

Standard ASCO solenoid valves will meet the needs of most applications. However, there are times when fluids must be handled at higher temperatures, in less than ideal ambient locations, when the fluids, themselves, are hostile, etc.

For this reason, ASCO offers a wide range of options which can help tailor new valves to your precise applications. Specifying these options when you order is easy. Simply attach the proper prefix (electrical options) or suffix (construction options) to the basic catalog number.

### Optional Electrical Features

- Coils for high-temperature applications.
- Spade and screw terminations in place of leads.
- Battery service coils.
- Open frame solenoids.
- Variety of solenoid enclosures, from Rainproof to Explosionproof, for hydrogen atmospheres.

### Optional Construction Features

- Special materials for handling a wide variety of fluids.
- Manual operators.
- Metering devices.
- Special cleaning procedures.

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## How to Select and Specify

Not all optional features are appropriate or available for all valves.

Table 1 lists the optional electrical feature prefixes available for each Red-Hat II® solenoid and coil. Specify these features by adding the indicated prefixes to the valve catalog number.

*For those prefixes marked with a “•” or for optional Red-Hat® electrical features not covered here, contact your local ASCO sales office.*

Table 2 lists the suffixes for optional construction features available for each valve Series. Specify these features by adding the indicated suffixes to the valve catalog number.

**Table 1: Optional Red-Hat II® Electrical Feature Prefixes** (For Red-Hat® optional electrical features, contact your local sales office.)

Code	Solenoid
EF	Type 7 Explosionproof
EV	Type 7 Explosionproof with 316 Stainless Steel Hub and Stainless Steel Base Plate
GP	Panel Mount Type 1 General Purpose Solenoid
J	Junction Box
JP	Panel Mount Junction Box
OF	Open Frame Spade and Screw Terminal Solenoids
OP	Panel Mount Spade, Screw and DIN Terminal Solenoids
Code	Coil
HB	Class H - Intermediate Power
• HC	Class H - Battery Charging Coil
HT	Class H - High Temperature
KB	Class H - Intermediate Power - Screw Terminals
• KC	Class H - Battery Charging Circuit - Screw Terminals
KF	Class F - High Temperature - Screw Terminals
KH	Class H - High Temperature - Screw Terminals
KP	Class F - Intermediate Power - Screw Terminals
SC	Class F - High Temperature - DIN Connection
SD	Class F - Intermediate Power - DIN Connection
SF	Class F - High Temperature - Spade Terminals
SP	Class F - Intermediate Power - Spade Terminals
SS	Class H - Intermediate Power - Spade Terminals
ST	Class H - High Temperature - Spade Terminals
SU	Class H - High Temperature - DIN Connection
SV	Class H - Intermediate Power - DIN Connection
• SW	Class H - Battery Charging Circuit - Spade Terminals
Code	Feature
• L	72" continuous leads
• X	Other special constructions

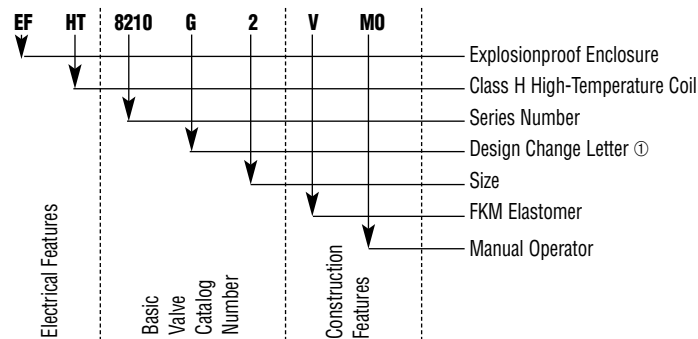
**Table 2: Suffixes for Optional Construction Features**

SUFFIX I		SUFFIX II		SUFFIX III	
Code	Seat/Disc/Etc. Material	Code	Form of Flow	Code	Feature
E	EPDM (Ethylene Propylene)	† F	Normally Closed	† HW	Hot Water Construction
J	CR (Neoprene)	† G	Normally Open	† LT	Low Temperature
† K	Air Operated, 3-30 psi	† U	Universal	M	Metering Device
N	Oxygen			† MB	Mounting Bracket
† Q	Long-Life Construction			MO	Manual Operator
† R	Resilient			MS	Screw Type Manual Operator
T	PTFE (Teflon*)			† VH	High Vacuum
V	FPM (Viton*)			† VM	Medium Vacuum

† Covered on the pages of the Series in which it is used.  
\* DuPont Co. trademark.

Note: See chart on page 10.02 for specific power and temperature ratings.

An example of an ASCO valve catalog number with prefixes and suffixes:



① The Design Change Letter indicates a major design change affecting spare parts kits, rebuild kits, and coils. The correct replacement parts for each change letter are shown in ASCO's Rebuild Kits and Coils Catalog.

### Optional Electrical Features

Most optional electrical features shown here can be included on ASCO valves approved by UL, FM, and CSA.

Identify the options you want by adding the appropriate prefix to the catalog number of the valve you are specifying.

To determine the proper prefix, use the Valve Series Specification Table for the valve you are ordering to determine its watt rating/class of coil insulation.

#### Red-Hat II Solenoid Options

Using Table 3, find the desired solenoid option in the left column and the watt rating/class of coil insulation in the next column. The choice of prefixes is shown in the next two columns on that line. The first column indicates the prefix if Class F temperature protection is sufficient for your requirements. The second column provides the desired solenoid option, plus the higher temperature protection of a Class H coil.

For example, to select an 8262G2 valve with a Class H Open Frame Spade Terminal Solenoid, assuming the voltage to be 120 volts AC, 60 Hz:


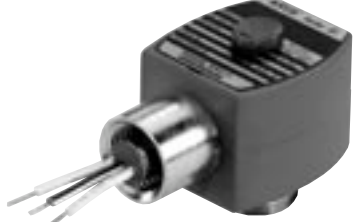


- In the Specification Table for Series 8262, the Watt Rating/Class of Coil Insulation is 6.1/F for Catalog Number 8262G2.
- Using Table 3, find the listing for “Open Frame Solenoid with Spade Terminal Coil” in the left column. Then, find 6.1/F under AC coils in the next column. Reading across the column headed “Class H Coil,” you’ll find the prefix “OFST.” To order, specify Catalog Number OFST8262G2, 120/60.


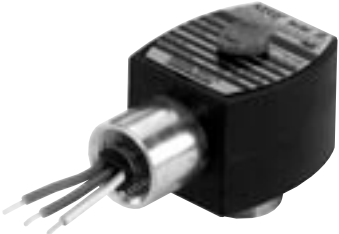



**(Note: Always include the voltage and frequency.)**





**Table 3: Solenoid Options for Red-Hat II® Valves**





Solenoid Option Required	Watt Rating/Class of Insulation		Class F Coil Prefix	Class H Coil Prefix
	AC	DC		
General Purpose Solenoid (Standard Valve Construction)	6.1/F 10.1/F	1.4/F 10.6/F 11.6/F	—	— HT HT
	9.1/F 17.1/F	22.6/F	—	HB
Panel Mount Type 1 General Purpose Solenoid	6.1/F 10.1/F	10.6/F 11.6/F	GP	GPHT
	9.1/F 17.1/F	22.6/F	GP	GPHB
Type 7 Explosionproof Solenoid	6.1/F 10.1/F	10.6/F 11.6/F	EF	EFHT
	9.1/F 17.1/F	22.6/F	EF	EFHB
	10.1/F 15.1/F 17.1/F	1.4/F 11.6/F 22.6/F	EV	— EVHT EVHB
Open Frame Solenoid with Spade Terminal Coil	6.1/F 10.1/F	10.6/F 11.6/F	OFSF	OFST
	9.1/F 17.1/F	22.6/F	OFSP	OFSS
Panel Mount Solenoid with Spade Terminal Coil	6.1/F 10.1/F	10.6/F 11.6/F	OPSF	OPST
	9.1/F 17.1/F	22.6/F	OPSP	OPSS
Open Frame Solenoid with Screw Terminal Coil	6.1/F 10.1/F	10.6/F 11.6/F	OFKF	OFKH
	9.1/F 17.1/F	22.6/F	OFKP	OFKB
Panel Mount Solenoid with Screw Terminal Coil	6.1/F 10.1/F	10.6/F 11.6/F	OPKF	OPKH
	9.1/F 17.1/F	22.6/F	OPKP	OPKH
Junction Box with Spade Terminal Coil	6.1/F 10.1/F	10.6/F 11.6/F	JSF	JST
	9.1/F 17.1/F	22.6/F	JSP	JSS
Panel Mount Junction Box with Spade Terminal Coil	6.1/F 10.1/F	10.6/F 11.6/F	JPSF	JPST
	9.1/F 17.1/F	22.6/F	JPSP	JPSS
Junction Box with Screw Terminal Coil	6.1/F 10.1/F	10.6/F 11.6/F	JKF	JKH
	9.1/F 17.1/F	22.6/F	JKP	JKB
Panel Mount Junction Box with Screw Terminal Coil	6.1/F 10.1/F	10.6/F 11.6/F	JPKF	JPKH
	9.1/F 17.1/F	22.6/F	JPKP	JPKB
DIN Connection Solenoid	6.1/F 10.1/F	10.6/F 11.6/F	SC	SU
	9.1/F 17.1/F	22.6/F	SD	SV
Panel Mount DIN Connection Solenoid	6.1/F 10.1/F	10.6/F 11.6/F	OPSC	OPSU
	9.1/F 17.1/F	22.6/F	OPSD	OPSV

**Important Note:** One-piece molded epoxy Red-Hat II® solenoids are a unique combination of coil and enclosure. When ordering some Red-Hat II options, it may be necessary to specify the appropriate catalog number prefixes for both the enclosure and the coil.

<p>Type 1 General Purpose Solenoids with <b>Class F</b> High-Temperature Coils</p>	<p><b>Enclosures:</b></p> <ul style="list-style-type: none"> <li>• Also meet Type 2 Dripproof, Types 3 and 3S Raintight, and Types 4 and 4X Watertight requirements.</li> <li>• Supplied standard with 1/2" threaded conduit hub and built-in strain relief for leads.</li> </ul> <p><b>Coils:</b></p> <ul style="list-style-type: none"> <li>• Insulation system for coil temperatures up to 311°F (155°C).<sup>①</sup></li> <li>• <i>For ambient temperature requirement, refer to specific Series and charts in Engineering Information Section, beginning on page 11.00.</i></li> <li>• Suitable for 50 and 60 Hz.<sup>②</sup></li> </ul>	<p><b>Ordering Information:</b> Supplied standard on all Red-Hat II valves.</p>	
<p>Type 1 General Purpose Solenoids with <b>Class H</b> High-Temperature Coils</p>	<p><b>Enclosures:</b></p> <ul style="list-style-type: none"> <li>• Same as Class F.</li> </ul> <p><b>Coils:</b></p> <ul style="list-style-type: none"> <li>• Insulation system suitable for coil temperatures up to 356°F (180°C).<sup>①</sup></li> <li>• <i>For ambient temperature requirements, refer to specific Series and charts in Engineering Information Section, page 11.00.</i></li> <li>• Suitable for 50 and 60 Hz.<sup>②</sup></li> </ul>	<p><b>Ordering Information:</b> Depending on wattage, use catalog number prefix "HT" or "HB" (e.g., HT8210G2).</p>	
<p><b>Panel Mount</b> Type 1 General Purpose Solenoids with <b>Class F or H</b> High-Temperature Coils</p>	<p><b>Enclosures:</b></p> <ul style="list-style-type: none"> <li>• Same as above, but with provision for mounting on a panel (panel not included).</li> </ul> <p><b>Coils:</b></p> <ul style="list-style-type: none"> <li>• Same as Class F or H above.</li> </ul>	<p><b>Ordering Information:</b> For Class F coil, use catalog number prefix "GP" (e.g., GP8210G2) and specify voltage. For Class H coil, depending on wattage, use catalog number prefix "GPHT" or "GPHB" (e.g., GPHT8210G2) and specify voltage.</p>	
<p>Type 7 (A, B, C, and D) <b>Explosionproof</b> Solenoids with <b>Class F</b> High-Temperature Coils</p>	<p><b>Enclosures:</b></p> <ul style="list-style-type: none"> <li>• Also meets Types 3 and 3S Raintight, Types 4 and 4X Watertight, Types 6 and 6P Submersible, and Type 9 (E, F, and G) Dust Ignitionproof requirements. <i>Refer to Engineering Information Section, beginning on page 11.00 for details.</i></li> </ul> <p><b>Coils:</b></p> <ul style="list-style-type: none"> <li>• Insulation systems suitable for coil temperatures up to 311°F (155°C) <sup>①</sup></li> <li>• <i>For ambient temperature requirements, refer to specific Series charts in Engineering Section, page 11.00.</i></li> <li>• Suitable for 50 and 60 Hz. <sup>②</sup></li> </ul>	<p><b>Approvals:</b> UL listed; CSA certified.</p> <p><b>Ordering Information:</b> Use catalog number prefix "EF" (e.g., EF8210G2) and specify voltage.</p>	
<p><b>Notes:</b> <sup>①</sup> UL limitations are 284°F (140°C) for Class F insulation systems and 320°F (160°C) for Class H insulation systems. <sup>②</sup> Can be supplied for 50 Hz at a reduced voltage, which is standard throughout the world; i.e., 120/60, 110/50.</p>			

<p>Type 7 (A, B, C, and D) <b>Explosionproof</b> Solenoids with <b>Class H</b> High-Temperature Coils</p>	<p><b>Enclosure:</b></p> <ul style="list-style-type: none"> <li>• Same as Class F Explosionproof Coil: Insulation system suitable for coil temperatures up to 356°F (180°C).<sup>①</sup> <i>For ambient temperature requirements, refer to specific Series and charts in Engineering Information Section, beginning on page 11.00</i></li> <li>• Suitable for 50 and 60 Hz.<sup>②</sup></li> </ul>	<p><b>Approvals:</b> UL listed; CSA certified.</p> <p><b>Ordering Information:</b> Depending on wattage, use catalog number prefix “EFHT” or “EFHB” (e.g., EFHT8210G2) and specify voltage.</p>	
<p>Type 7 (A, B, C, and D) <b>Explosionproof</b> Solenoids with <b>Class F or H</b> High-Temperature Coils</p>	<p><b>Enclosure:</b></p> <ul style="list-style-type: none"> <li>• Same as above, but with 316 stainless steel conduit hub and stainless steel base plate.</li> </ul> <p><b>Coils:</b></p> <ul style="list-style-type: none"> <li>• Same as Class F or H Coil.</li> </ul>	<p><b>Ordering Information:</b> For Class F Coil, use catalog number prefix “EV” (e.g., EV8262G220) and specify voltage. For Class H coil, depending on wattage, use catalog number prefix “EVHT” or “EVHB” (e.g., EVHT8327G2) and specify voltage.</p>	
<p>Type 7 (A, B, C, and D) <b>Low Power</b> Solenoids with <b>Class F DC Surge</b> <b>Suppression</b> Coils</p>	<p><b>Enclosure:</b></p> <ul style="list-style-type: none"> <li>• Same as Class F Explosionproof coil.</li> </ul> <p><b>Coils:</b></p> <ul style="list-style-type: none"> <li>• Built-in surge suppression diodes.</li> <li>• Low power – 1.7 Watts.</li> <li>• Class F insulation only.</li> </ul>	<p><b>Ordering Information:</b> Fo Surge Suppression coils, use catalog number prefix “EFMF” or “EVMF” (e.g., EFMF8314G300), and specify voltage.</p> <p><b>Note:</b> Surge Suppression coils are only available for Explosionproof Low Power coils.</p>	
<p><b>Open Frame</b> Solenoids with Class F or H High-Temperature <b>Spade Terminal</b> Coils</p>	<ul style="list-style-type: none"> <li>• Valves with Open Frame solenoid construction are intended for use when a solenoid enclosure is not needed; e.g., mounting in a control cabinet.</li> <li>• Same as Class F or H above, but with 1/4" spade terminals.</li> <li>• Suitable for 50 and 60 Hz. <sup>②</sup></li> </ul>	<p><b>Ordering Information:</b> For Class F coil, depending on wattage, use catalog number prefix “OFSF” or “OFSP” (e.g., OFSF8210G2) and specify voltage. For Class H coil, depending on wattage, use catalog number prefix “OFSS” or “OFST” (e.g., OFST8210G2) and specify voltage.</p> <p><b>Note:</b> Spade Terminal Coils are not available above 250 volts AC or DC.</p>	
<p><b>Panel Mount</b> Solenoids with Class F or H High-Temperature <b>Spade Terminal</b> Coils</p>	<p>Same as above, but with provision for mounting on a panel (panel not included).</p>	<p><b>Ordering Information:</b> For Class F coil, use catalog number prefix “OPSF” or “OPSP” (e.g., OPSF8210G2) and specify voltage. For Class H coil, depending on wattage, use catalog number prefix “OPSS” or “OPST” (e.g., OPST8210G2) and specify voltage.</p> <p><b>Note:</b> Spade Terminal Coils are not available above 250 volts AC or DC.</p>	
<p><b>Notes:</b> <sup>①</sup> UL limitations are 284°F (140°C) for Class F insulation systems and 320°F (160°C) for Class H insulation systems. <sup>②</sup> Can be supplied for 50 Hz at a reduced voltage, which is standard throughout the world; i.e., 120/60, 110/50.</p>			

