P70, P72, and P170 Controls for High Pressure Applications

The P70, P72, and P170 controls for high pressure applications are designed primarily for high pressure cut-out control, head-pressure control, and condenser fan cycling control on commercial refrigeration and air conditioning applications. Some models are UL® (Underwriters Laboratories) Listed as refrigeration pressure limiting controls.

Controls are available in several pressure ranges and are compatible with most common refrigerants. They may also be used on other non-corrosive fluid applications. Ammonia compatible models are also available.

Several different electrical ratings and switch configurations are available. The P72 models provide direct control of 208-240 volt single-phase motors up to 3 hp, and 208-220 volt 3-phase motors up to 5 hp.

Figure 1: P70CA-2 High Pressure Cutout Control

Features and Benefits

❑ **All Steel Case and Cover**	Provides long lasting, rugged protection for internal components
❑ **“Sight-Set” Calibrated Pressure Adjustment**	Displays a visible pressure scale, fully adjustable through the range without removing the cover (on NEMA 1 enclosure models)
❑ **Manual Reset Lockout Option**	Provides “trip-free” lockout that cannot be overridden or reset until pressure returns to specified level
❑ **A Variety of Pressure Connection Styles Available**	Allows greater flexibility when mounting control and adapting pressure connections to field application requirements

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Application

P70, P72, and P170 Series controls for high pressure applications are designed primarily to provide high-side pressure control on commercial refrigeration and air conditioning applications.

IMPORTANT:	Except for those models listed as *Refrigeration Pressure Limiting Controls*, the P70, P72, and P170 Series controls for high pressure applications are intended to control equipment under normal operating conditions. Where failure or malfunction of the P70, P72, and P170 pressure controls could lead to an abnormal operating condition that could cause personal injury or damage to the equipment or other property, other devices (limit or safety controls) or systems (alarm or supervisory systems) intended to warn of or protect against failure or malfunction of the P70, P72, and P170 pressure controls must be incorporated into and maintained as part of the control system.

- **P70C, P70D P170C and P170D models** with Single-Pole Single-Throw (SPST) Open-high switch action are the most popular models, and are typically used for high-pressure cutout. The **C models** are automatic reset. The **D models** have a manual reset lockout mechanism. Some **P70C, P70D P170C and P170D models** are UL Listed as refrigeration pressure limiting controls.
- **P70A and P170A models** are available with SPST Open-low switch action, and typically are used for condenser fan cycling control.
- **P70 and P170 models** with Single-Pole Double-Throw (SPDT), or 4-wire, 2-circuit switch action allow users to install alarm devices or other control circuits.
- **P72 models** have a Double-Pole Single-Throw (DPST) switch with load-carrying contacts that can provide direct control of 208-240 V single-phase motors up to 3 hp, and 208-220 V 3-phase motors up to 5 hp. Refer to Table 8.

Controls are available in several pressure ranges and are compatible with most common refrigerants. They may also be used on air, water and other non-corrosive fluid applications. Ammonia compatible models are also available.

⚠ CAUTION:	**Equipment Damage Hazard.** Ammonia is very corrosive to copper and brass components. On ammonia applications, **only** ammonia-compatible control models and pressure connections must be used. The pressure control must be mounted separately from the electrical cabinet and all electrical piping sealed to prevent ammonia from migrating to electrical components.

The **Manual Reset Lockout** mechanism does not allow the pressure control to automatically reset after the control has cut out, providing shutdown capability for unmonitored equipment. See *Manual Reset Operation.*

NEMA 1 enclosures are standard on most models. **NEMA 3R enclosures** are also available.

Operation

A pressure-actuated bellows on the control is connected to a pressure tap on the controlled equipment by a capillary or a field-installed hose (except ammonia models). The bellows responds to equipment pressure changes and operates a snap-action electrical switch.

