 / 20	15.0	1-1/2 / 40	90.0
1 / 25	29.0	2 / 50	140.0

PRESSURE LOSS CALCULATION FORMULA

$$\Delta P = \left[\frac{Q}{Cv}\right]^2$$

ΔP = Pressure Drop

Q = Flow in GPM

Cv = Flow Coefficient

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EAU Series Electric Actuators

FOR BALL VALVES UP TO 2"

KEY FEATURES

- UL/CSA Listed Motor
- Thermoplastic NEMA 4 / 4X Enclosure
- 2.5 Second, 90° Cycle Time, 5.0 sec 180° Cycle Time
- Permanently Lubricated Gear Train
- Actuator Brake
- 90 or 180° Operation
- Unidirectional, Not Reversing
- Terminal Block Connections
- Standard 120 VAC
- End of Travel Dry Contact Limit Switch
- Thermal Overload Protection
- Lightweight, Compact and Inexpensive

OPTIONS

- Voltage Options of 12, 24 or 220 VAC and 12 or 24 VDC

MATERIALS

- PP per ASTM D4101

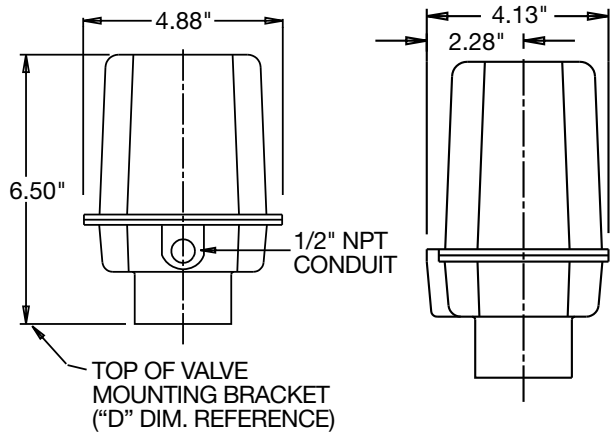
TECHNICAL INFORMATION

SPECIFICATIONS

HOUSING	GFPP
OPERATION	Unidirectional
CONDUIT SIZE	1/2"
DUTY CYCLE	25%
CYCLE TIMES	2-1/2 Seconds, 90º Rotation; 5 Seconds, 180º Rotation
ENCLOSURE	NEMA 4 / 4X
VOLTAGE	120 VAC
THERMAL OVERLOAD PROTECTION MECHANICAL BRAKE MOTOR	UL Listed
AUXILIARY LIMIT SWITCHES	Rated 10A @ 230 VAC Resistive

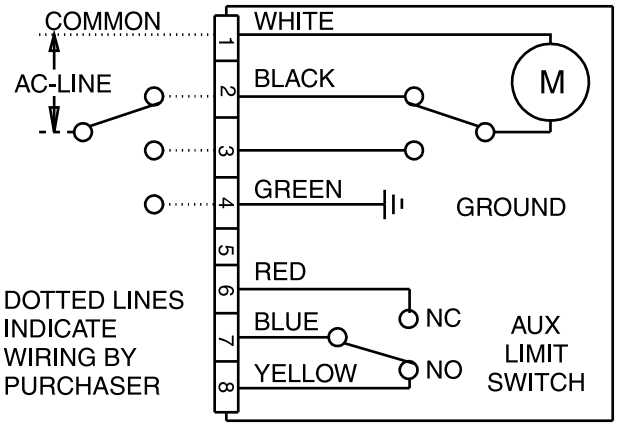
TECHNICAL INFORMATION, *CONTINUED*

DIMENSIONS



Dimensions are subject to change without notice – consult factory for installation information

WIRING DIAGRAM



ACTUATOR SPECIFICATIONS

MODEL	EAU
Torque Output (in-lbs)	120
Standard Voltage	120 VAC
Duty Cycle	25%
Thermal Overload	Standard
Cycle Time (in seconds)*	2.5 / 5.0
Auxiliary Switch Limit Rating	SPDT 10A Resistive @ 230 VAC
Conduit Entry	1/2" NPT
Enclosure	NEMA 4 / 4X
Enclosure Material	Polypropylene
Max Current Amps @ 120 VAC	1.8
Weight (lbs / kg)	6.2 / 2.7

* EAU28 = 180° (5.0 sec) EAU29 = 90° (2.5 sec)

VALVE SELECTION CHART

SIZE in / DN	TB / TBH / TN / LA90 SERIES BALL VALVES	TW / LA SERIES BALL VALVES
1/2 – 2 / 15 – 50	EAU29 (90º)	EAU28 (180º)

* Actuator size selections based on clean water at 70ºF

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ECP Series
Glass Filled Polypropylene Electric Actuators

FOR BALL VALVES 1/2" - 6"
BUTTERFLY VALVES 2" - 6"

KEY FEATURES

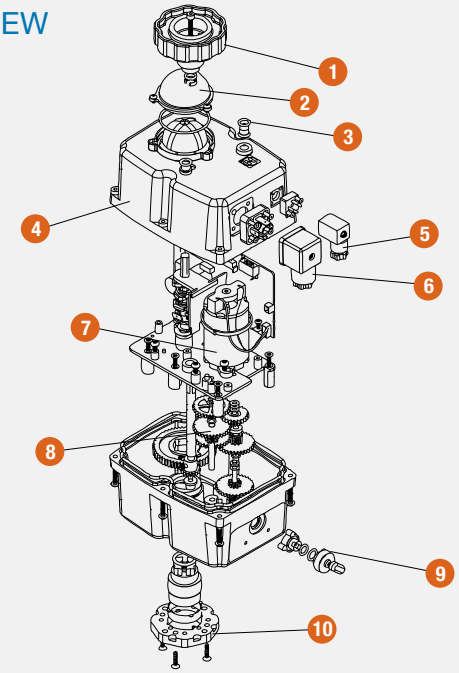
- Ideal for Corrosive Atmosphere and Environments
- Corrosion-Resistant GFPP Housing
- LED Status Light
- Anti-Condensation Heater
- Manual Override
- Position Indicator
- 4 SPDT Micro Limit Switches
- Lightweight - Easy for Installation
- ISO 5211 Mounting Base
- Stainless Steel Fasteners 303 SS
- 100% Factory Tested
- CE Mark
- Thermal Overload Protection
- Auto Switching Power Supply

OPTIONS

- Digital Positioner 4-20mA or 2-10V
- Battery Fail Safe Kit

TECHNICAL INFORMATION

EXPLODED VIEW



SPECIFICATIONS

OPERATION	1/4 Turn
DUTY RATING	75%
ENCLOSURE	NEMA 4 / 4X
PROTECTION	IP67 265
VOLTAGE	Single Phase 24V~V AC/DC
HOUSING	GFPP (Glass Filled Polypropylene) per 314ASTM D4101 Cell Class 85580
OUTPUT SHAFT	303 Stainless Steel per ASTM A314

ECP Series
Electric Actuators

FOR BALL VALVES 1/2" - 6" AND BUTTERFLY VALVES 2" - 6"

TECHNICAL INFORMATION, *CONTINUED*

PARTS LIST

1. Manual Override
2. Position Indicator Assembly
3. LED Indicator
4. Housing
5. Auxiliary Switch DIN Connector
6. Power DIN Connector
7. DC Drive Motor
8. Hardened Steel Gear Set
9. Declutch Lever
10. ISO5211 Mount Plate

DIMENSIONS

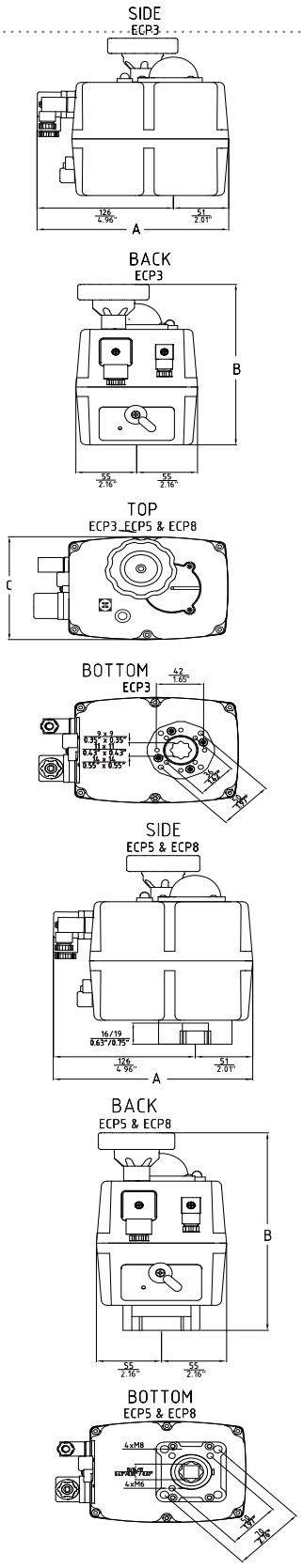
MODEL	A in / mm	B in / mm	C in / mm	ISO PATTERN
ECP3	6.96 / 177	6.73 / 171	4.33 / 110	F05 X 14 mm
ECP5	6.96 / 177	7.72 / 196	4.33 / 110	F07 X 14 mm
ECP8	6.96 / 177	7.72 / 196	4.33 / 110	F07 X 14 mm

ACTUATOR SPECIFICATIONS

	ECP3	ECP5	ECP8
Torque Output (in / lbs / Nm)	359 / 40	530 / 60	796 / 90
Enclosure Material	Glass Filled Polypropylene		
Output Shaft	303 Stainless Steel		
Cycle Time	11 sec.	14 sec.	30 sec.
Operatiing Temperature	4° F to 160° F / 16° C to 71°C		
Weight (lbs / kg)	1.90 / 0.86	2.40 / 1.09	3.00 / 1.36

VALVE SELECTION CHART

VALVE TYPE	SIZE	ECP3	ECP5	ECP8
TB / TBH Series Ball Valves	1/2"	•		
	3/4"	•		
	1"	•		
	1-1/4"	•		
	1-1/2"	•		
	2"	•	•	•
	2-1/2" - 3"	•	•	•
	4" - 6"	•	•	•
TW/LA Series Three Way Valves	1/2"	•		
	3/4"	•		
	1"	•		
	1-1/4"	•	•	
	1-1/2"	•	•	
	2"	•	•	•
	2-1/2" - 3"	•	•	•
	4" - 6"	•	•	•
BYV Series Butterfly Valves	2"	•		
	3"	•		
	4"		•	
	6"			•



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HZSN1 Series On/Off Proportional Electric Actuators

KEY FEATURES

- Equipped with two 2 Volt-free Form A Auxiliary Switches Rated at up to 1A 250VAC (on/off models only)
- Proportional Models have 4-20mA or 2-10vdc Feedback Output Standard
- ISO5211 Compliant with an 11mm Double Square Female Drive
- Furnished with a 39" (1M) Cable to Facilitate Field Connections Outside the Compact Enclosure
- Low Profile Visual Position Indicator and Three Flush Mounted LEDs Allow At-a-glance Position Indication
- Manual Override Lever and 8mm Access Shaft at the Bottom of the Actuator Housing
- NEMA 4X/IP67 Compliant
- PG6 EMT Entry Port with Sealed Cable Gland

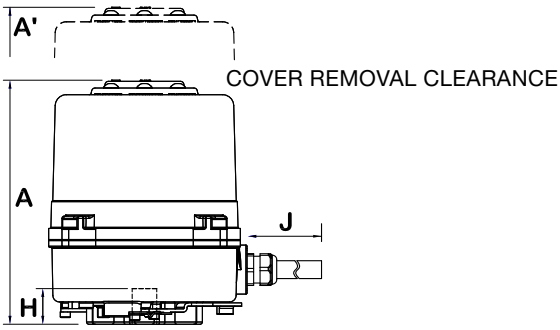
OPTIONS

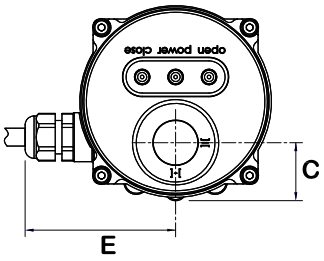
- Power Supply Flexibility – 24 VAC/VDC, 120 VAC and 230 VAC
- On / Off or Proportional Control

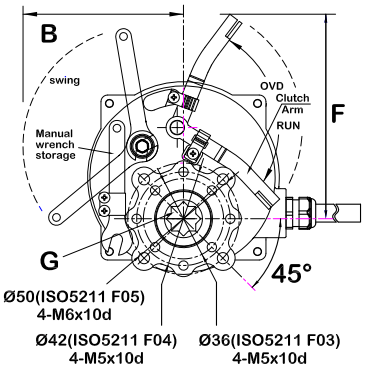
TECHNICAL INFORMATION

ACTUATOR SPECIFICATIONS		HZSN1C
Supply	Torque Output (**lbf-in** / Nm)	**266 /** 30
24VAC - 24VDC	Current Draw (Start / Run / LRA)	2.1A / 1.2A / 2.3A
	Speed (90°) DC, seconds	11
	Motor - 24vdc Perm Magnet Brush Type	10W
	Duty Cycle (on/off / mod)	75%
	Motor Starts, per hour, Max	1200
	Motor Class	Class B
120V	Current Draw (Start / Run / LRA)	.39A / .36A / .48A
	Speed (90°) 60Hz / 50Hz, seconds	11
	Motor - 120vac Split-Phase Cap TENV	10W
	Duty Cycle (on/off / mod)	25% / 75%
	Motor Starts, per hour, Max	1200
	Motor Class	Class B
230V	Current Draw (Start / Run / LRA)	.23A / .21A / .28A
	Speed (90°) 60Hz / 50Hz, seconds	11
	Motor - 230vac Split-Phase Cap TENV	10W
	Duty Cycle (on/off / mod)	25% / 75%
	Motor Starts, per hour, Max	1200
	Motor Class	Class B
All	Control	On/Off or Proportional
	Electrical Entry (1)	PG6 Nylon Gland with 39" 10C-24 Cable On/Off or 8C-24 Proportional
	Manual Override	Bottom Mounted 8mm Hex Shaft
	Ambient Operating Range	-22°F to +158°F (-30°C to +70°C)
	Humidity Range	0-95% RH
	Altitude Limit	9850 ft / 3000 m

TECHNICAL INFORMATION, *CONTINUED*



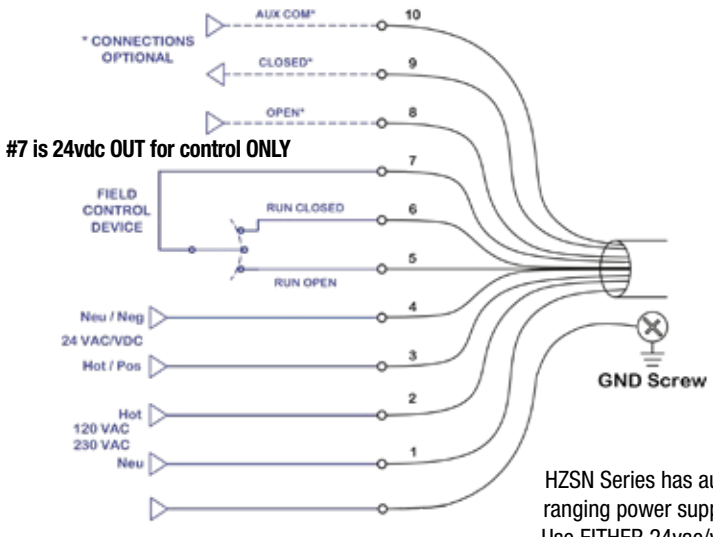




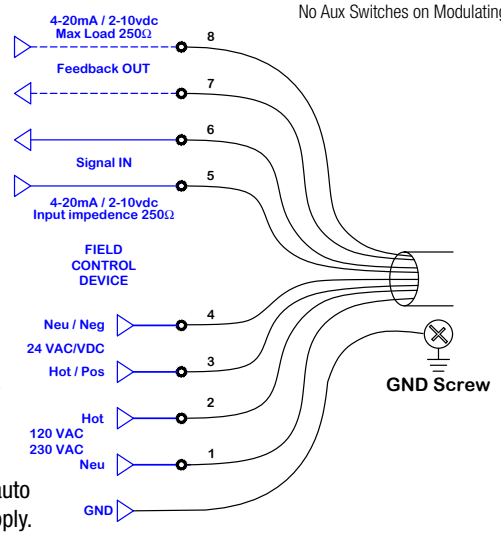
DIMENSIONS

MODEL	A in / mm	A' in / mm	B in / mm	C in / mm	E in / mm	F in / mm	G in / mm	H in / mm	J in / mm	WEIGHT lbs / kg
HZSN1A,B,C	4.33 / 110	2.95 / 75	2.83 / 72	1.00 / 25	2.75 / 70	3.72 / 95	.433 / 11	.630 / 16	39.4 / 1000	2.2 / 1.0

No Aux Switches on Modulating Models



ON/OFF WIRING DIAGRAM



PROPORTIONAL WIRING DIAGRAM

HZSN Series has auto ranging power supply. Use EITHER 24vac/vdc OR 85~265vac for on/off and proportional control

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HRSN2 Series On/Off Proportional Electric Actuators

FOR BALL UP TO 6" AND
BUTTERFLY VALVES UP TO 4"

KEY FEATURES

- Units are equipped with two (2) volt-free Form A Auxiliary switches
- ISO5211 compliant mounting with a double square female drive socket
- Raised visual position indicator
- NEMA 4X/IP67 compliant
- Two (2) EMT entry ports with sealed cable glands

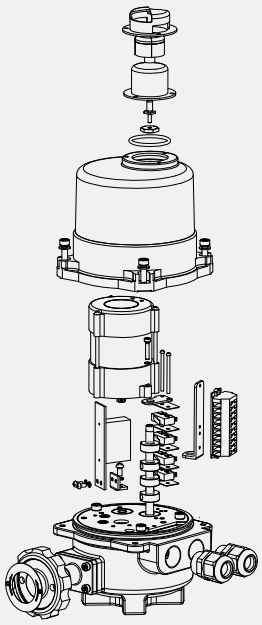
OPTIONS*

- Manual Override Handwheel
- Local Control Stations
- IP68 Submersion
- Battery Backup
- Supercap Backup

* Not Available on All Models

TECHNICAL INFORMATION

EXPLODED VIEW



SPECIFICATIONS

OPERATION	Reversing
CONDUIT SIZE	HRSN2 Two Conduit Fittings 1/2" NPT Each
DUTY CYCLE	HRSN2A~2S AC Versions On/Off = 25%, Ext Dty = 75%, Proportional = 75%, DC Versions On/Off & Proportional = 75%
CYCLE TIMES	8–13 Seconds, Depending on Model
ENCLOSURE	NEMA 4/4X
VOLTAGES	HRSN2A~2S 12VAC/VDC, 24VAC/VDC, 120/230VAC
THERMAL OVERLOAD PROTECTION	Class B 24V, Class F 120/230V, Extended Duty Class H
MECHANICAL OVERRIDE	2A, 2R: 8mm Bottom Mounted Shaft 2B, 2S Side Mounted Handwheel
HOUSING	Aluminum Alloy Dry Powder Coated

TECHNICAL INFORMATION, *CONTINUED*

ACTUATOR SPECIFICATIONS

		HRSN2A	HRSN2B	HRSN2R	HRSN2S
		310 / 35	310 / 35	440 / 50	440 / 50
Supply Voltage		12VAC/VDC			
		24VAC/VDC			
		120/230VAC			
Duty Cycle	12VDC	75%			
	24VDC	75%			
	120/230VAC	25% ON/OFF, 75% PROPORTIONAL			
	120/230V Extended Duty	75%			
Thermal Overload		STANDARD			
Cycle Time	90˚ 12V/24V(sec)	9	9	13	13
	90˚ 120V/230V(60hz/50hz, sec)	9 / 11	9 / 11	13 / 15	13 / 15
Aux Switch Rating		(2) FORM A - 3A @ 250VAC			
Conduit Entry		(2) 1/2" NPT			
Enclosure Material		NEMA 4 / 4X / ALUMINIUM ALLOY - ELECTROSTATIC POWDER COAT			
Maximum Inrush Current	12VDC	3.45A	3.45A	3.45A	3.45A
	24VDC	2.1A	2.1A	2.1A	2.1A
	120VAC	0.39A	0.39A	0.39A	0.39A
	230VAC	0.23A	0.23A	0.23A	0.23A
Running Current	12VDC	1.95A	1.95A	1.95A	1.95A
	24VDC	1.2A	1.2A	1.2A	1.2A
	120VAC	0.36A	0.36A	0.36A	0.36A
	230VAC	0.21A	0.21A	0.21A	0.21A
WEIGHT (LBS / KG) - ON/OFF (MOD)		3 / 6.6 (5.5 / 12.1)	3.5 / 7.7 (6 / 13.2)	3 / 6.6 (5.5 / 12.1)	3.5 / 7.7 (6 / 13.2)

BALL VALVE SELECTION CHART*

SIZE in / DN	TB / TBH SERIES BALL VALVES	TW/LA SERIES BALL VALVES
1/2 – 2 / 15 – 50 2-1/2 – 3 / 65 – 80 4 – 6 / 100 – 150	HRSN2A~2S	HRSN2A~2S

* Actuator size selections based on clean water at 70°F

BUTTERFLY VALVE SELECTION CHART*

SIZE in / DN	BYV SERIES BUTTERFLY VALVES
2, 3 / 50, 80	HRSN2A, 2B
4 / 100	HRSN2R, 2S

* Actuator size selections based on clean water at 70°F

Please Note: All HRS Series Reversing Electric Actuators are considerably heavier than those typically used with plastic ball and butterfly valves, and they must be supported independently of the valves on which they are mounted. The weight must not be borne by the valve or piping.
Please consult the factory if you need help with your particular application.