<p><b>Open Frame Solenoids</b> with Class F or H High-Temperature <b>Screw Terminal Coils</b></p>	<ul style="list-style-type: none"> <li>Valves with Open Frame solenoid construction are intended for use when a solenoid enclosure is not needed; e.g., mounting in a control cabinet.</li> <li>Same as Class F or H above, but with #8 screws terminals.</li> <li>Suitable for 50 and 60 Hz.②</li> </ul>	<p><b>Ordering Information:</b> For Class F coil, depending on wattage, use catalog number prefix "OFKF" or "OFKP" (e.g., OFKF8210G2) and specify voltage. For Class H coil, depending on wattage, use catalog number prefix "OFKH" or "OFKB" (e.g., OFKH8210G2) and specify voltage.</p> <p><b>Note:</b> Screw Terminal Coils are not available above 250 volts AC or DC.</p>	
<p><b>Panel Mount Solenoids</b> with Class F or H High-Temperature <b>Screw Terminal Coils</b></p>	<p><b>Coils:</b></p> <ul style="list-style-type: none"> <li>Same as above, but with provision for mounting on a panel (panel not included).</li> </ul>	<p><b>Ordering Information:</b> For Class F coil, depending on wattage, use catalog number prefix "OPKF" or "OPKP" (e.g., OPKP8210G2) and specify voltage. For Class H coil, depending on wattage, use catalog number prefix "OPKH" or "OPKB" (e.g., OPKH8210G2) and specify voltage.</p> <p><b>Note:</b> Screw Terminal Coils are not available above 250 volts AC or DC.</p> <p>For replacement coil, order coil and kit number 276982.</p>	
<p><b>Junction Box Solenoids</b> with Class F or H High-Temperature <b>Spade or Screw Terminal Coils</b></p>	<ul style="list-style-type: none"> <li>Enclosures meet Type 1 General Purpose, Type 2 Dripproof, Types 3 and 3S Raintight, and Types 4 and 4X Watertight requirements.</li> <li>Supplied standard with 1/2" threaded conduit hub and grounding provision.</li> <li>Must be ordered with spade or screw terminals.</li> </ul>	<p><b>Ordering Information:</b> For Class F coil, depending on wattage, use catalog number prefix "JSF," "JSP," "JKF," or "JKB" (e.g., JSF8210G2) and specify voltage. For Class H coil, depending on wattage, use catalog number prefix "JSS," "JST," "JKH," or "JKB" (e.g., JKH8210G2) and specify voltage.</p> <p><b>Note:</b> Junction Box Options are not available above 250 volts AC or DC.</p>	
<p>Class F General Purpose Only with <b>Quick Disconnect Pin Connectors</b></p>	<ul style="list-style-type: none"> <li>Available for wattages 10.1, 17.1, 11.6, and 22.6.</li> <li>Materials: aluminum, 3 &amp; 4 pin in popular sizes.</li> <li>Electrical Connection Size: 1/2 - 20 unf.</li> <li>ZT or ZB 3 pin epoxy coated zinc electrical termination.</li> <li>VT or VB 4 pin - anodized aluminum electrical termination.</li> </ul>	<p><b>Ordering Information:</b> For Class F coil, depending on wattage, use catalog number prefix "VT" or "VB" and specify voltage.</p>	
<p><b>Notes:</b> ① UL limitations are 284°F (140°C) for Class F insulation systems and 320°F (160°C) for Class H insulation systems. ② Can be supplied for 50 Hz at a reduced voltage, which is standard throughout the world; i.e., 120/60, 110/50.</p>			

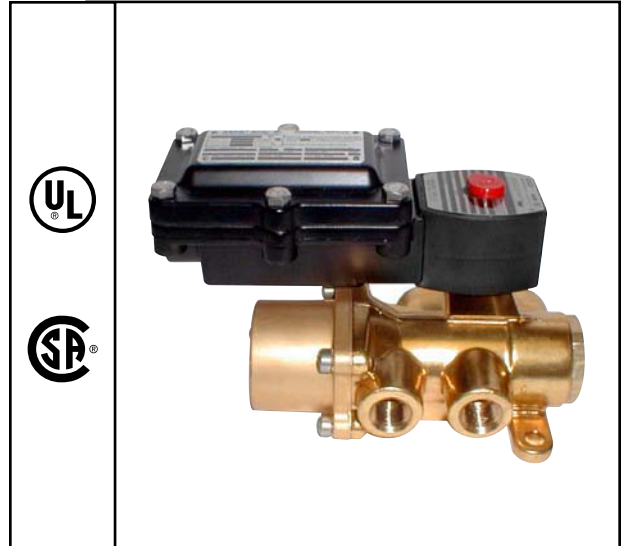
<p>Class F or H High-Temperature Coils with <b>DIN Connections</b></p>	<ul style="list-style-type: none"> <li>• Meets ISO 4400/DIN 43650 requirements.</li> <li>• Class F insulation system suitable for coil temperatures up to 311°F (155°C).<sup>①</sup> <i>For ambient temperature requirements, refer to specific Series and charts in Engineering Information Section, beginning on page 11.00.</i></li> <li>• Class H insulation system suitable for coil temperatures up to 356°F (180°C).<sup>①</sup> <i>For ambient temperature requirements, refer to specific Series and charts in Engineering Information Section, beginning on page 11.00.</i></li> <li>• Enclosure protection with DIN connector equivalent to Types 1 and 4.</li> <li>• Suitable for 50 and 60 Hz.<sup>②</sup></li> </ul>	<p><b>Ordering Information:</b> For Class F Coil, depending on wattage, use catalog number prefix "SC" or "SD" (e.g., SC8210G2) and specify voltage.</p> <p>For Class H coil, depending on wattage, use catalog number prefix "SU" or "SV" (e.g., SU8210G2) and specify voltage.</p> <p><b>Note:</b> Optional DIN-type strain-relief connector kit includes a gasket and mounting screw. Outlet accommodates cable with O.D. of 0.310" to 0.400".</p> <p><b>Note:</b> DIN Connection Coils are not available above 250 volts AC or DC.</p> <p>Must be ordered separately as Kit No. K236034.</p> <p>For replacement coil, order coil and Kit No. 258631.</p>	
<p><b>Junction Box</b> for Class F or H Coils</p>	<p>Junction box (shown installed on Red-Hat II solenoid) is a zinc coated steel housing with two 7/8" knock-outs for through wiring. UL listed when ordered factory assembled. Also available, without UL listing, as a kit with grounding screw for field installation.</p>	<p><b>Ordering Information:</b> For factory assembly, add prefix "JB" to Valve Catalog Number. For kit, use number K272140.</p>	
<p><b>Sub-Miniature Coils</b> for Series 8225, 8325, 8280, 8380, 8401, and 8551 Class F High-Temperature Molded Coils with <b>DIN Connection</b></p>	<p>These sub-miniature coils meet 3 x DIN 46244 requirements.</p> <ul style="list-style-type: none"> <li>• Insulation system suitable for coil temperatures up to 311°F (155°C).<sup>①</sup> <i>For ambient temperature requirements, refer to specific Series and charts in Engineering Information Section, beginning on page 11.00.</i></li> <li>• Suitable for 50 and 60 Hz.<sup>②</sup></li> <li>• "Enclosure Protection" with DIN connector equivalent to Types 1 and 4.</li> </ul>	<p><b>Ordering Information:</b> Use catalog prefix "SC" (e.g., SC8225A1V) and specify voltage.</p> <p><b>Note:</b> Optional DIN-type strain-relief connector kit includes a gasket and mounting screw. Outlet accommodates cables with O.D. of 0.310" to 0.400". Must be ordered separately as Kit No. K226061-1.</p>	
<p><b>1/2" Threaded Conduit Hubs</b></p>	<p>These conventional threaded hubs allow connection with 1/2" BX cable. Can be supplied with leaded coil only. Kit includes gasket and attaching screw.</p>	<p><b>Ordering Information:</b> Order separate Kit No. K224735.</p>	
<p><b>Notes:</b> <sup>①</sup> UL limitations are 284°F (140°C) for Class F insulation systems and 320°F (160°C) for Class H insulation systems.  <sup>②</sup> Can be supplied for 50 Hz at a reduced voltage, which is standard throughout the world; i.e., 120/60, 110/50.</p>			



# Explosion Proof Junction Box for Hazardous Locations

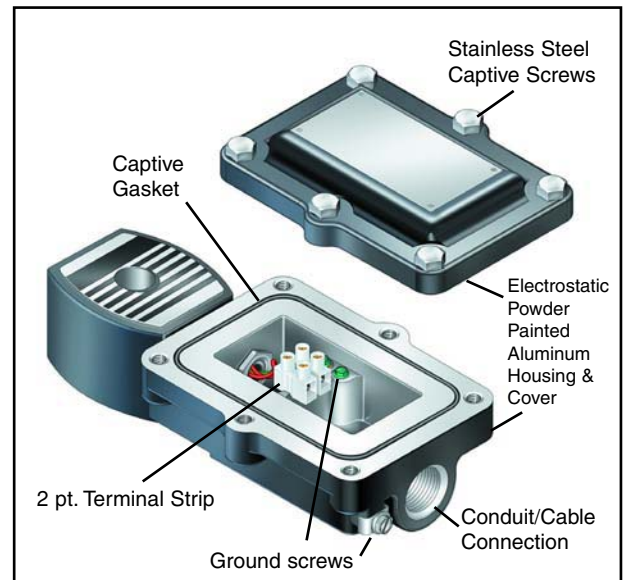
## Features

- Junction Box Enclosure for the wiring of ASCO solenoids are Rain-tight Type 3 and 3S, Water-tight Type 4 and 4X, Submersible Type 6 and 6P, Explosion proof Class 7, Class I, Groups B, C, and D Dust-Ignition proof Type 9, Class II, Div. I, Groups E, F and G, Nonincendive Class I, Div. II (1.4 watts only).
- Approvals: UL, CSA.
- Electrostatic powder paint, stainless steel screws, and molded epoxy coils provide excellent protection in corrosion environments.
- Factory pre-wired and assembled to any explosion proof ASCO Red-Hat II solenoid valve.
- Reduces installation costs by eliminating the need to use a separate explosion proof splice box to terminate the solenoid valve's wiring.



## Materials of Construction

<b>Housing &amp; Cover</b>	Epoxy painted die cast aluminum
<b>Gasket</b>	Buna-N
<b>Cover Screws</b>	Stainless Steel
<b>Coil</b>	Epoxy Molded
<b>Ground Screws</b>	Steel
<b>Terminal Block</b>	Plastic
<b>Lock Nut</b>	Zinc



## Electrical

**Standard Voltages AC:** 24, 120, 240, 480 volts, 60 Hz  
or (110, 220 volts, 50 Hz)

**DC:** 6, 12, 24, 120, 240

(Valves with JBEF housing maintain wattage and current ratings as shown on individual catalog sheets.)

**Conduit Sizes**

1/2" NPT	JBEF Prefix	(Standard)
3/4" NPT	JCEF Prefix	(Optional)
M20	JDEF Prefix	(Optional)

## Ordering Information

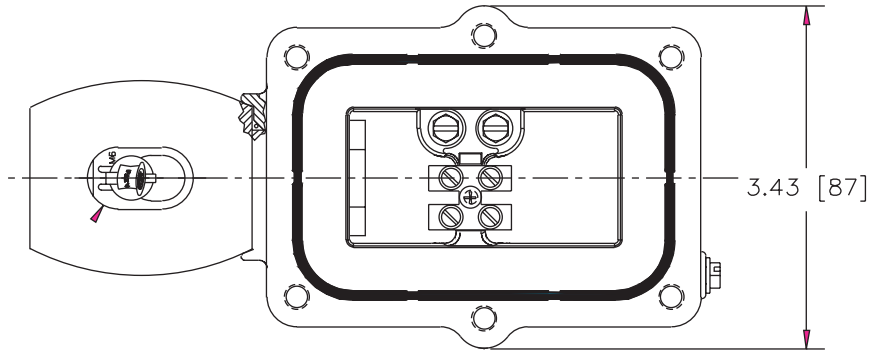
Add prefix corresponding to specific conduit size required to any Red-Hat II valve catalog numbers & specify the voltage. Example JBEF8210G095, 120/60.

## Approvals

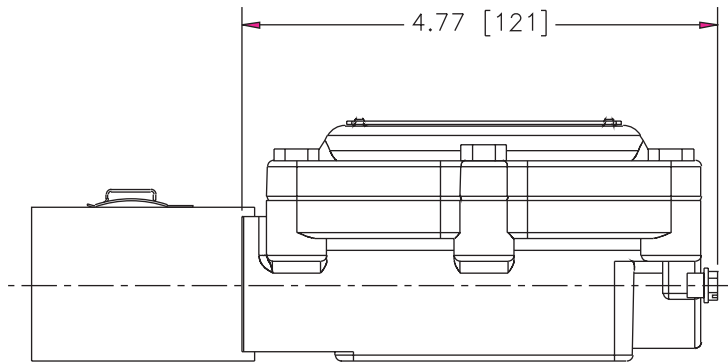
UL & CSA



Dimensions: inches (mm)

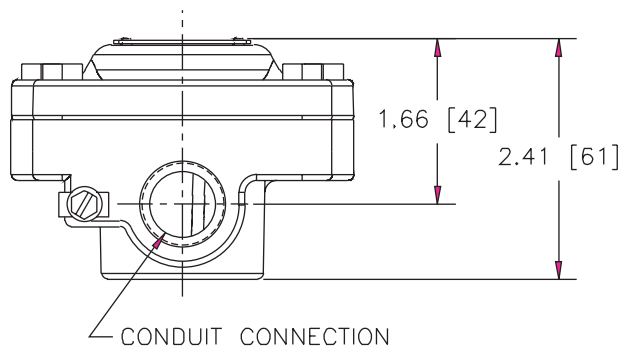


SHOWN WITH SCREWS  
AND COVER REMOVED



**Replacment Coil Kits**

Kit Number	Size (watts)	Voltage
278000-032	6.1	120/60
278000-132	9.1	120/60
278001-006	10.6	24DC
278012-032	10.1	120/60
278012-132	17.1	120/60
278013-006	11.6	24/DC
278024-032	20.1	120/60



### Optional Construction Features

Standard valve construction materials for standard valves are shown on the Series pages. If handling fluids other than those listed in the Specifications section, you may require special constructions, however. The most frequently used elastomers are listed in Table 4 along with the Valve Series in which they are available. Other considerations for a variety of liquids and gases are included in the Valve Material Selection Guide, which starts on page 11.20. A solenoid valve must use certain construction material for proper electrical function. *If you cannot find the specific fluid in the guide, please consult your local ASCO office.*

Certain fluids may also require that we change the solenoid shading coil. The standard valves use a copper shading coil. Aluminum and silver are also available and, due to their different magnetic properties, additional electrical changes may be necessary. *When a change in shading coil material is indicated in the guide, please consult your local ASCO office.*

**Table 4: Optional Construction Features for ASCO Solenoid Valves Handling Liquids and Gases other than Air, Inert Gas, Water, and Light Oil.** Orders entered using this table MUST state actual fluid and pressure of application.

Pipe Size (ins.)	Series Number or Valve Type	Valve Construction Number	Special Construction Features ③ ELASTOMERS				
			EPDM	Oxygen Service	PTFE	FKM	CR
			Use Suffix "E"	Use Suffix "N" ①	Use Suffix "T" ②	Use Suffix "V"	Use Suffix "J"
<b>SOLENOID OPERATED VALVES</b>							
3/8 - 3/4	8030, 8040	1-10, 13	Available on all constructions	Available on all constructions	Not Available	Available	Available on all constructions
3/8 - 1 1/2	8210	1, 2, 5, 6, 7, 8, 9, 11, 12, 16, 18, 23, 24, 25, 26, 28, 29, 31-51			Not Available	Available	
3/4 - 2 1/2	8210	10, 20, 21, 27, 30			Available	Available	
3/8 - 3	8215	All			Not Available	Available	
All	8260	1, 2, 3			Not Available	Available	
All	8260	4, 5, 6			Not Available	Not Available	
1/8 - 3/8	8262, 8263	1 - 7, 11, 12, 13, 16, 17			Available	Available	
1/8 & 1/4	8262	8, 9, 14			Available	Available	
3/8 & 1/2	8316	1, 2			Not Available	Available	
3/4 & 1	8316	3, 4, 5			Not Available	Available	
All	8320, 8360	All	Available	Available			
<b>AIR OPERATED VALVES</b>							
1/4	2 Ports	1, 2, 22	Available on all constructions	Available on all constructions	Available	Available	Available on all constructions
3/8 - 3/4	2 Ports	8			Not Available	Available	
3/8 - 3/4	2 Ports	3, 4			Not Available	Not Available	
3/8 - 3/4	2 Ports	6, 7, 16, 17			Not Available	Available	
1 & 1 1/4	2 Ports	10, 12, 18, 19			Not Available	Available	
1 1/2	2 Ports	14, 20			Not Available	Available	
1/4	3 Ports	1			Available	Available	
3/8 & 1/2	3 Ports	2			Not Available	Available	
3/4 & 1	3 Ports	3, 4			Not Available	Not Available	

**Notes:** ① For valves requiring special cleaning and/or testing procedures, such as for oxygen, freon, & sanitary service, refer to Table 6.  
 ② Pressure ratings must be reduced by 25%.  
 ③ Unless otherwise indicated in the Series Specification Tables, all soft seating valves are supplied with NBR discs, diaphragms, or gaskets.