Dimensions

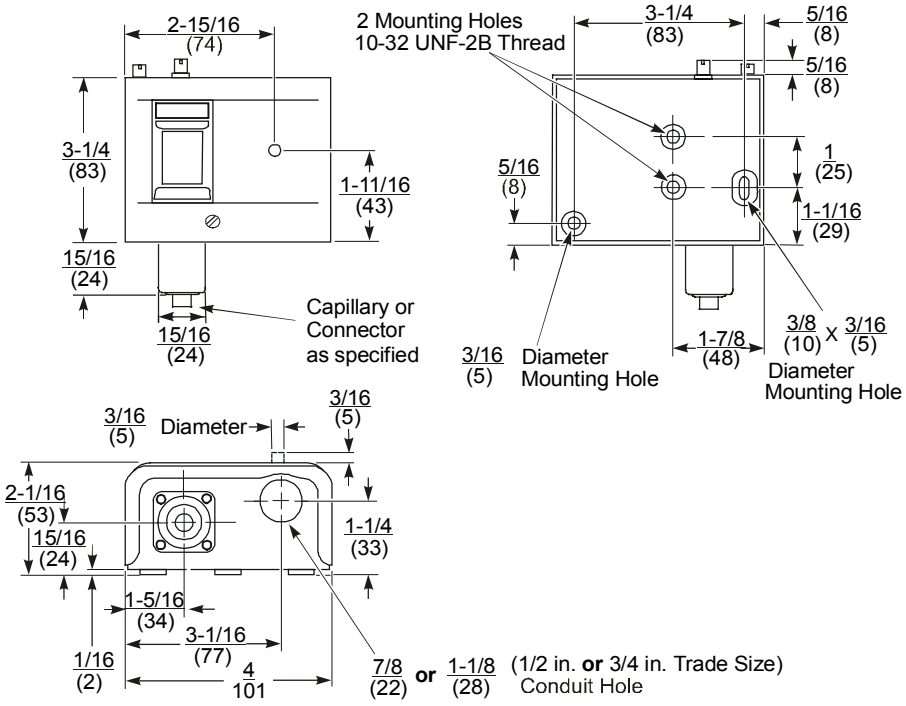


Figure 2: Dimensions for High Pressure Controls with NEMA 1 Enclosure, in. (mm)

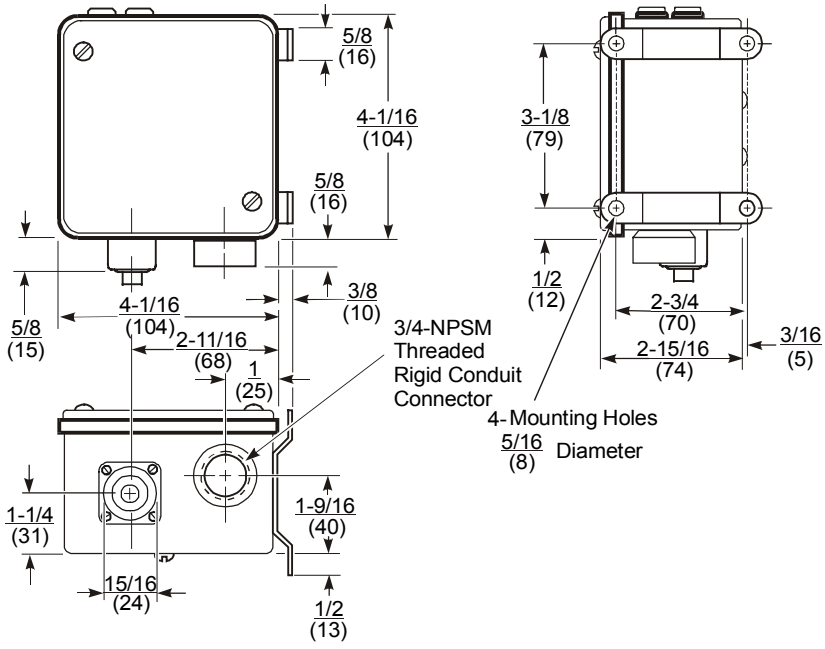


Figure 3: Dimensions for High Pressure Controls with NEMA 3R Enclosure, in. (mm)

Note: These dimensions are nominal and are subject to accepted manufacturing tolerances and application variables.