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HRSN3-HRSN7 Series On/Off Proportional Electric Actuators

FOR BALL AND BUTTERFLY VALVES UP TO 24”

KEY FEATURES

- Units are equipped with two (2) volt-free Form A Auxiliary switches
- ISO5211 compliant mounting with double square female drives and inserts
- Raised visual position indicator
- NEMA 4X/IP67 compliant
- Two (2) EMT entry ports with sealed cable glands

OPTIONS*

- Local Control Stations
- IP68 Submersion
- Battery Backup
- Interchangeable ISO5211 Flange & Drives

PARTS LIST

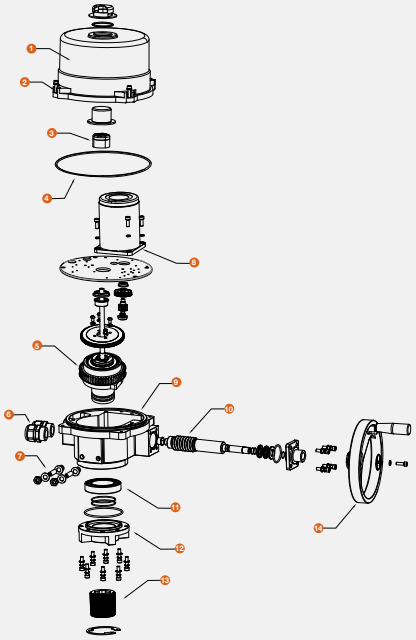
1. Cast Aluminum Cover
2. Captured Cover Screws
3. High Visibility Position Indicator
4. Cover O-Ring Seal
5. Epicyclic Transmission Set
6. EMT Glands
7. External Mechanical Stops
8. Drive Motor
9. Cast Aluminum Housing
10. Worm Override Shaft
11. Heavy Final Drive Bearing
12. ISO5211 Flange
13. Splined Drive Insert
14. Handwheel w/Collapsible Knob[t]

* Not Available on All Models

[t] Collapsible knob HRSN3-4 models

TECHNICAL INFORMATION

EXPLODED VIEW



SPECIFICATIONS

OPERATION	Reversing
CONDUIT SIZE	HRSN3~7 Two Conduit Fittings 3/4" NPT Each
DUTY CYCLE	HRSN3A~4D AC Versions On/Off = 25%, Ext Dty = 75%, Proportional = 75%, DC Versions On/Off & Proportional = 75% 3 Phase On/Off = 25%, Proportional = 75% HRSN4E~6A AC Versions On/Off = 25%, Ext Dty = 50%, Proportional = 50%, 3 Phase On/Off = 25%, Proportional = 50% HRSN7A~7C 3 Phase On/Off = 25%, Proportional = 50%
CYCLE TIMES	8–155 Seconds, Depending on Model
ENCLOSURE	NEMA 4/4X
VOLTAGES	HRSN3A~4D 24VAC/VDC, 120/230VAC HRSN4E~6A 120/230VAC HRSN3A~7C 220/3, 380/3, 440/3, 480/3
THERMAL OVERLOAD PROTECTION	Class B 24V, Class F 120/230V, Extended Duty Class H
MECHANICAL OVERRIDE	Clutchless Manual Hand Wheel
HOUSING	Aluminum Alloy Dry Powder Coated

HRSN3-HRSN7 Series
On/Off Proportional Electric Actuators

FOR BALL AND BUTTERFLY VALVES UP TO 24"

ACTUATOR SPECIFICATIONS

		HRSN3A	HRSN3B	HRSN4A	HRSN4B	HRSN4C	HRSN4D	HRSN4E	HRSN4F	HRSN5A	HRSN5B
		880/100	1770/200	3540/400	5310/600	7080/800	8850/1000	15040/1700	20350/2300	30970/3500	44250/5000
Supply Voltage		12VAC/VDC					N/A				
		24VAC/VDC						N/A			
		120/230VAC									
		230/3 ~ 480/3 Polyphase									
Duty Cycle	12VDC	75%					N/A				
	24VDC	75%						N/A			
	120/230VAC	25% ON/OFF, 75% PROPORTIONAL						25% ON/OFF, 50% PROPORTIONAL			
	120/230V Extended Duty	75%						50%			
	Polyphase	25% ON/OFF, 75% PROPORTIONAL						25% ON/OFF, 50% PROPORTIONAL			
Thermal Overload		STANDARD									
Cycle Time	90˚ 12V/24V(sec)	14	28	21	28	34	34	N/A			
	90˚ 120V/230V(60hz/50hz, sec)	16 / 19	33 / 39	24 / 29	33 / 39	39 / 47	39 / 47	28 / 34	39 / 47	63 / 76	88 / 105
Aux Switch Rating		(2) FORM A - 10A @ 250VAC									
Conduit Entry		(2) 3/4" NPT									
Enclosure Material		NEMA 4 / 4X / ALUMINIUM ALLOY - ELECTROSTATIC POWDER COAT									
Maximum Inrush Current	12VDC	7.2A	7.2A	11.4A	11.4A	11.4A					
	24VDC	4.2A	4.2A	7.0A	7.0A	7.0A	10.5A				
	120VAC	1.16A	1.16A	2.95A	2.95A	2.95A	3.8A	7.2A	7.2A	7.2A	7.2A
	230VAC	.54A	.54A	1.71A	1.71A	1.71A	2.16A	4.05A	4.05A	4.05A	4.05A
	480/3	0.24A	0.24A	0.7A	0.7A	0.7A	.089A	1.2A	1.2A	1.2A	1.2A
Running Current	12VDC	3.2A	3.2A	9.4A	9.4A	9.4A					
	24VDC	3.2A	3.2A	5.8A	5.8A	5.8A	7.8A				
	120VAC	0.93A	.093A	1.8A	1.8A	1.8A	2.3A	4.5A	4.5A	4.5A	4.5A
	230VAC	0.42A	0.42A	0.91A	0.91A	0.91A	1.1A	2.2A	2.2A	2.2A	2.2A
	480/3	0.21A	0.21A	0.4A	0.4A	0.4A	0.53A	0.87A	0.87A	0.87A	0.87
WEIGHT (LBS / KG)		25 / 11	25 / 11	49 / 22	49 / 22	49 / 22	49 / 22	80 / 36	80 / 36	168 / 76	168 / 76

BALL VALVE SELECTION CHART*

SIZE in / DN	TB / TBH SERIES BALL VALVES	TW/LA SERIES BALL VALVES
1/2 – 2 / 15 – 50 2-1/2 – 3 / 65 – 80 4 – 6 / 100 – 150	HRSN2A~2S	HRSN2A~2S

* Actuator size selections based on clean water at 70°F

Please Note: All HRS Series Reversing Electric Actuators are considerably heavier than those typically used with plastic ball and butterfly valves, and they must be supported independently of the valves on which they are mounted. The weight must not be borne by the valve or piping. Please consult the factory if you need help with your particular application.

BUTTERFLY VALVE SELECTION CHART*

SIZE in / DN	BYV SERIES BUTTERFLY VALVES
2, 3 / 50, 80	HRSN2A, 2B
4 / 100	HRSN2R, 2S
6 / 150	HRSN3A
8 / 200	HRSN3B
10 / 250	HRSN4A
12 / 300	HRSN4B
14 / 350	HRSN4D
16 / 400	HRSN4E
18-20 / 450, 500	HRSN4F
24 / 600	HRSN5A

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PMD Series Double Acting Pneumatic Actuators

FOR BALL VALVES UP TO 2"
FOR BUTTERFLY VALVES UP TO 3"

KEY FEATURES

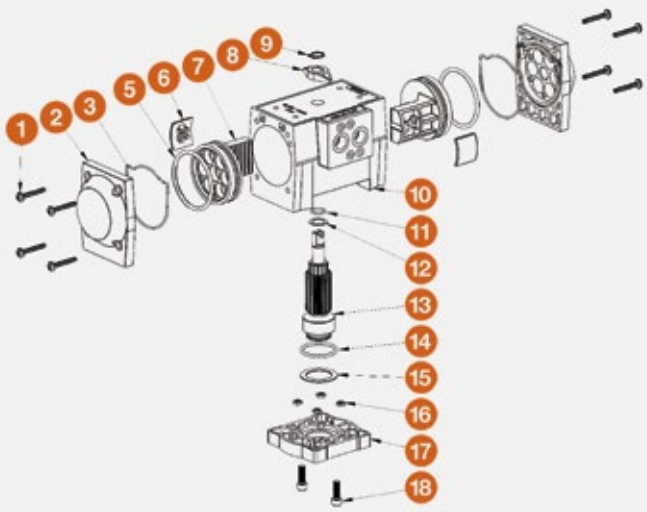
- Double Acting Air-to-Open and Close
- Corrosion-Resistant Thermoplastic Housing
- Permanently Lubricated Gear Train
- Manual Override
- Two-Piston Rack and Pinion Design
- Namur-Style Mounting
- Position Indicator
- Lightweight
- ISO 5211 Mounting Base

OPTIONS

- Solenoid Valves with Optional Voltages
- Auxiliary Limit Switch
- Cycle Speed Controls
- Positioners

TECHNICAL INFORMATION

EXPLODED VIEW



SPECIFICATIONS

HOUSING	Polyamide
OUTPUT SHAFT	Carbon Steel, Nickel Plated
MINIMUM AIR PRESSURE	80 PSI
MAXIMUM AIR PRESSURE	120 PSI
SEALS	Nitrile
CYCLE TIME	Half Second, Typical
AIR PORT CONNECTIONS	1/4" NPT

PMD Series
Double Acting Pneumatic Actuators

FOR BALL VALVES UP TO 2"
FOR BUTTERFLY VALVES UP TO 3"

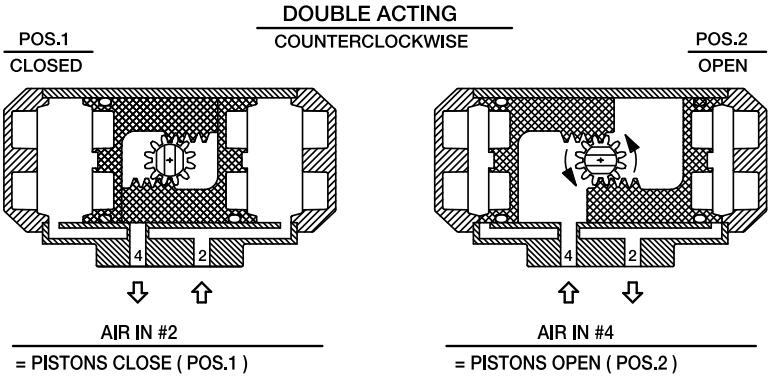
TECHNICAL INFORMATION, *CONTINUED*

DIMENSIONS

MODEL	øA in / mm	B in / mm	C in / mm	L in / mm	P in / mm	R in / mm
PMD15	.551 / 14 ISO F05	1/4-20 x .512 UNC-ISO F05	ø1.969 / 50 ISO F05	6.299 / 160	4.370 / 111	3.386 / 86

Dimensions are subject to change without notice – consult factory for installation information

ACTUATOR OPERATING SYSTEMS



ACTUATOR SPECIFICATIONS

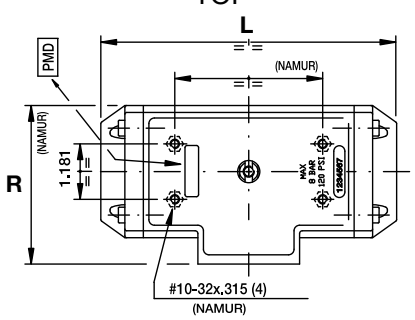
MODEL	PMD15
Torque Output (in-lbs) @ 80 PSI	275
Enclosure Material	Polyamide
Output Shaft	Carbon Steel, Nickel Plated
Air Port Connections	1/4" NPT
Air Consumption (cu. in.)	22.0
Air Transfer	Internal
Stroke Time (seconds)	.5
Cycle Time	1/2 Second
Minimum Air Pressure	80 PSI
Maximum Air Pressure	120 PSI
Operation	Rack and Pinion
Weight (lbs / kg)	2.624 / 1.2

VALVE SELECTION CHART

SIZE* in / DN	TB / TBH / CV / CVH SERIES BALL VALVES	TW/LA SERIES BALL VALVES	BYV SERIES BUTTERFLY VALVES
1/2 - 2 / 15 - 50	PMD15	PMD15	N/A
2 - 3	–	–	PMD15

* Actuator selection based on clean water @ 70°F

TOP



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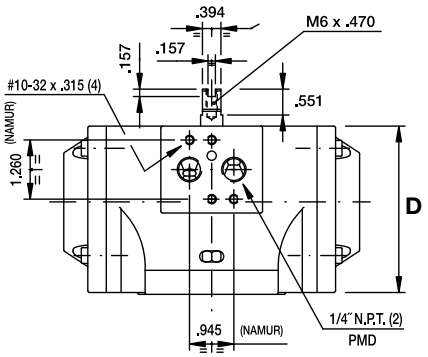

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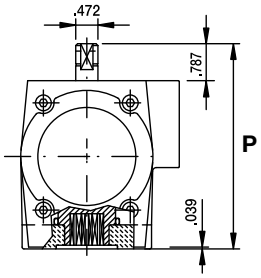

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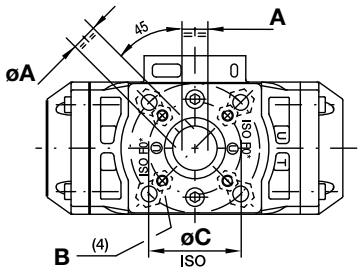

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PMS Series Spring Return Pneumatic Actuators

FOR BALL VALVES UP TO 2"

KEY FEATURES

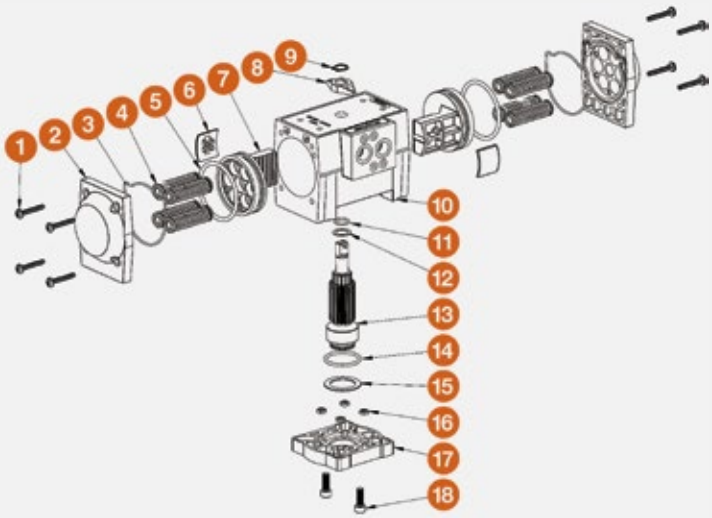
- Air to Spring Fail-Safe Operation
- Corrosion-Resistant Thermoplastic Housing
- Permanently Lubricated Gear Train
- Manual Override
- Two-Piston Rack and Pinion Design
- Namur-Style Mounting
- Position Indicator
- Lightweight
- ISO 5211 Mounting Base

OPTIONS

- Solenoid Valves with Optional Voltages
- Auxiliary Limit Switch
- Cycle Speed Controls
- Positioners

TECHNICAL INFORMATION

EXPLODED VIEW



SPECIFICATIONS

HOUSING	Polyamide
OUTPUT SHAFT	Carbon Steel, Nickel Plated
MINIMUM AIR PRESSURE	80 PSI
MAXIMUM AIR PRESSURE	120 PSI
SEALS	Nitrile
CYCLE TIME	Half Second, Typical
AIR PORT CONNECTIONS	1/4" NPT

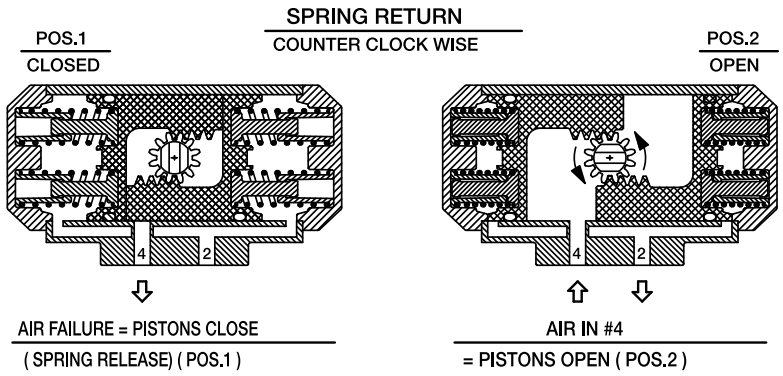
TECHNICAL INFORMATION, *CONTINUED*

DIMENSIONS

MODEL	øA in / mm	B in / mm	C in / mm	L in / mm	P in / mm	R in / mm
PMD15	.551 / 14 ISO F05	1/4-20 x .512 UNC-ISO F05	ø1.969 / 50 ISO F05	6.299 / 160	4.370 / 111	3.386 / 86

Dimensions are subject to change without notice – consult factory for installation information

ACTUATOR OPERATING SYSTEMS



ACTUATOR SPECIFICATIONS

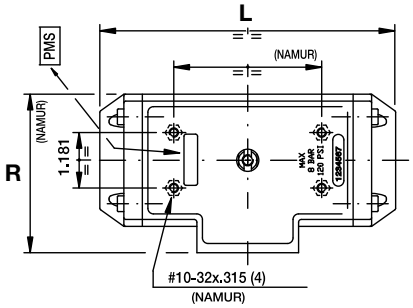
MODEL	PMS15
Torque Output (in-lbs) @ 80 PSI	168 / 125
Spring Stroke (Start/End)	150 / 107
Enclosure Material	Polyamide
Output Shaft	Carbon Steel, Nickel Plated
Air Port Connections	1/4" NPT
Air Consumption (cu. in.)	10.8
Air Transfer	Internal
Stroke Time (seconds)	.5
Cycle Time	1/2 Second
Minimum Air Pressure	80 PSI
Maximum Air Pressure	120 PSI
Operation	Rack and Pinion
Weight (lbs / kg)	3.1 / 1.4

VALVE SELECTION CHART

SIZE* in/DN	TB / TBH / CV / CVH SERIES BALL VALVES	TW/LA SERIES BALL VALVES
1/2 – 2 / 15 – 50	PMS15	PMS15

* Actuator selection based on clean water @ 70°F

TOP



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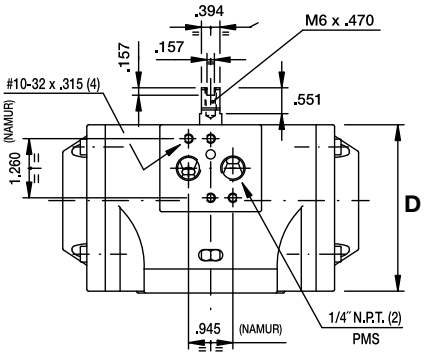

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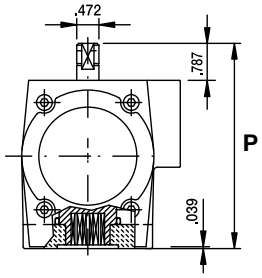

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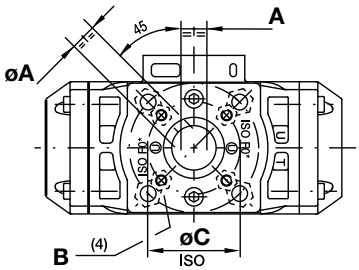

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PMD4 Series Double Acting Pneumatic Actuators

FOR BALL VALVES UP TO 6"
FOR BUTTERFLY VALVES UP TO 6"

KEY FEATURES

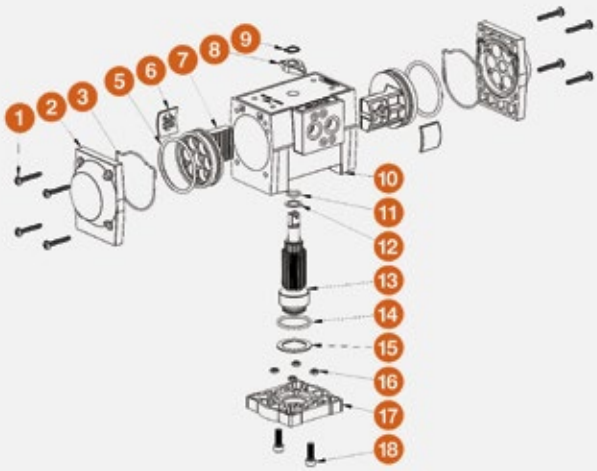
- Double Acting Air-to-Open and Close
- Corrosion-Resistant GFPP Housing
- Ideal for Corrosive Atmosphere and Environments
- Anodized Aluminum Two-Piston Rack and 303 Stainless Steel Pinion
- Manual Override
- Position Indicator
- Permanent Lubrication
- Lightweight – Easy for Installation
- Namur-Style Solenoid Mounting
- ISO 5211 Mounting Base
- Stainless Steel Fasteners
- Alternative Operating Media for 80 PSI to 120 PSI
- All Units are Marked for Traceability
- 100% Factory Tested

OPTIONS

- Solenoid Valves with Optional Voltages
- Auxiliary Limit Switch
- Cycle Speed Controls
- Positioners

TECHNICAL INFORMATION

EXPLODED VIEW



SPECIFICATIONS

HOUSING	GFPP per ASTM D4101 Cell Class 85580
OUTPUT SHAFT	03 Stainless Steel per ASTM A314
SEALS	Nitrile
MINIMUM AIR PRESSURE	80 PSI
MAXIMUM AIR PRESSURE	120 PSI
CYCLE TIME	Half Second, Typical
AIR PORT CONNECTIONS	1/4" NPT
NAMUR MOUNTING	VDI / VDE / 3845
OPERATING TEMPERATURE RANGE	-4°F to 176°F

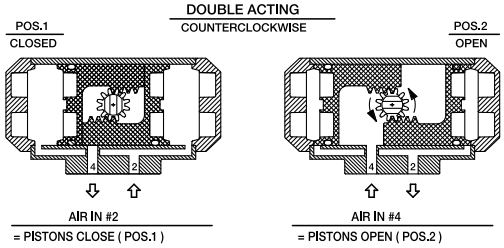
PMD4 Series
Double Acting Pneumatic Actuators
FOR BALL AND BUTTERFLY VALVES UP TO 6"

TECHNICAL INFORMATION, *CONTINUED*

DIMENSIONS

MODEL	A in / mm	B in / mm	E in / mm	H in / mm	J in / mm	K in / mm	L in / mm	FLANGE STANDARD (dim M)	WEIGHT (lbs)
PMD415	3.54 / 90	4.37 / 111	0.47 / 12	1.30 / 33	3.39 / 86	0.55 / 14	6.30 / 160	F05	2.3
PMD419	4.39 / 112	5.22 / 133	0.47 / 12	1.30 / 33	3.98 / 101	0.67 / 17	6.89 / 175	F07	3.6

ACTUATOR OPERATING SYSTEMS



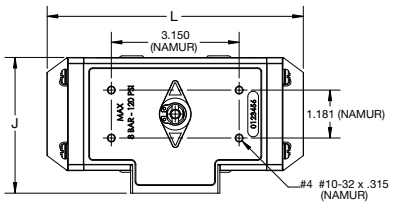
ACTUATOR SPECIFICATIONS

	PMD415	PMD419
Torque Output (in. /lb.) @ 80psi	275	500
Spring Stroke (Start/End)	NA	NA
Enclosure Material	Glass Filled Polypropylene	
Output Shaft	303 Stainless Steel	
Air Port Connections	1/4" NPT	
Air Consumption (cu. in.)	22	40.6
Air Transfer	Internal	
Stroke Time (seconds)	0.5	
Cycle Time	1/2 second	
Minimum Air Pressure	80psi	
Maximum Air Pressure	120psi	
Operation	Rack and Pinion	
Weight (lb / kg)	2.25 / 1.02	3.55 / 1.61

VALVE SELECTION CHART

SIZE* in / DN	TB / TBH / CV / CVH SERIES BALL VALVES	TW/LA SERIES BALL VALVES	BYV SERIES BUTTERFLY VALVES
1/2 / 15	PMD415	PMD415	N/A
3/4 / 20	PMD415	PMD415	N/A
1 / 25	PMD415	PMD415	N/A
1-1/4 / 32	PMD415	PMD415	N/A
1-1/2 / 40	PMD415	PMD415	N/A
2 / 50	PMD415	PMD415	PMD415 / PMD419
2-1/2 / 65	PMD419	PMD419	PMD415 / PMD419
3 / 80	PMD419	PMD419	PMD415 / PMD419
4 / 100	PMD419	PMD419	PMD419
6 / 150	PMD419	PMD419	N/A

TOP



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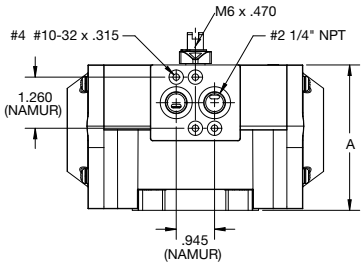

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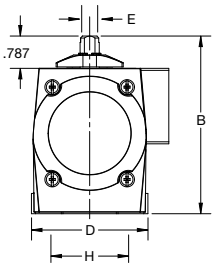