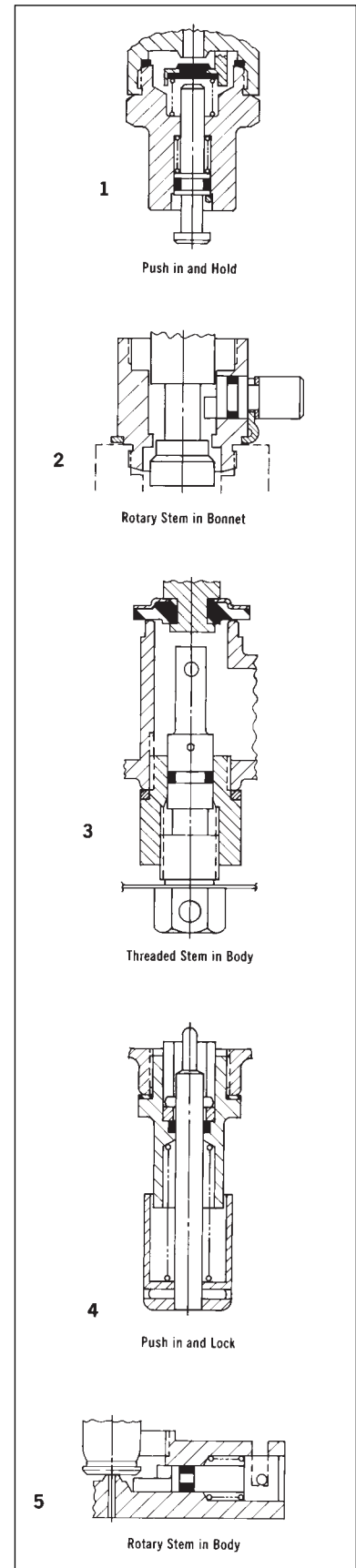
## Manual Operators

Manual operators are provided to operate the valve manually when electric power is off. There are basically two types of manual operators: momentary and maintained. Series 8320, 8321, and 8342 can be fitted with either type.

To determine which type is available for your valves, check the Construction Reference Numbers in their Series Specification Tables against the Table below. Schematics of the manual operators and how they are fitted to the valves are shown on the right. *If no manual operator is listed or a different type is required, consult your local ASCO office. Add suffix "MO" or "MS" to the catalog number.*

**Table 5: Manual Operators**

MANUAL OPERATORS ④ FOR 2 WAY SOLENOID VALVES						
Series Number	Pipe Size (ins.)	Valve Construction Reference Number	Valve Body Materials	Manual Operator Suffix	Type of Manual Operator	Illustration Number
8030	3/8, 1/2	1, 2, 3, 11	Brass	MO	Maintained	5
8030	3/4	9	Brass	MO	Maintained	3
8030	3/8, 1/2	1, 2, 3, 11	Stainless Steel	MO	Maintained	5
8030	3/4	10	Stainless Steel	MO	Maintained	3
8210	3/8, 1/2	1, 2	Stainless Steel	MO	Maintained	5
8210	3/8, 1/2	1, 2	Brass	MO	Maintained	5
8210	3/8 to 2 1/2	3, 5, 6, 8, 9, 11, 12, 16, 18, 20, 21	Brass	MO	Maintained	2
8210	3/4 to 1 1/2	10, 31, 32, 33	Brass	MO	Maintained	3
8210	1	42	Brass	MO	Maintained	4
8210	3/4	7	Stainless Steel	MO	Maintained	2
8221	3/8 to 3/4	1, 2, 5, 6, 7, 11, 12	Brass	MO	Maintained	2
8262	1/8	1	Brass	MO	Maintained	3
8262	1/8	1	Stainless Steel	MO	Maintained	3
8262	1/8	8	Brass	MS MO	Maintained Momentary	3 1
8262	1/8	8	Stainless Steel	MS MO	Maintained Momentary	3 1
8262	1/4	2, 4, 6, 16, 17	Brass	MO	Maintained	2
8262	1/4	11, 12, 13	Stainless Steel	MO ⑥	Maintained	2
8263	3/8	3, 5, 7	Brass	MO	Maintained	2
MANUAL OPERATORS ④ FOR 3 WAY SOLENOID VALVES						
8300	All	All	Brass	MO	Maintained	4
8300	All	All	Stainless Steel	MO	Maintained	4
8316	All	All	Brass	MO	Maintained	2
8320	1/8, 1/4	All	Brass Stainless Steel	MS ⑤ MO ①	Maintained Momentary	3 1
8321	All	All	Brass	MS MO	Maintained Momentary	3 1
MANUAL OPERATORS ④ FOR 4 WAY SOLENOID VALVES						
8340	1/4	8340A1, A3, A4	Aluminum	MO	Momentary	1
8342	1/4, 3/8	Single Solenoid Only	Brass Stainless Steel	MS MO	Maintained Momentary	4 1
8344 ③	All	All	Brass	MO	Maintained	2
8345	1/4	1	Brass	MO	Maintained	5
8401	1/8, 1/4	All	Aluminum	②	Momentary Maintained	— —
MANUAL OPERATORS ARE ALSO AVAILABLE FOR ALL LOW POWER AND INTRINSICALLY SAFE VALVES (MANUAL OR MOMENTARY). USE SUFFIX "MO."						
<b>Notes:</b> ① Limited to 100 psi (7 bar) maximum on Normally Open and Universal operation. ② Supplied as standard, no suffix required. ③ Two manual operators required for Dual Solenoid construction. ④ Limited to 250 psi (17 bar) pressure, except where noted otherwise. ⑤ Valves with MS suffix maintain full catalog ratings. ⑥ Manual operator not available for this series with steam application.						



### Metering Devices

Metering Devices are used for obtaining an exact flow from solenoid valves for dispensing or for moving an air operator in a given time period. Valves which can be fitted with metering devices are Series 8262 (1/8" NPT size only), 8260, 8401, 8402, and 8342. Add suffix "M" to catalog numbers.

### Special Cleaning and Testing Procedures:

If special cleaning and testing procedures are required, they must be specified when ordered. *These procedures cannot be done after the valve is built.*

**Table 6: ASCO Special Cleaning and Testing Procedures**

Fluid	Description of Cleaning or Testing Procedure	Order by Specifying
Freon	All valve parts inspected for oil, grease, metal dust, and other foreign matter and degreased, if necessary. Assembled in clean, dry area and helium mass spectrometer tested for external leakage. Pipe connections sealed with plugs.	Clean and test per ASCO AP-1-005 Procedure.
Oxygen	All valve parts degreased and blacklight inspected for cleanliness. Assembled and tested in clean area using oil-free air or nitrogen. Helium mass spectrometer tested for external leakage. Pipe connections sealed with plugs. Each valve tagged covering certification of tests and put in a sealed bag.	Clean and test per ASCO AP-1-004 Procedure. Add Suffix "N" to catalog Number.
Sanitary distilled water and other clean systems	All valve parts inspected for oil, grease, metal dust, and other foreign matter and degreased, if necessary. Valves assembled in clean area and tested with clean, dry air or nitrogen. Pipe connections sealed with plugs.	Clean and test per ASCO AP-1-008 Procedure.



ASCO Engineering has always been a significant contributor to the growth and success of our company. Today, we are better equipped than ever before to meet the challenges of our customers. Whether your specific product needs are routine or exotic, we have the best tools, talent, and experience to design and produce the exact product you need to control, move, and monitor your fluid.

Our engineering teams have the most advanced computers and computer programs at their disposal to aid in new product design. These include the latest 2D and 3D computer modeling programs to assist in development of a design concept, specialized magnetic and flow analysis programs to help optimize the magnetic efficiency of our solenoids and fluid flow-through in our valves. Other computer programs assist us in structural analysis, motion analysis, and the design of molds for thermoplastic parts.

Our Engineering Department has the latest rapid prototyping and computer controlled machining equipment. This allows us to quickly turn our

computer designs into functional models. We also have a modern Valve Laboratory to development test and verify the performance of our new products and a Pilot Plant to simulate the production environment and to ensure a smooth transition from Engineering to Manufacturing.

However, the most important elements of our Engineering Department are the many highly educated, creative, experienced, and talented people who comprise it. They not only know how to make the best new products, but they also are there, whenever needed, to help make sure all of our products continue to perform to the standards that have made ASCO the world leader in fluid control.

This section provides additional information which may be necessary to determine the exact ASCO solenoid or air operated valve for your requirements.

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## Solenoid Valves

### Principles of Operation

A solenoid valve is a combination of two basic functional units:

- A solenoid (electromagnet) with its core.
- A valve body containing one or more orifices.

Flow through an orifice is shut off or allowed by the movement of the core when the solenoid is energized or de-energized. ASCO valves have a solenoid mounted directly on the valve body. The core is enclosed in a sealed tube, providing a compact, leaktight assembly.

#### Direct Acting Valves (Figures 1A, 1B)

When the solenoid is energized in a direct acting valve, the core directly opens the orifice of a Normally Closed valve or closes the orifice of a Normally Open valve. When de-energized, a spring returns the valve to its original position. The valve will operate at pressures from 0 psi to its rated maximum.

The force needed to open the valve is proportional to the orifice size and fluid pressure. As the orifice size increases, so does the force required. To open large orifices while keeping solenoid size small, a Pilot Operated construction is used.

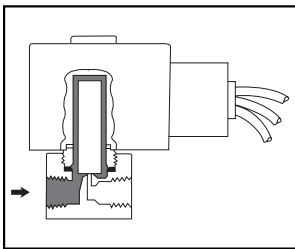


Figure 1A: Direct Acting, Normally Closed Valve, De-Energized

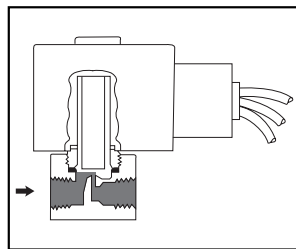


Figure 1B: Direct Acting, Normally Closed Valve, Energized

#### Internal Pilot Operated Valves (Figures 2A, 2B)

Normally, these valves have a pilot and bleed orifice which enable them to use line pressure for operation.

When the solenoid is de-energized, the pilot orifice is closed and full line pressure is applied to the top of the piston or diaphragm through the bleed orifice, providing seating force for tight closure.

When the solenoid is energized, the core opens the pilot orifice, relieving pressure from the top of the piston or diaphragm via the outlet side of the valve. The line pressure then opens the valve by lifting the diaphragm or piston off the main orifice.

Two constructions are available for 2 way valves:

- Floating diaphragm or piston which requires a minimum pressure drop across the valve to remain in the open position (Figures 2A, 2B).
- Hung-type diaphragm or piston held open mechanically by the solenoid core. The valve opens and remains open with zero pressure drop (Figures 3A, 3B).

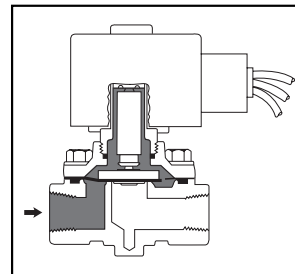


Figure 2A: Pilot Operated, Normally Closed Valve, De-Energized

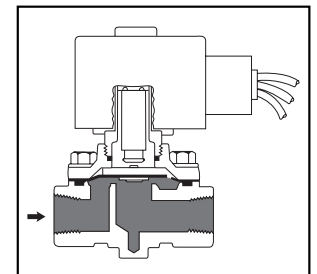


Figure 2B: Pilot Operated, Normally Closed Valve, Energized

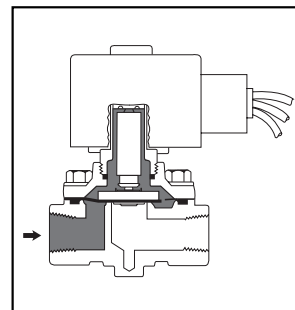


Figure 3A: Pilot Operated, Normally Closed Valve, De-Energized

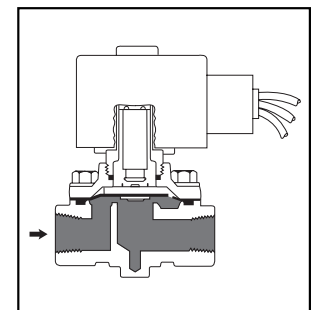


Figure 3B: Pilot Operated, Normally Closed Valve, Energized

#### Manual Reset Valves (Figures 4A, 4B)

Manual reset valves must be manually latched into position and will return to their original position only when the solenoid has been energized or de-energized, depending on construction.

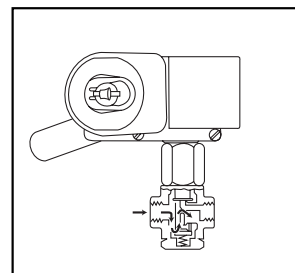


Figure 4A: No Voltage Release Manual Reset Valve, Un-Latched, De-Energized

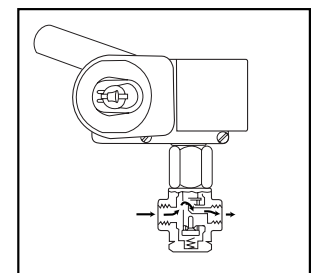


Figure 4B: No Voltage Release Manual Reset Valve, Latched, Energized

### Types of Solenoid Valves

#### 2 Way Valves (Figures 1A, 1B, 2A, 2B, 3A, 3B)

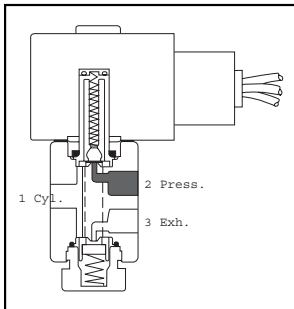
Two way valves have one inlet and one outlet pipe connection. They are used to allow or shut off fluid flow, and are available in either:

Normally Closed - closed when de-energized and open when energized.

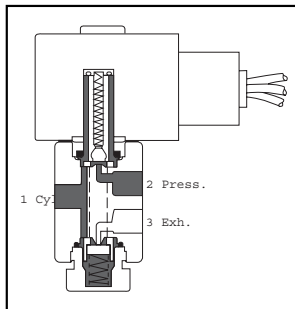
Normally Open - open when de-energized and closed when energized.

#### 3 Way Valves (Figures 5A, 5B)

Three way valves have three pipe connections and two orifices (when one is open, the other is closed, and vice versa). They are commonly used to alternately apply pressure to and exhaust pressure from the diaphragm operator of a control valve, single-acting cylinder, or rotary actuator.



**Figure 5A: Three Way Normally Closed Valve, De-Energized**



**Figure 5B: Three Way Normally Closed Valve, Energized**

Three modes of operation are available:

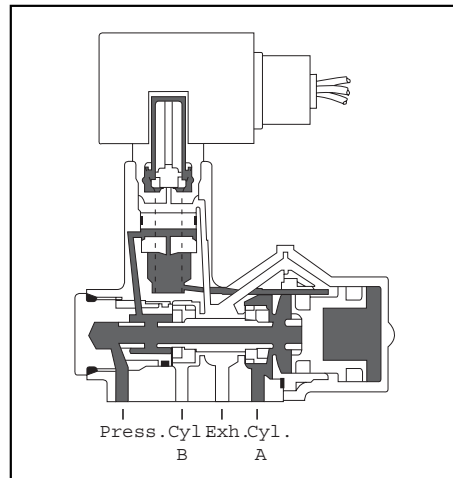
Normally Closed - when the valve is de-energized, the pressure port is closed and the cylinder port is connected to the exhaust port. When the valve is energized, the pressure port is connected to the cylinder port and the exhaust port is closed.

Normally Open - when the valve is de-energized, the pressure port is connected to the cylinder port and the exhaust port is closed. When the valve is energized, the pressure port is closed and the cylinder port is connected to the exhaust port.

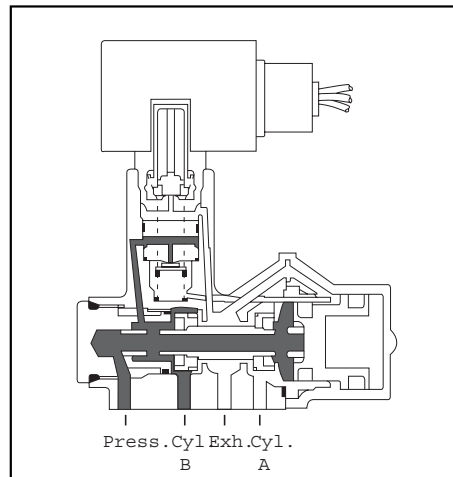
Universal - allows the valve to be connected in either the Normally Closed or Normally Open position to select one of two fluids or to divert flow from one port to another.

#### 4 Way Valves (Figures 6A, 6B)

Four way valves are generally used to operate double-acting cylinders or actuators. They have four or five pipe connections: one pressure, two cylinder, and one or two exhausts. In Position A, pressure is connected to one cylinder port, the other is connected to exhaust. In Position B, pressure and exhaust are reversed at the cylinder ports.