Mounting

Mounting Holes for Flat Vertical Surfaces

Use mounting screws provided. Longer screws may damage control.

Universal Mounting Bracket (Part No. 271-51)

Mount bracket to horizontal surface.

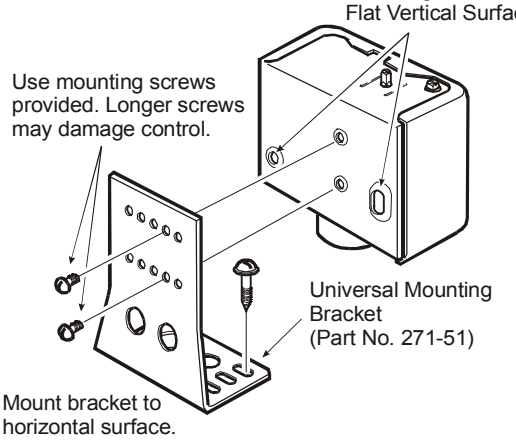


Figure 4: Mounting the P70, P72, and P170 High Pressure Control with NEMA 1 Enclosure

Mount the control in an accessible position, where the control and pressure connection line will not be subject to damage.

CAUTION:	**Equipment Damage Hazard.** Mount the pressure control upright and level. Position the pressure connection line to allow drainage away from control bellows. Pressure tap points must be located on the top side of the refrigerant lines. This reduces the possibility of oil, liquids, or sediment accumulating in the bellows, which could cause control malfunction.

Controls with NEMA 1 enclosures may be mounted on flat, horizontal, or vertical surfaces.

Use two screws or bolts through the two outer holes on the back of the control case when mounting control directly to a flat vertical surface.

Use the two inner holes with the Universal Mounting Bracket (and screws supplied) when mounting the control to a flat horizontal surface.

IMPORTANT:	Use **only** the mounting screws provided with the Universal Mounting Bracket to avoid damaging internal components. Do not warp control case when mounting control to uneven surface.

Controls with NEMA 3R enclosures are designed to be mounted in a level, upright position with the bellows and conduit connection facing down. All gaskets must be in place. Mounting NEMA 3R enclosures in any position other than upright and level may trap water in the enclosure and submerge internal control components.

Pressure Connections

P70, P72, and P170 high pressure controls are connected to the controlled equipment by a capillary or flexible hose (except ammonia models). These controls are available with a variety of pressure connection styles. See Figure 10 for pressure connection styles.

Follow these guidelines when installing pressure connection lines.

IMPORTANT:	If these controls are installed on equipment that contain hazardous or regulated materials, such as refrigerants or lubricants, the installer and user should observe all regulations governing the handling and containment of those materials.

Avoid Sharp Bends in the Capillary Tube

Sharp bends can weaken or kink capillary tubes, which may result in leaks or restrictions.

Allow for Slack in the Capillary Tube

Leaving a little slack in the capillary tube helps dampen mechanical vibration that can weaken or damage capillary tubes.

Coil and Secure Excess Capillary Tubing

Carefully loop any excess capillary tubing into smooth, circular coils (approximately 3 in. diameter). Securely fasten the coiled tubing.

Avoid Contact Between the Capillary Tubing and Sharp or Abrasive Objects

Vibration of sharp or abrasive objects in contact with capillary tubes can result in leaks.

Do Not Overtighten Flare Nuts on Pressure Connection Line Fittings

Overtightening flare connections may damage the threads on the flare nuts or flare connectors, and may result in leaks. Do not exceed 9 ft-lb (12 N-m) of torque when tightening brass flare connections.

Avoid Severe Pressure Pulsation at Pressure Connections

Install pressure connection lines to pressure tap points away from the compressor, to minimize the effects of pressure pulsation from reciprocating compressors.