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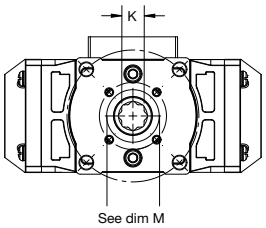

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PMS4 Series Spring Return Pneumatic Actuators

FOR 1/2" TO 4" BALL VALVES /
UP TO 4" BUTTERFLY VALVES

KEY FEATURES

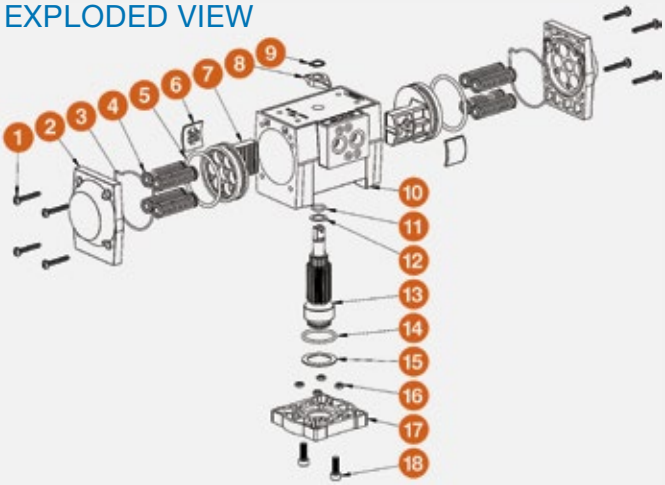
- Air to Spring Fail Safe Operation
- Corrosion-Resistant GFPP Housing
- Ideal for Corrosive Atmosphere and Environments
- Anodized Aluminum Two-Piston Rack and 303 Stainless Steel Pinion
- Position Indicator
- Permanent Lubrication
- Lightweight – Easy for Installation
- Namur-Style Solenoid Mounting
- ISO 5211 Mounting Base
- Stainless Steel Fasteners
- Alternative Operating Media for 40 PSI to 120 PSI
- All Units are Marked for Traceability
- 100% Factory Tested

OPTIONS

- Solenoid Valves with Optional Voltages
- Auxiliary Limit Switch
- Cycle Speed Controls
- Positioners

TECHNICAL INFORMATION

EXPLODED VIEW



SPECIFICATIONS

HOUSING	GFPP per ASTM D4101 Cell Class 85580
OUTPUT SHAFT	03 Stainless Steel per ASTM A314
SEALS	Nitrile
MINIMUM AIR PRESSURE	80 PSI
MAXIMUM AIR PRESSURE	120 PSI
CYCLE TIME	Half Second, Typical
AIR PORT CONNECTIONS	1/4" NPT
NAMUR MOUNTING	VDI/VDE 3845
OPERATING TEMPERATURE RANGE	-4°F to 176°F

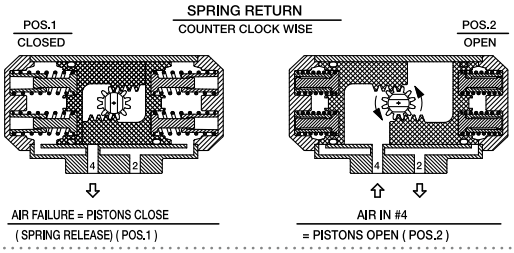
PMS4 Series
Spring Return Pneumatic Actuators
FOR BALL AND BUTTERFLY VALVES UP TO 4"

TECHNICAL INFORMATION, *CONTINUED*

DIMENSIONS

MODEL	A in / mm	B in / mm	E in / mm	H in / mm	J in / mm	K in / mm	L in / mm	FLANGE STANDARD (dim M)	WEIGHT (lbs)
PMS415	3.54 / 90	4.37 / 111	0.47 / 12	1.30 / 33	3.39 / 86	0.55 / 14	6.30 / 160	F05	3.1
PMS419	4.39 / 112	5.22 / 133	0.47 / 12	1.30 / 33	3.98 / 101	0.67 / 17	6.89 / 175	F07	5.2
PMS420	4.39 / 112	5.22 / 133	0.47 / 12	1.30 / 33	3.98 / 101	0.67 / 17	6.89 / 175	F07	5.2

ACTUATOR OPERATING SYSTEMS



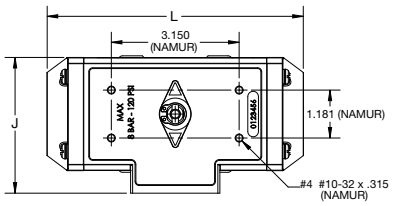
ACTUATOR SPECIFICATIONS

	PMS415	PMS419	PMS420
Torque Output (in. /lb.) @ 80psi	168 / 125	316 / 255	270 / 193
Spring Stroke (Start/End)	150 / 107	245 / 184	307 / 230
Enclosure Material	Glass Filled Polypropylene		
Spring Set	4+4	4+4	5+5
Air Port Connections	1/4" NPT		
Air Consumption (cu. in.)	10.8	17.5	17.5
Air Transfer	Internal		
Stroke Time (seconds)	0.5 second		
Cycle Time	1/2 second		
Minimum Air Pressure	80psi		
Maximum Air Pressure	120psi		
Operation	Rack and Pinion, Spring Return		
Weight (lb / kg)	3.1 / 1.4	5.2 / 2.4	5.2 / 2.4

VALVE SELECTION CHART

SIZE* in / DN	TB / TBH / CV / CVH SERIES BALL VALVES	TW/LA SERIES BALL VALVES	BYV SERIES BUTTERFLY VALVES
1/2 / 15	PMS415	PMS415	N/A
3/4 / 20	PMS415	PMS415	N/A
1 / 25	PMS415	PMS415	N/A
1-1/4 / 32	PMS415	PMS415	N/A
1-1/2 / 40	PMS415	PMS415	N/A
2 / 50	PMS415	PMS415	PMS420
2-1/2 / 65	PMS419	PMS419	PMS420
3 / 80	PMS419	PMS419	PMS420
4 / 100	PMS420	PMS420	N/A
6 / 150	PMS420	PMS420	N/A

TOP



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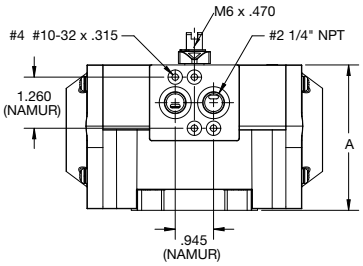

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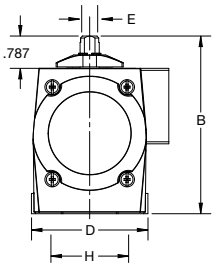

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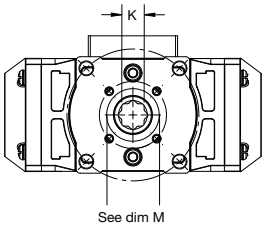

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PCD Series Double Acting Pneumatic Actuators

FOR BALL AND BUTTERFLY VALVES UP TO 18"

KEY FEATURES

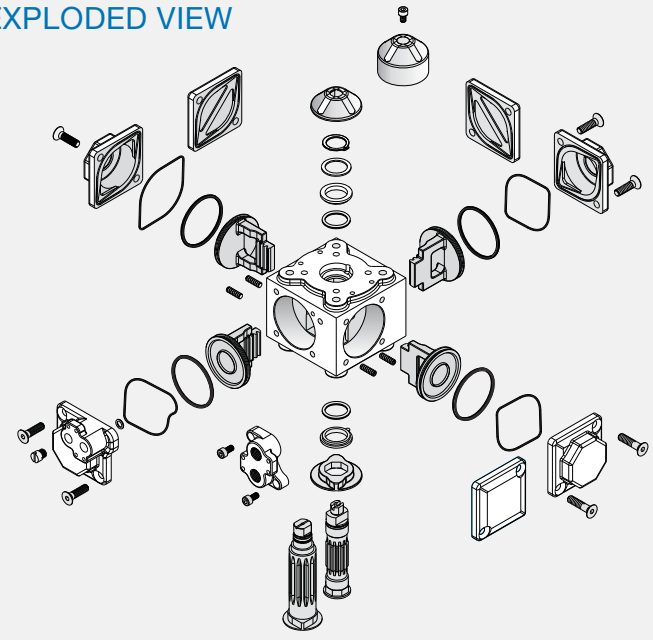
- Double Acting Air-to-Open and Close
- For All Sizes of Ball and Butterfly Valves
- Four-Piston Rack and Pinion Design
- Manual Override
- Compact, Lightweight
- Position Indicator
- Namur-Style Solenoid Mounting (Inlet/Outlet)
- Adjustable Travel Stops
- ISO 5211 Mounting Base

OPTIONS

- Solenoid Valves with Optional Voltages
- Positioners
- Auxiliary Limit Switches
- Cycle Speed Controls

TECHNICAL INFORMATION

EXPLODED VIEW



SPECIFICATIONS

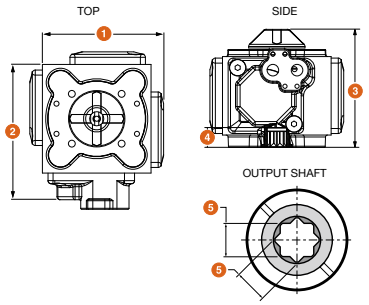
HOUSING	Epoxy-Coated Aluminum
OUTPUT SHAFT	Plated Steel
MINIMUM AIR PRESSURE	80 PSI
MAXIMUM AIR PRESSURE	120 PSI
CYCLE TIME	Less Than One Second, Typical
AIR PORT CONNECTIONS	1/4" NPT

PCD Series
Double Acting Pneumatic Actuators
FOR BALL AND BUTTERFLY VALVES UP TO 18"

TECHNICAL INFORMATION, *CONTINUED*

DIMENSIONS

MODEL	1 in / mm	2 in / mm	3 in / mm	4 in / mm	5 in / mm	ISO 5211 MOUNT	AIR CONSUMPTION cu. in.
PCD 15	3.39 / 86	3.85 / 98	3.50 / 89	.53 / 13	.35 / 9	F05 (1.97)	5.5
PCD 20	4.03 / 102	4.60 / 117	3.96 / 101	.59 / 15	.43 / 11	F05 (1.97)	9.2
PCD 25	5.24 / 133	5.79 / 147	4.61 / 117	.77 / 20	.55 / 14	F07 (2.76)	20
PCD 35	7.15 / 182	7.94 / 202	6.10 / 155	1.02 / 26	.87 / 22	F10 (4.02)	49
PCD 45	8.70 / 220	9.65 / 245	7.24 / 184	1.30 / 33	1.06 / 27	F12 (4.92)	81
PCD 60	11.22 / 285	N/A	9.76 / 248	1.69 / 43	1.42 / 36	F14 (5.51)	195
PCD 75	13.46 / 342	N/A	11.81 / 300	1.69 / 43	1.42 / 36	F14 (5.51)	351



Dimensions are subject to change without notice – consult factory for installation information

ACTUATOR SPECIFICATIONS

MODEL	PCD15	PCD20	PCD25	PCD35	PCD45	PCD60	PCD75
Torque Output (in-lbs) @ 80 PSI	172	311	639	1,848	3,622	8,585	15,856
Enclosure Material	Epoxy-Coated Aluminum						
Output Shaft	Plated Steel						
Air Port Connections	1/4" NPT						
Air Consumption (cu. in.)	5.5	9.2	20	49	81	195	351
Air Transfer	Internal						
Stroke Time (seconds)	0.2	0.4	0.7	1.0	1.5	2.5	4.0
Cycle Time	Under 1 Second Typical-Depends on Solenoid						
Minimum Air Pressure	80 PSI						
Maximum Air Pressure	120 PSI						
Operation	Rack and Pinion						
Weight (lbs / kg)	2.1 / 0.9	3.3 / 1.5	6.2 / 2.8	16 / 7.1	24 / 11	57 / 26	112 / 51

VALVE SELECTION CHART

SIZE* in / DN	TB / TBH / CV / CVH SERIES BALL VALVES	TW/LA SERIES BALL VALVES	BYV/BYB SERIES BUTTERFLY VALVES
1/2 - 1-1/2 / 15 - 40	PCD15	PCD15	N/A
2 / 50	PCD15	PCD15	PCD20
2-1/2 / 65	PCD20	PCD20	PCD20
3 / 80	PCD20	PCD20	PCD20
4 / 100	PCD20	PCD20	PCD25
6 / 150	PCD20	PCD20	PCD25
8 / 200	N/A	N/A	PCD35
10 – 12 / 250 – 300	N/A	N/A	PCD45
14 / 350	N/A	N/A	PCD60
16 – 18 / 400 – 450	N/A	N/A	PCD75

* Actuator size selections based on clean water at 70°F

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Visit us at: haywardflowcontrol.com

PCS Series Spring Return Pneumatic Actuators

FOR BALL AND BUTTERFLY VALVES UP TO 8"

KEY FEATURES

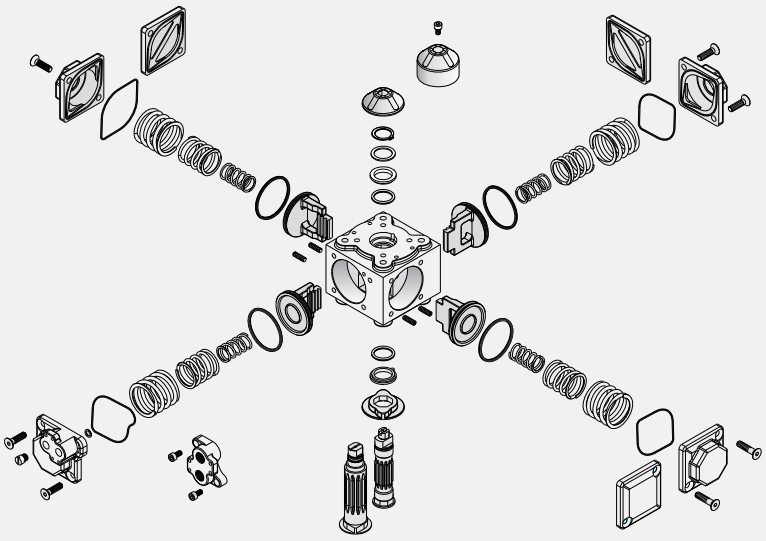
- Spring Return Fail-Safe Operation
- For All Sizes of Ball and Butterfly Valves
- Four-Piston Rack and Pinion Design
- Manual Override
- Compact, Lightweight
- Position Indicator
- Namur-Style Solenoid Mounting (Inlet/Outlet)
- Adjustable Travel Stops
- ISO 5211 Mounting Base

OPTIONS

- Solenoid Valves with Optional Voltages
- Positioners
- Auxiliary Limit Switches
- Cycle Speed Controls

TECHNICAL INFORMATION

EXPLODED VIEW



SPECIFICATIONS

HOUSING	Epoxy-Coated Aluminum
OUTPUT SHAFT	Plated Steel
MINIMUM AIR PRESSURE	80 PSI
MAXIMUM AIR PRESSURE	120 PSI
CYCLE TIME	Less Than One Second, Typical
AIR PORT CONNECTIONS	1/4" NPT

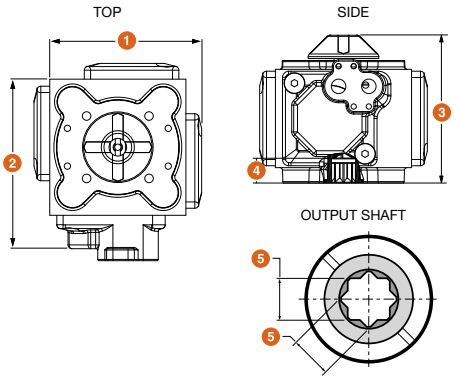
PCS Series
Spring Return Pneumatic Actuators
FOR BALL AND BUTTERFLY VALVES UP TO 8"

TECHNICAL INFORMATION, *CONTINUED*

DIMENSIONS

MODEL	1 in / mm	2 in / mm	3 in / mm	4 in / mm	5 in / mm	ISO 5211 MOUNT	AIR CONSUMPTION cu. in.
PCS 15	4.31 / 109	4.31 / 109	3.50 / 89	.53 / 13	.35 / 9	F05 (1.97)	5.5
PCS 20	5.17 / 131	5.17 / 131	3.96 / 101	.59 / 15	.43 / 11	F05 (1.97)	9.2
PCS 25	6.34 / 161	6.34 / 161	4.61 / 117	.77 / 20	.55 / 14	F07 (2.76)	20
PCS 30	7.33 / 186	7.33 / 186	5.37 / 136	.87 / 22	.67 / 17	F07 (2.76)	33
PCS 35	8.74 / 222	8.74 / 222	6.10 / 155	1.02 / 26	.87 / 22	F10 (4.02)	49
PCS 45	10.59 / 269	10.59 / 269	7.24 / 184	1.30 / 33	1.06 / 27	F12 (4.92)	81

Dimensions are subject to change without notice – consult factory for installation information



ACTUATOR SPECIFICATIONS

MODEL	PCS15	PCS20	PCS25	PCS30	PCS35	PCS45
Torque Output (in-lbs) @ 80 PSI	61	109	217	345	607	1,218
Enclosure Material	Epoxy-Coated Aluminum					
Output Shaft	Plated Steel					
Air Port Connections	1/4" NPT					
Air Consumption (cu. in.)	5.5	9.2	20	33	49	81
Air Transfer	Internal					
Stroke Time (seconds)	0.2	0.4	0.7	0.8	1.0	1.5
Cycle Time	Under 1 Second Typical-Depends on Solenoid					
Minimum Air Pressure	80 PSI					
Maximum Air Pressure	120 PSI					
Operation	Rack and Pinion					
Weight (lbs / kg)	2 / 1.1	4 / 1.9	8 / 3.5	11 / 5.0	20 / 9.0	33 / 15

VALVE SELECTION CHART

SIZE* in / DN	TB / TBH / CV / CVH SERIES BALL VALVES	TW/LA SERIES BALL VALVES	BYV SERIES BUTTERFLY VALVES
1/2 - 1 / 15 - 25	PCS15	PCS15	N/A
1-1/4 - 1-1/2 / 32 - 40	PCS15 / PCS20	PCS20	N/A
2 / 50	PCS20	PCS20	PCS25
2-1/2 / 65	PCS25	PCS25	PCS25
3 / 80	PCS25	PCS25 / PCS30	PCS25
4 / 100	PCS25	PCS30	PCS30
6 / 150	PCS25	PCS30	PCS35
8 / 200	N/A	N/A	PCS45

* Actuator size selections based on clean water at 70°F

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Material Description

PVC (POLYVINYL CHLORIDE)

Type 1, Grade 1 PVC is the most frequently specified of all plastic valve materials. It has been successfully used for over 40 years in such areas as chemical processing, industrial plating, chilled water, deionized water lines, chemical drainage, DWV piping and irrigation systems. PVC is generally inert to most mineral acids, bases, salts and paraffinic hydrocarbon solutions. PVC is not recommended for use with chlorinated or aromatic hydrocarbons, esters or ketones. PVC possesses excellent fire performance properties. In particular, it will not burn once the source of heat or flame is removed. PVC has excellent weatherability. The PVC used in Hayward products conforms to ASTM D1784 Cell Classification 12454. The maximum recommended working temperature of PVC is 140°F. PVC products can be installed using solvent cement, threaded or flanged end connections.

CPVC (CHLORINATED POLYVINYL CHLORIDE)

CPVC is generally inert to most mineral acids, bases, salts and paraffinic hydrocarbon solutions. CPVC is not recommended for use with chlorinated or aromatic hydrocarbons, esters or ketones. The CPVC used in Hayward products conforms to ASTM D1784 Cell Classification 23447. The maximum working temperature for Hayward products made of CPVC is 190°F. It has been proven an excellent material for hot corrosive liquids and hot and cold water distribution. CPVC products can be installed using solvent cement, threaded or flanged end connections.

GFPP (GLASS FILLED POLYPROPYLENE)

GFPP is a material with generally high resistance to chemical attack. It has the highest long-term temperature resistance of any material furnished by Hayward. It has been used successfully for years in such areas as chemical processing, industrial plating, chilled water, deionized water lines and chemical drainage. GFPP is generally inert to most mineral acids, bases, salts and hydrocarbon solutions. The GFPP material used in Hayward products conforms to ASTM D4101. The maximum recommended working temperature of GFPP is 240°F. GFPP products can be installed using threaded or flanged end connections.

PP (POLYPROPYLENE)

PP is a member of the polyolefin family of pure hydrocarbon plastics. PP is superior for concentrated acetic acid or hydroxides. It is also very suitable for milder solutions of most acids, alkalis, salts and many organic chemicals, including solvents. However, PP is not compatible with strong oxidizers, such as the hypochlorites and higher concentrations of sulfuric, nitric and hydrofluoric acids. The PP used in Hayward products conforms to ASTM D4101. The maximum recommended working temperature of PP is 180°F. PP products can be installed using fusion weld, threaded or flanged joinery.

EASTAR®

Eastar is a clear polyester thermoplastic compound having excellent impact strength and high clarity.
It is used in a variety of applications such as chemical processing process water applications.

PVDF (POLYVINYLIDENE FLUORIDE)

PVDF is a thermoplastic polymer with excellent corrosion, chemical and abrasion resistance. It has a good mechanical and thermal stability with a maximum operating temperature of 300°F. The material has a high impact resistance and excellent UV resistance. It is used in applications of high purity and chemical processing.

EPDM (ETHYLENE PROPYLENE DIENE MONOMER)

EPDM rubber is an elastomer prepared from ethylene and propylene compounds. It has been used continuously to a temperature of 300°F. The material is recommended for water, steam, dilute acids, dilute alkalis and alcohols. EPDM is not recommended for petroleum oils or diester lubricants.

FPM OR FKM (FLUOROCARBON RUBBER)

The fluorocarbon elastomers have a maximum service temperature of 400°F. Fluorocarbon materials are recommended for petroleum oils, diester base lubricants, silicate fluids and greases, halogenated hydrocarbons, acids and vacuum environments. Fluorocarbon materials are not recommended for ketones, amines, anhydrous ammonia, hot hydrofluoric or chlorosulfonic acids.

NITRILE OR BUNA-N

Nitrile, chemically, is a copolymer of butadiene and acrylonitrile. Nitrile maximum service temperature is 275°F. The material is recommended for petroleum oils and fluids, cold water, silicone greases and oils, diester base lubricants and ethylene glycol base fluids. Nitrile is not recommended for halogenated hydrocarbons, nitro hydrocarbons, phosphate ester hydraulic fluids, ketones, strong acids, ozone and automotive brake fluid.

PTFE (POLYTETRAFLUOROETHYLENE)

PTFE is chemically stable and virtually unaffected by chemicals, acids, bases and solvents. It has a maximum service temperature of 500°F. PTFE is used as a seat material in several lines of Hayward valves due to its low coefficient of friction and chemical stability.

ETFE (ETHYLENE TETRAFLUOROETHYLENE)

ETFE is a fluorocarbon based polymer. It has a very good resistance to solvents and chemicals as well as outdoor weathering. The material has a maximum service temperature of 300°F. It is widely used in the electronics, chemical processing and laboratory testing equipment industries.