**Figure 6A: Four Way Valve, De-Energized**



**Figure 6B: Four Way Valve, Energized**



### Solenoids

#### Solenoid Coils

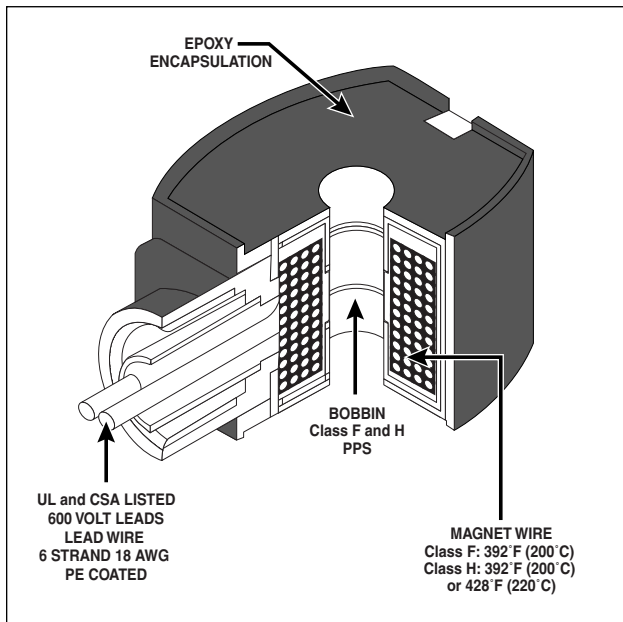
Except where noted, all ASCO valves are equipped with coils which can be energized continuously without danger of overheating or failure. Standard coils have 18" leads which can be connected to any controlling device. Spade, screw terminal, and DIN-type spade connector coils are also available. For three phase power systems, the two leads can be connected to any two of the three phases.

All coils are constructed in accordance with Underwriters Laboratories Inc., NEMA, IEEE, and other industrial standards. ASCO Class B, F, and H insulation systems are UL listed in the Recognized Component Index (yellow book) under Guide No. OBJ2.

For AC ambient capabilities, see chart to the right. DC ambient capabilities are 104°F (40°C) for Red-Hat II®. These ambients are based on a minimum available voltage of 85% of nominal. If minimum available voltage is greater, a higher ambient limitation may be possible. *Consult factory for details.*

#### Coil Insulation Systems and Temperature Limitations

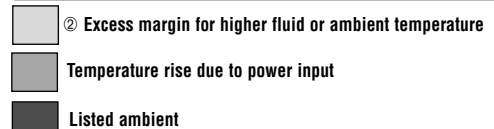
Red-Hat II® Solenoid Class F 314°F (155°C) and Class H 356°F (180°C)



#### AC Ambient Capabilities

##### Industrial Temperature Limitations ① ⑤ and Thermal Characteristics of ASCO® Red-Hat II® Solenoids and Coils

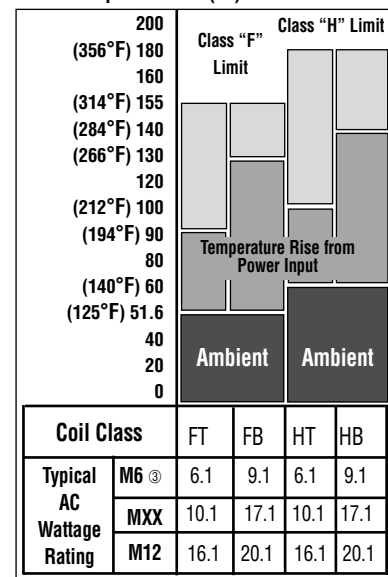
The typical watt ratings given show the relationship between different classes of coil insulation and the watt ratings to achieve higher temperature capabilities. The information contained in these tables applies only to Non-Explosionproof, AC constructions.④



##### Notes:

- ① As measured by the "Resistance Method."
- ② Ambient temperatures are directly additive to coil rise — fluid temperature is not.
- ③ For M-6, 50 Hz wattage values, add 2 watts to the indicated values.
- ④ Because of explosionproof codes and surface temperature limitations, the maximum listed ambients for specific valves should not be exceeded. *Consult factory concerning explosionproof applications where higher-than-listed ambients are encountered.*
- ⑤ Maximum temperatures shown are industrial limits. For UL limits, subtract 59°F (15°C) for Class F coils and 68°F (20°C) for Class H coils.

##### Final Temperature °C (°F)



### Coil Operating Voltage Ranges

All coils are designed for industrial operating voltages and can be used on the following voltage ranges:

AC		DC	
Nominal Voltage Rating	Normal Operating Range	Nominal Voltage Rating	Normal Operating Range
24	20-24	6	5.1-6.3
120	102-120	12	10.2-12.6
—	—	24	20-25
240	204-240	120	102-126
480	408-480	240	204-252

**Note:** Special coils are required for battery charging circuits where wider voltage ranges are typically encountered. For these applications, special continuous duty Class H coils are available that will accommodate a voltage range equivalent to 12% over nominal, 28% under nominal, and a 140°F (60°C) ambient. Standard nominal voltages are 125 and 250 DC, which translate to a voltage range of 90-140 and 180-280, respectively. Add prefix "HC" to the catalog number. "HC" prefix is only applicable to valves with coil classes FT and HT. *Consult factory or other constructions.*

Most ASCO valves, depending on construction, will operate at 15% under nominal voltage and maximum operating pressure differential, and are capable of operating for short periods at 10% over nominal voltage. For coil classes other than FT and HT, over voltage is not recommended. *For wider voltage ranges than shown here or for operating voltage ranges for specific catalog numbers, please consult your local ASCO sales office.*

### Power Consumption

Power consumption can be determined from the ratings shown on individual Series pages. For AC valves, the watts, volt-ampere "inrush" (the high momentary surge occurring at coil energization), and volt-ampere "holding" (the continuous draw following inrush) are given.

The current rating for inrush and holding may be determined by dividing the voltage into the volt-amp rating:

$$\text{Inrush Amps} = \frac{\text{volt-amp inrush}}{\text{voltage}}$$

$$\text{Holding Amps} = \frac{\text{volt-amp holding}}{\text{voltage}}$$

DC valves have no inrush current. The amp rating can be determined by dividing the voltage into the DC watt rating:

$$\text{Amps} = \frac{\text{watts (DC)}}{\text{voltage}}$$

#### Notes:

1. When a valve has been energized for a long period, the solenoid becomes hot and can be touched by hand for only an instant. This is a perfectly safe operating temperature. Any excessive heating will be indicated by smoke and the odor of burning coil insulation.
2. Valves for AC service can be converted to other AC voltages simply by changing the coil. Similarly, DC valves can be converted to other DC voltages. *When converting from AC to DC, or vice versa, consult your local ASCO sales office for instructions.*

### Solenoid Constructions

Internal parts in contact with fluids are of non-magnetic 300 and magnetic 400 series stainless steel. In AC constructions, the shading coil is normally copper, except that silver is mostly used in valves with stainless steel bodies. Other materials are available, when required. In DC constructions, no shading coil is required. Typically, the core tubes are of 300 series stainless steel and are formed by deep drawings, eliminating the need for silver brazed or welded joints.

### Solenoid Enclosures

ASCO offers two types of enclosures, each for a variety of applications: a one-piece molded epoxy construction called the Red-Hat II® solenoid and a conventional Red-Hat metallic construction. Both meet ICS-6 ANSI/NEMA, and UL Standards 429, 508, and/or 1002. These standards define enclosure protection levels and the tests passed to earn each Type designation.

#### Red-Hat II®

Red-Hat II® solenoid enclosures are of one-piece molded epoxy construction, with an integral 1/2" NPT conduit hub. This epoxy encapsulation serves as the enclosure. The magnetic frame is molded into the coil.

Red-Hat II® solenoids are offered as Type 1 General Purpose or Type 7 (A, B, C, and D) Explosionproof.

**Type 1** - Solenoids are green and come equipped with three 18" long leads (the green lead is a ground wire). Also available as options are 1/4" spade connectors, screw terminals, and DIN-type terminals meeting ISO 4400 and DIN Standard 43650. When ordered with optional electrical connection enclosure, it is defined as Open Frame.

An optional junction box/terminal coil construction is also available for use with spade and screw terminal constructions. See the "Optional Features" Section, page 10.06.

**Type 7** - Solenoids are black and are available only in the leaded construction.

All Red-Hat II® solenoids also meet the requirements for Types 2 Dripproof, 3 and 3S Raintight, and 4 and 4X Watertight-Corrosion Resistant.

The Following wattages carry Type 7 and Type 9 approvals as shown; for

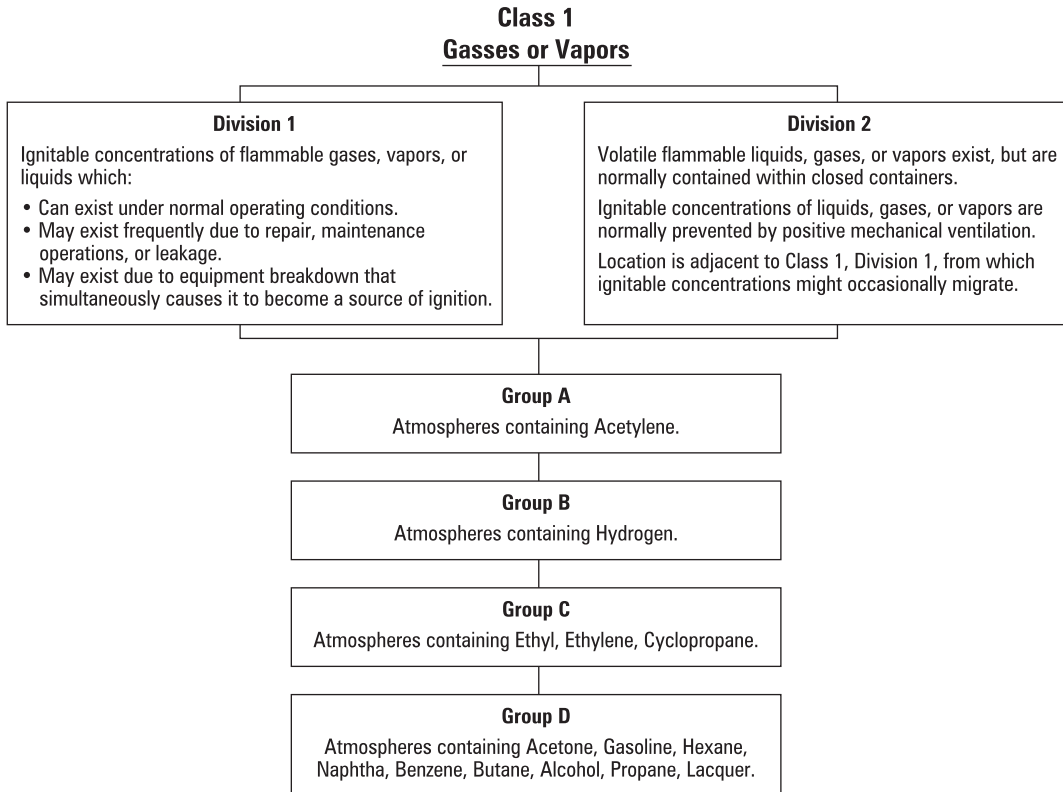
Wattage	Type 7 Class I, Div. 1 & 2 Gas Groups	Type 9 Class II, Div. 1 Dust Groups
6.1, 10.1, 17.1	A, B, C, D	E, F, G
16.1, 20.1	A, B, C, D	E, F
10.6, 11.6	A, B, C, D	E, F, G

### Enclosure Classifications and Types

<b>Type 1</b>	General Purpose	Intended for indoor use, primarily to provide protection for enclosed parts in locations without unusual service conditions.
<b>Type 2</b>	Dripproof	Intended for indoor use, primarily to provide protection against limited amounts of falling water or dirt.
<b>Type 3</b>	Raintight, Dusttight, and Sleet (Ice) Resistant	Intended for outdoor use, primarily to provide protection against wind-blown dust, rain, and sleet; undamaged by the formation of ice on the enclosure.
<b>Type 3S</b>	Raintight, Dusttight, and Sleet (Ice) Resistant	Intended for outdoor use, primarily to provide protection against wind-blown dust, rain, and sleet; external mechanism remains operable when ice laden.
<b>Type 3R</b>	Rainproof, Sleet (Ice) Resistant	Intended for outdoor use, primarily to provide protection against falling rain and sleet; undamaged by the formation of ice on the enclosure.
<b>Type 4</b>	Watertight and Dusttight	Intended for indoor or outdoor use to provide protection against splashing water, water seepage, falling or hose-directed water, and severe external condensation; undamaged by the formation of ice on the enclosure.
<b>Type 4X</b>	Watertight, Dusttight, and Corrosion Resistant	Same as Type 4, but provides additional protection to resist corrosion.
<b>Type 6</b>	Submersible	Intended for indoor or outdoor use to provide protection against entry of water during submersion at a limited depth. (Tested to 6' for 30 minutes.)
<b>Type 6P</b>	Submersible	Same as Type 6 Enclosure, but provides prolonged submersion protection at a limited depth. (Tested to 6' for 24 hours.)
<b>Type 7 and Type 9</b>	See charts on page 11.06	

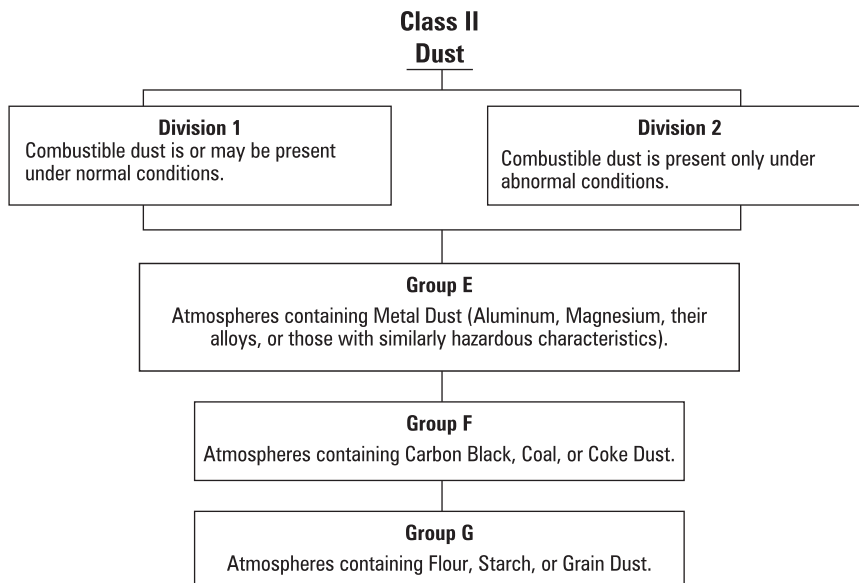
### Type 7 (A, B, C, and D)

Explosionproof enclosures are designed to contain an internal explosion, without causing an external hazard, when installed in the following atmospheres or locations:



### Type 9 (E, F, and G)

Dust-ignitionproof enclosures are designed to prevent the entrance of dust, and the enclosed devices do not produce sufficient heat to cause external surface temperatures capable of igniting dust on the enclosure or in the surrounding atmosphere.



### Red-Hat® Metallic Enclosures

Conventional metallic enclosures are offered to meet Type I General Purpose enclosure applications and Type 7 (C and D) Explosionproof enclosure applications.

**Type 1** – General Purpose metallic enclosures are epoxy-painted, zinc-coated steel with a 7/8" diameter hole to accept standard conduit hubs or connectors.

**Type 7 (C and D)** – Explosionproof metallic enclosures are epoxy-painted, zinc-plated steel or die-cast aluminum with a 1/2" threaded conduit hub.

Type 7 enclosures also meet Type 3 (Raintight) requirements as well as Type 7 (C and D) Explosionproof and Type 9 (E, F, and G) Dust-Ignitionproof requirements for Class I, Division 1, Groups C and D; Class I, Division 2, Groups A and B; and Class II, Division 1, Groups E, F, and G.

**Also available as options are:** Type 3R (Rainproof), Type 4 and 4X (Watertight), Type 6 (Submersible), Type 7B (Explosionproof for Hydrogen Atmospheres, Class I, Division 1, Group B), as well as Splice Box enclosures. *Please contact your local ASCO sales office for details on these options.*

**Note:** Metallic solenoid enclosures provide part of the magnetic circuit for the solenoid. Removal will affect valve operation.

### Hazardous Location Solenoid Temperature Range Codes

Hazardous location solenoids are marked to indicate the maximum exposed surface temperature or temperature indicating code. This temperature is based on the maximum obtained in the temperature or burnout (blocked core) tests, whichever is higher, at a minimum ambient of 104°F (40°C) or at the rated maximum ambient temperature.

To prevent ignition of hazardous atmospheres, do not install in areas where vapors or gases having ignition temperatures lower than the marked temperatures are present.

The operating temperatures for each indicating code are shown in the following chart:

### Operating Temperature Range Indicating Code Numbers

Maximum Temperature		Code Number
Degrees in C	Degrees in F	
450	842	T1
300	572	T2
280	536	T2A
260	500	T2B
230	446	T2C
215	419	T2D
200	392	T3
180	356	T3A
165	329	T3B
160	320	T3C
135	275	T4
120	248	T4A
100	212	T5
85	185	T6

**Note:** Except where otherwise noted in specific Series, all Red-Hat® metallic enclosure solenoids have temperature range Code T3C.