IMPORTANT:	After installing control, evacuate control and pressure connection lines in accordance with applicable EPA and other regulations, to remove air, moisture, and other contaminants.

*W*iring

P70, P72, and P170 controls for high pressure applications are available with several switch options and electrical ratings. Check the label inside the control cover for model number, switch action, and electrical rating. (See to Table 1 for switch action and models.)

Check the wiring terminal designations on the control switch-block and refer to the following guidelines and applicable wiring diagrams, when wiring the control.

⚠ WARNING:	**Risk of Electrical Shock.** Disconnect power supply before making electrical connections to avoid possible electrical shock or equipment damage.

IMPORTANT:	Use terminal screws furnished in the switch block. Using other terminal screws will void the warranty and may damage the switch.

IMPORTANT:	Make all wiring connections in accordance with the National Electrical Code and all local regulations. Use copper conductors only. Do not exceed the control's electrical rating.

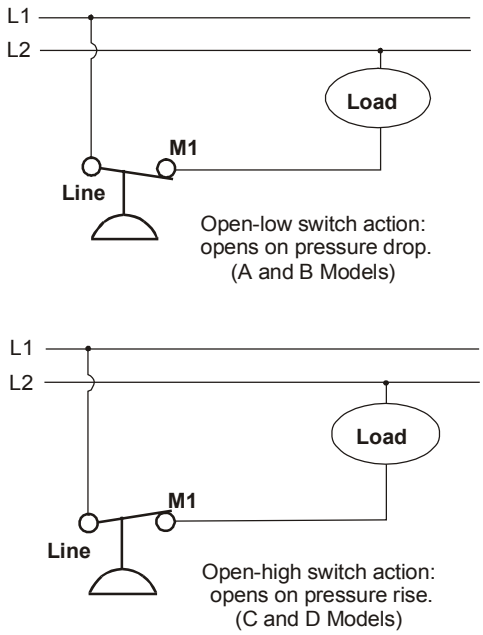


Figure 5: Typical Wiring for SPST Switch (P70A, B, C, D and P170A, C, D Models)

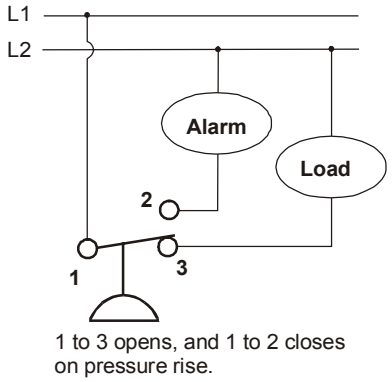
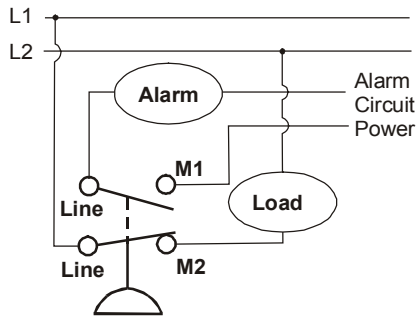
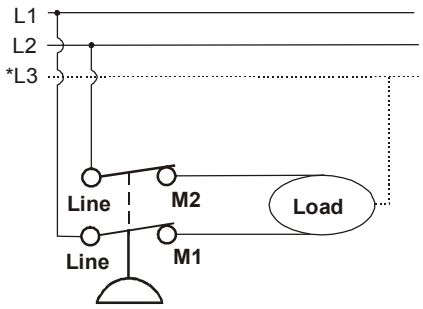


Figure 6: Typical Wiring for SPDT Switch (P70E, F Models)



Main circuit (Line to M2) opens and auxiliary circuit (Line to M1) closes on pressure rise.

Figure 7: Typical Wiring for 4-wire 2-circuit Switch used for a High Pressure Cutout Application with an Alarm Circuit (P70J, K, and P170K Models)



Line to M1, and Line to M2 open on pressure rise.