Abbreviations

ANSI	American National Standards Institute
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
AWWA	American Water Works Association
BS	British Standards
CPVC	Chlorinated Polyvinyl Chloride
CRN	Canadian Registration Number
CSA	Canadian Standards Association
DIN	Deutsches Institute für Normung (German Institute for Standards)
DPDT	Double Pole, Double Throw
EN	European Standards
EPDM	Ethylene Propylene Diene Monomer
ETFE	Ethylene Tetrafluoroethylene
FM	Factory Mutual
FPM	Fluoro Polymer
GPM	Gallons per Minute
GFPP	Glass Filled Polypropylene
IAPMO	International Association of Plumbing and Mechanical Officials
I/P	Instrument Signal to Pressure
ISO	International Standards Organization
LED	Light Emitting Diode
NEMA	National Electrical Manufacturers Association
NPT	American National Standard Taper Pipe Thread
NSF	National Sanitation Foundation
PP	Polypropylene
PSI	Pounds per Square Inch
PSIG	Pounds per Square Inch Gauge Pressure
PTFE	Polytetrafluoroethylene
PVC	Polyvinyl Chloride
PVDF	Polyvinylidene Fluoride
SPDT	Single Pole, Double Throw
SPST	Single Pole Single Throw
UL	Underwriters Laboratories, Inc.

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Flow Coefficient Cv

Extensive experimentation has shown that, in general, for a given flow passage and completely turbulent flow, the relationship between fluid flow rate and pressure drop follows a power law.

Variable: ΔP = Pressure drop across flow passage (PSI)
Q = Volume flow rate of fluid through passage (GPM)
Cv = Flow coefficient [GPM/PSI$^{1/2}$]

The flow coefficient Cv is the necessary proportionality constant, and it is typically determined experimentally. Usually, flow coefficient is expressed as the flow rate in GPM for a pressure drop of 1 PSI across a flow passage. By definition:

$$Cv = \sqrt{\frac{1}{\Delta P}}$$

A standardized test procedure for finding Cv factors is presented in ISA S75.02. A form of the equation is:

$$\Delta P = \left[\frac{Q}{Cv}\right]^2$$

EXAMPLES

EXAMPLE ONE

A Hayward® 1/2" True Union Ball Valve has an experimentally-determined Cv rating of 8 for water. It is required to flow 20 GPM of water through this valve. The anticipated pressure drop across this valve may be calculated as follows:

$$\Delta P = \left[\frac{20}{8}\right]^2 = 6.3 \text{ PSI}$$

EXAMPLE TWO

If a 0.5 PSI pressure drop has been allotted for a Hayward 4" True Union Ball Valve, the associated flow rate may be calculated by:

$$Q = Cv\sqrt{\Delta P}$$

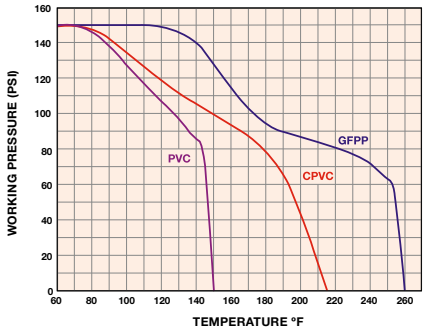
A Hayward 4" True Union Ball Valve has an experimentally-determined Cv rating of 600 for water. The approximate flow rate at a 0.5 PSI pressure drop is calculated by:

$$Q = 600\sqrt{0.5} = 420 \text{ GPM}$$

How to Select a Bag Filter

1. CHECK THE TEMPERATURE AND PRESSURE RATING OF A VESSEL

To make sure that the temperature/pressure of the application falls within the OK range, see the chart below.



2. DETERMINE THE FLOW RATE

In GPM, of the system into which the bag filter is to be installed. Hayward® single and double length bag filters work with flows of up to 150 GPM. If the system's flow rate is greater, consider using two or more filters manifolded together in parallel. For example, if the system flow rate is 150 GPM or higher, using two manifolded filters would reduce the flow to a manageable 75 GPM through each. Constantly running the flow through the vessels at their maximum rating limit is not recommended.

3. SELECT THE BAG

Hayward bags are available from 1 to 800 microns. The bags are made from several types of materials and are either of a sewn or welded construction. All bags are sold in Carton Quantities. A single length bag has a surface area of 2.0 sq ft and a double length of 4.1 sq ft.

4. CONSIDER STARTUP PRESSURE LOSS

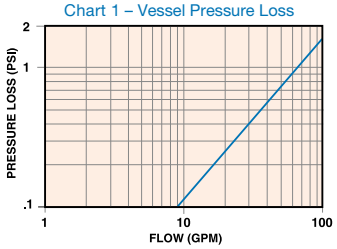
Bag filters are typically sized so that there is a 2 PSI or less pressure loss across them with a clean bag installed. Keep in mind that this is just a guide. The time between bag change outs for a double length filter is more than twice that of a single length filter in the same application.

5. CALCULATE STARTUP PRESSURE LOSS

To figure the total pressure loss across the filter with a clean bag requires making two pressure loss calculations and adding them together: The loss across the filter vessel without a bag and the bag loss.

First: Use the system flow rate and Chart 1 to determine the loss across the filter without a bag (single and double length filter vessels have virtually the same pressure loss without a bag).

Chart 1 – Vessel Pressure Loss



Example: A flow rate of 30 GPM results in a 0.4 PSI pressure loss. If the process media is water or has a viscosity less than 200 CPS, that's it. If the viscosity is greater, select the correction factor that matches the process media viscosity in CPS units from Table

Table 1 – Vessel Viscosity Correction

VISCOSITY IN CPS	200	400	600	800
CORRECTION FACTOR	1.10	1.20	1.40	1.50

Number One. Multiply the pressure drop by this factor.

Second: Single and double length filter bags have different pressure losses. Use Chart 2A and 2B to determine the pressure loss per square foot of bag surface. Example: with a system flow rate of 30 GPM, a 5 or 10 micron bag would have a 0.2 PSI loss per square foot. This loss is divided by 2.0 for a single length bag or 4.1 for a double length bag. These factors are the respective surface areas of the bags in square feet. The loss for a single bag would be 0.1 PSI (0.2 ÷ 2.0) and 0.05 for a double length bag (0.2 ÷ 4.1). For fluids with viscosities other than water, select the correction factor from Table 2 and multiply the pressure drop by it. Example: If the fluid viscosity were 800 CPS, the pressure loss for a single length bag would be 5.0 (0.1 x 50.0).

Chart 2A – Bag Pressure Loss

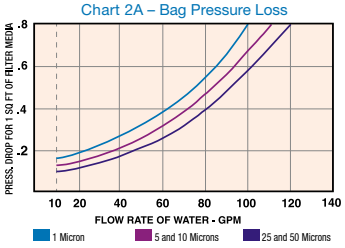
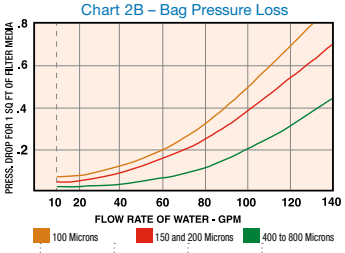


Chart 2B – Bag Pressure Loss



Last: Add the pressure loss of the vessel and the bag together to get the pressure loss across the filter with the bag installed.

Table 2 – Bag Viscosity Correction

VISCOSITY IN CPS	Water 1	50	100	200	400	600	800
CORRECTION FACTOR	1.00	4.50	8.50	16.60	27.70	38.90	50.00

Pressure Drop Correction Factors for Various Size Basket Screens

PLASTIC		STAINLESS STEEL		STAINLESS STEEL	
PERFORATION	CORRECTION FACTOR	PERFORATION	CORRECTION FACTOR	MESH	CORRECTION FACTOR
1/32"	1.05	1/32"	0.82	20	0.79
1/16"	1.00	3/64"	0.63	40	1.01
1/8"	0.58	1/16"	0.74	60	1.20
3/16"	0.46	5/64"	0.50	80	1.16
		7/64"	0.51	100	1.20
		1/8"	0.58	200	1.09
		5 /32"	0.37	325	1.22
		3/16"	0.46		
		1/4"	0.58		
		3/8"	0.45		
		1/2"	0.48		

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How to Select a Basket Strainer

SELECTION CRITERIA

The first consideration when selecting a Hayward basket strainer is the amount of free open area. This is the ratio of the open area through the strainer basket to the cross sectional area of the pipe. A well-designed basket strainer should have an open area ratio of at least 4 to 1. Anything less may cause excessive pressure drop. The area is calculated with a clean basket – and as the basket begins to clog, the ratio will drop. Unless there is a wide safety margin, the area through the basket may quickly become smaller than the pipe area. This will reduce flow through the strainer and necessitate very frequent cleaning. A small open area ratio also means the holding capacity of the basket is small (an important consideration if there is a lot of solid material to be removed.)

Second, is ease of basket removal. Since a basket strainer is used where cleaning may occur often, it stands to reason that the basket should be able to be removed and replaced as simply as possible. Hayward Simplex and Duplex strainers feature hand removable, threaded covers which can be quickly loosened or tightened by hand without the use of tools.

Another item to look for in selecting a strainer is compactness of design. Is the strainer unnecessarily bulky or tall? In many industrial areas, space is at a premium and the less room a strainer takes the better.

Lastly, a wide variety of basket perforation sizes should be available. This is necessary to cope with the great range of particle sizes which the strainer may be called upon to remove.

SELECTION AND SIZING

Selecting the proper size basket strainer for a particular application is extremely important for optimum performance of the strainer. Factors such as viscosity, specific gravity and mesh lining size all influence pressure drop of flow through the strainer. As a general rule of thumb, a pressure of greater than 2 PSI through a clean strainer usually indicates the strainer selected is too small for the intended application.

In some cases, the strainer size may not always be the same size as the pipe diameter. For example, the pressure drop of highly viscous liquids passing through a mesh basket can cut flow considerably making it necessary to use a strainer several times larger than pipeline to ensure adequate flow. Likewise, if an unusually large amount of material needs to be taken out of the process flows, a larger strainer or multiple strainer should be specified. By using two strainers in series, the first with large openings designed to catch larger particles and the second with a fine mesh lining to trap smaller material, the load is spread over two strainers and time between maintenance for cleaning is also extended.

PROPER BASKET SELECTION

The question of which perforation or mesh lining size to use comes up regularly. Here again, the basic rule is to use the coarsest size which will strain out the product to be removed. Using a finer mesh than needed will only result in premature clogging. When in doubt about which of two basket screens to use, it is best to choose the larger. As a rule of thumb, size the baskets for one half the particle size to be removed.

BASKET SIZES OFFERED FOR HAYWARD SIMPLEX AND DUPLEX PLASTIC BASKET STRAINERS

Comparitive Paricle Size

PERF	INCHES	MILLIMETERS	MICRONS	MESH	INCHES	MILLIMETERS	MICRONS
1/32	0.033	0.838	838	400	0.0015	0.0381	38
3/64	0.045	1.143	1143	300	0.0018	0.0457	45
1/16	0.070	1.778	1776	250	0.0024	0.0609	60
3/32	0.094	2.387	2387	200	0.0027	0.0686	68
1/8	0.125	3.175	3175	150	0.0041	0.1041	104
5/32	0.150	3.810	3810	100	0.0065	0.1651	165
3/16	0.1875	4.762	4762	80	0.007	0.1778	177
1/4	0.250	6.350	6350	60	0.009	0.2286	228
3/8	0.375	9.525	9525	40	0.015	0.8636	380
1/2	0.500	12.700	12700	20	0.034	0.8636	862

Note: To calculate pressure drop through vessels using other than 1/16" perforated baskets, first calculate the pressure drop using the listed Cv, and then multiply the result by the correction factor in the Correction Factors chart above. See page 102 for the applicable pressure drop calculation.

Flow of Water Through Schedule 80 Plastic Pipe

DISCHARGE		VELOCITY IN SCHEDULE 80 PLASTIC PIPE FOR WATER @ 60°F VELOCITY							
GALLONS / MINUTE	*CUBIC FEET/SECOND*	*FEET/SECOND*	*FEET/SECOND*	*FEET/SECOND*	*FEET/SECOND*	*FEET/SECOND*	*FEET/SECOND*	*FEET/SECOND*	*FEET/SECOND*
			1/4"	3/8"	1/2"	3/4"	1"	1-1/4"	1-1/2"
0.2	0.000446	—	0.824	—	—	—	—	—	—
0.3	0.000668	—	1.237	0.651	0.392	—	—	—	—
0.4	0.000891	—	1.646	0.867	0.529	—	—	—	—
0.5	0.00111	—	2.061	1.083	0.653	0.359	—	—	—
0.6	0.00134	—	2.476	1.303	0.782	0.431	—	—	—
0.8	0.00178	—	3.295	1.728	1.043	0.574	—	—	—
1	0.00223	—	4.122	2.167	1.311	0.718	0.435	—	—
2	0.00446	—	8.245	4.335	2.609	1.432	0.871	0.525	—
3	0.00668	—	12.381	6.502	3.919	2.161	1.306	0.788	0.538
4	0.00891	2"	16.502	8.671	5.218	2.876	1.747	1.051	0.717
5	0.01114	—	—	10.837	6.528	3.592	2.181	1.313	0.896
6	0.01337	0.65	2-1/2"	13.005	7.827	4.308	2.614	1.579	1.076
8	0.01782	0.86	—	—	10.448	5.741	3.482	2.105	1.434
10	0.02228	1.08	0.752	3"	13.057	7.185	4.351	2.632	1.798
15	0.03342	1.61	1.134	—	—	10.778	6.531	3.941	2.697
20	0.04456	2.15	1.505	0.986	—	—	8.712	5.252	3.596
25	0.0557	2.69	1.886	1.238	—	4"	10.881	6.574	4.484
30	0.06684	3.23	2.256	1.476	—	—	13.062	7.884	5.383
35	0.07798	3.78	2.638	1.726	—	0.973	15.232	9.193	6.282
40	0.08912	4.32	3.009	1.976	—	1.114	17.413	10.515	7.171
45	0.1003	4.84	3.391	2.215	—	1.247	—	11.838	8.069
50	0.1114	5.39	3.761	2.465	—	1.391	—	13.147	8.969
60	0.1337	6.47	4.513	2.953	—	1.665	—	15.779	10.778
70	0.156	7.55	5.266	3.453	—	1.942	—	—	12.577
80	0.1782	8.62	6.018	3.942	—	2.228	—	6"	14.36
90	0.2005	9.69	6.771	4.442	—	2.504	—	—	16.162
100	0.2228	10.77	7.523	4.931	—	2.781	—	1.225	17.96
125	0.2785	13.48	9.409	6.168	—	3.475	—	1.534	22.445
150	0.3342	16.18	11.284	7.395	—	4.171	—	1.893	—
175	0.3899	18.87	13.171	8.633	—	4.865	—	2.141	8"
200	0.4456	21.56	15.068	9.861	—	5.561	—	2.451	—
225	0.5013	—	16.943	11.098	—	6.255	—	2.759	1.577
250	0.557	—	—	12.325	—	6.951	—	3.069	1.752
275	0.6127	—	—	13.563	—	7.645	—	3.367	1.927
300	0.6684	—	—	14.768	—	8.341	—	3.675	2.102
325	0.7241	—	—	16.041	—	9.035	—	3.985	2.277
350	0.7798	—	—	—	—	9.731	—	4.294	2.453
375	0.8355	—	—	—	—	10.425	—	4.592	2.628
400	0.8912	—	—	—	—	11.121	—	4.901	2.803
425	0.9469	10"	—	—	—	11.815	—	5.211	2.989
450	1.003	—	—	—	—	12.511	—	5.519	3.164
475	1.059	2.199	—	—	—	13.205	—	5.817	3.329
500	1.114	2.229	—	—	—	13.901	—	6.126	3.515
550	1.225	2.459	—	—	—	15.279	—	6.744	3.865
600	1.337	2.679	12"	—	—	16.681	—	7.352	4.215
650	1.225	2.899	—	—	—	—	—	7.971	4.566
700	1.56	3.129	2.205	—	—	—	—	8.588	4.916
750	1.671	3.349	2.359	—	—	—	—	9.195	5.267
800	1.56	3.569	2.513	—	—	—	—	9.802	5.617
850	1.782	3.799	2.677	—	—	—	—	10.421	5.968
900	2.005	4.019	2.831	—	—	—	—	11.028	6.318
950	2.117	4.239	2.984	—	—	—	—	11.646	6.668
1000	2.228	4.469	3.149	—	—	—	—	12.253	7.019
1100	2.451	4.919	3.458	—	—	—	—	13.489	7.719
1200	2.674	5.359	3.775	—	—	—	—	14.715	8.431
1300	2.896	5.809	4.093	—	—	—	—	15.929	9.121
1400	3.119	6.259	4.401	—	—	—	—	17.165	9.833
1500	3.342	6.698	4.718	—	—	—	—	18.391	10.534
1600	3.565	7.148	5.037	—	—	—	—	19.611	11.235
1800	4.01	8.038	5.662	—	—	—	—	22.067	12.636
2000	4.456	8.938	6.228	—	—	—	—	24.517	14.038
2500	5.57	11.168	7.868	—	—	—	—	—	17.552
3000	6.684	13.396	9.437	—	—	—	—	—	21.068
3500	7.798	15.637	11.006	—	—	—	—	—	24.572
4000	8.912	17.866	12.587	—	—	—	—	—	28.08
4500	10.13	20.106	14.156	—	—	—	—	—	31.613
5000	11.14								
6000	13.37								
7000	15.6								
8000	17.82								
9000	20.05								
10000	22.28								
12000	26.74								

The following wave surge constants may be used to quickly calculate pressure rise due to water hammer where: "C"= the wave surge constant from the table below multiplied by "V" the line velocity in feet per second. The resultant number is then added to the line pressure to determine the resulting wave surge (Water Hammer Effect).

Pipe Size	1/4"	1/2"	3/4"	1"	1-1/2"	2"	3"	4"	6"	8"	10"	12"
Constant	40	35	32	31	27	25	23	23	21	20	19	19

Maximum recommended fluid velocity is 8 feet per second (solenoid valves 5 feet per second)

Chemical Resistance Guide

The data in the following tables was compiled from public information. The information is based primarily on the immersion of unstressed strips of tested material in the chemicals at 70F / 23C. The user should be aware that actual service conditions will affect the chemical resistance. It should be noted in the following charts that the "A" rating does not mean or imply that material will perform. The chemical resistance table should be used for reference only. It is the ultimate responsibility of the end user to determine the compatibility of a selected product with the chemical being used in his or her particular application. Testing of products by the user in actual application conditions is recommended. Contact Hayward for information on Eastar® products.

CHEMICALS	CPVC	PP	PTFE	PVC	PVC-GF (Fiberloc™)	PVDF	Ultem® (GF 40%)	EPDM	FPM	Nitrile (Buna N)	Hastelloy® C	Monel®	18-8 SS	316 SS	416 SS	Titanium
Acetal Benzene			A				A	X	X							
Acetal Oxide			A				B	X	C							
Acetaldehyde	X	B	A	X	X	C	B	X	X				A	A	A	
Acetaldehyde, Aq.	X	A	A	X	X	X	A	A	B		A	A	A		A	
Acetamide		A	A				A	A	C	A	A			A	A	
Acetate Solv., Crude	X	X		X	X	A					A		A	A	B	
Acetate Solv., Pure	X	X	A	X	X	A		C	X	X	A		A	A	A	
Acetic Acid 10%	A	A	A	A	A	A	A	B	X	B				A	A	B
Acetic Acid 20%	B	A	A	A	A	A	A	B	C	B				A	B	A
Acetic Acid 30%	B		A	A	A		A	A	C	B						
Acetic Acid 5%	A		A	A			A	A	A	B						
Acetic Acid 50%	B	A	A	A	A	A	A	B	C	A				A	C	
Acetic Acid 60%	B	B	A	A	A	A	A	C	C					A	X	
Acetic Acid 80%	B	C	A	B	C	A	A	B	C	C				A	X	
Acetic Acid, Glacial	X	B	A	X	C	B	C	B	X	X				A	X	B
Acetic Aldehyde			A					A	X	X						
Acetic Anhydride	C	B	A	X	X	B		C	X	C	A		AB	A	X	B
Acetic Ester			A					B	X	X						
Acetic Ether			A					B	X	X						
Acetol			A													
Acetone	X	B	A	X	X	X	C	A	X	C	A		A	A	AB	A
Acetonitrile		B	A	X	X	A	C	A	C	C			A	A	AB	
Acetophenone	X	A	A	X		A		A	X	C			A	A	X	
Acetyl Acetone	X		A	X	X	X		A	X	X			A		AB	
Acetyl Bromide			A			A										
Acetyl Chloride	X	A	A	X	X	A		X	C	C			BC	AC	AB	
Acetyl Propane			A					B	X	X						
Acetylene Dichl.			A						A					X		
Acetylene Tetrachl.			A					X	A	X	A		A	A	A	
Acetylene	C	A	A	C	C	A		A	A	A	A		A	A	A	
Acid Mine Water	A	B	A	A	A	A			A							
Acrylic Acid	X		A	X	X	A							A			

CHEMICALS	CPVC	PP	PTFE	PVC	PVC-GF (Fiberloc™)	PVDF	Ultem® (GF 40%)	EPDM	FPM	Nitrile (Buna N)	Hastelloy® C	Monel®	18-8 SS	316 SS	416 SS	Titanium
Acrylic Emulsions		X														
Acrylonitrile	X	B	A	X	X	A		X	X	C	AB	A	A	A	A	A
Adipic Acid, Aq.	A	A	A	A	A	A		A	A	A	A	AB	A	A	A	A
Air	A	A	A	A	A	A	A	A	A	A						
Alcohol	C		A				A	B	A	A	A	A	A	AC	AB	
Aldehyde			A				A	X	X							
Alkanes			A				X	A	A							
Alkazene			A				X	B	X							
Allyl Alcohol	X	A	A	X	C	A	A	B	A	A	A	A	A	A		
Allyl Aldehyde			A					A	B							
Allyl Bromide			A					B	X							
Allyl Chloride	X		B	X	X	A	X	B	X	A			AB		A	
Allyl Trichloride			A					A	X							
Alum	A	A	A	A	A	A	A	A	A	A	AB	AC	AB	X	A	
Aluminum Acetate	A		A				A	C	B	A	AC	A	AB	AC	A	
Aluminum Bromide			A				A	A	A							
Aluminum Chloride	A	A	A	A	A	A	A	A	A	A		X	X	X	AB	
Aluminum Fluoride	A			A	C	A	A	A	A	AB	A	X	C	X	A	
Aluminum Formate			A					X	X							
Aluminum Salts		A	A	A	A	A	A	A	A				X	X		
Aluminum Sulfate	A	A	A	A	A	A	A	A	A				B	X	A	
Amber Acid	A	A	A	A	A	A	A	A								
Amines	X		A	C	C	B		X	X	AB	A	A	A	A	AB	
Ammon. Metaphosph.	A	A	A	A	A	A	A	A	A							
Ammonia 10%	X	A	A	A	A			A	X				A	A	A	
Ammonia, Anhydrous	X	A	A	X	X	B	A	X	C	A	AB		A	A	AB	
Ammonia, Aq. 25%	A	A		A	A	A								B		
Ammonia, Dry Gas	A	A	A	A	A		A	X	A			A		A	A	
Ammonia, Liquid	X	A	A	X	X	A	C	A	X	B	A	A	AB	A	A	AB
Ammonia. Nitrate	B	A		B	C	A		A	A	B				A	A	
Ammonium Acetate	A	A	A	A	A			A	A	A	A	A		A		X
Ammonium Alum	X	A	A	X	C	A		A	A	B	A	BC	A	A	A	

A = Excellent, no effect • B = Good, minor effect • C = Fair, data not conclusive, testing recommended • X = Not recommended.
Ratings are based on testing at an ambient temperature of 70°F. The chemical resistance table is for reference only. End users should test to determine application suitability.
Butterfly valves, Solenoid valves, Diaphragm valves and all other valves with elastomers fully exposed to process media should derate elastomer scores by one level (i.e. "B" becomes "C", "C" becomes "X").