Most Red-Hat II® solenoids and/or solenoid valves are marked:

"To prevent fire or explosion, do not install where ignition temperature of hazardous atmosphere is less than 329°F (165°C). Open circuit before disassembly." This corresponds to code number T3B.

Valves with Class H solenoids and valves used on steam service are marked:

"To prevent fire or explosion, do not install where ignition temperature of hazardous atmosphere is less than 356°F (180°C). Open circuit before disassembly." This corresponds to code number T3A.

The Class II, Group F, Dust Location designation is not applicable for solenoids and/or solenoid valves used for steam service, or when a Class H solenoid is used.

Red-Hat II® Explosionproof solenoids include an internal, non-resettable thermal fuse to limit solenoid temperature in the event that extraordinary conditions occur which could cause excessive temperatures. These conditions include high input voltage, a jammed valve, excessive ambient temperature, shorted coil, etc. This unique feature is standard only in Red-Hat II® solenoids.

*When used on valves having fluid temperature ratings exceeding 248°F (120°C), consult ASCO for applicable enclosure class, groups and temperature range codes. For temperature range codes of optional solenoids and features, or if a better temperature range code is desired, consult your local ASCO sales office.*

### Operating Pressures

#### Maximum Operating Pressure Differential (M.O.P.D.)

The maximum operating pressure differential refers to the maximum difference in pressure between the inlet and outlet, against which the solenoid can safely operate the valve. If the pressure at the valve outlet is not known, it is safest to regard supply pressure as the M.O.P.D.

#### Minimum Operating Pressure Differential

The minimum operating pressure differential is that which is required to open the valve and keep it open. For 2 way valves with a floating piston or diaphragm, the valve will start to close below the minimum operating differential pressure. For 3 and 4 way pilot valves, the minimum operating pressure is measured

between the pressure and exhaust ports, and must be maintained throughout the operating cycle to ensure complete transfer from one position to the other.

**Note:** Directing acting, hung diaphragm or hung piston valves do not require a minimum pressure, but may not yield maximum flow on low pressure differentials.

#### Safe Working Pressure

Safe working pressure is the line or system pressure to which the valve may be subjected without being damaged.

#### Proof Pressure

Proof pressure is five times the safe working pressure. *Contact the factory or your local ASCO sales office if you require this value.*

### Ambient Temperatures

#### Minimum Ambient Temperature

The nominal limitation of 32°F (0°C) is advisable for any valve that might contain moisture (water vapor). Where freezing water is not a factor, minimum ambience as low as 0°F (-18°C) can be tolerated. In addition, special constructions are available for ambient temperatures down to -40°F (-40°C). *Consult your local sales office with your specific needs.*

#### Maximum Ambient Temperature

The nominal maximum ambient temperatures listed are based primarily on test conditions used by Underwriters

Laboratories, Inc. for setting safe limits for coil insulation. They are determined under continuously energized conditions and with maximum fluid temperatures in the valves. Actual conditions, in many applications, will permit use at considerably higher ambient temperatures. In addition, modifications to standard constructions are available to extend maximum ambient temperature limitations. *Consult your local ASCO sales office with your specific needs.*

### Response Times

Response time from fully closed to fully open or vice versa depends on the valve size and operating mode, electrical service, fluids, temperature, inlet pressure, and pressure drop. The response time for AC valves on air service, under average conditions, can be generalized as follows:

- Small direct acting valves: 5 to 10 milliseconds.
- Large direct acting valves: 20 to 40 milliseconds.
- Internal pilot operated valves:
  1. Small diaphragm types: 15 to 50 milliseconds.
  2. Large diaphragm types: 50 to 75 milliseconds.
  3. Small piston types: 75 to 100 milliseconds.
  4. Large piston types: 100 to 150 milliseconds.

Generally speaking, operation on liquids has relatively little effect on small direct acting valves; however, response time of large direct acting and internally piloted valves will slow by 50% to 100%.

Response time of DC valves will be 50% slower than equivalent AC valves. For specific response time on any critical-timing applications, response time can be reduced to meet specific requirements.

## Air Operated Valves

### Principles of Operation

An air operated valve has two basic functional units:

- An operator with a diaphragm or piston assembly which, when pressurized, develops a force to operate.
- A valve containing an orifice in which a disc or plug is positioned via air pressure to stop or allow flow.

### Operators

Two operators are offered in this catalog, each having a pressure range to suit various industrial requirements: instrument air range 3 to 30 psi (0.2 to 2.1 bar) and pneumatic range 30 to 125 psi (2.1 to 8.6 bar).

Control air for the operator is completely isolated from the main line fluid by a unique seal arrangement (see Figure 7). This permits a wide range of main line fluids to be handled.

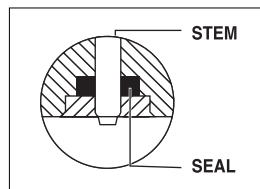


Figure 7

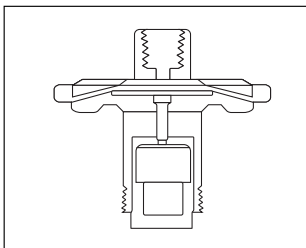


Figure 8A: Instrument Air Pressure Range Operator

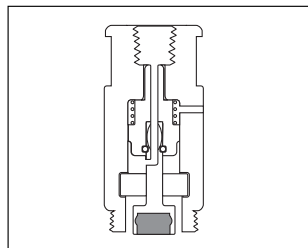


Figure 8B: Pneumatic Range Operator

When a particular valve is selected, any pressure within its pressure range will operate the valve, regardless of variations in the main line pressure.

The instrument air pressure range operator utilizes a diaphragm (see Figure 8A) for operation, while the pneumatic range operator has a piston (see Figure 8B). By applying pressure to and exhausting pressure from the operator, the main valve will open or close.

### Direct Acting Valves (Figures 9A, 9B)

In a direct acting valve, the operator stem is moved by the diaphragm or piston and directly opens or closes the orifice, depending on whether the operator is pressurized or exhausted. The valve will operate from zero psi to its maximum rated pressure.

### Internal Pilot Operated Valves (Figure 10A, 10B)

This valve is equipped with a pilot and bleed orifice and uses the line pressure for operation. When the operator is pressurized, it opens the pilot orifice and releases pressure from the top of the valve piston or diaphragm to the outlet side of the valve. This results in unbalanced pressure, which causes the line pressure to lift the piston or diaphragm off the main orifice, thereby opening the valve. When the operator is exhausted, the pilot orifice is closed and full line pressure is applied to the top of the valve piston or diaphragm through the bleed orifice, providing a seating force for tight closure.

Two types of construction are available:

- Floating diaphragm or piston, which requires a minimum pressure drop to hold it in the open position.
- Hung type diaphragm or piston, which is mechanically held open and operates from zero to the maximum pressure rating.

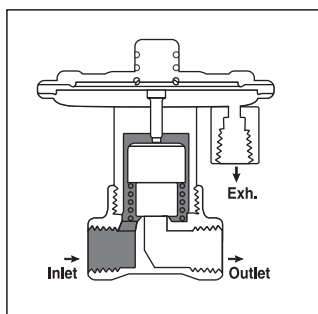


Figure 9A: Normally Closed, Direct Acting, Air Operated Valve with Operator Exhausted

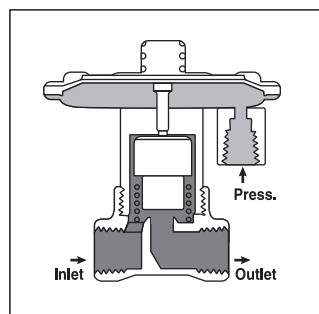


Figure 9B: Normally Closed, Direct Acting, Air Operated Valve with Operator Pressurized

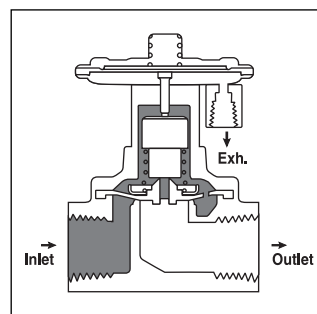


Figure 10A: Normally Closed, Internal, Pilot Operated Valve with Operator Exhausted

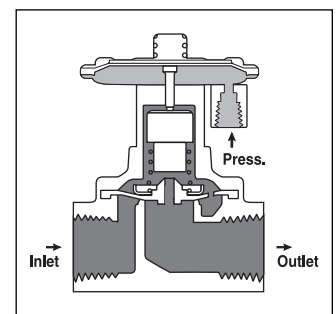


Figure 10B: Normally Closed, Internal, Pilot Operated Valve with Operator Pressurized

### Types of Air Operated Valves

#### 2 Way Valves:

Normally closed and normally open operation. Figures 9A, 9B, 10A, 10B, 11A, 11B.

#### 3 Way Valves:

Normally closed, normally open and universal operation. Figures 12A-D, 13A-D.

#### 4 Way Valves:

Figures 14A-D

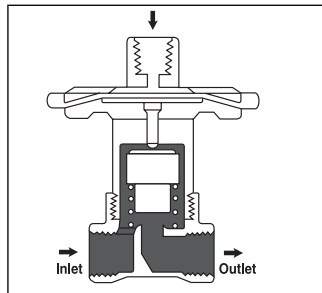


Figure 11A: Normally Open, Operator Exhausted

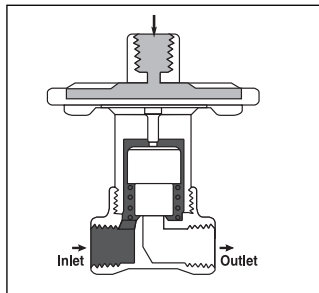


Figure 11B: Normally Open, Operator Pressurized

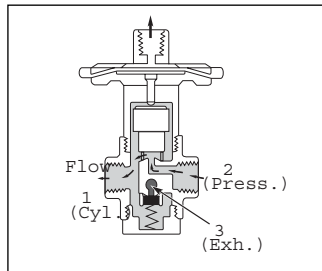


Figure 12A: Normally Open, Operator Exhausted

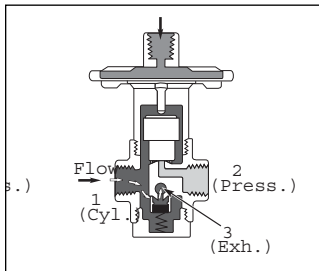


Figure 12B: Normally Open, Operator Pressurized

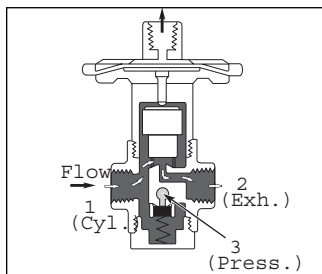


Figure 12C: Normally Closed, Operator Exhausted

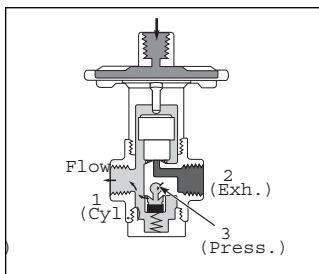


Figure 12D: Normally Closed, Operator Pressurized

### Operating Pressures

#### Minimum Operating Pressure Differential

The minimum operating pressure differential is that which is required to open the valve and to keep it open. Two way valves with floating piston or diaphragm will start to close below the minimum differential pressure. Three and four way pilot valves must maintain the minimum operating pressure throughout the operating cycle to ensure complete transfer from one position to the other.

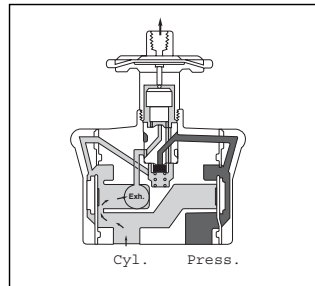


Figure 13A: Normally Closed, Operator Exhausted

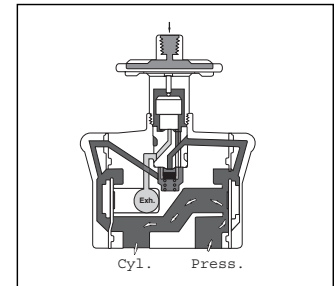


Figure 13B: Normally Closed, Operator Pressurized

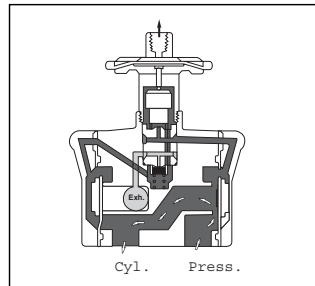


Figure 13C: Normally Open, Operator Exhausted

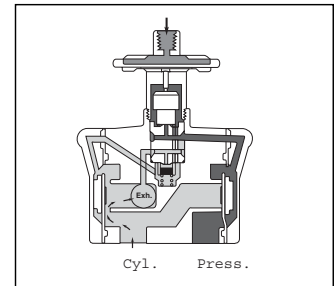


Figure 13D: Normally Open, Operator Pressurized

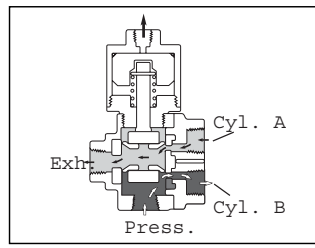


Figure 14A: Operator Exhausted

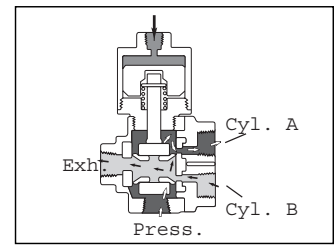


Figure 14B: Operator Pressurized

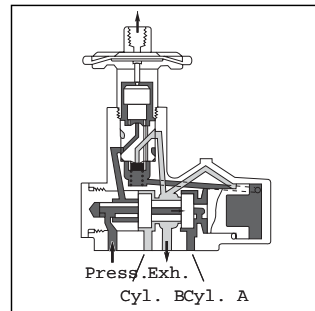


Figure 14C: Operator Exhausted

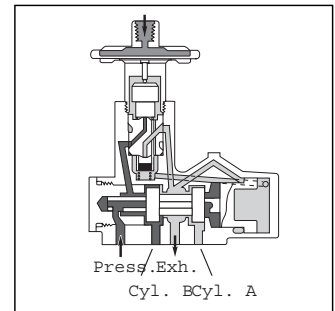


Figure 14D: Operator Pressurized

#### Maximum Operating Pressure

Maximum operating pressure is the highest pressure at the inlet side of the valve, against which the operator can operate the valve. This pressure may be much less than the maximum safety rating of the valve body.

Note: Direct acting valves do not require a minimum pressure.



## Approvals

### Approval Listing Code and Information

UL, FM, CSA listings and compliance to applicable CE directives have been indicated for each Series in this catalog. Listing codes and other information follow in this section.

In addition to approvals with the standard features and for the standard voltages listed in each Series, many valves with optional features and other voltages have also been approved. *Consult your local ASCO sales office for details.*

#### Agency Valve Classifications and Code Reference

**General Purpose Valve** - a Normally Open or Normally Closed valve intended to control the fluid flow, but not to be depended upon to act as a safety valve. This is a UL and CSA classification, and is not intended to indicate valve service or application.

**Safety Shutoff Valve** - a Normally Closed valve of the "on" and "off" type, intended to be actuated by a safety control or emergency device, to prevent unsafe fluid delivery. It may also be used as a General Purpose valve. A multiple port valve may be designated as a Safety Shutoff valve only with respect to its Normally Closed port. This is a UL, FM, and CSA valve classification.

**Process Control Valve** - an FM approved valve to control flammable gases, not to be relied upon as a Safety Shutoff valve. Refer to note under individual valve listing. Unless otherwise stated under the individual Series numbers, valves are listed as General Purpose valves.

#### Underwriters Laboratories, Inc.

UL standards governing solenoid valves are:  
 UL 429, "Electrically Operated Valves," and  
 UL 1002, "Electrically Operated Valves for Use in Hazardous Locations."



UL provides two "Listing" categories for solenoid valves:

**General Use.** Valves authorized for general use are complete in their requirements; therefore, they may be installed in the field. They are identified by the UL symbol, followed by the word "Listed" and the valve classification. UL Listings for ASCO "General Use" valves and solenoids can be found in the "UL Gas and Oil

Equipment Directory" (gray book) under Electrically Operated Valves, Guide No. YIOZ (File MP-618), and in the "UL Hazardous Location Equipment List" (red book) under Electric Valves, Guide No. YTSX (File E25549) or under Solenoids, Guide No. VAPT (File E12264).

**Component.** Valves in this category are intended for use as factory-installed components of equipment where final acceptability must be determined by UL. They are not intended for installation in the field.

Component valves are termed "UL Recognized" and may, at the manufacturer's option, use UL's special Recognized Component mark. UL Listings of ASCO Component Valves can be found in the "UL Recognized Component Index" (yellow book) under Electrically Operated Valves, Guide No. YIOZ2 (File MP-618).

#### Canadian Standards Association

Standard C22.2 No. 139, "Electrically Operated Valves," covers the standards governing solenoid valves.



CSA certified valves and solenoids are listed in the "CSA Certified Electrical Equipment Book" under Valves, Guide No. 440-A-0 (File 10381) and Guide No. 440-A-0.8 (File 13976).