*(L3 is third supply line in 3-phase applications.)

Figure 8: Typical Wiring for DPST Switch (P72C, and D Models)

Table 1: Single Pressure Controls Switch Action, Low Event, High Event, and Models

Switch and Action	Low Event	High Event	Models
Single-Pole Single-Throw (SPST) Open-low	Cut Out (Opens Line to M1)	Cut In (Closes Line to M1)	P70A, P70B, P170A
Single-Pole Single-Throw (SPST) Open-high	Cut In (Closes Line to M1)	Cut Out (Opens Line to M1)	P70C, P70D, P170C, P170D
Single-Pole Double-Throw (SPDT)	Opens 1 to 2 and closes 1 to 3	Closes 1 to 2 and Opens 1 to 3	P70E, P70F
4-Wire, 2-Circuits, 1-NO, 1-NC Open-low	Cut Out (Opens M2 to Line and Closes M1 to Line)	Cut In (Closes M2 to Line and Opens M1 to Line)	P70G, P70H
4-Wire, 2-Circuits, 1-NO, 1-NC Open-high	Cut In (Closes M2 to Line and Opens M1 to Line)	Cut Out (Opens M2 to Line and Closes M1 to Line)	P70J, P70K, P170K
Double-Pole Single-Throw (DPST) Open-low	Cut Out (Opens M1 to Line and M2 to Line)	Cut In (Closes M1 to Line and M2 to Line)	P72A, P72B
Double-Pole Single-Throw (DPST) Open-high	Cut In (Closes M1 to Line and M2 to Line)	Cut Out (Opens M1 to Line and M2 to Line)	P72C, P72D

Adjustments

Adjustment of the P70, P72, and P170 high pressure controls vary, depending on the model. The following guidelines and diagrams illustrate the procedures for adjusting these controls. Refer to the product label inside the control cover for model number and switch action. Refer to Table 1 for switch action, low event, and high event for the various control models.

High Pressure Cutout - Automatic Reset

High pressure cutout controls with automatic reset have a scaleplate that displays the CUT IN and CUT OUT setpoints. (See the visible scale on the control.) Turning the range screw adjusts the CUT IN and CUT OUT setpoints up or down simultaneously, while maintaining a constant pressure differential. Turning the differential screw adjusts only the low event on the left side of the scale, and changes the pressure differential between the CUT IN and CUT OUT pressures.

High Pressure Cutout - Manual Reset Lockout

High pressure cutout controls with the Manual Reset Lockout option have a scaleplate that displays the CUT OUT setpoint. There is no pointer for the CUT IN setpoint. (See the visible scale on the control.)

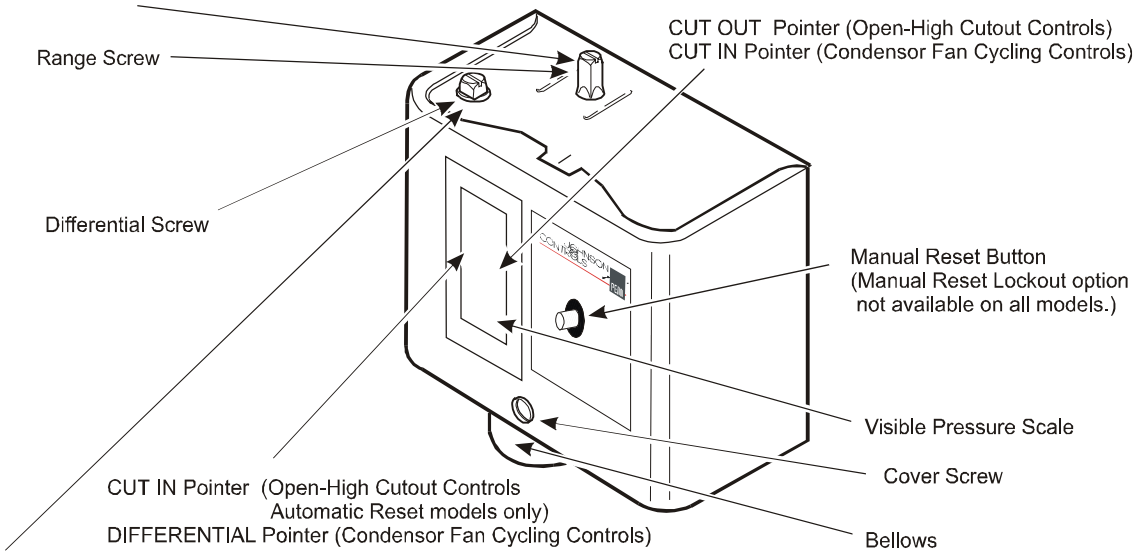
Turning the range screw adjusts the CUT OUT setpoint on the right side of the scale. There is no differential screw on Manual Reset Lockout models.