Chemical Resistance Guide, *CONTINUED*

CHEMICALS	CPVC	PP	PTFE	PVC	PVC-GF (Fiberloc™)	PVDF	Ultem® (GF 40%)	EPDM	FPM	Nitrile (Buna N)	Hastelloy® C	Monel®	18-8 SS	316 SS	416 SS	Titanium
Ammonium Bichrom.			A					A		A						
Ammonium Bifluoride	A	A	A	A	A	A		A	A	B	A	B	X	X		X
Ammonium Bisulfide				A	A	A										
Ammonium Carbonate	A	A	A	A	A	A		A	A	C	AB	AB	AB	AB	B	A
Ammonium Casenite														A		
Ammonium Chloride	A	A	A	A	A	A		A	A	B	AB	A	X	AB	X	A
Ammonium Dichromate	A		A	A	A			A		A						
Ammonium Fluoride 20%	A	A	A	A	C	A		A	A							
Ammonium Fluoride	A		A	A						B	A			X		BC
Ammonium Hydroxide	X	A	A	A	A	A	X	A	B	B	A	X	AC	A	A	A
Ammonium Nitrate	B	A		B	A	A		A	A	A	AB	C	A	A	B	A
Ammonium Oxalate										A	A	A	A	A	A	
Ammonium Persulfate	A	C	A	A	A	A		B	C	C	B	X	AC	A	AC	A
Ammonium Ph. Di Basic	A	A	A	A	A			A	A	A	AB	AB	BC	A	AC	A
Ammonium Ph. Mono	A	A	A	A	A			A	A	A	A	B	C	A	A	A
Ammonium Ph.Tri.	A	A	A	A	A			A	A	A	A	AB	AB	A	AB	A
Ammonium Phosphate	A	A	A	A	A	A	A	A	A	A					A	
Ammonium Salts		A	A	A	A	A		A	C	A				X		
Ammonium Sulfate	A	A	A	A	A	A	A	A	C	B	A	AB	AB	A	B	A
Ammonium Sulfide	A	A	A	A	A	A		A	C	A	A		BC	A	C	
Ammonium Thiocyanate	A	A	A	A	A			A	A	A	A			A		
Ammonium Thiosulfate			A					A	A	A			AB	A	C	A
Ammonium, Fluoride 10%	A	A	A	A	C	A		A	A							
Ammonium, Fluoride 25%	A	A		X	X	A										
Amyl Acetate	X	X	A	X	X	C		A	X	C	A	A	AB	A	AB	A
Amyl Alcohol	B	A	A	C	C	A		A	A	A	A	A	AB	A	A	AB
Amyl Borate			A			A		X	A	A						
Amyl Bromide			A					X	B	X						
Amyl Chloride	X	X	A	X	X	A		X	A	X	A	A	AB	A	AC	X
Aniline Chlorohydrate				X	X											
Aniline Hydrochloride	X	A	A	X	X	A		B	B	C					X	
Aniline	X	A	A	X	X	C		B	B	X	A	B	AB	A	B	AC
Anthraquinone Sulf. Ac.	A	A		A	A	A			A							
Antichlor			A					A	A	A						
Anti-Freeze		A	A	A	A		C	A	A	A	A			A		
Antimony Chloride		A	A			A			A	X						
Antimony Pentachloride			A							X						
Antimony Trichloride	A	A	A	A		A		A	A	A	A	AB	X	A	X	AB
Aqua Regia	X	X	A	X		A		C	C	C	X	X	X	X	X	A

CHEMICALS	CPVC	PP	PTFE	PVC	PVC-GF (Fiberloc™)	PVDF	Ultem® (GF 40%)	EPDM	FPM	Nitrile (Buna N)	Hastelloy® C	Monel®	18-8 SS	316 SS	416 SS	Titanium
Argon	X		A	X				A	A	C		A	A	A	A	
Arochlor									A	X	A	A		B		A
Aromatic Hydrocarbons	X			X	X			X	A	X				A		
Arsenic Acid	A	A	A	A	A	A		A	A	B	AB	A	AB	AB	B	AB
Arsenous Acid																
Aryl Supfonic Acid	X	X		X		X										
Asphalt	X	A	A	X	X	A		X	A	B	A	A	A	A	AB	A
Aviation Fuel			A								A	A	A	A	A	
Aviation Turbine Fuel			A								A	A	A	A	A	A
Baking Soda			A					A	A	A					A	
Barium Carbonate	A	A	A	A	A	A		A	A	A	B	AB	AB	B	AB	A
Barium Chloride	A	A	A	A	A	A		A	A	A	A	AB	A	AB	BC	A
Barium Cyanide									A	C	A		A	A	C	
Barium Hydrate			A					A	A	A	A	A	A	A	A	
Barium Hydroxide	A	A	A	A	A	A		A	A	A	B	A	AB	AB	AB	A
Barium Nitrate	A	A	A	A	A				A	A		X	AB	B	B	A
Barium Salts		A	A	A	A	A		A	A	A				A		
Barium Sulfate	A	A	A	A	A	A			A	A	A	AB	AB	AB	C	AB
Barium Sulfide	A	A	A	A	A	A		A	A	A		A	A	AB	A	A
Beer	A	A	A	A	A	A		A	A	C	A	A	A	A	A	A
Beet Sugar Liquid	A	A	A	A	A			A	A	A				A	A	
Beet Sugar Liquor	A	A	A	A	A	A		A	A	A	A	A	A	A	B	A
Benzaldehyde	X	C		X	X	C		C	C	X	A	B	A	A	C	A
Benzalkonium Chl.				A												
Benzene Sulf Ac .	X	X	A	X	X	B		X	A	C	B	B	A	AB		AB
Benzene Sulf. Ac. 10%	X	X	A	X	X	B			A							
Benzene	X	C	A	X	X	B	C	X	B	C	AB	A	A	AB	A	A
Benzoic Acid	A	A	A	A	A	A		B	A	X				B	B	A
Benzyl Alcohol	X	A	A	X	X	A	X	C	A	X		A	C	AB	A	A
Benzyl Benzoate			A					C	A	X			C	AB	C	
Benzyl Chloride	X	A	A					X	A	X	B		C	AB	C	
Bismuth Carbonate	A	A	A	A	A	A		A	A	A						
Black Liquor	A	A	A	A	A	A		B	A	A	AC		A	A	AC	
Borax	A	A	A	A	A	A		A	A	A	A	A	A	A	A	A
Boric Acid	A	A	A	A	A	A		A	A	B	A	AC	B	B	BC	A
Brake Fluid			A				C	A	X	C	A	A	A	A	A	
Brewery Slop									A	A				A		
Brine Acid	A	A	A	A	A	A		A	A	A						
Brine	A	A	A	A	A	A		A	A	A	A	A	A	A		A

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CHEMICALS	CPVC	PP	PTFE	PVC	PVC-GF (Fiberloc™)	PVDF	Ultem®	EPDM	FPM	Nitrile (Buna N)	Hastelloy® C	Monel®	18-8 SS	316 SS	416 SS	Titanium
Bromic Acid	A	X	A	A	A	A		B	A		A			X		
Bromine Gas		X	A	C	C	A		X	A	X	A	X	X	X	X	A
Bromine Dry			A					X	A	X	A	A	X	X	X	AB
Bromine Liquid, Br	X	X	A	X	X	A		X	A	X	A	A	X	X	X	X
Bromine Water	C	C	A	X	X	A		X	A	C	A	X	X	X	X	A
Bromobenzene	X		A	X	X			X	A	C						
Bromotoluene	X	X		X	X											
Butadiene Gas	A	A	A	B	C	A		X	A	X	AC	A	A	A	A	
Butane	A	A	A	A	A	A		X	A	A	A	A	A	A	A	A
Butanediol	B			A	A	A		X	A							
Butter			A						A	A				A	A	
Buttermilk			A						A	A				A	A	
Butyl Acetate	X	C	A	X	X	B	C	B	X	C	A	A	A	A	A	A
Butyl Acrylate Pure	X	X	A	X	X	A		A	X							
Butyl Acrylate Satur.								A	X							
Butyl Alcohol (Butanol)	A	A	A	C	C	A		A	A	A	A	A	A	A	A	A
Butyl Amine	X	X	A	X	X	B		X	X	C	AB			A	A	AB
Butyl Benzoate			A					A	A	X						
Butyl Bromide			A			A			B	X						
Butyl Butyrate			A					B	C	X						
Butyl Carbitol	X		A					A	A	C						
Butyl Cellosolve	X		A	A	A	A		B	X	C	A	A	C	A	AC	AB
Butyl Chloride			A			A			A	X	A	A	A	A		A
Butyl Diol	A	A	A	B	C	A		A	A							
Butyl Ether	X	X	A	X	X	A		X	X	B			A	A	A	
Butyl Formate			A							X						
Butyl Hydrate			A					B	A	A						
Butyl Hydride			A					X	A	A						
Butyl Hydroxide			A					B	A	A						
Butyl Mercaptan			A	X	X	A										
Butyl Phenol	A	A		C	C	A					A			A	A	
Butyl Phthalate	X	A	A	X	X	A		B	C	X	AB	AB	AB	AB	A	A
Butyl Stearate			A			A		B	A	B			C	A	AC	
Butylbenzene			A						A	X						
Butylene	A	X	A	A	A	A		X	A	B	A	A	A	A	A	
Butyraldehyde			A					B	X	X	A					
Butyric Acid	B	A	A	X		A		B	B	X	A	A	AC	AB	X	A
Cadmium Cyanide	A			A	A				A							

CHEMICALS	CPVC	PP	PTFE	PVC	PVC-GF (Fiberloc™)	PVDF	Ultem®	EPDM	FPM	Nitrile (Buna N)	Hastelloy® C	Monel®	18-8 SS	316 SS	416 SS	Titanium
Cadmium Salts		A	A			A			A							
Caffeine Citrate			A	A		A										
Calamine			A						A	B						
Calcium Acetate	A	A	A	A	A	A		A	X	B		AB	C	AB	C	
Calcium Bisulfate	A	A	A	A	A	A		X	A	A			C	X	X	
Calcium Bisulfide	A	A	A	A	A	A		X	A	A	A			AB		A
Calcium Carbonate	A	A	A	A	A	A		A	A	A	B	AB	A	AB	A	AB
Calcium Chlorate	A	A	A	A	A	A		A	A	A	AB	AC	A	B	C	A
Calcium Chloride	A	A	A	A	A	A		A	A	A	A	AC	X	B	X	A
Calcium Cyanide			A					A		A						
Calcium Hydroxide	A	A	A	A	A	A	A	A	A	A	A	A	AB	AB	A	A
Calcium Hypochloride			A					A	A	X						
Calcium Hypochlorite	A	B	A	A	A	A	A	A	A	B	A	X	X	AB	X	A
Calcium Nitrate	A	A	A	A	A	A		A	A	B	AB	A		AB		AB
Calcium Oxide	A	A	A	A	A	A		A	A	A	A	A	A	A		A
Calcium Phosphate			A					A	A	A	AB		C	AB	C	AB
Calcium Sulfate	A	A	A	A	A	A		A	A	A	AB	A		A	AB	A
Calcium Sulfide	A	A	A	A	A	A		A	A	A		AB	A	AB	BC	
Calcium Thiosulfate			A					A	A	B						
Calgon		C	A			A			A	A			A	A	A	
Cane Sugar Liquors	A	A	A	A	A	A		A	A	A		A	A	A	B	
Caprylic Acid			A			A				C						
Carbinol			A					A	X	A						
Carbolic Acid	A	A								C	A	B	A	A	AB	AB
Carbon Bisulfide	X	X	A	X	X	A			A	X				C		
Carbon Dioxide	A	A	A	A	A	A		B	A	A	A	A	A	A	A	A
Carbon Disulfide	X	X	A	X	X	A		X	A	C	A	B	A	A	AC	AB
Carbon Monoxide	A	A	A	A	A			A	A	A	A	A	A	A	A	
Carbon Tetrachloride	X	X	A	X	X	A	A	X	B	C	A	A	AB	AB	A	A
Carbonic Acid	A	A	A	A	A	A		A	A	B	A	A	AB	A	AC	AB
Casein			A			A		A	A	A						
Castor Oil	C	A	A	A	A	A		B	A	A	A	A	A	A	A	A
Catsup	A	A		A	A				A	A	A			A	A	
Caustic Lime	(See Calcium Hydroxide)															
Caustic Potash	(See Potassium Hydroxide)															
Caustic Soda	(See Sodium Hydroxide)															
Cellosolve	X	A	A	B		A	C	B	C	C	A	A	C	C	AC	AB
Chloral Hydrate	A	A		A	A	A			A	C						

A = Excellent, no effect • B = Good, minor effect • C = Fair, data not conclusive, testing recommended • X = Not recommended.
Ratings are based on testing at an ambient temperature of 70°F. The chemical resistance table is for reference only. End users should test to determine application suitability.
Butterfly valves, Solenoid valves, Diaphragm valves and all other valves with elastomers fully exposed to process media should derate elastomer scores by one level (i.e. "B" becomes "C", "C" becomes "X").

Chemical Resistance Guide, *CONTINUED*

CHEMICALS	CPVC	PP	PTFE	PVC	PVC-GF (Fiberloc™)	PVDF	Ultem® (GF 40%)	EPDM	FPM	Nitrile (Buna N)	Hastelloy® C	Monel®	18-8 SS	316 SS	416 SS	Titanium
Chloric Acid 20%	A	X		A	A	A										
Chloric Acid	A		A	A		A				X	AB	X	X	X	X	
Chlorinated Glue								B	A	C				A		
Chlorine Dioxide	A	C	A	A	A	A		X	A		A	X	X	X	X	AB
Chlorine Gas, Dry	X	X	A	X	X	A	A	X	B	C	A	AB	B	B	BC	X
Chlorine Gas, Wet	X	X	A	X	X	A	C	X	C	C	A	C	X	X	X	A
Chlorine Water	A	C	A	A	A	A		B	A	C	A	C	X	X	X	A
Chlorine, Dry	X		A					B	C	X				A		X
Chlorine, Liquid	X	X	C	X	X	A				C						
Chloroacetic Acid		X	A	A				B	X	X	A	B	X	X	X	A
Chlorohydr. Alum			A													
Chlorosulfonic,Acid	X	X	A	X	X	C		X	X	X	A	AC	X	X	X	A
Chocolate Syrup		A							A	A	AB	AB	A	A	A	
Chresylic Acid 50%				A		B			A	X				A		
Chrome Alum	A	A		A	A				A	A						
Chrome Alum	A	A		A	A	A			A	A						
Chromic Acid 10%	A	B	A	A	A	A	A	B	A	X						A
Chromic Acid 20%	A	X	A	B	C	A		B	B	C						A
Chromic Acid 30%	A	X	A	B	C	A			A	X						A
Chromic Acid 5%	A	X		A	A		A	A	A	X				A		A
Chromic Acid 50%	X	X	A	X	X	A	C	B	A	X				X		A
Chromium Alum	A	A	A	A	A	A		A	A							
Citric Acid	A	A	A	A	A	A	A	A	A	B	A	AB	AB	B	BC	A
Citric Oils	X	A	A					B	A	A	A			A		
Cobalt Chloride			A					A	A	A						
Coconut Oil	A	A	A	A	A	A		B	A	A	A	BC		A	AC	
Cod Liver Oil			A					A	A	B	A	A	A	A	A	
Coffee	A	A						A	A	A	A	AC	A	A	A	A
Coke Oven Gas	A	A	A	X	X	A		A	A	X			A	A	A	
Cola Concentrates		A														
Copper Acetate	A	A	A	A	A	A		A	X	B	A	X	A	A	AB	
Copper Borofluoride	A	A	A	A	A	A		A	A							
Copper Carbonate	A	A	A	A	A	A		A	A	X	A	X	A	A	BC	A
Copper Chloride	A	A	A	A	A	A		A	A	A	A	X	X	X	BC	A
Copper Cyanide	A	A	A	A	A	A		A	A	B	A	X	A	B	AB	A
Copper Fluoborate			A	A	A				A	B	B	C		X		
Copper Fluoride	A	A	A	A	A	A		A	A			C		A		
Copper Nitrate	A	A	A	A	A	A		A	A	A	A	X	AB	A	B	A
Copper Salts	A	A	A	A	A	A		A	A	A						
Copper Sulfate 5%	A	A	A	A	A				A	A				A	B	A

CHEMICALS	CPVC	PP	PTFE	PVC	PVC-GF Fiberloc™	PVDF	Ultem® (GF 40%)	EPDM	FPM	Nitrile (Buna N)	Hastelloy® C	Monel®	18-8 SS	316 SS	416 SS	Titanium
Copper Sulfate	A	A	A	A	A	A		A	B	B	A	AB	AB	A	AB	A
Corn Oil	A	A	A	A	A			B	A	A	A	A	A	A	A	
Corn Syrup	A	A	A	A	A	A		B	A	A				A		
Cottonseed Oil	A	A	A	A	A	A		B	A	B	A	A	AB	A	A	A
Cream	A	A							A	A				A		
Creosol	X	C	A	X	X	C		X	A	X			A	A		
Creosote	X		A	X	X			X	A	B	A	A	A	A	AB	A
Cresols	X	C	A	X	X	A		X	A	X	AB			A	A	AB
Cresylic Acid	C	A	A	C		A		X	A	X	A	A	A	A	A	A
Croton Aldehyde	X	A	A	X	X	C		B	A							
Crude Oil	A	A	A	A	A	A		X	A	X	A	AB	A	A	A	A
Cryolite	B	A	A	B		A		A	A	B						
Cupric Fluoride	A	A	A	A	A	A		A	A							
Cupric Nitrate			A					A	A	A						
Cupric Salts		A	A	A	A	A		A	A					X		
Cupric Sulfate	A	A	A	A	A	A		A	A	A						
Cutting Oil			A					X	A	A			A	A	A	
Cyanic Acid			A					A		A		B		A		
Cyclohexane	X	X	A	X	X	A	A	X	A	C	AB	A	AC	A	AC	A
Cyclohexanol	X	A	A	X	X	C		B	A	B	A		C	A	AC	
Cyclohexanone	X	B	A	X	X	C		C	X	C	A	BC	C	A	BC	
Decalin	X	A	A	X	X	A		X	A	X						
Decanal			A						X	X						
Decane			A			A		X	A	B						
Detergents	B	B	A	A	A	A		A	A	A	AB	A		A	A	A
Detergents, Heavy Duty	A	A		A	A	A										
Developers			A							A	A	AB	A	A	A	A
Dextrin	A	A	A	A	A	A		A	A				A	A		
Dextrose	A	A	A	A	A	A		A	A	A	A	A		A	A	A
Diacetone Alcohol	X	C	A	X	X	B		A	X	C	A	A	A	A	A	A
Diallyl Phthalate																
Diazo Salts	A	A		A	A	A										
Dibenzyl Ether			A			A		C					A	A	A	
Dibutyl Amine			A			A		X	C	C						
Dibutyl Ether			A			A		C	C	C			A	A	A	
Dibutyl Phthalate	X	B	A	X	X	A		A	B	X	AB			AB	A	
Dibutyl Sebacate			A	B		A		B	C							
Dichlorobenzene	X		A	X	X	A	X	X	B	X	A		A	A	A	
Dichloroethane			A	X	X		X		C		A	A	A	A	A	AB
Dichloroethylene	X	X	A	X	X	A		X	A	X	AB	A		BC		

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Visit us at: haywardflowcontrol.com

CHEMICALS	CPVC	PP	PTFE	PVC	PVC-GF (Fibertoc™)	PVDF	Ultem® (GF 40%)	EPDM	FPM	Nitrile (Buna N)	Hastelloy® C	Monel®	18-8 SS	316 SS	416 SS	Titanium
Dichloroisopropyl Ether						A										
Dichloromethane			A				X	X	B	X						
Diemethyl Phthalate											A		AB	A		
Diesel Fuel	A	B	A	A	A	A	A	X	A	A	A	A	A	A	A	A
Diethanolamine											A	A	A	A	A	A
Diethyl Cellosolve						A		X								
Diethyl Ether	X	B	A	X	X	A		C	C	X	A	B	AB	A	AB	A
Diethyl Ketone			A					B	X	X						
Diethyl Oxide			A					X	X	B						
Diethylamine	X	A	A	X	X	C		B	X	B		BC	A	A	A	X
Diethylbenzene			A					X	A	X						
Diethylene Glycol	A	A	A				A		A	A	B	AB	A	A	A	A
Diethylenetriamine			A			A				B						
Diglycolic Acid	A	A	A	A	A	A		A	A							
Diisobutyl Ketone						A		X	X							
Diisobutylene			A			A		X	A					A		
Diisooctyl Phthalate			A				A	B	B							
Diisopropyl Ketone			A			B		B	X			C	A	A	A	
Dimethyl Amine	X	A	A	X	X	B		C	X	B						
Dimethyl Benzene			A					X	A	X						
Dimethyl Ether			A					B	B	B	C	C	C	C	C	A
Dimethyl Formamide	X	A	A	X	X	A	X	B	C	B	A	A		A		
Dimethyl Ketone			A					A	X	X						
Dimethyl Phthalate			A			B		B	B	X	A			A		
Dimethylamine	X	A		X	X	X		X	X							
Dioctyl Phthalate	X	X	A	X	X	A		B	A	X	A		A	A	A	
Dioxane	X	B	A	X	X	X	X	B	X	X	X	A	A	AB		
Dioxolane						X		X	X							
Diphenyl Ether											A			A		
Diphenyl Oxide								X	A	X						
Diphenyl			A					X	A	X	B	AB	B	B	A	A
Dipropylene Glycol			A						A	A						
Disodium Phosphate	A	A	A	A	A	A		A		A	A			A		
Distilled Water	A	A		A	A	A										
Divinylbenzene	X	X		X	X	X										
Dolomite			A					B	A	A						
Dowtherm											A	A	A	A	A	A
Dry Cleaning Solvents			A		X			X	A	A			A	A	A	