CSA valves require special handling, testing, and marking. They are supplied only when specified on an order.

#### Factory Mutual Research Corporation

FM "approves" and lists in the "Factory Mutual Approval Guide" fuel oil and fuel gas safety shutoff valves, process control valves, explosionproof/dust-ignitionproof, and intrinsically safe valves for hazardous locations. Valves designated for other fluids and operational characteristics, although not subject to FM approval, are usually "accepted" by FM on specific equipment installations.



### Industrial Risk Insurers (Formerly FIA)

Industrial Risk Insurers does not approve equipment. It established "recommended good practices" in such areas as combustion safeguards on single-burner boiler-furnaces, and safeguarding Class B and Class C furnaces and ovens. Conforming to these practices results in either insurability for fire protection or in more advantageous rates for their protection.

To meet the standards of good practice, safety controls must be either listed by Underwriters Laboratories, accepted by Industrial Risk Insurers or other nationally recognized testing laboratories (NRTL). The National Fire Protection Association (NFPA) maintains similar requirements and recommendations for safety shutoff and vent valves in oil and gas burner boiler systems.

### European Directives - CE

The Council of the European Communities, under the treaty establishing the European Economic Community (EEC), adopted into law a series of directives to harmonize technical standards. Solenoid valves are controlled by:



Machinery	89/392/EEC	Annex II B
EMC (electromagnetic compatibility)	89/336/EEC	Art 10.2
Low Voltage	72/23/EEC	

ASCO valves complying to these directives, through third-party or self-certification, display the CE mark on the nameplate or coil and on the Instruction and Maintenance sheet packaged with each valve. On request, ASCO will issue a Declaration of Incorporation and/or Declaration of Conformity for the valve supplied.

### Agency Approvals – Worldwide

ASCO's Quality Assurance Program meets all the requirements of ISO-9001-94. We are also certified to IQ Net, providing customers with the products from 17 ISO-certified facilities around the world. The US, Canada, UK, France, the Netherlands, Germany, and Japan are included.

When desired, ASCO solenoid valves can be supplied to meet the additional requirements of a variety of approval agencies around the world. The following can be requested. *Consult your local ASCO sales office for details.*

### United States of America

AGA	American Gas Association
ANSI	American National Standards Institute, Inc.
EIA	Electronic Industries Association
ETL	Electronic Testing Laboratory
FM	Factory Mutual Research Corporation
IEEE	Institute of Electrical and Electronics Engineers, Inc.
IRI	Industrial Risk Insurers (formerly Factory Insurance Association)
JIC	Joint Industrial Council
MIL	Military Standards
MSHA	Mine Safety and Health Administration
NACE	National Association of Corrosion Engineers
NAVSEA	Naval Sea Systems Command
NEC	National Electric Code
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
NFPA	National Fluid Power Association, Inc.
NSF	National Sanitation Foundation
UL	Underwriters Laboratories, Inc.
USCG	United States Coast Guard

### European Economic Community

CE	European Directives
CEE	International Commission on Rules for the Approval of Electrical Equipment
CENELEC	European Committee for Electrotechnical Standardization
IEC	International Electrotechnical Commission
ISO	International Organization for Standardization

### Austria

TÜV-A	Technischer Überwachungs-Verein Österreich
BVFA	Bunderversuchs-und Forschungsanstalt Arsenal
ETI	Elektrotechnisches Institut

### Australia

AGA	Australian Gas Association
SAA	Standards Association of Australia

### Belgium

CEB	Comite Electrotechnique Belge
IBN	Institut Belge de Normalisation
ISSEP	Institut Scientifique de Service Public (anciennement INIEX)
K.V.B.G.	Koninklijke Vereniging der Belgische Gasvakienden
VERGAS	Technische Vereniging van de Gasindustrie in Belgie V.Z.W.D.

### Brazil

INMETRO	Instituto Nacional de Metrologia
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### Canada

CGA	Canadian Gas Association
CSA	Canadian Standards Association
EEMAC	Electrical and Electronic Manufacturers Association of Canada
ULC	Underwriters Laboratories of Canada

### China

NEPSI	National Supervision and Inspection Center for Explosion Protection and Safety of Instrumentation
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### Denmark

DEMKO	Danmarks Elektriske Materielkontrol
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### Finland

SL	Sähkötarkastuslaitos Laboratoria
VTT	Technical Research Centre of Finland

### France

AFNOR	Association Française de Normalisation
INERIS	Institut National de l'Environnement Industriel et des Risques (anciennement CERCHAR)
Bureau Veritas	
LCIE	Laboratoire Central des Industries Electriques
MDIS	Ministère du Développement Industriel et Scientifique

### Germany

BVS	Bergbau-Versuchsstrecke
DIN	Deutsches Institut für Normung
DVGW	Deutscher Verein des Gas - Und Wasserfaches e.V.
Germanischer Lloyd	
PTB	Physikalisch - Technische Bundesanstalt
VDE	Verband Deutscher Electrotechniker

### Italy

CEI	Comitato Elettrotecnico Italiano
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### Japan

JEM	Japan Electrical Manufacturers Association
JIS	Japanese Industrial Standards
MIL	Ministry of Labor
NK	Japan Maritime Association
RIIS	Research Institute of Industrial Safety, Department of Labor

### Korea

KISCO	Korea Industrial Safety Corp.
KGSG	Korea Gas Safety Corp.

### Luxembourg

Service de l'énergie de l'état	
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### Northern Ireland

Industrial Science Centre, Department of Economic Development	
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### Norway

Det Norske Veritas	
NEMKO	Norges Elektriske Materielkontroll

### Russia

USSR Register of Shipping	
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### South Africa

SABS	South African Bureau of Standards
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### Spain

CESI	Centro Elettrotecnico Sperimentale Italiano
LOM	Laboratorio Oficial José Maria Madariaga

### Sweden

SEMKO	Svenska Elektriska Material Kontrollanstalen
SP	Swedish National Testing and Research Institute

### Switzerland

ASE	Association Suisse des Electriciens
SEV	Schweizerischer Electrotechnischer Verein

### The Netherlands

DGA	Direktoraat - Generaal van de Arbeid
KEMA	Koninklijk Instituut voor het Testen van Elektrische Materialen N.V.
NEC	Nederlands Elektrotechnisch Comité
NNI	Nederlands Normalisatie - Instituut
REGO	Richtlijnen Voor de Samenstelling van Elektrisch Material In Verband Met Gasontplofingsgevaar
VEG	VEG-Gasstituut N.V.
VGN	Vereniging van Gasfabrikanten In Nederland

### United Kingdom

BASEEFA	British Approvals Service for Electrical Equipment in Flammable Atmospheres
BGC	British Gas Corporation
BSI	British Standard Institution
EECS	Electrical Equipment Certification Service (BASEEFA)
Lloyds Register of Shipping	
MRS	Midlands Research Station
NWC	National Water Council
SCS	Sira Certification Service
SFA	Special Flammable Atmospheres
WH	Watson House

## Flow Data

### Importance of Valve Sizing

Improper sizing of a solenoid valve results in below-standard performance and can involve unnecessary cost.

The basic factors in valve sizing include:

- Maximum and minimum flows to be controlled.
- Maximum and minimum pressure differential across the valve.
- Specific gravity, temperature, and viscosity of fluids being controlled.

The Cv method of valve sizing reduces all variables to a common denominator called the Flow Coefficient. After existing or projected conditions have been converted to this coefficient (the Cv), the proper valve size can be found in the catalog pages.

This section provides the complete procedure and reference data for accurate sizing of ASCO solenoid valves in liquid, gas services, and steam. The graphs provide the simplest means of finding the required Cv factor, and are based on the formula:

$$Cv = \frac{\text{Flow Required}}{\text{Graph Factor}}$$

The graph factor can be determined by aligning known pressure conditions on the graphs.

### Estimating Cv or Orifice Size:

The table below can be used to estimate a Cv if the orifice size is known or, conversely, to relate the approximate orifice size if the Cv is known. The chart is based on the ASCO designs of inline globe type valves.

The flow charts must be used for precise sizing and converting Cv factors to actual flow terms, and the catalog must be consulted for the actual Cv of a particular valve.

Approximate Orifice Size (ins.)	Approximate Cv	Approximate Orifice Size (ins.)	Approximate Cv
1/32	.02	1/2	3.5
3/64	.06	5/8	4.5
1/16	.09	11/16	5
3/32	.20	3/4	7.5
1/8	.30	1	13
9/64	.36	1 1/4	17
3/16	.53	1 1/2	25
1/4	.70	2	48
5/16	1.7	2 1/2	60
3/8	2	3	100

## Sample Problems

### Liquids:<sup>①</sup>

To find Cv: What Cv is required to pass 20 GPM of oil, with a specific gravity of 0.9 and a pressure drop of 25 psi? The viscosity is less than 300 SSUs.<sup>②</sup>

Solution: Formula is:

$$Cv = \frac{GPM}{Fg \times Fsg}$$

To find Fg (Graph Factor), use Liquid Flow Graph on page 11.16. The Fg factor is that corresponding to 25 psi pressure drop and equals 5. The Fsg factor (Specific Gravity Factor) can be obtained from the Fsg Chart, and is that corresponding to .9 specific gravity and equals 1.05.

Therefore:

$$Cv = \frac{20}{5 \times 1.05} = 3.81$$

### Air and Gases:

To find Cv: A valve is required to pass 500 SCFH at an inlet pressure of 60 psig and a  $\Delta p$ <sup>③</sup> of 10 psi. Find Cv if the fluid is carbon dioxide at room temperature.

Solution: Refer to 10-100 psig graph on page 11.17. The formula to be used is:

$$Cv = \frac{SCFH}{Fg \times Fsg \times Ft}$$

Locate Fg at the intersection of 60 psig inlet pressure and 10 psi  $\Delta p$ <sup>③</sup> (curved lines). Read down to Fg. Fg=1560.

Locate Fsg corresponding to specific gravity of carbon dioxide (S.G.=1.5). Fsg=0.81. (Refer to next page.) Since the gas is at room temperature, the Ft factor can be ignored.

Insert values into formula:

### Steam:

To find Cv: A valve is required to pass 25 lb/hr of saturated steam at an inlet pressure of 7 psig and a  $\Delta p$ <sup>③</sup> of 3 psi. What is the Cv?

Solution: Refer to the Steam Graph on page 11.18. Use formula:

$$Cv = \frac{lb / hr}{Fg}$$

Locate Fg on graph corresponding to 7 psig inlet pressure and 3 psi  $\Delta p$ <sup>③</sup> (curved lines). Fg = 23.5.

Insert values into formula:

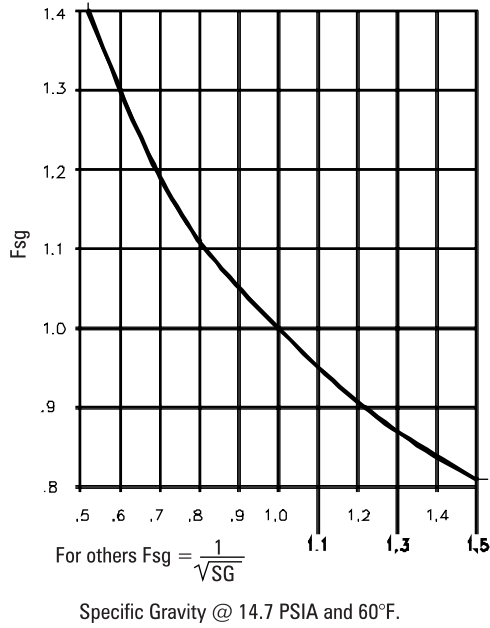
$$Cv = \frac{25}{23.5} = 1.06$$

*For further information, consult your local ASCO sales office.*

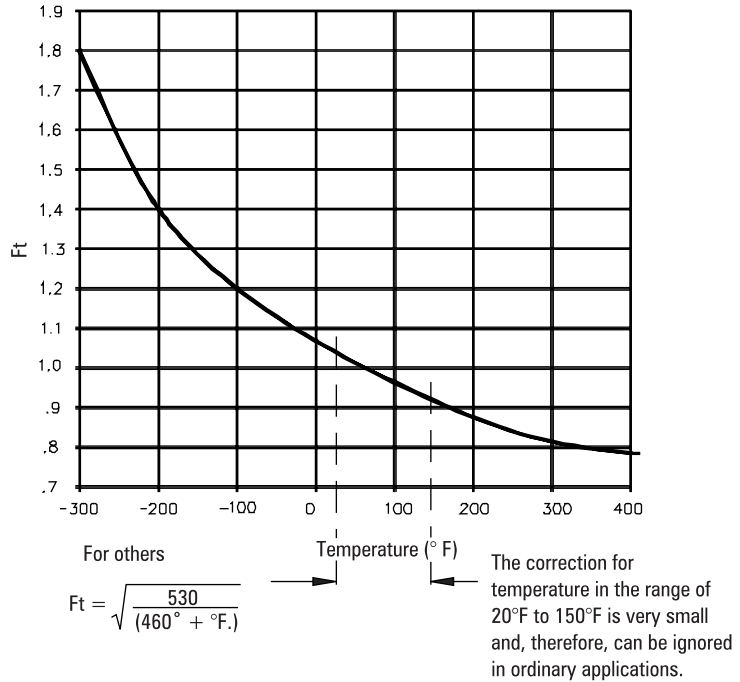
#### Notes:

- ① Liquid formulas and flow graphs are based on US gallons.
- ② If viscosity is less than 300 SSU, correction factors are not necessary.
- ③  $\Delta p$  stands for pressure drop.

