

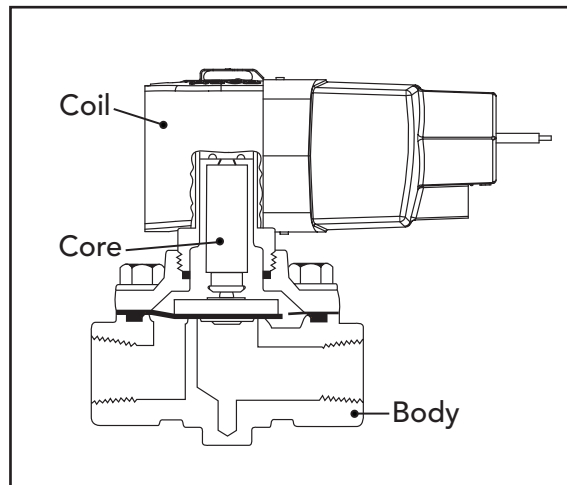
## Engineering Section

### 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 controlled by the movement of the core when the solenoid is energized or de-energized. The core is enclosed in a sealed tube, providing a compact, leaktight assembly. For additional information on different types and functions of solenoid valves including direct acting, internally pilot operated valves, two-way, three-way, and four-way valves please visit our website at [www.ascovalve.com](http://www.ascovalve.com).



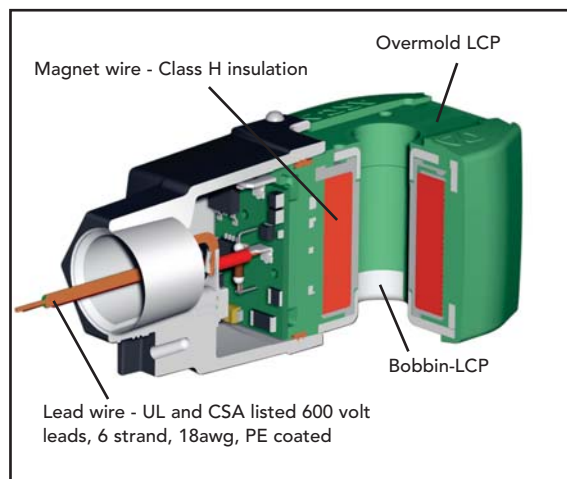
### Solenoids

All RedHat Next Generation solenoid valves are rated for continuous duty under the operating conditions outlined within this section.

#### Coil Operating Voltage Ranges

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

Voltage Range	Minimum Voltage	Maximum Voltage
100-240V/50 or 60Hz/DC	85	264
24-99V/50 or 60Hz/DC	20.4	109
12-24/DC only	10.4	26.4



The coils with voltage ranges of 100-240 and 24-99 have three lead wires, 24 inches long (2 red for power input, and one green lead for grounding where necessary). These two versions are not polarity sensitive.

The coil with a voltage range of 12-24/DC has 3 lead wires, one red, one black, and one green. This coil is polarity sensitive. The red lead is the positive, black is the negative, and green is the ground wire. This solenoid is also polarity protected. Reversing the polarity will not damage the coil, but the coil will not function until the correct polarity is applied.

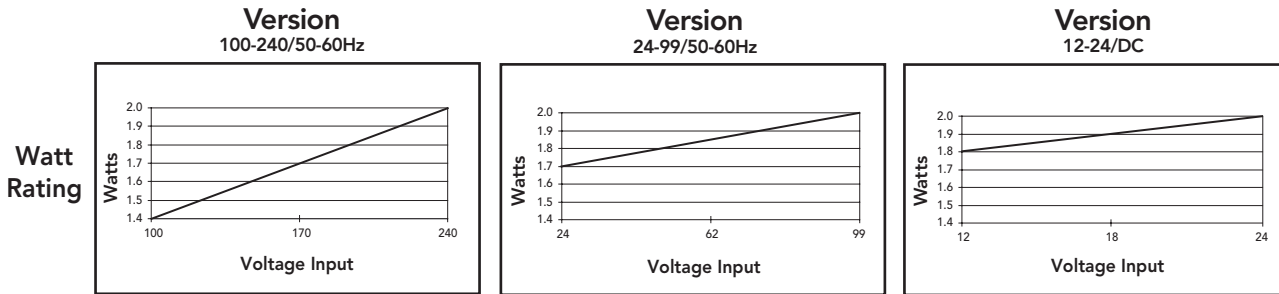
**Note:** The 100-240 voltage range is also suitable for battery charging circuits designed around a 125/DC nominal voltage range.