CHEMICALS	CPVC	PP	PTFE	PVC	PVC-GF (Fibertoc™)	PVDF	Ultem® (GF 40%)	EPDM	FPM	Nitrile (Buna N)	Hastelloy® C	Monel®	18-8 SS	316 SS	416 SS	Titanium
Epichlorohydrin	X	A	A	X		A		X	X		A		A	A	A	
Epsom Salt		A	A	A	A	A		A	A	A	A	A	A	AB	AB	A
Esters	X	C	A	X	X	A										
Ethane			A					X	A	A			A	A	A	A
Ethanol	B	A	A	A	A	A	A	A	B	A				A	B	A
Ethanolamine	X	X	A	X	X	X		A	X	B	AB	A	A	A	A	A
Ether Alcohol			A					A	B	C						
Ethers	X	C	A	X	X			C	C	X	A	A	A	A	A	A
Ethyl Acetate	X	C	A	X	X	A	C	B	X	X	A	A	AB	A	A	A
Ethyl Acetoacetate	X		A	X	X	A		A	X	X						
Ethyl Acrylate	X	X	A	X	X	A	C	B	X	X	A	A	A	A	A	BC
Ethyl Alcohol	A	A	A	A	A	A	A	A	B	A	A	A	A	A	A	A
Ethyl Benzene	X		A			A		X	A	X	A	A	A	A	A	
Ethyl Bromide		X											A	A	A	
Ethyl Chloride	X	X	A	X	X	A		A	A	B	B	AB	A	A	A	A
Ethyl Ether	X	B	A	X	X	A	A	X	C	X	A	B	AB	AB	AB	A
Ethyl Formate			A					B	B	X			A	A	A	
Ethyl Hexanol			A			A		A	A	B						
Ethyl Sulfate			A						X	C	A	A	C	X	A	
Ethylene Bromide	X	C	A	X	X	A		C	B	X	AB			AB	B	BC
Ethylene Chloride	X	C	A	X	X	A		C	A	X	A	AB	A	A	A	AB
Ethylene Chlorohydrin	X	A	A	X	X	A		A	A	X	B			AB		BC
Ethylene Diamine	X	A	A	X	X	C	X	A	X	A	AC		A	A	A	A
Ethylene Dichloride	X	C	A	X	X	A		X	A	X	A	AB	A	A	A	AB
Ethylene Glycol	C	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
Ethylene Oxide	X	X	A	X	X	A		X	X	X	A	A	A	AB	A	
Extrin	A	A	A	A		A		A	A							
Fatty Acids	B	A	A	A	A	A		X	A	B	A	A	A	A	B	A
Ferric Acetate			A	B	B				X	X						
Ferric Chl. Anhydrous	A	A	A	A	A	A		A	A	B				X	X	A
Ferric Hydroxide	A	A	A	A	A			A	C							
Ferric Nitrate	A	A	A	A	A	A		A	A	A	AB	X	A	B	B	A
Ferric Sulfate	A	A		A	A	A		A	A	B	A	B	A	B	B	A
Ferrous Chloride	A	A	A	A	A	A		A	A	B	AB	X	X	X	X	A
Ferrous Nitrate	A	A	A	A	A	A		B	A	A						
Ferrous Sulfate	A	A	A	A	A	A		A	A	A	A	AB	A	C	B	A
Fish Solubles	A	B		A	A											
Fluoboric Acid	A	A		A	A	A	B	A	A	B	A	A		B		X

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Ratings are based on testing at an ambient temperature of 70°F. The chemical resistance table is for reference only. End users should test to determine application suitability.
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Chemical Resistance Guide, *CONTINUED*

CHEMICALS	CPVC	PP	PTFE	PVC	PVC-GF Fiberloc™	PVDF	Ultem® (GF 40%)	EPDM	FPM	Nitrile (Buna N)	Hastelloy® C	Monel®	18-8 SS	316 SS	416 SS	Titanium
Fluorine Gas (Wet)	A	B	A	A	C	A		A	A	X	A	A				
Fluorine Liquid		X	B	C	X	A		C	B	X				X		X
Fluosilicic Acid 25%	A	A	A	A		A		A	A	A	B	A	X	B	C	X
Formaldehyde 35%	A	A	A	A	A	A		A	A						B	
Formaldehyde 50%	A	A	A	A	A	A		X	B							
Formaldehyde	A	A	A	X	B	A	A	B	B	B	B	A	A	A	B	A
Formic Acid	A	A	A	A	A	A	B	A	X	C	A	AB	B	B	B	C
Freon 11	A	A	A	X	X	A		X	B	B	A	A	A	A	A	
Freon 113	B	X	A	B	C	A		X	B	A	A	A	A	A	A	
Freon 114			A	A	A	A		C	A	A			A			
Freon 12 (Wet)		A	A	B	C			B	A	A				X	A	
Freon 12	A	A	A	C	C	A		A	B	B	A	AB	A	A	A	
Freon 22	X	A	A	X	X	A		B	X	X			A	A	A	
Freon TF	(See Freon 113)															
Fructose	A	A	A	A	A	A		A	A	A	A	A	A	A		
Fruit Juice	A	A	A	A	A	A			A	A	A	A	A	A		
Fruit Pulp	A	A		A	A	A			A							
Fuel Oil		B	A	B	C	A		X	A	A	A	A	A	A		A
Fumaric Acid			A						A	A			A			
Furan			A					X	X		B					
Furfural (Ant Oil)	X	C	A	X	X	B		B	X	X	AB	B	AB	A	A	
Furfuryl Alcohol			A			B		C	X				A			
Gallic Acid	A	A	A	A	A	A		A	A	A	B	B	A	A	B	
Gas, Natural	A	A		A	A	A		X	A	A	A	A				
Gasoline, Leaded	X	X	A	A	A	A	A	X	B	A	A	A	A	A	A	X
Gasoline, Sour	B	X	A	A	A	A		X	A	A	A	X	A	A	A	X
Gasoline, Unleaded	X	X	A	C	C	A	A	X	B	A	A	A	A	A	A	X
Gelatin	A	A	A	A	A	A		A	A	A	A	A	A	A	A	
Gin	A	A	A	A	A	A		A	A							
Glucose	A	A	A	A	A	A		A	A	A	A	A	A	A	A	
Glue	A	A	A	A	A	A		B	A	A	A	A	A	A	A	A
Glycerine	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
Glycerol	A	A	A	A	A	A		A	A	A			A			
Glycolic Acid	A	A	A	A	A	A		A	A	A	A					
Glycols	A	A	A	A	A	A		A	A	A		AB				
Glyoxal									A							
Gold Monocyanide									A	A			A			
Grape Juice	A			A	A				A	A			A			
Grape Sugar	A	A	A	A	A	A		A	A	A						
Grease		A	A	A	A	A		X	A	B	A	A	A	A		

CHEMICALS	CPVC	PP	PTFE	PVC	PVC-GF Fiberloc™	PVDF	Ultem® (GF 40%)	EPDM	FPM	Nitrile (Buna N)	Hastelloy® C	Monel®	18-8 SS	316 SS	416 SS	Titanium
Green Liquor	A	A	A	A	A	A		A	A	B		A				
Helium			A					A	A	A			A			
Heptane	A	B	A	A	A	A		X	A	A	A	A	A	A		
Hexane	A	B	A	X	X	A	A	X	A	A	A	A	A	A		
Hexene			A					X	A	A						
Hexyl Alcohol	A	A	A	A	A	A		B	A	A	A	A	A	A		A
Honey		A	A	A	A	A			A	A	A			A		
Hydraulic Oil (Synth.)		X			C				A	C	A	A	A	A		
Hydraulic Oil			A				A	X	A	A	A	A	A			
Hydrazine	X	X	A	X	X	X		A	X	C			A	A		
Hydrobromic Acid 20%	A	A	A	A	A	A		A	A	X				X	X	A
Hydrobromic Acid 50%	A	B	A	A	A	A		A	A	X			X	C	X	X
Hydrobromic Acid	A	B	A	A	A	A		A	A	X	A	X	X	X	X	A
Hydrochloric Acid 10%	A	A	A	A	A	A	A	A	A	B			X		X	C
Hydrochloric Acid 20%	A	A	A	A	A	A	A	A	A	B			X	X	X	C
Hydrochloric Acid 25%	A	A	A	A	A	A	A	A	A	C			X		X	
Hydrochloric Acid 37%	A	A	A	A	A	A	A	C	A	C			X	X	X	C
Hydrochloric Acid	A		A	A			A	A			B	X	X	A		
Hydrocyanic Acid 10%	A	A	A	A	A	A		A	A	B				X	X	
Hydrocyanic Acid	A	A	A	A	A	A		A	A	B	A	AB	A	A	B	A
Hydrofluoric Acid 10%	A	A	A	A	C	A		A	A	B			X		X	
Hydrofluoric Acid 20%	A	A	A	A	C			A	A	X			X	X	X	X
Hydrofluoric Acid 30%	A	A	A	A	C	A		A	A				X		X	
Hydrofluoric Acid 40%	C	A	A	B	C	A		A	A				X		X	
Hydrofluoric Acid 50%	C	A	A	X	X	B	A	A	A	C				X	X	X
Hydrofluoric Acid 65%	C		A					B	A	X			X		X	
Hydrofluoric Acid 75%	C	A	A	X	X	A		X	A	X	A	A	X	X	X	
Hydrofluosilic Acid	A	A	A	A	A	A		A	A	A	B	A	X	X	X	A
Hydrofluosilicic Acid 20%	A	A	A	A	A			A	A	B				X	X	X
Hydrogen Chl. Gas Dry		A				A					A	A	A		X	
Hydrogen Cyanide	A	A	A	A	A	A		A	A	B	A	B	A		C	
Hydrogen Fluoride	X	A		X	X	A					B	AB	AB		C	
Hydrogen Peroxide 10%	A	A	A	A	A	A				A				C	B	C
Hydrogen Peroxide 30%	A	C	A	A	A		A	B	A	X				B	B	B
Hydrogen Peroxide 5%	A	A	A	A	A	A		A	A						B	
Hydrogen Peroxide 50%	A	A	A	B	C	A		C	A	X					C	
Hydrogen Peroxide 90%	X	X	A	X	C	A		C	B	X					X	
Hydrogen Peroxide		A	A	A	A	A		B	A	C	A	AB	AB	B	B	B
Hydrogen Phosphide	A	A		X	C	A				C						
Hydrogen Sulf. (Aq. Sol.)	A	A	A	A	A			A	C	C				A	C	A

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CHEMICALS	CPVC	PP	PTFE	PVC	PVC-GF Fibertoc™	PVDF	Ultem® (GF 40%)	EPDM	FPM	Nitrile (Buna N)	Hastelloy® C	Monel®	18-8 SS	316 SS	416 SS	Titanium
Hydrogen Sulfide (Dry)	A	A	A	A	A	A		A	A	A	A	B	C	A	C	
Hydrogen Sulfide	A	A	A	A	A	A		A	A		A	BC	AB		C	
Hydrogen	A	A	A	A	A	A		A	A	A	A	A	A	A	A	
Hydroquinone	A	A	A	A	A	A		A	A	X	B	A	C			
Hydroxide Alum	A	A	A	A	C	A	A	A	C	A				A	A	A
Hydroxyacetic Acid 70%	A			A	A			A	A	A						B
Hydroxyacetic Acid	A								A	A						A
Hydroxylamine Sutfate	A	A		A	A	A		A								
Hypochlorous Acid	A	A	A	A	A	A		B	B	X	A		X	X		
Ink		A				A				A	A	AC	A	A		
Iodine Solution	A	C	A	X	X	A	A	A	A	C	A	A	B	X	X	A
Isobutyl Alcohol			A			A	A	A	A	B	A	A		A		A
Isooctane	A	A	A	A	A	A		X	A	A	A	A	A			
Isophorone	X			X	X			X	X		A					
Isopropyl Acetate			A					B	X	X	B	AB		B		
Isopropyl Alcohol	A	A	A	A	A	B		A	A	B	A	AB	AB	A		A
Isopropyl Ether	X	C	A	X	X	A		X	X	B	A	A		A		
Jet Fuel JP-3		A	A					X	A	A	A	A	A	A	A	
Jet Fuel JP-4	A	C	A	A	A	A		X	A	B	A	A	A	A	A	
Jet Fuel JP-5	A	C	A	A	A	A	A	X	A	A	A	A	A	A	A	
Kerosene	A	A	A	A	A	A	A	X	A	A	A	A	A	A	A	A
Ketones	X	A	A	X	X	A		C	X	X	A	A	A	A		A
Kraft Liquor	A	A		A	A	A										
Lacquer Thinner		B	A	C	C			A		X	A	A	A	A		A
Lacquer		A	A					X	X	X	A	A	A	A		
Lactic Acid	A	A	A	A	A	A	A	B	B	B	A	AB	A	A	C	B
Lard Oil	A	A	A	A	A	A		C	A							
Lard	A	A	A	A	A	A	A	C	A	A	A	AC	A	A	A	
Latex		A	A					B	A	B	A			A	A	
Lauric Acid	A	A	A	A	A	A										
Lauryl Chloride	A	A	A	A	A	A										
Lead Acetate	A	A	A	A	A	A		A	C	B	AB	A	B	B	B	A
Lead Chloride	A	A	A	A	A	A		A	A							
Lead Nitrate	A	A	A	A	A			A	A	A	B	B	C		B	
Lead Sulfate	A	A	A	A	A	A		A	A	A						
Lemon Oil	A	X	X	A	A	A						A				
Ligroin	X	C		X	X	A		C	A	A	A	A	A	A		
Lime - Sulfur Solution	A	A		A	A	A				X					B	

CHEMICALS	CPVC	PP	PTFE	PVC	PVC-GF Fibertoc™	PVDF	Ultem® (GF 40%)	EPDM	FPM	Nitrile (Buna N)	Hastelloy® C	Monel®	18-8 SS	316 SS	416 SS	Titanium
Lime	(See Calcium Oxide)															
Linoleic Acid	A	A	A	B	C	A		X	B	B	A	A	A		A	
Linseed Oil	A	A	A	A	A	A		B	A	A	A	A	A		A	
Lithium Bromide			A	A	A	A			A	A	AB	AB				
Lithium Chloride	A				A						AB	A	A		X	
LPG			A								A	A	A			
Lubricants		A	A	A	A			A	A					A	A	A
Lubricating Oil	A	A	A	A	A	A		A		A	A	A		A		
Lye Solution											A	A	A			
Machine Oil	A	A	A	A	A	A		A								
Magnesium Acetate			A					X	X							
Magnesium Carbonate	A	A	A	A	A	A		B	A	A	AB	A	AB	A	A	
Magnesium Chloride	A	A	A	A	A	A		A	A	A	A	A	X	B	B	A
Magnesium Citrate	A	A	A	A	A	A		A	A							
Magnesium Hydroxide	A	A	A	A	A	A		A	A		A	A	A			
Magnesium Nitrate	A	A	A	A	A	A		B	A	A	A	B	AB	A	A	A
Magnesium Oxide	A		A					A	A	A	A	AB		A	B	
Magnesium Sulfate (Epsom Salts)	A	A	A	A	A	A		C	A	A	A	A	A	A	A	A
Maleic Acid	A	A	A	A	A	A		C	A	X	A	AC	B	A	A	A
Maleic Anhydride									A	X	A					
Malic Acid	A	A	A	A	A	A		X	A	A	A	A	A	A	B	A
Manganese Sulfate	A	A	A	A	A			A	A	A	A	A				
Mash										A	A	A		A		
Mayonnaise		A	A						A	A	A	AC	A	A		
Melamine										C				X		
Mercuric Chloride	A	A	A	A	A	A		A	A	A	AB	X	X	X	X	A
Mercuric Cyanide	A	A	A	A	A	A		B	A	A	A	X	A	A	X	A
Mercuric Nitrate	A		A					A	A		A				A	
Mercuric Sulfate	A	A	A	A	A	A		A	A	A						
Mercurous Nitrate	A	A	A	A	A	A		A	A			X	A			
Mercury	A	A	A	A	A	A		A	A	A	A	B	A	A	A	B
Methacrylic Ac.Glacial				X												
Methane Sulfonic Ac.			A		A											
Methane	A	A	A	A	A	A		C	A	A	A	A	A		A	
Methanol (Methyl Alcohol)	X	A	A	A	A	A	A	A	X	A	A	A	AB	A		A
Methoxyethyl Oleate				A	A											
Methyl Cellosolve	X	A		X	X	A		B	X	X	A	A	AC			
Methyl Acetate	X	B	A	X	X	A		B	X	X		AB	A	A		

A = Excellent, no effect • B = Good, minor effect • C = Fair, data not conclusive, testing recommended • X = Not recommended.
Ratings are based on testing at an ambient temperature of 70°F. The chemical resistance table is for reference only. End users should test to determine application suitability.
Butterfly valves, Solenoid valves, Diaphragm valves and all other valves with elastomers fully exposed to process media should derate elastomer scores by one level (i.e. "B" becomes "C", "C" becomes "X").

Chemical Resistance Guide, *CONTINUED*

CHEMICALS	CPVC	PP	PTFE	PVC	PVC-GF (Fiberloc™)	PVDF	Ultem® (GF 40%)	EPDM	FPM	Nitrile (Buna N)	Hasteloy® C	Monel®	18-8 SS	316 SS	416 SS	Titanium
Methyl Acetone			A					X	X		AB	A	A			
Methyl Acrylate			A			A		B	X	X		AB	A	A			
Methyl Alcohol	X	A	A	A	A	A		A	X	A				A		A
Methyl Benzene	(See Toluene)															
Methyl Bromide	X	X	A	X	X	A		C	A	X	AB		A			
Methyl Butanol			A						B	A						
Methyl Butyl Ketone			A					B	X	X				A		
Methyl Chloride	X	X	A	X	X	A		C	C	C	A	A	A	A	B	A
Methyl Chloroform	X	C	A	X	X	A		X	B		A	C				
Methyl Ether			A					C	C	B	C	C	C			
Methyl Ethyl Ketone	X	C	A	X	X	X	C	A	X	X	A	A	A	A		A
Methyl Formate	X							A	X		AB		A			
Methyl Isobutyl Alcohol										X						
Methyl Isopropyl Ketone	X	B	A	X	X	A		C	X	X			A	A		
Methyl Isobutyl Carbinol			A					A	A							
Methyl Isobutyl Ketone	X	C	A	X	X	A		B	X	X				A		A
Methyl Methacrylate	X		A	A			C	X	X	X			C			
Methyl Propanol			A					B	A	A						
Methyl Salicylate	A	A		A	A	A										
Methyl Sulfate	A	A		B	C	A										
Methylamine	X	X	A	X	X	C		A		B				A		
Methylene Bromide				X	X	X										
Methylene Chloride	X	X	A	X	X	C		X	B	X	A	A	AC	A	B	A
Methylene Iodine			A	X	X	C			A							
Methylhexane			A					X	A	A						
Methylisobutyl Carb.	A	A		A	A	A		A	A							
Methylmethacrylate			A			A		X	X							
Methylsulfuric Acid	A	A	A	A	A	A										
Milk	A	A	A	A	A	A	B	A	A	A	A	BC	A	A	A	
Mineral Oil	A	A	A	B	A	A	A	X	A	A	A	A	A		A	
Molasses	A	A	A	A	A			C	A	A	A	A	A	A	A	
Monochlorobenzene		B	A			A		X	A		A	A	AB			
Monochlorocetic Acid	A	B	A	A	A	A		C	B		A	B			X	
Monoethanolamine	X		A	X	X	X		A	A	A	AB	A	A		A	
Morpholine			A								A			A		
Motor Oil	A	C	A	A	A	A	A	X	A	A	A	A				
Mustard	A	A		A	A				A	B	A	BC	A	A		
Naphtha	A	A	A	A	A	A	A	X	A	B	A	A	A	A	A	A
Naphthalene	X	B	A	X	X	A		X	B	X	A	A	B	B	A	A
Natural Gas	A	A		A	A	A		X	A	A	A	A	A			

CHEMICALS	CPVC	PP	PTFE	PVC	PVC-GF (Fiberloc™)	PVDF	Ultem® (GF 40%)	EPDM	FPM	Nitrile (Buna N)	Hasteloy® C	Monel®	18-8 SS	316 SS	416 SS	Titanium
Neon			A				A	A	A			A				
Nickel Acetate	A	A	A	A	A	A		A	X	B		A	C			
Nickel Chloride	A	A	A	A	A	A		A	A	B	A	AB	AC	B	X	A
Nickel Cyanide	A			A	A											
Nickel Nitrate	A	A	A	A	A	A		B	A	A	B	B	A		B	
Nickel Sulfate	A	A	A	A	A	A		A	A	A	AB	AB	A	C	B	
Nickel	A	A	A	A	A			A	A	A						
Nicotine Acid	A	A	A	A	A	A		A								
Nicotine	A	X	A	A	A	C										
Nitrate Alum	A	A	A	A	A	A		A	B	A					A	
Nitric Acid 10%	A	A	A	A	A	A	A	B	A	X	B	X	A	A	B	A
Nitric Acid 20%	A	A	A	A	A		A	X	A	X	B	X	A		B	
Nitric Acid 30%	A	A	A	A	A	B	A	B	A	X	B	X	A		B	
Nitric Acid 40%	A	C		A	A	B	A	X	A	X	B	X	A		C	
Nitric Acid 50%	A	C	A	A	A	B		X	A	X	B	X	A		X	
Nitric Acid 70%	A	X	A	X	X	X	A	X	C	X	B	X	A		X	
Nitric Acid Concentr.	A	X	A	X	X	X		X	C	X	B	X	A		C	
Nitric Acid Fuming	X	X		X	X	X									C	
Nitrobenzene	X	C	A	X	X	A	C	C	C	C	A	AB	B	B	B	A
Nitroethane			A			A		A	X				A			
Nitrogen Dioxide			A			A										
Nitrogen			A					A	A	A	A	A	A		A	
Nitroglycerine				X				A			A	A	A			
Nitromethane			A			A		B			A		A			
Nitrous Oxide	A	A	A	A	A	A		A	A	A	A	X	C			
Ocenol	A	X		A	A	A										
Octane			A			A		X	A							
Octyl Acid			A			A				C						
Octyl Alcohol									A	B	A		A	A		A
Octylamine			A						X	C						
Oils, Crude Sour	X														C	
Oils	X	A		A	A	A										
Oils, Aniline		A	A	X	X			B	A	X				A		A
Oils, Anise														A		
Oils, Bay									A					A		
Oils, Bone									A	A				A		
Oils, Castor				A				B	A	A				A		
Oils, Cinnamon				A					A					A		
Oils, Citric		A							A	A				A		
Oils, Clove		B								A				A		

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CHEMICALS	CPVC	PP	PTFE	PVC	PVC-GF (Fiberloc™)	PVDF	Ultem® (GF 40%)	EPDM	FPM	Nitrile (Buna N)	Hastelloy® C	Monel®	18-8 SS	316 SS	416 SS	Titanium
Oils, Coconut		A					A	A	A				A			
Oils, Cod Liver		A					A	A	A				A			
Oils, Corn	X	A					C	A	A				A			
Oils, Cotton Seed	X	A	A	A	A		C	A	A				A			
Oils, Creosote		X			X		X	A	B				A			
Oils, Diesel Fuel		A			A		X	A	A				A			
Oils, Fuel			A	A	A		X	A	B				A			A
Oils, Linseed	X	A		A	A		X	A	A				A			
Oils, Mineral		A		A	A		X	A	A	A	A	A	A	A		
Oils, Olive	X	A	A	A	A		B	A	A	A	A	A	A	A		
Oils, Pine	X		A	A	A		X	A	C		A	A	A			
Oils, Silicone		A			A			A	A				A			
Oils, Vegetable	X	A		A	A	A			A	A	A	A	A		A	
Oleic Acid	B	A	A	A	A	A	A	C	B	B	A	A	A	A	B	
Oleum	X	X	A	X	X	X		X	X	X				A		
Orange Extract		A	A			A										
Oxalic Acid	A	A	A	A	A	A		A	A	B	A	B	A	B	C	C
Oxychloride Alum	A	A		A	A	A			X							
Oxygen Gas	A	A	A	A	A	A		A	A	C	A	A	A			
Ozone	B	C		B	B	A		A	A	X	A	A	A			
Palmitic Acid 10%	A	A	A	A	A	A		B	A	A						
Palmitic Acid 70%	A	A	A	X				B	A	A						
Paraffin	A	A	A	A	A	A		X	B	A	A	A	A	A	A	
Pentane			A					X	A	A	A	A	A	C		
Peracetic Acid 40%	X	X	A	X	X	A		B	A							
Perchlorlc Acid 10%	A	A	A	A	A	A		B	A	X					B	
Perchlorlc Acid 70%	X	A	A	X	X	A	X	A	A	X					X	
Perchloroethylene	X	C	A	X	X	A		X	A	X	A	A	AB	A		
Perphosphate	A	A	A	A	A			A	A							
Petrolatum	A	A	A	A	A	A		C	A	A	A	A	A	A		
Petroleum (Sour)				A	A			X	A	A					C	
Petroleum Oils	A	B	A	A	A	A		X	A	A					A	
Phenols 100%	A	A	A	X	X	A	X	C	B	X	A	B	A	A		C
Phenylacetate			A					B	X	X						
Phenylhydrazine Hydrochl	A	X		X	X	A										
Phenylhydrazine	X	X	A	X	X	A		C	C	X						
Phosgene Gas	X	C		X	X	A		A	X	X						
Phosgene Liquid	X	X		X	X	C		A	X	X						