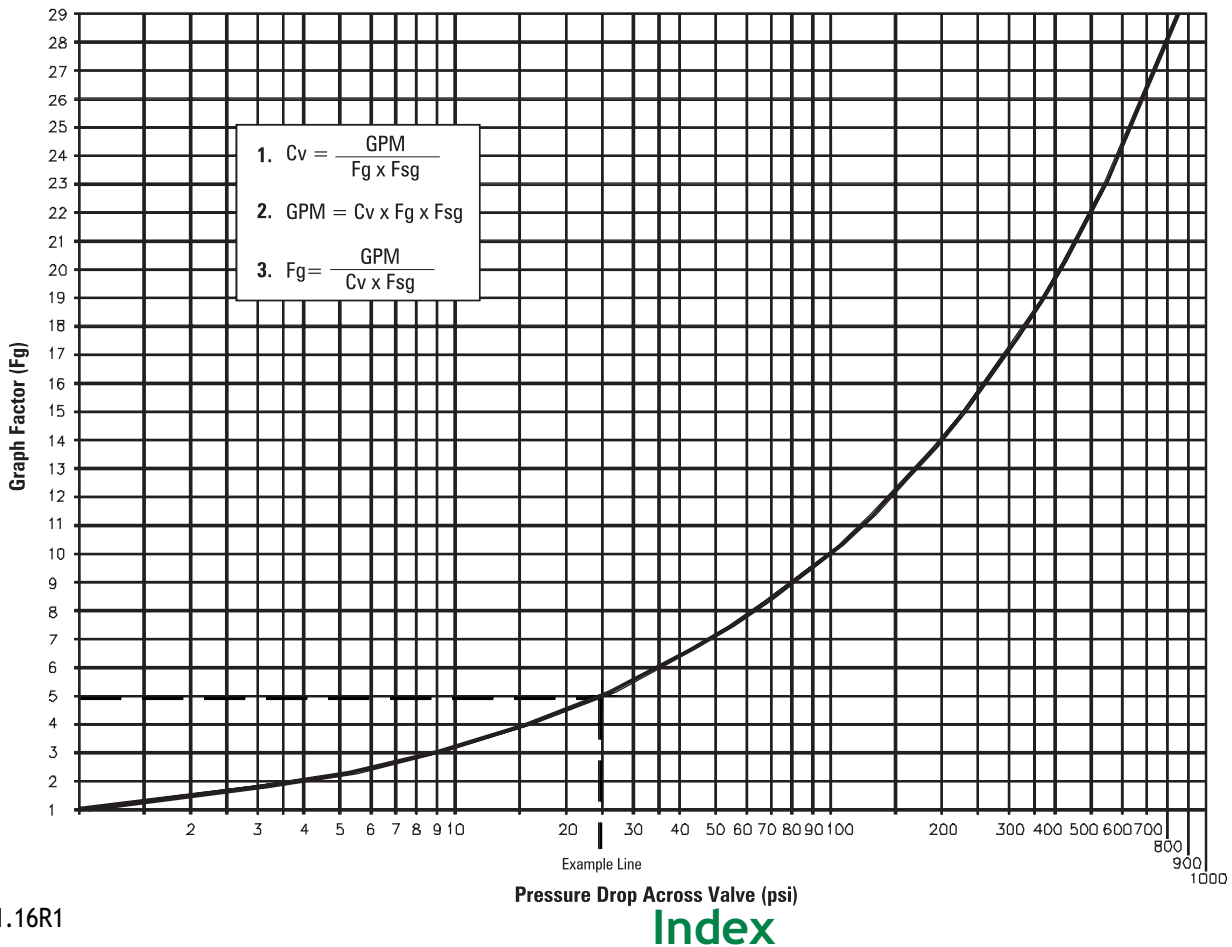
## Fsg Chart



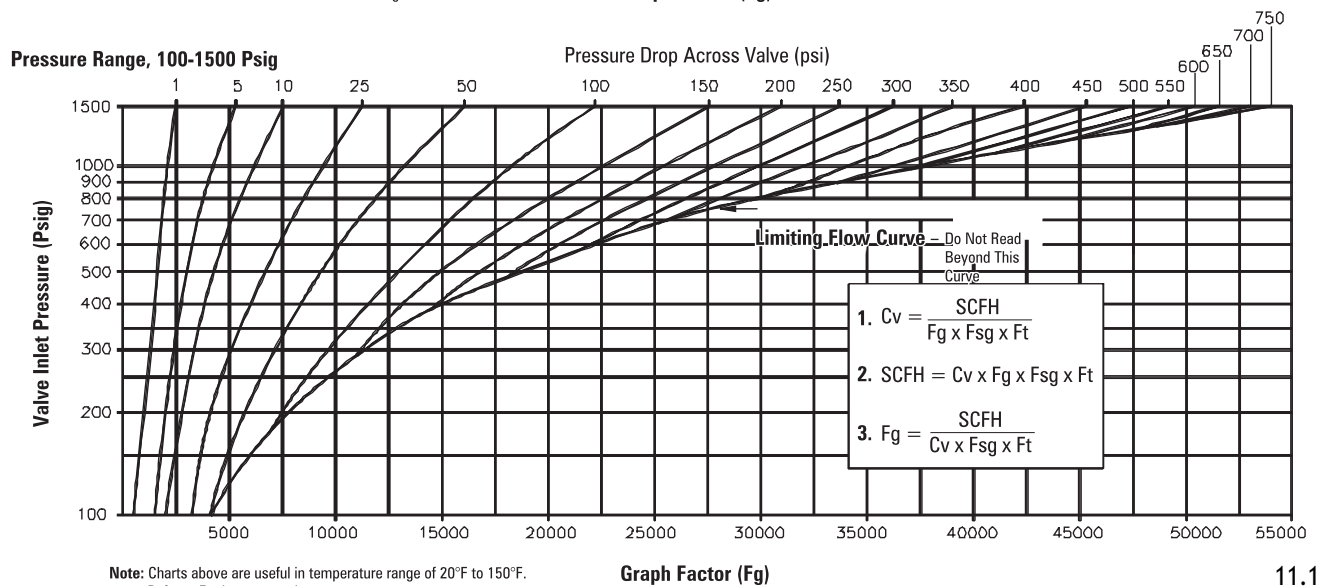
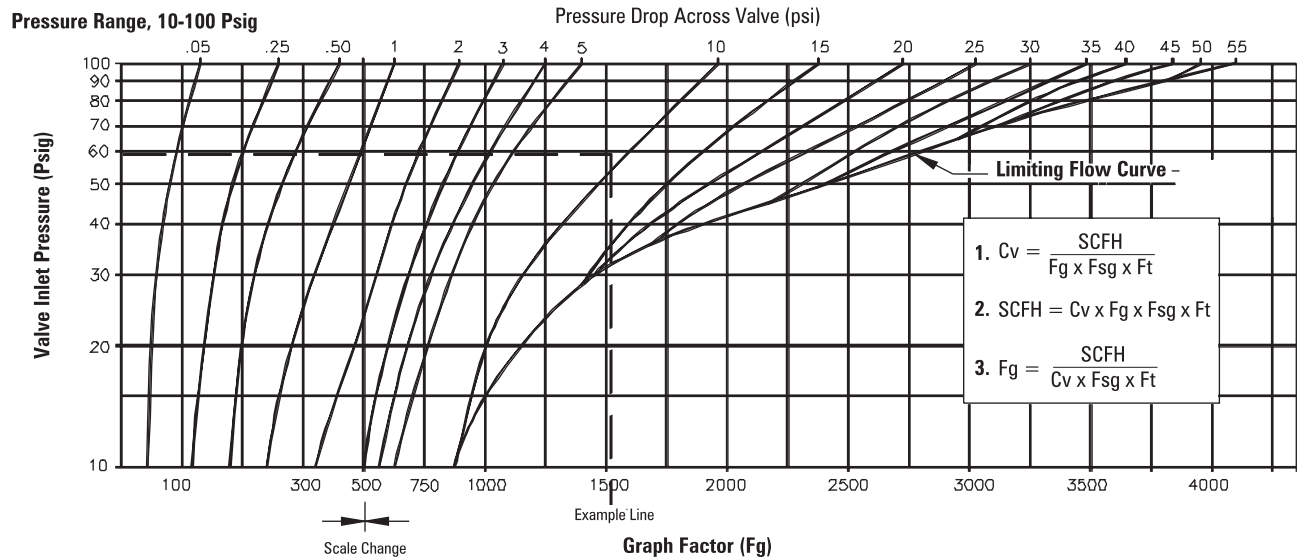
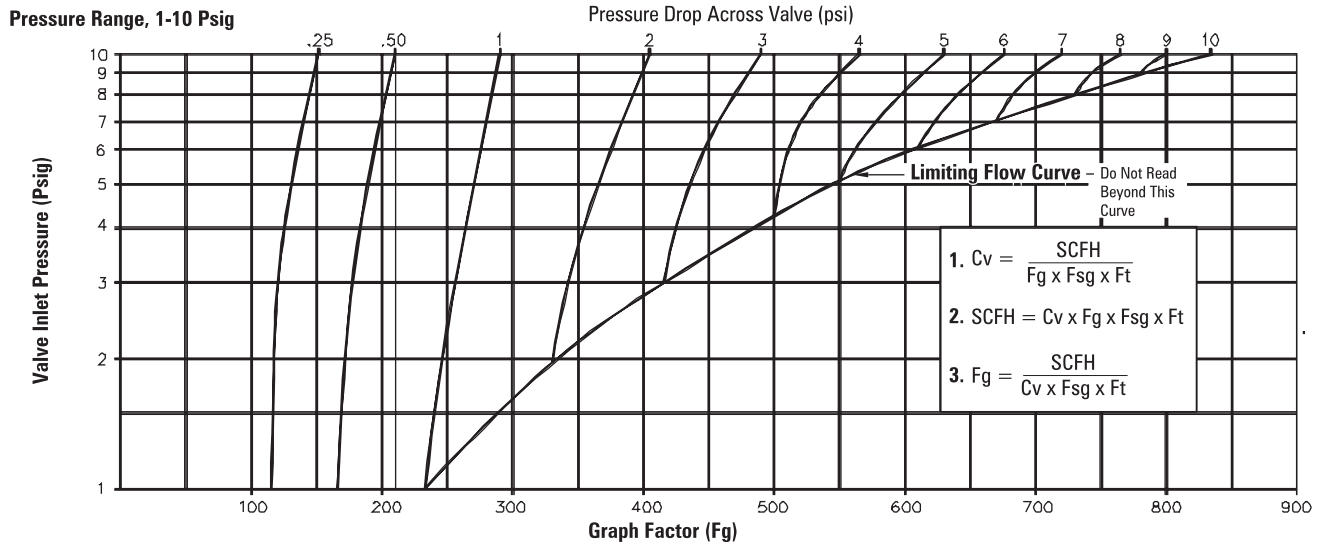
## Ft Chart



## Liquid Flow Graph

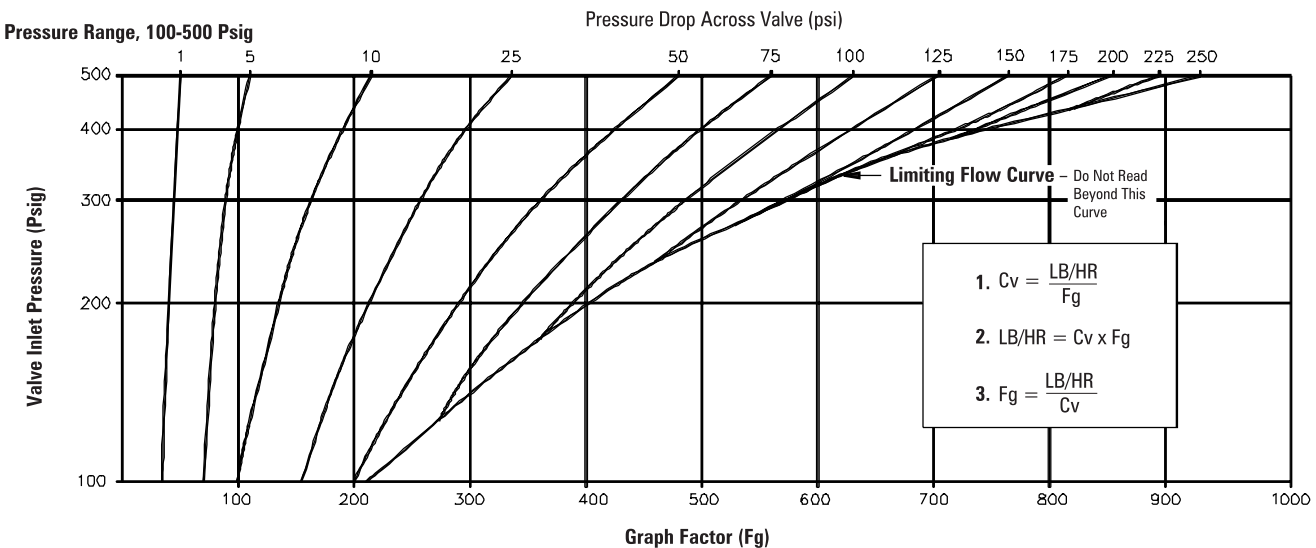
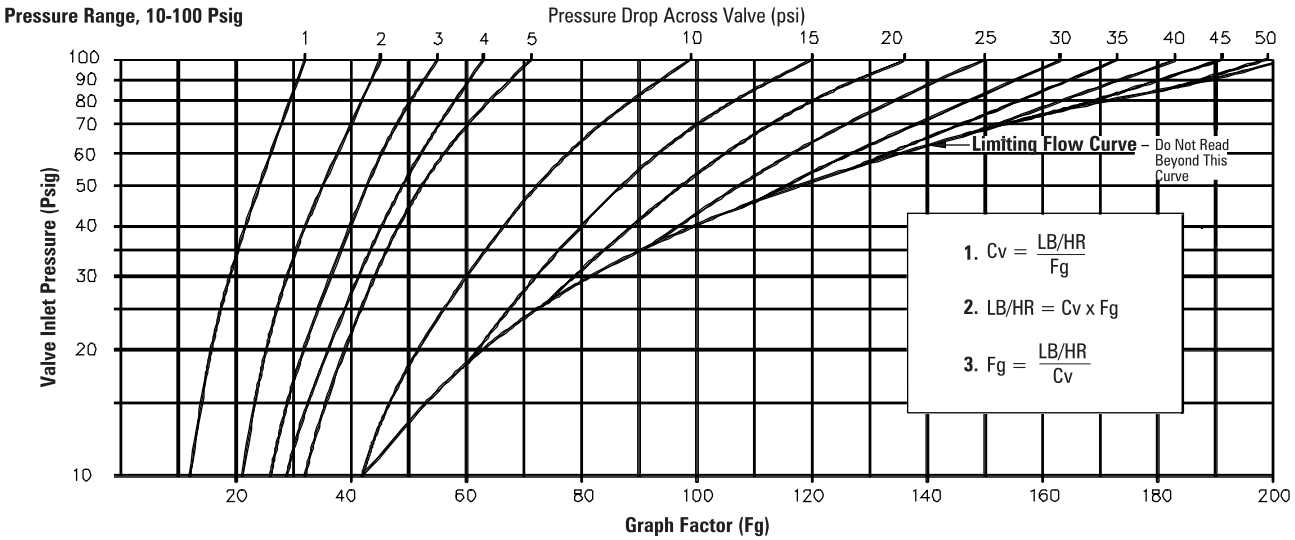
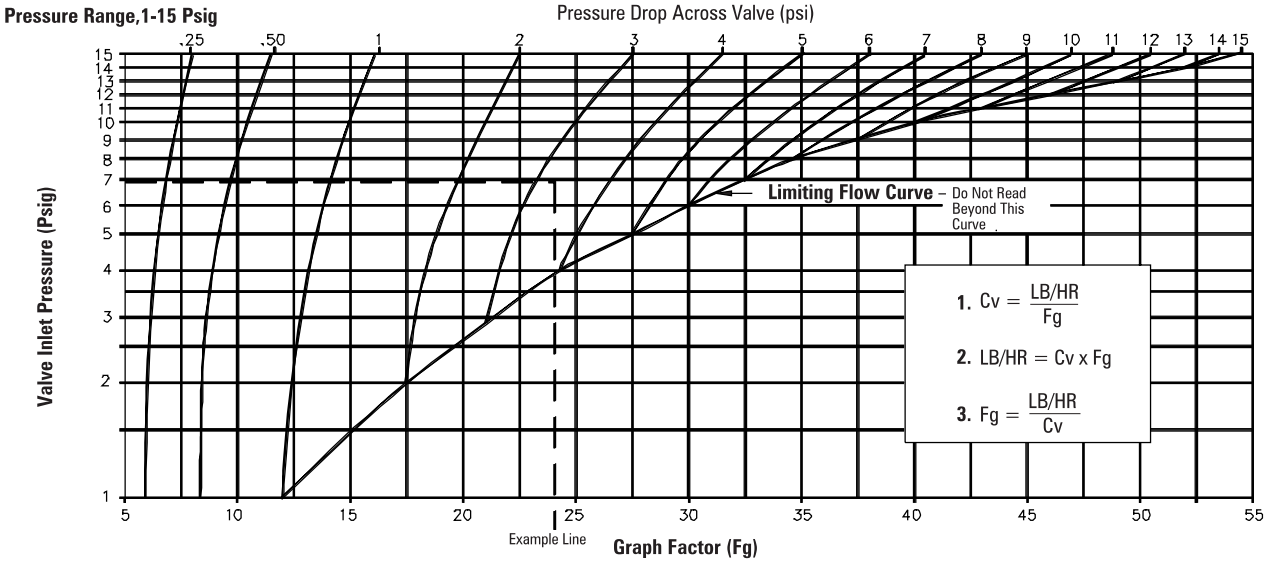


### Air and Gas Flow Graphs



Note: Charts above are useful in temperature range of 20°F to 150°F.  
Refer to Ft chart on previous page.

### Steam Flow Graphs





### Material Selection Guide for Commonly Used Fluids

All orders entered using this guide must state actual fluid, fluid pressure, fluid concentration, and fluid temperature of the application. Actual fluid is extremely important when elastomer options are specified because other substitutions may be required.

ASCO valves are available to control many acids, alcohols, bases, solvents, and corrosive gases and liquids. Modified or special designs are sometimes required, depending upon the application.

Corrosion occurs either as a chemical or electrochemical reaction. Therefore, consideration must be given to both the galvanic and electromotive force series, as well as to pressure, temperature, and other factors that might be involved in the application.

This guide provides information on types of valves that are available for most common corrosive and non-corrosive gases and liquids. *For applications in which abnormal conditions exist and for other fluids, consult your local ASCO office, giving full details on operating conditions.*

This guide is not intended as a specific recommendation; factors beyond our control could affect valve operation or materials.

### General Information on Elastomer Materials Frequently Used in ASCO Valves

#### NBR (Buna 'N', Nitrile)

NBR is commonly referred to as a nitrile rubber and is the standard synthetic elastomer for accomplishing resilient-type seating or sealing in ASCO valves. It has excellent compatibility for most air, water, and light oil applications. It has a useful temperature range of 0°F to 180°F (-18°C to 82°C)

#### CR (Neoprene)

CR is principally used as an external seal in refrigeration applications. It is also utilized for oxygen service. It has a useful temperature range of 0°F to 180°F (-18°C to 82°C)

#### EPDM (Ethylene Propylene)

EPDM is selected for applications above the NBR temperature range, such as handling hot water and steam. Ethylene propylene has an extremely wide range of fluid compatibility, but has the distinct disadvantage that it cannot be used with petroleum-based fluids or contaminated fluids (such as lubricated air). It has a useful temperature range of -10°F to 300°F (-23°C to 149°C).

#### FKM (Viton\*/Fluorel\*\*, etc.)

FKM is a fluorocarbon elastomer primarily developed for handling such hydrocarbons as jet fuels, gasolines, solvents, etc., which normally cause detrimental swelling to NBR. FKM has a high temperature range similar to EPDM, but with the advantage of being

somewhat more resistant to "dry heat." FKM has a wide range of chemical compatibility. It has a useful temperature range of 0°F to 350°F (-18°C to 177°C).

#### PTFE (Teflon\*, Rulon)

PTFE and PTFE with fillers are considered more a plastic than a resilient-type material. They are virtually unattacked by any fluid. Their temperature usage has ranged from discs for cryogenic valves to discs for steam valves. They are not easily fabricated and are known to have "cold flow" characteristics which may contribute to objectionable leakage, particularly on gases.