Condenser Fan Cycling - Open-low Switch Action

Condenser fan cycling pressure controls have a scaleplate that displays the CUT IN setpoint and DIFFERENTIAL setting. (See visible scale on the control.) Turning the range screw adjusts the CUT IN setpoint on the right side of the scale. Turning the differential screw adjusts the DIFFERENTIAL setting on the left side, which changes the resulting cutout pressure.

IMPORTANT:	Do not adjust pointers beyond the highest or lowest indicator marks on the control's pressure scale. Adjusting pointers beyond indicator marks may damage screw threads and cause inaccurate control operation

Step 1. Set high event by adjusting range screw.
Open-High Cutout Controls: Turn screw clockwise to raise CUT OUT.
Condenser Fan Cycling Controls: Turn screw clockwise to lower CUT IN.



Step 2. Adjust the differential screw.
Open-High Cutout Controls (Automatic Reset only): Turning the differential screw changes the CUT IN setpoint. Turn screw clockwise to lower CUT IN setpoint.
Condensor Fan Cycling Controls: Turning the differential screw changes the differential setting. Turn screw clockwise to increase DIFFERENTIAL.

Figure 9: Adjusting P70, P72, and P170 Controls for High Pressure Applications

IMPORTANT:	Use the pressure control settings recommended by the manufacturer of the controlled equipment. Do not exceed the pressure ratings of the controlled equipment or any of its components when checking pressure control operation or operating the controlled equipment.

IMPORTANT:	After installing and adjusting pressure control, and before leaving installation, cycle the controlled equipment several times (at least three) at normal operating conditions. Use reliable pressure gauges to verify proper control settings and equipment operation.

Manual Reset Operation

Pressure controls with the Manual Reset option, lock out when they reach cut out pressure and must be manually reset by the user to restart the controlled equipment. The manual reset mechanism is “trip-free” and cannot be overridden by blocking or tying the reset button down.

On equipment with locked out controls, first determine and remedy the cause of the lockout, and allow the sensed pressure to drop at least 70 psig below the CUT OUT setpoint. Then, press and release the reset button on the front of the control to restore operation of the controlled equipment.

Ordering Information

P70, P72, and P170 controls for high pressure applications are available in a variety of standard and non-standard models. Table 2 lists the standard models available through most Johnson Controls/PENN Authorized Distributors.

Table 3 is a model identification matrix that depicts all the potential P70, P72, and P170 control models. Not all control models depicted in Table 3 are manufactured and available. Figure 10 illustrates the pressure connection styles available on P70, P72, and P170 control models.

Contact your Johnson Controls/PENN Authorized Representative for availability and price.