## Electrical Specifications

2 Watt Electronic Coils	Type
Maximum Ambient Temperature	140°F
Maximum Cycle Rate	1 Operation/Second
Standard Coil Class of Insulation	H

## Power Consumption

The Next Generation solenoid nominal power rating is 2 watts. Depending on the input voltage applied, the actual power rating may vary. Please use the charts below to determine your actual power rating.



The advanced technology used in the Next Generation coil includes electronic circuitry which may limit the compatibility with certain control system components. The following issues need to be considered when specifying an output card or device to operate the Next Generation coil. An initial inrush current spike is drawn by the Next Generation coil. This inrush spike is 72 msec in duration, which is sufficient time for the core to reach the plugnut. The electrical requirement then drops to the holding value.

**Inrush Current:** The power source, wiring, and output device used need to have surge ratings equal to or greater than the inrush current value (appropriate to the voltage range) specified in the table below.

Inrush Current Rating	
Coil Version	Peak Inrush Current (Amps)
12-24/DC	3.2
24-99/50-60Hz/DC	1.4
100-240/50-60Hz/DC	0.32
Maximum Duration = 72 ms	

**Holding Current:** The power source, wiring, and output device used need to have continuous current ratings equal to or greater than the holding current value (appropriate to the voltage range) specified in the table below.

Holding Current Rating			
Coil Version	Input Voltage	Average Holding Current (Amps)	Average Holding Volt-Amps (VA)
12-24/DC	12	0.340	4.0
	24	0.250	6.0
24-99/50-60Hz/DC	24	0.170	4.0
	99	0.100	10.0
100-240/50-60Hz/DC	100	0.040	4.0
	240	0.032	7.5

**Leakage Currents:** The leakage current is defined as a current that is supplied from an output device when the device is in its off or de-activated state. Operation of Next Generation coil in a system that utilizes supervisory currents is not recommended.

Maximum Leakage Current	3 mA
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## Solenoid Enclosures

The Next Generation solenoid coil is fully encapsulated using Dupont™ Zenite® Liquid Crystal Polymer resin (LCP). Zenite (LCP) is a thermoplastic polyester resin which exhibits several advantages over other thermoplastics. The advantages include excellent resistance to a wide range of organic solvents and automotive fluids\*, resistance to impact, and long term retention of properties at continuous-use temperatures.

\*Chemical resistance of Zenite LCP may not be suitable for all applications. Zenite LCP is not suitable for caustic solution. Please consult ASCO for appropriate product solutions.

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**General Purpose/Watertight** – Intended for indoor and outdoor use and provides protection classifications from NEMA types 1 through 4X.

**Type 1 General Purpose** – Intended for indoor use, primarily to provide protection for enclosed parts in locations without unusual service conditions. DIN-type terminals meeting ISO 4400 and DIN Standard 43650.

**Type 2 Dripproof** – Intended for indoor use, primarily to provide protection against limited amounts of falling water or dirt.

**Type 3 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.

**Type 3S 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.

**Type 3R 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.

**Type 4 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.

**Type 4X Watertight, Dusttight, and Corrosion Resistant** – Same as Type 4 but provides additional protection to resist corrosion.

**Class I, Division 2 for Hazardous Locations/Watertight** – Meets Types 1 through 4X and is UL listed and CSA certified for Class I, Division 2, Groups A, B, C, and D and Class II, Division 2, Groups F and G. Operating temperature code T4A (120°C).

## Valve Specifications

### Minimum Operating Pressure Differential

The minimum operating pressure differential is required to fully open the valve and keep it open. For 2-way valves with a floating diaphragm, the valve may start to close below the minimum pressure differential. For 3 and 4-way valves, the minimum operating pressure differential is measured between the pressure and exhaust ports and must be maintained through the operating cycle to ensure complete transfer from one position to the other.

**Note:** Hung diaphragm constructions do not require a minimum pressure differential, however, may not yield maximum flow rates at low-pressure differentials.

### Maximum Operating Pressure Differential (MOPD)

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

### 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, the minimum ambient temperature of the products listed in this catalog is 14°F (-10°C). Special constructions are available with low temperature elastomers to provide service at -40°F (-40°C) ambient temperatures. Consult ASCO for more information.

### Maximum Ambient Temperature

The maximum ambient temperature is 140°F (60°C). This limit is based on continuous energization with the maximum fluid temperatures as shown on each catalog page.

### Response Time

Response time from fully closed to fully open or vice versa depends on valve size, operating mode, fluids, temperature, inlet pressure, and pressure drop. The response times for Next Generation are defined as:

Small direct acting valves – 10 to 60 msec

Large direct acting valves – 25 to 90 msec

#### Internally pilot operated valves:

- Small diaphragm types – 20 to 100 msec

- Large diaphragm types – 80 to 150 msec

- Small piston types – 80 to 150 msec

- Large piston types – 105 to 200 msec

Operation on liquids has relatively little effect on small direct acting valves, however, response times of large direct acting and internally piloted valves may be lengthened by 50% to 100%.