CHEMICALS	CPVC	PP	PTFE	PVC	PVC-GF (Fiberloc™)	PVDF	Ultem® (GF 40%)	EPDM	FPM	Nitrile (Buna N)	Hastelloy® C	Monel®	18-8 SS	316 SS	416 SS	Titanium
Phosphate Alum			A				A	A	A							
Phosphoric Acid 10%	A	A	A	A	A	A	A	A	C	A		A	A		B	
Phosphoric Acid 100%	A	A	A	A	A		B	A	X	A		A	B		B	
Phosphoric Acid 20%	A	A	A	A	A	A	A	A	C	A		A				
Phosphoric Acid 40%	A	A	A	A	A		B	A	X	A		A	A		A	
Phosphoric Acid 50%	A	A	A	A	A	A	A	A	C	A		A	B		B	
Phosphoric Acid 80%	A	A	A	A	A	A	A	A		A		AB				
Phosphoric Acid 85%	A	A	A	A	A	B	A	A	C	A		AB	B		C	
Phosphoric Acid Crude			A				B	A	C				C		C	
Phosphorous Oxychloride			A									X				
Phosphorous Red	A	A	A	A	A	A										
Phosphorous Trichloride	X	C	A	X	X	A	C	C	X	A	A	A	A			
Phosphorous Yellow	A	A	A	A	A	A										
Photographic Developer	A	A		A	A	A		A	A	A	A	C	A		A	
Photographic Solutions	A	A	A	A	A	A		A	A	AB	AC	C				
Phthalic Acid	X	X	A	X	X	A	A	A		A	X	C		B		
Phthalic Anhydride	X	X	A	X	X		A	A	C	A	A	B	B	A		
Pickle Brine	A	A		A	A	A										
Pickling Solutions	A	A	A	A	A	A	C	B	X							
Picric Acid	C	A	A	X	X	A	C	A	B	B	X	AB	A	B		
Plating Solutions, Antimony	A	A	A	A	A			A	A	A	A		A		A	
Plating Solutions, Arsenic	A	A		A	A			A	A	A			A		A	
Plating Solutions, Brass	A	A	A	A	A	A	A	A	A	A			A		A	
Plating Solutions, Bronze	A	A	A	A	A			A	A	A			A		A	
Plating Solutions, Cadmium	A	C	A	A	A	A	A	A	A	A			A		A	
Plating Solutions, Chrome	A	C	A	A	A	A	B	C	X	X	C		C	A	A	
Plating Solutions, Copper	A	A	A	A	A	A	A	A	A	A			X		A	
Plating Solutions, Gold	A	C	A	A	A	A	A	A	A	A			C		A	
Plating Solutions, Iron	A	C	A	X	X			A	A	A			C		A	
Plating Solutions, Lead	A	A	A	A	A	A	A	A	B	A	A		C		X	
Plating Solutions, Indium	A	A	A	A	A			A	A				C		A	
Plating Solutions, Nickel	A	A	A	A	A	A	A	A	A	A			C		A	
Plating Solutions, Rhodium	A	A	A	A	A	A	A	A	A				X		X	
Plating Solutions, Silver	A	A	A	A	A	A	A	A	A	A			A		A	
Plating Solutions, Tin	A	A	A	A	A	A	A	A	B	A	A		C		X	
Plating Solutions, Zinc	A	A	A	A	A	A	A	A	A	A			X		A	
Polyethylene Glycol	A	A	A	A	A	A	A	A	A							
Polyvinyl Acetate Emul			A			A	A	A								

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Ratings are based on testing at an ambient temperature of 70°F. The chemical resistance table is for reference only. End users should test to determine application suitability.
Butterfly valves, Solenoid valves, Diaphragm valves and all other valves with elastomers fully exposed to process media should derate elastomer scores by one level (i.e. "B" becomes "C", "C" becomes "X").

Chemical Resistance Guide, *CONTINUED*

CHEMICALS	CPVC	PP	PTFE	PVC	PVC-GF (Fiberloc™)	PVDF	Ultem® (GF 40%)	EPDM	FPM	Nitrile (Buna N)	Hastelloy® C	Monel®	18-8 SS	316 SS	416 SS	Titanium
Polyvinyl Alcohol	X	A	A	A	A	A		A	A							
Potash	A	A	A	A	A	A		B	C	C				A		
Potassium Acetate	A	A	A	A	A	A		A	X	B		A	C			
Potassium Alum	A	A	A	A	A	A		A	A	A					X	
Potassium Bichromate	A	A	A	A	A	A		A	A	A		AC	AB		B	
Potassium Bisulfate	A	A	A	A	A	A		A	A	A	A					
Potassium Bromate	A	A	A	A	A	A		A	A	A		A				
Potassium Bromide	A	A	A	A	A	A		A	A	A	A	A	AC	B	B	A
Potassium Carbonate	A	A	A	A	A	A	A	A	A	B	AB	A	AB	A	B	A
Potassium Chlorate	A	A	A	A	A	A		A	A	A	AC		AB	A	B	A
Potassium Chloride	A	A	A	A	A	A		A	A	A	A	AB	C	A	B	A
Potassium Chromate	A	A	A	A	A	A		A	A	A	A	A	C	B	B	
Potassium Coppercyanide	A	A	A	A	A	A		A	A							
Potassium Cyanide	A	A	A	A	A	A		A	B	A	B	B	AC	B	B	A
Potassium Dichromate	A	A	A	A	A	A		A	A	A				A	B	A
Potassium Ferricyanide	A	A	A	A	A	A		A	A	A	A	BC	AC		A	
Potassium Ferrocyanide	A	A	A	A	A	A		A	A	C	B	AC	B		A	
Potassium Fluoride	A	A	A	A	A	A		A	A	A		A				
Potassium Hydroxide 25%	A				A						A	A	A			
Potassium Hydroxide 50%	A	A		A	A	B					A	A	A			
Potassium Hydroxide	A	A	A	A	A	A	A	B	C	C	AB	A	A	C	B	C
Potassium Hypochlorite	A	A	A	A	A	A		A	A	X	B	X	X		X	
Potassium Iodide	A	A	A	A	A	A		A	A	A	A	AB	A		A	
Potassium Nitrate	A	A	A	A	A	A		A	B	A	AB		A	B	B	A
Potassium Perborate	A	A	A	A	A	A										
Potassium Perchlorate	A	A	A	A	A			A								
Potassium Permanganate	A	B	A	A	A	A		A	B	C	B	AC	AC	B	B	B
Potassium Persulfate	A	A	A	A	A	A		A			A	X				
Potassium Phosphate	A									A						
Potassium Salts		A	A			A		A	A							
Potassium Sulfate	A	A	A	A	A	A		A	A	A	A	A	AB	B	B	A
Potassium Sulfide	A		A	A	A			A	A	A	AB		A		B	
Potassium Thiosulfate			A						A	A						
Potossium Bicarbonate	A	A	A	A	A	A		A	A	A				B	B	A
Propane	A	B	A	A	A	A		X	A	A	A	A	A	A	A	
Propargyl Alcohol	A	A		A	A	A										
Propyl Acetate			A			A		B	X	X		A				
Propyl Alcohol (Propanol)	A	A	A	A	A	A		A	A	A	A	A	A	A	A	A
Propylene Dichloride	X	C	A	X	X	A		X	B	X		A	C			
Propylene Glycol	C		A				A	A	A	A	B	B	AB	A		

CHEMICALS	CPVC	PP	PTFE	PVC	PVC-GF (Fiberloc™)	PVDF	Ultem® (GF 40%)	EPDM	FPM	Nitrile (Buna N)	Hastelloy® C	Monel®	18-8 SS	316 SS	416 SS	Titanium
Propylene			A				X	A	X			A				
Pyridine	X	C	B	X	X	C	X	C	X	X	A	A	B	C	B	
Pyrogallic Acid			A	B	C	X		A	A	AB	AB	AB	A	B		
Rayon Coagulating Bath	A	A		A	A	A										
Rhodan Salts	A	A	A	A	A	A		A	A							
Rosins		A	A					A	A				A	B		
Rum		A	A	A	A		A	B	A							
Rust Inhibitors		A						A	A				A			
Salad Dressings		A		A	A			A	A				A			
Salicylaldehyde			A	X	X	C	X	A	A							
Salicylic Acid			A	A	A	A	A	A	C	A	AB	A		B		
Saline Solutions	A	A		A	A	A										
Salt Brine	A	A	A	A	A	A		A	A	A	A	A				
Sea Water	A	A	A	A	A	A		A	A	A	A	B	AB	C	C	A
Selenic Acid	A	A		A	A	A										
Sewage	A	A	A	A	A	A		A	A	A	A	A	A			
Shellac Orange		A	A						A							
Shellac Bleached		A	A						A					A	A	
Silicic Acid	A	A	A	A	A	A		A	A							
Silicone Oil	A	A	A	A	A			A	A	A	A	A	A	A		
Silver Bromide										A	B	X	C	X		
Silver Cyanide	A	A	A	A	A	A		A	A		A	AB	A		A	
Silver Nitrate	A	A	A	A	A	A		C	A	C	AB	X	B	B	B	A
Silver Salts		A	A	A	A	A		A	A					A		
Silver Sulfate	A	A	A	A	A	A		A	A	C						A
Soap Solutions	A	A	A	A	A	A		A	A	A	A	A	A	A	A	A
Soda Ash			A					A	A	A						
Sodium Acetate	A	A	A	A	A	A		A	C	C	A	A	AB	B	B	A
Sodium Aluminate	A	A	A	A	A	A		A	A	A	AB	AB	AB	A	C	B
Sodium Benzoate	A	A	A	A	A	A					A	AB				
Sodium Bicarbonate	A	A	A	A	A	A		A	A	A	A	A	A	A	A	A
Sodium Bichromate	A	A	A	A	A	A		A	A		B		AC		B	
Sodium Bisulfate	A	A	A	A	A	A		A	A	B	B	AB	X	A	A	A
Sodium Bisulfite	A	A	A	A	A	A		A	A	A	B	B	C	A	C	A
Sodium Borate	A	A	A	C	C	A		A	A	A	A	AB	A		A	
Sodium Bromide	A	A	A	A	A	A		A	A		AB	AC	A		C	
Sodium Carbonate	A	A	A	A	A	A		A	A	A	A	A	A	A		A
Sodium Chlorate	A	A	A	A	A	A		A	A	C	A	X	BC	B	B	A
Sodium Chloride	A	A	A	A	A	A		A	A	A	A	A	A	C	B	A
Sodium Chlorite	X	X	B	X	X			X	X							

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Sodium Chromate	A	A	A						B	A	A	AB	AC	A	B	
Sodium Cyanide	A	A	A	A	A	A		A	A	A	A	X	A	A	A	A
Sodium Dichromate	A	A	A	A	A	A		A	A							
Sodium Ferricyanide	A	A	A	A	A	A		A	A		A	AC	C		B	
Sodium Ferrocyanide	A	A	A	A	A	A		A	A		A	A				
Sodium Fluoride	A	A	A	A	A	A		A	B	C	A	A	B		C	A
Sodium Hydrosulfide											A	A				
Sodium Hydrosulfite			A	C					A		A	A				
Sodium Hydroxide 15%	A	A	A	A	A	A	A	A	C	A	A			B	B	A
Sodium Hydroxide 20%	A	A	A	A	A	A		A	C	A	A			B	B	A
Sodium Hydroxide 30%	A	A	A	A	A	A		A	C		A			B	B	
Sodium Hydroxide 50%	A	A	A	A	A	A		A	C	X	A			B	C	A
Sodium Hydroxide 70%	A	B	A	A	A	B		A	X	X	A				X	A
Sodium Hydroxide Conc	A	A	A	A	A	A		A	B	X	A	AB	A		C	
Sodium Hypochlorite 20%	A	C	A	A	A	A		X	A	C	A			C		A
Sodium Hypochlorite 5% (Bleach)	A	C	A	A	A	A	A	B	A	X	AB	X	X	B	X	AC
Sodium Hypochlorite	A	C	A	A	A	A	A	X	X	X	AB	X	X		X	
Sodium Hyposulfate			A											A		
Sodium Metaphosphate	A	C	A	A	A	A		A	A	A		A	A	A		
Sodium Metasilicate	A	A	A	A	A	A		A	A	A	A	A	A	A	A	
Sodium Nitrate	A	A	A	A	A	A		A	B	C	AB	B	A	B	B	A
Sodium Nitrite	A	A	A	A	A	A		A	A		AC	BC	A	B		
Sodium Palmitrate	A	A	A	A	A	A										
Sodium Perborate	A	A	A	A	A	A		A	A	C	A	A	AB	C	B	
Sodium Perchlorate	A	A	A	A	A	A					B	A				
Sodium Peroxide	A	A	A	A	A	A		B	A	C	AB	AC	A	A	A	
Sodium Phosphate Acid	A	A	A	A	A	A		A	A	A	A	A	B			
Sodium Phosphate Alkaline	A	A	A	A	A	A		A	A	A	A	A	A			
Sodium Phosphate Neutral	A	A	A	A	A	A		A	A	A	A	AB	AC			
Sodium Polyphosphate			A					A	A	B				A		A
Sodium Silicate	A	A		A	A	A		A	A	A	A	A	AB	B	B	A
Sodium Sulfate	A	A	A	A	A	A		A	A	A	A	A	A	B	B	A
Sodium Sulfide	A	A	A	A	A	A		A	A	C	A	AB	AC	B	X	A
Sodium Sulfite	A	A	A	A	A	A		A	A	A	A	B	A	C	B	A
Sodium Tetraborate				A					A	A	A	AB	A	A	A	
Sodium Thiocyanate	A	A	A	A	A	A		A	A							
Sodium Thiosulfate	A	A	A	A	A	A		A	A	B	A	AB	A	A	A	
Sodium	A	A	A	A	A	A		A	A							

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Sorghum									A	A				A		
Soy Sauce									A	A				A		
Soybean Oil	A	A	A	A	A	A		A	A		A	AB	A			
Stannic Chloride	A	A	A	A	A	A		A	A	A	AB	X	X	A	X	A
Stannic Salts		A	A	A	A	A		A	A							
Stannous Chloride	A	A	A	A	A	A		B	B	C	B	C	X	C	C	A
Starch	A	A	A	A	A			A	A	A		A	AB	A		
Stearic Acid	A	B	A	A	A	A		C	A	B	A	A	A	B	B	A
Stoddard Solvent	X	C	A	X	X	A		X	A	B	A	A	A	A		A
Styrene			A			A		X	C	X		AC	A	A		
Succinic Acid	A	A	A	A	A	A		A	A		A	AC	B			
Sugar Solutions	A	A	A						A	A				A	A	
Sulfamic Acid	X	X		X	X	X					B					
Sulfate Liquors	A	A		A	A	A		A	A	A	A	B	X	C	A	
Sulfated Detergents	A	A		A	A	A										
Sulfite Liquor	A	A	A	A	A	A		A	A	B	A	C	C		X	
Sulfur 10%	A	A	A	A	A			X	A	C	A		A	C		A
Sulfur Chloride	A	C	A	A	A	A		X	A	X	A	C	X	X	C	
Sulfur Dioxide Dry	A	A	A	A	A	A		A	A	X	B		A	B	B	
Sulfur Dioxide Wet	A	A	A	X	X	A		A	A	X	AC	X	A		B	
Sulfur Dioxide		X	A	X	C			A	C	X				A		A
Sulfur Slurries	A	A		A	A	A										
Sulfur Trioxide Dry	C	X	B	C	C	X		C	C	C		AB	A	C	B	
Sulfur	A	X	A	A	A	A		C	A	C	A		BC		A	
Sulfuric Acid 10%	A	A	A	A	A	A	A	B	A	C				C	X	A
Sulfuric Acid 100%	A	X	B	X	X	C		X	C	X				C	C	X
Sulfuric Acid 30%	A	A	A	A	A	A		A	A	C				X	X	C
Sulfuric Acid 50%	A	A	A	A	A	A		B	A	C				X	X	C
Sulfuric Acid 60%	A	A	A	A	A	B		B	A	X				X	X	C
Sulfuric Acid 70%	A	C	A	A	A	A		A	A	C				X	X	C
Sulfuric Acid 80%	A	A	A	X	X	A		A	A	C				X	X	X
Sulfuric Acid 90%	A	C	A	X	X	A		A	A	C				X	X	X
Sulfuric Acid 95%	A	X	A	X	X	A	X	X	A	X				X	X	X
Sulfuric Acid 98%	A	X	B	X	X	A		X	X					X	X	
Sulfurous Acid	A	A	A	A	A	A		C	A	X	B	X	BC	B	C	A
Sulfuryl Chloride			A	A												
Syrup		A	A	A	A				A	A				A		
Tall Oil	A	A	A	A	A	A		X	A	A	A	A	C		X	

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Tallow		A	A			A		A	A	A		B	A	A		
Tannic Acid	A	A	A	A	A	A		B	A	C	A	A	AC	C	B	A
Tanning Liquors	A	A	A	A	A	A		B	A	C	A			A		A
Tar	X	B	A	X	X	A		X	A	C	A	A	A		B	
Tartaric Acid	A	A	A	A	A	A		B	A	C	A	A	A	B	B	A
Tertiary Butyl Alcohol	A	A	A	A	A	A		B	A							
Tetrachlorethane		A	A	X	X			X	A	X	A	A	AB	A		A
Tetrachloroethane			A		X	A		X	A		A	A	A			
Tetraethyl Lead	A	A	A	B	C	A		X	B	C		A				
Tetrahydrofuron	X	B	A	X	X	B	X	X	X	X	A	B		A		
Tetralin	X	X	A	X	X	A		X	A	X						
Thionylchloride	X	X	A	X	X	X										
Thread Cutting Oils	A	A		A	A	A		X			A		A			
Titanium Tetrachloride	X	X	A	X	X	X		X	A	C	A	B	A			
Titanous Sulfate	A	A	A	A	A	A										
Toluene (Toluol)	X	C	A	X	X	B	C	X	C	X	A	A	A	A	A	A
Tomato Juice	A	C	A	A	A	A		A		A	A	AB	A	A	C	
Toxaphene-Xylene	X	X		X	X	A										
Transformer Oil	A	A	A	A	A	A		X	A	A	A	A	A			
Tributyl Phosphate	X	C	A	X	X	A		A	X	X						
Trichloroacetic Acid	A	C	A	A	A	A		X	X	X	A	BC	X	X	X	
Trichloroethane			A		X		X	X	A	X	A	C		A		A
Trichloroethylene	X	B	A	X	X	A	X	X	A	C	A	B	A	A	A	B
Trichloropropane			A		X				A	A	A	A	A	A	A	
Tricresyl Phosphate			A	X	X			A	B	X	A		A	A		B
Triethanolamine		C		B	C	C		A	X		A	A	A			
Triethyl Phosphate	A	A	A	A	A	A	C	A	A					A		
Triethylamine	A	X		A	A	C	A		A	A		A	A			
Trimethylpropane	A	A	A	A	A	A										
Trisodium Phosphate	A	A	A	A	A	A		A	A	A				A	B	
Turbine Oil	A	B	A	A	A			X	A	B			A			
Turpentine	A	B	A	X		A	A	C	A	C	A	AB	AB	A	B	
Urea	A	A	A	A	A	A	A	A	A	C	A					
Urine	A	A	A	A	A	A		A	A	A		A		A		

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Vanilla Extract		A	A		A											
Varnish		A	A			A		X	A	B	A	A	A	A	A	
Vaseline	A	A	A	X	X	A		X	A	A	A	A	A			
Vegetable Oil	C	A	A	A	A	A		A	A	A	A	A	A	A		
Vinegar	A	A	A	A	A	A	A	A	A	C	A	A	A	A	A	A
Vinyl Acetate	X		A	X	X	A	X	B	X	X	A		AC			
Vinyl Chloride			A					C	A	X	A	B	B		A	
Vinyl Ether			A						X	B						
Water Potable	A	A	A	A	A	A		A	A	A	A	A	A	A	A	
Water Salt	A	A	A	A	A	A		A	A	A	A	B	AB	A	C	
Water Sewage	A	A	A	A	A	A		A	A	A						
Water, Acid Mine	A	A	A	A	A	A		A	A	A	A			A	C	
Water, Deionized	A	A	A	A	A	A		A	B	A	A	A	A	A		
Water, Demineralized	A	A		A	A	A		A	A	A	A	A	A			
Water, Distilled	A	A	A	A	A	A		A	A	A	A	A	A	A	A	
Weed Killers									A	B				A		
Whey									A	A				A		
Whiskey	A	A	A	A	A	A		A	A	A	A	AB	A	A		
White Acid			A			A										
White Liquor	A	A	A	A	A	A		A	A	B	A	A		A		
Wines	A	A	A	A	A	A		A	A	A	A	AB	A	A	C	
Xenon			A					A	A	A			A			
Xylene	X	X	A	X	X	A	X	X	B	X	A	A	A	A		
Xylol	X	X	A	X	X	A		X	A	C						
Yeast		A	A			A		A	A							
Zeolite			A					A	A	B						
Zinc Acetate	A	A	A	A	A	A		A	C	B		A				
Zinc Carbonate	A		A						A	A	B	B	C		B	
Zinc Chloride	A	A	A	A	A	A	A	A	A	A	A	B	X	B	C	A
Zinc Chromate			A													
Zinc Nitrate	A	A	A	A	A	A		A	A							
Zinc Salts		A	A		A	A		A	A	A						
Zinc Sulfate	A	A	A	A	A	A		A	A	A	A	A	B	A	A	A
Zirilite			A					A	C	B						

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Engineering Terminology

ABRASION RESISTANCE
Ability to withstand the repeated action of rubbing, scratching, wearing, etc.

ADHESIVE
A substance capable of holding two or more objects together by attaching to their surfaces.

AGING
The effect of exposing plastic to a specific environment for an extended period of time.

ANNEAL
A procedure for preventing or removing stresses within a material through the use of controlled heating and subsequent cooling of the material.

BOND
To attach two or more objects by means of an adhesive.

BURST STRENGTH
The hydraulic pressure required to cause a pipe, fitting or vessel to fail. This value is typically dependent on the rate at which the pressure is applied as well as the pressure duration.

CALENDARING
A process by which sheet material (esp. rubber or plastic) is passed between sets of rollers to produce a specific thickness or finish. In certain applications this process may be used to combine two or more dissimilar sheet materials (e.g. cloth and rubber) to produce a single multi-layered sheet.

CEMENT
Any of a variety of solutions commonly used in the plastics industry for bonding objects. The solution either dissolves or softens the common surfaces of the objects such that they may be fused together.

CHEMICAL RESISTANCE
The degree to which a given plastic will resist degradation due to contact with certain chemicals. This characteristic will usually vary with chemical concentration and temperature.

COLD FLOW
The deformation of a material attributed to forces or pressures acting at ambient temperatures.