Table 2: Standard P70, P72, and P170 Controls for High Pressure Applications

Code Number	Switch Action	Range psig (kPa)	Differential psi (kPa)	Pressure Connection
Condenser Fan Cycling Controls (for Non-Corrosive Refrigerants)				
P70AA-118	SPST Open-low	100 to 400 (690 to 2758)	Minimum 35 (241) Maximum 200 (1379)	36 in. Capillary with 1/4 in. Flare Nut
P70AA-2		0 to 150 (0 to 1034)	Minimum 12 (83) Maximum 70 (482)	
P72AA-27	DPST Open-low	100 to 400 (690 to 2758)	Minimum 35 (241) Maximum 200 (1379)	
P170AA-118	SPST Open-low			1/4 in. Male Flare Connector
All Range Controls (for Non-Corrosive Refrigerants)				
P70CA-2*	SPST Open-high	50 to 500 (345 to 3448)	Minimum 60 (414) Maximum 150 (1034)	1/4 in. Male Flare Connector
P70CA-3*				36 in. Capillary with 1/4 in. Flare Nut
P70DA-1*			Manual Reset Lockout	
P70KA-1	4-wire, 2-circuit Line-M1 Close-high Line-M2 Open-high			
P72CA-2*	DPST Open-high		Minimum 60 (414) Maximum 150 (1034)	
P72DA-1*			Manual Reset Lockout	
P170CA-3*	SPST Open-high		Minimum 60 (414) Maximum 150 (1034)	1/4 in. Male Flare Connector
P170DA-1*			Manual Reset Lockout	
P170KA-1	4-wire, 2-circuit Line-M1 Close-high Line-M2 Open-high			
Ammonia Compatible Models				
P70AA-119	SPST Open Low	50 to 300 (345 to 2068)	Minimum 20 (138) Maximum 120 (827)	1/4 in. SS Female NPT
P70CA-5*	SPST Open-high	50 to 500 (345 to 3448)	Minimum 60 (414) Maximum 150 (1034)	
P70DA-2*			Lockout (requires manual reset)	

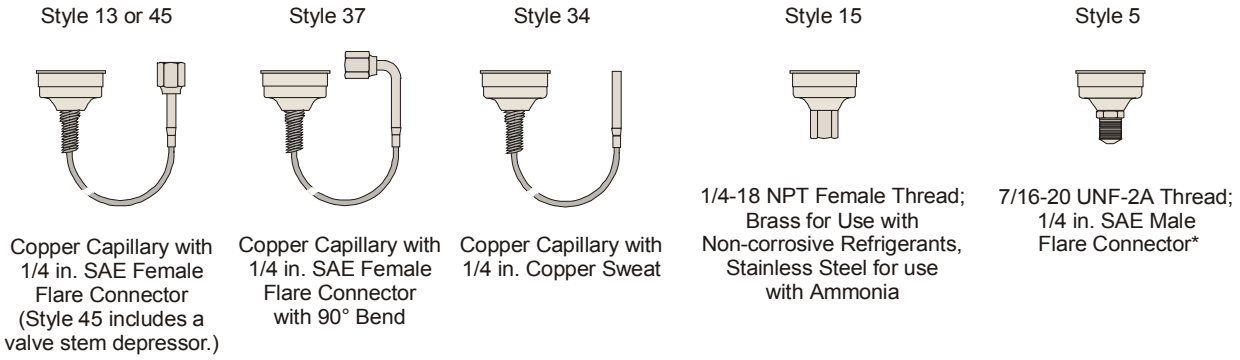
*****Models (Code Number) that are UL Listed as refrigeration pressure limiting controls.

Note: See *Dimensions* and *Specifications* for additional model information including Maximum Working Pressure and Maximum Over-pressure ratings.