### Viscosity

All valves with a pressure rating for light oil are designed for use with oils rated for a maximum of 300 SSU's with the following exceptions:

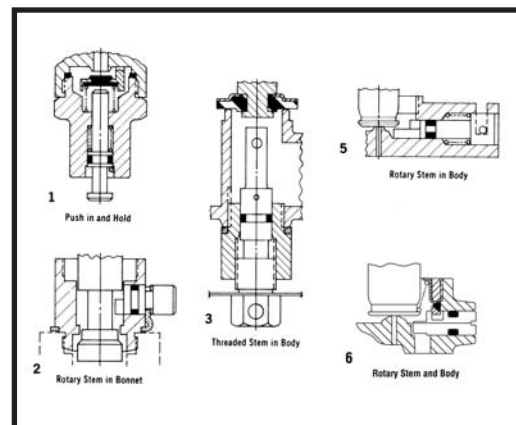
Series 8314, 8317, 8321 – 45 SSU

Series 8345 – 50 SSU

## Manual Operators

Manual operators are provided to operate the valves manually when electric actuation is not provided. There are two basic types of manual operators, momentary and maintained. To determine which type of manual operator is available for your valves, please see the Optional Features Chart on the relevant valve catalog page. Once it is determined that the subject valve can accommodate a manual operator, the chart below will tell you the type of manual operator. The chart also references the relevant cutaway illustration.

Series Number	Const. Ref.	Manual Operator Suffix	Manual Operator Type	Illustration Number
8030	8	MO	Maintained	3
8210	4, 7, 10, 11, 12	MO	Maintained	2
8262	1	MS	Maintained	6
8314	1	MS	Maintained	6
8316	5, 6	MO	Maintained	2
8320	2	MO	Momentary	1
8320	2	MS	Maintained	6
8321	4	MO	Momentary	1
8321	4	MS	Maintained	3
8344	1, 3, 4	MO	Maintained	2
8345	2	MO	Maintained	5



## Resilient Material Selection

**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).

**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 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).

**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).

**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).

**Oxygen Service** – All valve parts are degreased and blacklight inspected for cleanliness. They are assembled and tested in a clean area using oil-free air or nitrogen; helium mass spectrometer tested for external leakage. The pipe connections are sealed with plugs, and each valve is tagged certifying testing. All valves are shipped in sealed bags.

**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 ranges 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.

**Urethane** – Urethane is primarily used on high pressure valves, and/or for long life applications, because of its high strength and abrasion resistance. The physical and chemical properties of urethane vary depending on whether the compound is polyester or polyether based. Urethane has a wide range of chemical resistance including alcohols, non-aromatic compounds, ethers, edible fats and oils, hydraulic fluid, and water. It has a useful temperature range of -90°F to 200°F for ethers, and -30°F to 200°F for esters. Polyester based Urethanes in contact with moisture should be limited to a maximum temperature of 140°F.

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Fluorel is a registered Trademark of 3M.