COMPLETE TURBULENT FLOW
Pipe fluid flow characterized by a constant friction factor for increasing Reynolds Number.

COMPRESSION SET
Unrecoverable deformation (strain) that remains in a material after compressive loading has been removed.

CREEP
The elongation a material undergoes when subjected to a force or pressure loading. This elongation is in addition to the initial elastic elongation and will increase over time provided the loading is maintained.

CRITICAL FLOW
Fluid flow characterized by a Reynolds Number typically between 2000 and 4000. Flow in this region is neither laminar nor turbulent.

DEFLECTION TEMPERATURE
The temperature at which a plastic structure will deflect a specific distance for a given loading. Standardized conditions for this test may be found in ASTM D 648.

DELAMINATION
Separation in the layers of material.

DEGRADATION
A deleterious change in the chemical composition, appearance, physical or mechanical properties of a plastic.

DENSITY
The mass per unit volume of a substance. For solids and liquids, typically, temperature would also be provided with density. For gasses, both temperature and pressure should be given with the density.

DIMENSIONAL STABILITY
The ability of a part to retain its size and proportion over time.

DUROMETER
A numerical scale for measuring the hardness of rubber or plastic based on the depth of penetration of an indenter point on the surface of a test specimen.

ELASTICITY
The property that describes the tendency of a plastic material to return to its original dimensions after undergoing a deformation.

ELASTOMER
A material that exhibits almost complete recovery to its original size after undergoing dramatic strain levels (as high as 100% and sometimes more).

ENVIRONMENTAL STRESS CRACKING
The tendency of a material to craze and/or crack due to the combination of residual or applied stress in the material and chemical, thermal or electromagnetic environments.

FILLER
A substance added to plastic to alter its properties.

FRICTION FACTOR
A quantity that relates the head loss to the fluid velocity for a fluid flowing through a specific diameter and length of pipe.

FUSE
To join two or more plastic parts by the action of heat or solvents.

FULL PORT VALVE
A valve in which the resistance to flow, in the fully open position, is comparable to the equivalent length of pipe.

GASKET
A device installed within the gap of a joint for the purpose of retaining a fluid.

HEAD
A unit of measure representing the relative energy of a flowing fluid. Commonly recorded in "feet" of fluid, it provides a convenient means of combining the pressure, velocity and elevation energy portions of a flowing fluid.

HEAD LOSS
Energy loss in a fluid as it passes through a flow passage. The loss is due to friction between fluid particles and can be expressed as a linear change in the height of a column of fluid.

HOOP STRESS
The circumferential stress in a cylindrical shell due to internal or external pressure.

HOT STAMP
Process for marking plastic by applying roll leaf to the surface through the use of hot metal dies.

IMPACT STRENGTH
The degree to which a plastic will withstand the sudden application of a load.

IMPERMEABLE
Describes a material that prevents the passage of a substance into or through it.

LAMINATE
Object composed of two or more sheets or shells of material unitized by means of a bonding agent.

LAMINAR FLOW
Fluid flow characterized by a Reynolds Number typically less than 2000.

LIGHT STABILITY
Degree to which a plastic will resist degradation due to light exposure (especially ultraviolet).

MODULUS OF ELASTICITY
The ratio of applied stress to the associated strain developed within a material that has been elastically deformed.

NEWTONIAN FLUID
A fluid for which the ratio of the shear stress to the shear rate is equivalent to the absolute viscosity.

NOZZLE
A fluid flow passage characterized by a rapid transition from a large cross sectional area to a small cross sectional area.

OPERATING PRESSURE RANGE
The range of pressures for which the component will perform normally.

PLASTIC DEFORMATION
Unrecoverable deformation due to stresses beyond the yield strength of the material.

POISE
Unit of measure for absolute viscosity with dimensions of gram per centimeter per second. A one poise fluid would require a force of one dyne to move a one square centimeter layer at a velocity of one centimeter per second relative to a second parallel layer one centimeter away.

POROSITY
The presence of voids within an object.

PRESSURE DROP
Energy loss in a fluid as it passes through a flow passage. The loss is due to friction between fluid particles and can be measured as a decrease in pressure in the direction of flow.

RELATIVE ROUGHNESS
The ratio between the experimentally determined roughness to the pipe I.D.

REYNOLDS NUMBER
A dimensionless ratio of inertial to viscous forces for a fluid flowing through a conduit.

ROUGHNESS
An experimentally determined length that characterizes the degree to which the surface finish of a pipe tends to resist the motion of a fluid.

RUBBER
Polymers that can endure dramatic strain levels and still be able to return to their original form.

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Engineering Terminology, *CONTINUED*

SOLVENT
A substance that is capable of dissolving another material.

SCHEDULE
A system of pipe sizes that provides for standardized outside diameters and wall thicknesses.

SPECIFIC GRAVITY
The ratio of the weight density of a substance (solid or liquid) at a specific temperature and the weight density of water at 600°F. For solids and liquids the effect of pressure on the weight density of a substance is typically negligible, however, temperature usually has a more significant effect.

SPRING RATE
The force per unit deflection for a given object (especially a spring).

STRESS
The internal force per unit area that resists deformation due to applied external forces.

STRESS CRACKS
Cracks that form on the inside or outside of an object and are attributable to tensile stresses below the short term mechanical strength of the material.

STRAIN
The ratio of the change in dimension of an object, due to external loading and the original undeformed dimension.

THERMOPLASTIC
Material which when heated becomes sufficiently pliable that it can be formed into a variety of shapes and then quickly hardened by cooling.

TRANSITIONAL FLOW
Fluid flow region between critical flow and complete turbulent flow.

TURBULENT FLOW
Fluid flow region that encompasses transitional flow and complete turbulent flow. Typically it begins at a Reynolds Number greater than 4000.

VENTURI
A fluid flow passage characterized by smooth transitions from a large cross sectional area to a small cross sectional area, and back to a large cross sectional area.

VIRGIN MATERIAL
Plastic material that has not undergone any processing other than that required to prepare it for manufacturing parts.

VISCOSITY
The property of a fluid that describes its resistance to flow. It is due to shear stresses that result from friction between fluid particles.

WATER HAMMER
A phenomenon whereby a pressure shock wave is generated, due to a sudden change in fluid velocity within a piping system. The resulting pressure pulses can be significantly higher than the nominal working pressure of the system.

WEEPING
A very low leakage rate evidenced by the appearance of fluid at a pipe joint or fitting.

WEIGHT DENSITY
The weight per unit volume at a substance. For solids and liquids, typically, temperature would also be provided with density. For gasses, both temperature and pressure should be given with the density.

Glossary of Actuation Terms

AUTOMATIC RESET
(Electric) A component of the thermal overload device that permits it to automatically engage when the temperature falls to an acceptable level.

AMPERAGE RATING AUXILIARY LIMIT SWITCH
The maximum current carrying capacity of the extra limit switches contained within the actuator housing.

CONDUIT ENTRY, SIZE NPT
The electrical entrance into the housing of the actuator through which the operating wires are connected. The exterior of the entrance hole is usually tapped with an NPT thread (National Pipe Thread).

CONSTANT TORQUE OUTPUT
(Pneumatic) The torque in inch pounds developed by a double acting pneumatic rack and pinion or vane type actuator as measured at the beginning and end of a stroke or at any point in between.

CYCLE TIME
The time required for an actuator to rotate one complete cycle (typically 90° or 180°), expressed in seconds.

DESIGN TYPE
The basic design type of the actuator in terms of the method used to deliver rotational torque to the output shaft.

DIRECT MOUNTING
A method used to attach a valve to an actuator, being coupled without the use of separate bracketry or special mounting hardware.

DISCRETE MOUNTING BRACKET
A method used to attach a valve to an actuator, being a separate part from either the valve, actuator or both.

DPDT
Double Pole, Double Throw.

DUTY CYCLE
(Electric) The ratio of actual motor run time as compared to 100%. (Example: an actuator with a 20% duty cycle, having a required run time of 5 seconds to rotate 90°, would require an off time of 25 seconds before it can be cycled another 90°).

EMF
Electro-Magnetic Force.

ENCLOSURE MATERIALS (TOP AND BOTTOM)
Material of construction of the actuator base (bottom) and cover (top).

END OF STROKE TRAVEL STOPS (ADJUSTABLE)
A mechanical component on the actuator that can be adjusted to position the valve either open or closed.

EXTERIOR FINISH
The exterior coating or finish used to protect the actuator housing from corrosion.

EXTERNAL HARDWARE
The materials of construction of the fasteners and/or other hardware used to assemble the actuator components.

FEMALE OUTPUT SHAFT
The output drive of the actuator having a recessed opening into which the valve stem or coupling shaft fits.

HIGH AMBIENT LIMIT
The maximum operating temperature of the actuator, as designated by the actuator manufacturer.

HYSTERESIS
The cumulative rotational twist resulting from the “take-up” of clearances between the fitting dimensions of the ball, stem, coupling and actuator mechanism.

INTEGRAL MOUNTING BRACKET
A method used to attach a valve to an actuator, being a part of either the valve, actuator or both.

INTERNAL AIR PORTING
The high pressure (100 PSI) air passages contained within the actuator that shuttle the air pressure to either side of the torque producing components.

LOW AMBIENT LIMIT (°F)
The minimum operating temperature of the actuator as set by the actuator’s manufacturer, expressed in degrees Fahrenheit.

LOW AMBIENT LIMIT W/OUT “T” (HEATER AND THERMOSTAT)
The minimum operating temperature of the actuator, as designated by the actuator manufacturer without the use of a heater and thermostat.

MALE OUTPUT SHAFT
The output drive of the actuator consisting of an externally protruding shaft.

MANUAL OVERRIDE, (DE-CLUTCHING)
(Electric) An actuator component that allows mechanical turning of the valve, while simultaneously disengaging the gear train.

MANUAL OVERRIDE
An actuator component that allows mechanical turning of the valve.

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Glossary of Actuation Terms, *CONTINUED*

MAXIMUM OPERATING PRESSURE (PSI)
(Pneumatic) The pressure limitation established as the maximum safe operating pressure.

MOTOR BRAKE/MECHANICAL BRAKE (STANDARD ON BUTTERFLY VALVES)
(Electric) A mechanical device that is designed to apply a force to a motor shaft to prevent back drive of the actuator geartrain resulting from hydraulic pressure transfer of the process fluid through the valve.

MIN / MAX WIRE SIZE
The minimum and maximum wire size that the actuator requires or that will fit into the actuator's terminal connections.

MODULATING SERVICE
The ability of the actuator to be used in systems that require continuous control, typically with a positioner.

MOTOR DRIVE ROTATION
(Electric) The rotation of the actuator output shaft in either one direction (uni-directional) or two directions (reversing).

MOTOR SWITCHES (SPDT)
(Electric) The switches that control the motor's starting and stopping. (SPDT means Single Pole Double Throw).

MOTOR THERMAL PROTECTOR
(Electric) A device that protects the motor against overheating and subsequent burn-out due to (typically a 120 VAC 25% duty cycle motor is protected at 100°C) heat buildup resulting from excessive starting, stopping or continuous running.

MOUNTING POSITION
The ability of the valve/actuator to be physically mounted in the piping system.

NEMA RATING (AVAILABLE)
1, 4, 4X, 7, 9 National Electrical Manufacturers Association Rating.

NUMBER OF PISTONS
(Pneumatic) The number of torque producing surfaces within the actuator.

PERMANENT LUBRICATION
A type of lubrication sealed within the actuator to prolong cycle life.

PISTON SEALING MATERIAL
(Pneumatic) The type of elastomer used to maintain an airtight seal between the piston and the cylinder.

POSITION INDICATOR WITH LED
Light emitting diodes which, when illuminated, indicate visual confirmation of the valve's position in terms of open or closed.

POSITION INDICATOR
A mechanical or electrical device that allows visual confirmation of the valve's position in terms of open or closed (e.g., Red = "closed" or Green = "open").

PREWIRED TO TERMINAL STRIP
Internal component wire leads or printed circuit board connector pins which terminate at a terminal strip to which field wiring can be attached.

REVERSING
The output shaft of the actuator rotates in both CW and CCW directions.

SELF-LOCKING GEAR TRAIN
(Electric) Design of an actuator gear train that locks the actuator output shaft, thus preventing valve rotation.

SPDT
Single Pole, Double Throw.

SPRING CONFIGURATION (QTY/TYPE)
(Pneumatic) The quantity and design configuration of the springs used within a pneumatic actuator that affect the spring return (fail-safe) function.

STANDARD VOLTAGE (AC)
Unless otherwise specified, the voltage of all electrical devices in this catalog will be considered to be 115 / 120 VAC/60 Hz. All ratings, performance or specifications are based on standard voltage.

START/FINISH TORQUE
(Pneumatic) The torque in inch pounds, as measured at the actuator output shaft of a pneumatic actuator containing a spring return feature. The torque developed at the beginning of the stroke when the spring is fully compressed (START) and the torque at the end of the stroke (FINISH) when the spring has dissipated its stored energy.

START/STALL TORQUE:
(Electric) The torque in inch pounds, as measured at the actuator output shaft at the instant of the start of rotation, and at maximum stall when the motor is restricted from rotation while energized.

TWO STAGE SHUT-OFF (DRIBBLE CONTROL)
The closing of the valve in two, or more, distinct motions. The first movement, partially closing such that the remaining flow is small. The second movement, fully closing the valve.

UNI-DIRECTIONAL
The output shaft of the actuator rotates in only CW direction, as viewed from the top of the actuator.

UNIFORM BEARING LOAD DISTRIBUTION
The design of the torque producing components to be supported by bearing surfaces that allow high cycle life.

VOLTAGE VARIATIONS
The variations of optional voltages available for all products offered.

Notes:

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WARRANTY & RGA POLICY

1. **CLAIMS:** All claims must be made in writing and received by Hayward within 10 days after receipt of merchandise. If a shipment is received in a damaged condition, a claim must be filed with the delivering carrier and noted on the freight bill before you accept the merchandise.

2. **TWO YEAR WARRANTY:** All products manufactured by Hayward are warranted against defects in material or workmanship for a period of two 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 ANYEVENT EXCEED THE CONTRACT PRICE FOR THE PRODUCT.**

3. **RETURNS OF GOODS FOR NON-WARRANTY CLAIM:** Hayward Flow Control will authorize the return of products purchased within the last twelve (12) months in original “like new” packaging of current design, and listed in the current Complete Price Book. All returns must be accompanied by a “Return Goods Authorization” number, which must be obtained from Hayward Flow Control prior to shipment. All returns are subject to inspection upon receipt. No credit will be issued until the returned material has been inspected, accepted and processed. Customers will be contacted if quantity differences and/or non-acceptable material are found during inspection. Credit will reflect only quantities actually received and accepted. Disposition of product(s) not accepted by Hayward Flow Control must be provided by Distributor within 10 business days; otherwise, it will be subject to disposal. Minimum restock charge is $50.00. All material returns must be received within thirty (30) days of the RGA issuance and shipped freight prepaid. No collect shipments will be accepted. Prepaid freight does not apply to returns due to Hayward Flow Control order entry or shipping errors. Hayward Flow Control will authorize the return of product considered a stock item with a minimum restock charge of 25%. Hayward Flow Control will authorize the return of standard Pump or Actuated product with a minimum restock charge of 40%. Specialty products such as Strainer or Filtration assemblies and Engineered Products are non-cancelable/non-re-turnable. Restock charges do not apply to returns due to Hayward Flow Control order entry or shipping errors.

4. **RETURNS OF GOODS FOR WARRANTY CLAIM:** When requesting an RGA for product evaluation, the Customer must first complete and submit an In Service Form obtained from Hayward Flow Control Technical Services. Additionally, a Safety Data Sheet (SDS) must be submitted along with the In Service Form to Technical Services prior to receiving a Return Goods Authorization number. All Warranty Claim returns must be accompanied by the SDS, In Service Form and RGA number. Product must be washed and free of service media prior to returning for evaluation. Failure to do so may result in denial of claim and product returned back freight collect. Customers will be contacted if quantity differences and/or non-acceptable material are found during inspection.The Customer will be notified of the evaluation results. If the Warranty Claim is accepted, credit will be issued or replacement product sent. Freight will be credited upon approval of claim. If the Warranty Claim is declined, disposition of product(s) must be provided to Technical Services within 30 business days; otherwise, it will be subject to disposal. Rejected product returned to the Customer will ship freight collect. All warranty claim returns must be received within thirty (30) days of the RGA issuance and shipped freight prepaid. No collect shipments will be accepted.

Product Listings

NSF/ANSI Standard 61 and NSF/ANSI 372

NSF/ANSI Standard 61 is a standard defining the requirements for products that are destined for use in drinking water systems. In summary, the standard requires immersion testing of all products that will come into contact with drinking water for any chemicals, compounds, elements, etc. that may leach into the water that passes through the product.

Hayward products that are NSF 61 certified can easily be found on the NSF website, www.NSF.org. Additionally, those products certified to NSF61-G are also certified to NSF/ANSI 372 and conforms with the lead content requirements for "lead free" plumbing as defined by California, Vermont, Maryland and Louisiana state laws and the U.S. Safe Drinking Water Act.

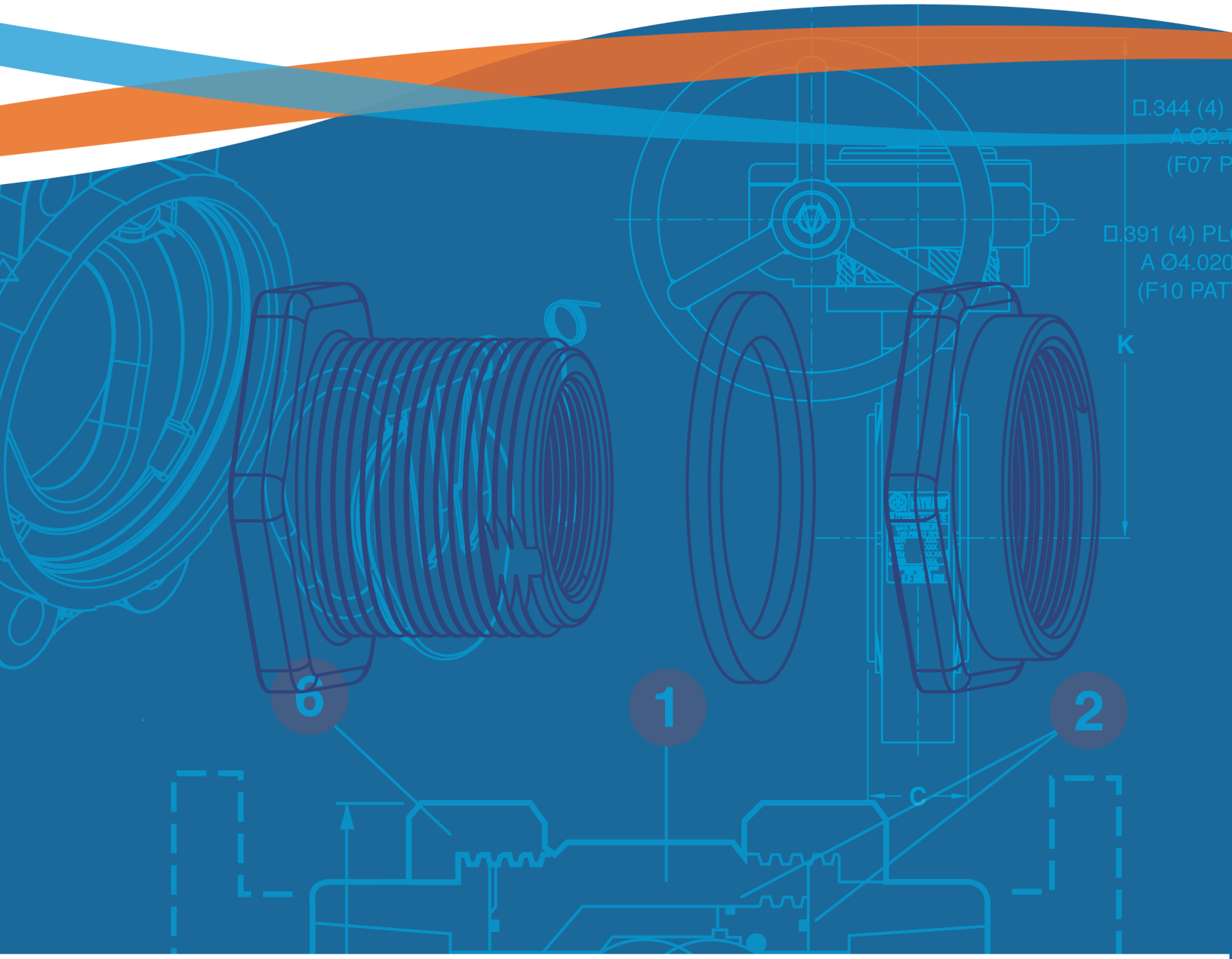
The following Hayward Flow Control products comply with this directive:

PRODUCT	SIZE	WATER CONTACT TEMP	WATER CONTACT MATERIAL
TBH SERIES BALL VALVES			
Hayward True Union Ball Valve (PVC)	**1/4" - 2"**	**CLD23**	MLTPL
Hayward True Union Ball Valve (CPVC)	**1/4" - 2"**	**CLD23**	MLTPL
CVH SERIES BALL VALVES			
CVH Series Ball Valve (CPVC)	**1/4" - 2"**	**CLD 23**	MLTPL
CVH Series Ball Valve (PVC)	**1/4" - 2"**	**CLD 23**	MLTPL
TB SERIES BALL VALVES			
Hayward True Union Ball Valve (PVC)	**1/4" - 4"**	**CLD23**	MLTPL
Hayward True Union Ball Valve (CPVC)	**1/4" - 4"**	**CLD23**	MLTPL
TC SERIES CHECK VALVES			
Hayward True Union Ball Check Valve (PVC)	**1/4" - 4"**	**CLD23**	MLTPL
Hayward True Union Ball Check Valve (CPVC)	**1/4" - 4"**	**CLD23**	MLTPL
BYV SERIES BUTTERFLY VALVES			
Hayward Butterfly Valve (PVC/EPDM)	**2" - 12"**	**CLD23**	MLTPL
Hayward Butterfly Valve (CPVC/EPDM)	**4" - 12"**	**D. HOT**	MLTPL
BYCN SERIES BUTTERFLY VALVES (PVC/EPDM)*	**3" - 8"**	**CLD23**	MLTPL
SIMPLEX SB SERIES STRAINERS**			
Hayward Simplex Basket Strainer (PVC)	**1/2" - 8"**	**CLD23**	MLTPL
Hayward Simplex Basket Strainer (CPVC)	**1/2" - 8"**	**D. HOT**	MLTPL
BFA SERIES (PVC/EPDM) BULKHEAD	**1/2" - 6"**	**CLD23**	MLTPL
BFAS SERIES (PVC/EPDM) BULKHEAD	**1/2" - 3"**	**CLD23**	MLTPL
FLOW CONTROL VALVES			
Universal Stopcock™	**1/4"**	**CLD23**	MLTPL
RPV SERIES PRESSURE RELIEF VALVES	**1/2" - 4"*****	**CLD23**	MLTPL
PBV SERIES BACK PRESSURE VALVES	**1/2" - 4"*****	**CLD23**	MLTPL

* Certified for use in distribution systems only.
** Certified for use in water treatment plant applications only with a minimum daily flow rate of 3,120 gallons.
*** See listing for specific size and material combination.
NOTE: Unless otherwise indicated for Materials, Certification is only for the Water Contact Material shown in the Listing.

Always consult NSF Listing online as changes and updates may occur.

Notes:



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