#### Other materials referred to in this catalog

CA	(Acetal, Celcon, Delrin)
FFKM	(Methyl tertiary-butyl)
FMQ	(Fluorosilicone)
HYT	(Hytrel)
MTBE	(Methyl tertiary-butyl ether)
PA	(Nylon, Zytel)
PA+FV	(Polyamide)
PE	(Polyethylene)
PP	(Polypropylene)
PPS	(Polyphenylene Sulfide, Ryton)
PUR	(Polyurethane)
UR	(Urethane)
VMQ	(Silicone)

\* DuPont Co. trademark  
\*\* 3m trademark

### Material Selection Guide for Commonly Used Fluids

Fluids	Qualifying Service Information	Materials of Construction and Ordering Information (Refer to List Price Schedule for availability and prices of Special Features)
<b>Acetic Acid</b>	Standard strengths of water solution are: 28, 56, 70, 80, 85, 98%.	For solutions of 40% or less, use stainless steel Type 316 Normally Closed valve with EPDM elastomers. Add suffix "E" to catalog number.
<b>Acetic Acid, Glacial</b>	99.9% solid.	Use appropriate ball valve with ASCO 3 or 4 way auxiliary air pilot valve.
<b>Acetone</b>	Colorless, flammable liquid with mint-like odor. Soluble in water and ether.	Standard catalog valves with EPDM elastomers. Add suffix "E" to catalog number. PTFE or metal seated valves also used.
<b>Acetylene</b>	A colorless, highly flammable gas used for welding and flame cutting of metals, and for producing other chemicals. If moisture is present, copper, silver, and alloys containing more than 66% copper are not suitable.	Standard catalog aluminum, brass, or stainless steel valves. Specify aluminum shading coil. Do not use bar stock brass valves.
<b>Air, Lubricated (Shop Air)</b>	Most sources of air carry lubrication from pumps and other equipment. Others are directly lubricated in lines.	Standard resilient seated catalog valves. For synthetic diester lubricating oils, FKM seals may be required. <i>Consult local ASCO office.</i>
<b>Air (or Gas), Dry, Unlubricated</b>	Used in instrument air applications and telephone lines where moisture and oil cannot be tolerated.	Special constructions required. Refer to Long-Life Solenoid Valve Constructions.
<b>Alcohol, Ethyl (Denatured Alcohol)</b>	A grain alcohol commonly used as solvent. Also used as a radiator antifreeze and rocket fuel.	Standard resilient seated catalog valves.
<b>Alcohol, Methyl (Methanol)</b>	A flammable wood alcohol used in automotive antifreeze, general solvent, aviation, and rocket fuel.	Standard catalog constructions; however, where high purity of liquid is essential, use Stainless Steel designs.
<b>Ammonia (Anhydrous or Dissociated)</b>	Used in refrigeration. Other uses include: for cleaning and bleaching, for etching aluminum, and in chemical processing. Presence of slight trace of water moisture can be harmful to brass.	Stainless Steel construction with aluminum shading coil and CR elastomers are required. Specify aluminum shading coil. Add prefix "X" and suffix "J" to catalog number.
<b>Argon</b>	The valves must be free of contaminants when filling incandescent lamps, luminescent tubes, gas thermometers, etc. Also used as an inert shielding gas in welding equipment.	Standard catalog aluminum and brass valves used in connection with welding equipment. Most other applications require stainless steel valves, especially cleaned to avoid contamination. Specify AP-1-005.
<b>Benzene, (Benzol)</b>	Solvent used for waxes, resins, rubber, and other organic materials. Also employed as a fuel or for blending with gasoline or other fuels.	Standard catalog valves with FKM, or PTFE disc and gasket.
<b>Butane</b>	One of the principal LP gases. Used as fuel for household and other industrial purposes. Also a refrigerant and a propellant in aerosol cans.	Special construction required. Refer to Combustion Section.

Fluids	Qualifying Service Information	Materials of Construction and Ordering Information (Refer to List Price Schedule for availability and prices of Special Features)
<b>Carbon Dioxide (Gas or Liquid) (CO<sub>2</sub>)</b>	Also known as carbonic anhydride. Used in industrial refrigeration and refrigeration of foods and carbonated beverages. Also, as a fire extinguisher and inert atmosphere in welding equipment.	For gas pressures below 100 psi, use standard valves with NBR discs. Above 100 psi, use Series 8264, especially designed for this service.
<b>Carbon Tetrachloride ("Carbona")</b>	Also known as tetrachloromethane. Mainly used as a metal degreasing agent. Also used in fire extinguishers. It is a general solvent and dry-cleaning medium. Its fumes are highly toxic and should be handled in well-ventilated areas.	Standard catalog brass valves with PTFE or FKM discs. Add suffix "T" or "V" to catalog number. Diaphragm valves must be equipped with FKM parts. Add suffix "V" to catalog number. Metal seated valves also used.
<b>Caustic Soda</b>	See "Sodium Hydroxide."	
<b>Cellulube</b>	One of the phosphate ester lubricating fluids which are fire resistant.	Standard catalog designs with EPDM elastomers. Add suffix "E" to catalog number. PTFE or metal seated valves also used.
<b>Chlorine</b>	Chlorine has a powerful suffocating odor and is strongly corrosive to organic tissues and to metals. Uses include: for bleaching textiles and paper pulp, but it is also used for the manufacture of many chemicals.	Use appropriate ball valve with ASCO 3 or 4 way auxiliary air pilot valve.
<b>City Gas</b>	See "Natural" and "Manufactured Gas."	
<b>Coffee</b>	Automatic or semiautomatic dispensing equipment.	Stainless steel or plastic valves. <i>For FDA approved elastomers, consult your local ASCO office.</i>
<b>Coke Oven Gas (Bench Gas; Coal Gas)</b>	Flammable gas used in domestic and industrial heating.	Standard steel or stainless steel valves with FKM elastomers.
<b>Coolant Oil</b>	Oil used in automatic screw machines and related equipment as cutting oils or coolants. Usually contain suspended solids.	<i>Consult your local ASCO office.</i>
<b>Diesel Fuel</b>	Petroleum oil used as fuel for diesel engines.	Standard resilient seated catalog valves with FKM seating.
<b>Ethylene Glycol (Ethylene Alcohol) "Prestone"</b>	Also known as glycol. Used in permanent antifreeze solutions, brake fluids, and as a dye solvent.	Standard resilient seated catalog valves.
<b>"Freon" Solvents "MF," "TF," and "BF"</b>	Trademark for a solvent which is commonly used in ultrasonic degreasers for removing oil, common grease, and dirt on metal or plastic parts.	Standard catalog items with metal-to-metal seating, or NBR elastomers only.

Fluids	Qualifying Service Information	Materials of Construction and Ordering Information (Refer to List Price Schedule for availability and prices of Special Features)
<b>Fuel Oil (Light) Nos. 1, 2, 3</b>	"Distillate" petroleum oil used in combustion applications without preheating.	Refer to Combustion Section.
<b>Fuel Oil (Heavy) Nos. 4, 5, 6</b>	Heavy "Bunker" fuel oil. Usually preheated to 135°F or more for combustion.	Refer to Combustion Section.
<b>Gasoline</b>	Special or high-test gasolines have additives or aromatics that affect synthetic rubber by excessive swell, or extraction of plasticizers.	Standard catalog valve constructions with FKM elastomers. Add suffix "V" to catalog number. If MTBE additive is present in gasoline, then use FFKM elastomers. Metal seated valves also used.
<b>Helium</b>	An inert gas used in heat treating, purging, and welding.	Standard resilient seated catalog valves.
<b>Hydraulic Oil</b>	Petroleum base only — viscosity usually 50 SSU or 300 SSU. For fire-resistant hydraulic oils, see "Cellulube," "Pydraul," and "Skydrol."	Standard resilient seated catalog valves.
<b>Hydrochloric Acid</b>	Also known as muriatic acid. Corrosive chemical.	Use an appropriate ball valve with ASCO 3 or 4 way auxiliary air pilot valve. For low pressure, small flow, and a maximum concentration of 20%, refer to Shielded Core valves.
<b>Hydrogen</b>	A highly flammable gas when exposed to air.	Standard resilient seated catalog valves with soft seats.
<b>Jet Fuels (JP1 through 8). For others, consult your local ASCO® office.</b>	These fuels are used in jet engines and are petroleum products, similar to kerosene. Some jet fuels contain substantial quantities of aromatics which affect most synthetic rubbers.	Standard catalog valves with FKM elastomers. Add suffix "V" to catalog number. PTFE and metal seated valves also used.
<b>Kerosene</b>	Generally used as a solvent for cleaning purpose and as a heating fuel.	Standard catalog valve with FKM elastomers. Add suffix "V" to catalog number.
<b>LP Gas</b>	See "Propane."	Refer to Combustion Section.
<b>Liquid Natural Gas, Nitrogen, and Oxygen</b>		Refer to Cryogenic Valves.
<b>Manufactured Gas</b>	Refine coke oven gas used in city applications.	Refer to Combustion Section.
<b>Mercury</b>	Uses: mercury cells and other electrical apparatus; mercury vapor boilers, lamps, barometers, thermometers, etc.	Use stainless steel body. Valve must be mounted upside down. Special construction required. <i>Consult your local ASCO office with application details.</i>
<b>Methyl Ethyl Ketone (MEK)</b>	Used in lacquers, paint removers, cements and adhesives. It is a flammable liquid.	Standard catalog valves with EPDM elastomers. Add suffix "E" to catalog number. PTFE or metal seated valves also used.
<b>Naphtha</b>	A coal-tar solvent.	Use NBR or FKM elastomers. For FKM elastomer, add suffix "V" to catalog number.
<b>Natural Gas</b>	Common heating fuel.	Refer to Combustion Section.

Fluids	Qualifying Service Information	Materials of Construction and Ordering Information (Refer to List Price Schedule for availability and prices of Special Features)
<b>Nitric Acid (aqua fortis or azotic acid)</b>	Normally, concentrations are 60% nitric and 40% water.	Stainless steel valves with aluminum shading coil and PTFE disc. Add suffix "T" to catalog number. Metal seated valves also used. Maximum temperature at which we can offer valve is 100°F.
<b>Nitric Acid-Red Fuming</b>	Red fuming is more than 86% nitric acid. These can be handled with all stainless steel valves.	
<b>Nitric Acid-White Fuming</b>	White fuming, which is pure to 97.5% acid, and nitric acid vapors are very difficult to handle.	For white fuming acid, use appropriate ball valve with ASCO pilot.
<b>Nitrogen</b>	An inert gas used in heat treating, purging, and welding.	Standard resilient seated catalog valves.
<b>Oils, Lubricating or Motor</b>	Common motor oils known as SAE oils and synthetic lube oils, etc.	Standard catalog valves for 300 SSU maximum. For higher SSU, consult your local ASCO office. <i>For compressor service involving refrigerants, consult your local ASCO office for elastomer selection.</i>
<b>Oxygen, Gas</b>	Used in conjunction with various fuels in furnaces, ovens, cutting torches, welding, and heat treating. A nonflammable gas. Contact with hydrocarbons will result in spontaneous combustion.	Metal body valves with FKM or CR elastomers, specially cleaned to avoid contamination with hydrocarbons. Add suffix "N" to catalog number.
<b>Perchloroethylene (Tetrachloroethylene) "Perk"</b>	Used as a dry-cleaning solvent and in vapor degreasing equipment.	Standard catalog items with FKM elastomers. Add suffix "V" to catalog number. Special piston valves available. Do not use diaphragm valves. <i>Consult your local ASCO office.</i>
<b>Phosphoric Acid</b>	Also known as orthophosphoric acid. Used in pickling and rust-proofing metals, soft drinks and flavoring syrups, as well as pharmaceuticals.	For concentration of up to 20% and temperatures of 100°F, use 300 series stainless steel with ethylene propylene, FKM, or NBR elastomers.
<b>Photographic Solutions</b>	Also known as sodium thiosulfate or hypo. Most metals corrode sufficiently to cause solution contamination.	For low pressure, small flow, and low concentrations (20% max.), refer to Shielded Core Valves.
<b>Potassium Sulfate</b>	Used in fertilizers. Also in aluminum and glass manufacturing.	Standard stainless steel catalog valves.
<b>Propane Gas</b>	One of the principal LP gases commonly used in grain dryer applications, and a bottled gas for heating and cooking.	Special construction required. Refer to Combustion Section.
<b>"Pydraul" (Monsanto)</b>	A trademark for a series of fire-resistant hydraulic fluids. Used in automatic welding machines, hydraulic presses, and air compressors. Also used in die-casting machines, forging, and extrusion presses.	Standard catalog items with FKM elastomers. Add suffix "V" to catalog number. PTFE or metal seated valves also used.
<b>Refrigerants, CFC (chlorofluorocarbon) "Freon®"</b>	CFCs are used as refrigerants; as blowing agents in the manufacture of insulation, packaging, and cushioning foams; as cleaning agents for metal and electronic components; and in many other applications. CFCs contain chlorine and have been targeted by the EPA to be phased out.	<i>Refrigerants require special selection of elastomers. Consult your local ASCO office.</i>

Fluids	Qualifying Service Information	Materials of Construction and Ordering Information (Refer to List Price Schedule for availability and prices of Special Features)
<b>Refrigerants, HFC (hydrofluorocarbon) "Suva<sup>®</sup>"</b>	Environmentally acceptable alternative to CFC. Contains no chlorine.	<i>Refrigerants require special selection of elastomers. Consult your local ASCO office.</i>
<b>"Skydrol"</b>	Trademark for fire-resistant jet aircraft hydraulic fluid.	Standard catalog items with EPDM elastomer. Add suffix "E" to catalog number. PTFE or metal seated valves also used.
<b>Sodium Hydroxide (Caustic Soda)</b>	Used in pulp and paper industry. Included in detergents and soap, also in textile processing. Solutions range between 50% and 73% commercial.	Stainless steel valves with EPDM elastomers. Add suffix "E" to catalog number. Stainless steel or PTFE seated valves also used.
<b>Sour Gas</b>	See "Coke Oven Gas."	
<b>Steam Condensate</b>	This is return condensate from steam boilers, which has various degrees of dissolved carbon dioxide or oxygen. Temperature is normally high to boiling point.	Brass valves suitable with EPDM elastomers. See Series 8210 and 8222 Hot Water Service Listings. Use suffix "E" on all others.
<b>Stoddard Solvent</b>	This is a dry-cleaning solvent of usually high-purity naphtha, clear and free of undissolved water. A coal-tar solvent.	Standard catalog items.
<b>Sulfuric Acid</b>	An oily, highly corrosive liquid oxidizing organic materials and most metals. It is used for pickling and cleaning metals in electric batteries and in plating baths, for making explosives and fertilizers.	Use an appropriate ball valves with ASCO 3 or 4 way auxiliary air pilot valve. For low pressure, small flow, and a concentration of up to 60%, refer to Shielded Core Valves.
<b>Toluene (Toluol)</b>	Also called methyl benzene or methyl benzol. One of the coal-tar solvents. Used in aviation and high octane gasolines. Also a solvent for paints, coatings, resins, etc. It is a flammable liquid.	Standard catalog valves with FKM disc and gasket. Add suffix "V" to catalog number.
<b>Trichloroethylene ("Carbona" or "TRIAD")</b>	Common degreasing solvent, noncombustible, but very toxic. Adequate ventilation required.	Standard brass catalog valves, if dry, use FKM elastomers (add suffix "V" to catalog number). If moisture is present, use stainless steel. Metal and PTFE seated valves also used.
<b>Turpentine</b>	Solvent or thinner for paints, varnishes, and lacquers. Also, a rubber solvent and reclaiming agent. The liquid is volatile.	Standard catalog valves with FKM elastomers. Add suffix "V" to catalog number.
<b>Vacuum</b>		Refer to Vacuum Valves.
<b>Vegetable Oils</b>	Edible oils extracted from seeds, fruits, or plants, such as peanut oils, cottonseed oils, etc.	Standard resilient seated catalog valves. <i>For FDA approved elastomers, consult your local ASCO office.</i>
<b>Vinegar</b>	A diluted impure solution of acetic acid.	Stainless steel valves with EPDM elastomers (FKM elastomers may also be used). Add suffix "E" to catalog number. <i>For FDA approved elastomers, consult your local ASCO office.</i>

Fluids	Qualifying Service Information	Materials of Construction and Ordering Information (Refer to List Price Schedule for availability and prices of Special Features)
<b>Water, Boiler Feed</b>	Commonly treated water with inhibitors to avoid corrosion of boiler tubes.	Standard stainless steel catalog valves with FKM elastomers. Add suffix "V" to catalog number.
<b>Water, Distilled or Deionized</b>	A purified water, sometimes called deionized water, neutral and free from contaminants.	Stainless steel valves with EPDM elastomers. Add suffix "E" to catalog number. Stainless steel or PTFE seated valves also used.
<b>Water, Fresh</b>		Standard resilient seated catalog valves. Aerated water, which is slightly acidic, will cause seat erosion by process known as dezincification. Stainless steel or plastic valves should then be selected.
<b>Water, High Pressure</b>	When handling water above 500 psi, erosion and water hammer must be considered.	<i>Special designs for car wash applications, etc. Consult your local ASCO office.</i>
<b>Water, Hot</b>	Water above 200°F: Often flashes to steam due to regulators or other line restrictions. Below 200°F, this change of state is unlikely.	Standard catalog designs suitable to temperatures listed in catalog. Also see Series 8210 and 8222 Hot Water Service listings. <i>For temperatures exceeding those listed, consult your local ASCO office.</i>
<b>Water, Sea, Brine, Brackish</b>	Difficult to handle due to galvanic corrosion.	Use appropriate ball valve with ASCO air pilot valve.