Valve Parts in Contact with Fluids								
Catalog Number	Body	Seals and Discs	Disc Holder	Core Guide	Springs	Shading Coil	Stem	
8030P003	Brass	NBR	-	-	302 Stainless Steel	Copper	-	
8030P083	Brass	NBR	-	-	302 Stainless Steel	Copper	PA	
8210P004	Brass	NBR	-	-	302 Stainless Steel	Copper	-	
8210P006	Brass	NBR	-	-	302 Stainless Steel	Copper	-	
8210P007	Brass	NBR	-	-	302 Stainless Steel	Copper	-	
8210P008	Brass	NBR	-	-	302 Stainless Steel	Copper	-	
8210P022	Brass	NBR	-	-	302 Stainless Steel	Copper	-	
8210P033	Brass	NBR	PA	-	302 Stainless Steel	Copper	-	
8210P034	Brass	NBR	PA	-	302 Stainless Steel	Copper	-	
8210P035	Brass	NBR	PA	-	302 Stainless Steel	Copper	-	
8210P087	304 Stainless Steel	NBR	-	-	302 Stainless Steel	Silver	-	
8210P088	304 Stainless Steel	NBR	-	-	302 Stainless Steel	Silver	-	
8210P093	Brass	NBR	-	-	302 Stainless Steel	Copper	-	
8210P094	Brass	NBR	-	-	302 Stainless Steel	Copper	-	
8210P095	Brass	NBR	-	-	302 Stainless Steel	Copper	-	
8210P100	Brass	NBR	-	-	302 Stainless Steel	Copper	-	
8223P003	Brass	NBR, PA, PTFE	-	-	302 Stainless Steel	Copper	-	
8223P005	Brass	NBR, PA, PTFE	-	-	302 Stainless Steel	Copper	-	
8223P010	304 Stainless Steel	PTFE, NBR	-	-	302 Stainless Steel	Silver	-	
8223P025	Brass	NBR, PA, PTFE	-	-	302 Stainless Steel	Copper	-	
8223P027	Brass	NBR, PA, PTFE	-	-	302 Stainless Steel	Copper	-	
8262P261	Brass	UR	-	-	302 Stainless Steel	Copper	PA	
8262P262	Brass	NBR	-	-	302 Stainless Steel	Copper	PA	
8262P263	Brass	NBR	-	-	302 Stainless Steel	Copper	PA	
8262P265	Brass	NBR	-	-	302 Stainless Steel	Copper	PA	
8262R077	Brass	LT NBR	-	CA	Inconel 600	Copper	-	
8262R078	Brass	LT NBR	-	CA	Inconel 601	Copper	-	
8262R099	Brass	UR	-	-	302 Stainless Steel	Copper	-	
8262R105	Brass	NBR	-	-	302 Stainless Steel	Copper	-	
8262R107	Brass	UR	-	-	302 Stainless Steel	Copper	-	
8262R109	Brass	NBR	-	-	302 Stainless Steel	Copper	-	
8262R174	304 Stainless Steel	NBR	-	-	302 Stainless Steel	Silver	-	
8262R175	304 Stainless Steel	UR	-	-	302 Stainless Steel	Silver	-	
8262R178	304 Stainless Steel	NBR	-	-	302 Stainless Steel	Silver	-	
8262R181	304 Stainless Steel	UR	-	-	302 Stainless Steel	Silver	-	
8262R183	304 Stainless Steel	NBR	-	-	302 Stainless Steel	Silver	-	
8262R185	304 Stainless Steel	NBR	-	-	302 Stainless Steel	Silver	-	
8262P202	Brass	NBR	-	-	302 Stainless Steel	Copper	-	
8262P208	Brass	NBR	-	-	302 Stainless Steel	Copper	-	
8262P212	Brass	NBR	-	-	302 Stainless Steel	Copper	-	
8262P220	304 Stainless Steel	NBR	-	-	302 Stainless Steel	Silver	-	
8262P226	304 Stainless Steel	NBR	-	-	302 Stainless Steel	Silver	-	
8262P230	304 Stainless Steel	NBR	-	-	302 Stainless Steel	Silver	-	
8262P232	Brass	NBR	-	-	302 Stainless Steel	Copper	-	
8262R277	Brass	NBR	-	-	302 Stainless Steel	Copper	-	
8263R115	Brass	NBR	-	-	302 Stainless Steel	Copper	-	
8263R124	Brass	NBR	-	-	302 Stainless Steel	Copper	-	
8263R191	304 Stainless Steel	NBR	-	-	302 Stainless Steel	Silver	-	
8263R193	304 Stainless Steel	NBR	-	-	302 Stainless Steel	Silver	-	
8263R200	Brass	NBR	-	-	302 Stainless Steel	Copper	-	
8263R210	Brass	NBR	-	-	302 Stainless Steel	Copper	-	
8263R332	304 Stainless Steel	NBR	-	-	302 Stainless Steel	Silver	-	
8263R333	304 Stainless Steel	NBR	-	-	302 Stainless Steel	Silver	-	
8314R035	Brass	NBR, FKM	-	CA	302 Stainless Steel	Copper	-	
8314R036	Brass	NBR, FKM	-	CA	302 Stainless Steel	Copper	-	
8314R121	304 Stainless Steel	NBR, FKM	-	CA	302 Stainless Steel	Silver	-	
8314R126	304 Stainless Steel	NBR, FKM	-	CA	302 Stainless Steel	Silver	-	
8316P054	Brass	NBR	CA	CA	302, 17-7PH Stainless Steels	Copper	-	
8316P064	Brass	NBR	CA	CA	302, 17-7PH Stainless Steels	Copper	-	
8316P074	Brass	NBR	CA	CA	302, 17-7PH Stainless Steels	Copper	-	
8317P035	Brass	NBR, FKM, CR	-	CA	302, 17-7PH Stainless Steels	Copper	-	
8320P136	Brass	NBR	CA	-	302 Stainless Steel	Copper	-	
8320P146	303 Stainless Steel	NBR	CA	-	302 Stainless Steel	Silver	-	
8320P172	Brass	NBR	CA	CA	302 Stainless Steel	Copper	-	
8320P174	Brass	NBR	CA	CA	302 Stainless Steel	Copper	-	
8320P176	Brass	NBR	CA	CA	302 Stainless Steel	Copper	-	
8320P182	Brass	NBR	CA	CA	302 Stainless Steel	Copper	-	
8320P184	Brass	NBR	CA	CA	302 Stainless Steel	Copper	-	
8320P186	Brass	NBR	CA	CA	302 Stainless Steel	Copper	-	
8320P190	Brass	NBR	CA	CA	302 Stainless Steel	Copper	-	
8320P192	Brass	NBR	CA	CA	302 Stainless Steel	Copper	-	
8320P194	Brass	NBR	CA	CA	302 Stainless Steel	Copper	-	
8320P704	Brass	NBR	CA	CA	302 Stainless Steel	Copper	-	
8320P714	303 Stainless Steel	NBR	CA	CA	302 Stainless Steel	Silver	-	
8321P001	Brass	NBR	CA	CA	302 Stainless Steel	Copper	-	
8321P002	Brass	NBR	CA	CA	302 Stainless Steel	Copper	-	
8344P070	Brass	NBR	CA	CA	302, 17-7PH Stainless Steels	Copper	-	
8344P072	Brass	NBR	CA	CA	302, 17-7PH Stainless Steels	Copper	-	
8344P074	Brass	NBR	CA	CA	302, 17-7PH Stainless Steels	Copper	-	
8344P076	Brass	NBR	CA	CA	302, 17-7PH Stainless Steels	Copper	-	
8344P078	Brass	NBR	CA	CA	302, 17-7PH Stainless Steels	Copper	-	
8344P080	Brass	NBR	CA	CA	302, 17-7PH Stainless Steels	Copper	-	
8345P001	Brass	NBR, PA	-	CA	302 Stainless Steel	Copper	-	
EE8551P401	Anodized Aluminum	NBR, PA	-	CA	302 Stainless Steel	Copper	-	
EE8551P409	316 Stainless Steel	NBR, PA	-	CA	302 Stainless Steel	Copper	-	

Note: All core tubes are 305 stainless steel and all cores and plugnuts are 430F stainless steel.

## Approvals

### Approval Listing Code and Information

UL, CSA, and CE listings are indicated on each series of valves in this catalog. Listing codes and other information follow in this section.

### Agency Valve Classifications and Code Reference

**Solenoid Recognized Components** – Solenoids in this category are intended for use as factory-installed components of equipment where final acceptability must be determined by UL or CSA. ASCO RedHat Next Generation solenoids are listed in the UL recognized component index under Guide No. YSYI2 for ordinary locations and VAPT for hazardous locations.

**General Purpose Valves** – Normally open or normally closed valves intended to control the fluid flow, but not to be depended upon to act as safety valves. This is a UL and CSA classification and is not intended to indicate valve service or application. General purpose valves are listed in UL index under Guide No YIOZ or YIOZ2 for ordinary locations and YTSX or YTSX2 for hazardous locations.

**Safety Shutoff Valves** – Normally closed valves of the “on” and “off” type, intended to be actuated by a safety control or emergency device, to prevent unsafe fluid delivery. They may also be used as General Purpose valves. Multiple port valves may be designated as safety shutoff valves only with respect to the normally closed port. This is a UL and CSA classification. Safety shutoff valves are listed in UL index under Guide YIOZ or YIOZ2 for ordinary locations and YTSX or YTSX2 for hazardous locations.

#### **Underwriters Laboratories (UL)**

UL429, “Electrically Operated Valves.”

UL1604, “Electrical Equipment for use in Class I and II, Division 2 and Class III hazardous classified locations.”

#### **Canadian Standards Association (CSA)**

Standard C22.2 No. 139, “Electrically Operated Valves.”

Standard C22.2 No. 213, “Electrical equipment for use in Class I, Division 2 hazardous locations.”

#### **European Directive (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:

<b>Council</b>	<b>Directive #</b>
Machinery	89/392/EEC
EMC (Electromagnetic Capability)	89/336/7EC
Low Voltage	72/23/EEC
PED (Pressure Equipment Directive)	97/23/EC

ASCO RedHat Next Generation valves comply with these directives, through third party or self-certification. The General Purpose/Watertight coils each bear the CE approval mark on the coil.



## Quality Assurance

ASCO’s Quality Assurance Program meets all the requirements of ISO9001-2000. ASCO can provide product from 17 ISO-certified facilities around the world.