Table 3: P70, P72, and P170 Single Pressure Control Identification Chart

P70	Various pressure connection styles available on many models (See Figure 10.)	
P170	1/4 in. male flare pressure connection only (Style 5, see Figure 10.)	
P72	DPST switch only, 3/4 in. conduit opening on most models, (E, F, G, H, J, and K, models not available)	
	A	SPST switch (DPST in P72), Open-low, automatic reset
	B	SPST switch (DPST in P72), Open-low, manual reset lockout
	C	SPST switch (DPST in P72), Open-high, automatic reset
	D	SPST switch (DPST in P72), Open-high, manual reset lockout
	E	1 hp SPDT switch (n/a in P72), automatic reset
	F	1/4 hp SPDT switch (n/a in P72), automatic reset
	G	4-wire, 2-circuit switch (n/a in P72), main switch Open-low, automatic reset
	H	4-wire, 2-circuit switch (n/a in P72), main switch Open-low, manual reset lockout
	J	4-wire, 2-circuit switch (n/a in P72), main switch Open-high, automatic reset
	K	4-wire, 2-circuit switch (n/a in P72), main switch Open-high, manual reset lockout
		A NEMA 1 enclosure, no adjustment knob
		B NEMA 1 enclosure, with adjustment knob
		C No enclosure, no adjustment knob
		D No enclosure, with adjustment knob
		E NEMA 3R enclosure, no adjustment knob
		G NEMA 3R enclosure, no adjustment knob, 1/2 in. conduit
		H NEMA 1 enclosure, no adjustment knob, 1/4 in. quick connects
		J NEMA 1 enclosure with adjustment knob, 1/4 in. quick connects
		N NEMA 1 enclosure no adjustment knob, transportation application
		P NEMA 1 enclosure with adjustment knob, transportation application
		S NEMA 3R enclosure, no adjustment knob, transportation application

Note: Not all combinations shown on this chart are available. To verify product availability and for quantity orders of non-standard items, please contact Refrigeration Application Engineering at (414) 524-5535.



*Note: Style 5, 1/4 in. SAE Male Flare Connector may require a copper flare saver gasket, which must be purchased separately.

Figure10: Pressure Connections Styles Available on P70, P72, and P170 Controls

Electrical Ratings

Table 4: SPST Electrical Ratings (P70A, B, C, and D, and P170A, C, and D Models)

	Standard Single-Phase Ratings			Hermetic Compressor Single-Phase Ratings
	120 VAC	208 VAC	240 VAC	208/240 VAC
Motor Horsepower	1.5	3	3	--
Motor Full-Load Amperes	20	18.7	17	20
Motor Locked-Rotor Amperes	120	112.2	102	120
Non-Inductive Amperes	22	22	22	--
Pilot Duty	125 VA at 120 to 600VAC; 57.5 VA at 120 to 300 VDC			

Table 5: SPDT Electrical Ratings 1hp Switch (P70E Models)

	Standard Single-Phase Ratings			
	120 VAC	208 VAC	240 VAC	277 VAC*
Motor Full Load Amperes	16.0	9.2	8.0	7.0
Motor Locked Rotor Amperes	96.0	55.2	48.0	42.0
Non-Inductive Amperes	16.0	9.2	8.0	--
Pilot Duty	125 VA at 120 to 600 VAC			125 VA at 24 to 600 VAC

* Rating for P70EC models only.

Table 6: SPDT Electrical Ratings 1/4 hp Switch (P70F Models)

	Standard Single-Phase Ratings		
	120 VAC	208 VAC	240 VAC
Motor Full Load Amperes	6.0	3.3	3.0
Motor Locked Rotor Amperes	36.0	19.8	18.0
Non-Inductive Amperes	6.0	6.0	6.0
Pilot Duty	125 VA at 24 to 240 VAC		

Table 7: 4-wire, 2-circuit Electrical Ratings (P70G, H, J, and K, and P170K Models)

	Standard Single-Phase Ratings							
	Line-M2 (Main Contacts)				Line-M1 (Auxiliary Contacts)			
	120 VAC	208 VAC	240 VAC	277 VAC	120 VAC	208 VAC	240 VAC	277 VAC
Motor Full Load Amperes	16.0	9.2	8.0	--	6.0	3.3	3.0	--
Motor Locked Rotor Amperes	96.0	55.2	48.0	--	36.0	19.8	18.0	--
Non-Inductive Amperes	16.0	9.2	8.0	7.2	6.0	6.0	6.0	6.0
Pilot Duty (for both sets of contacts)	125 VA at 24 to 600 VAC; 57.5 VA at 120 to 300 VDC							

Table 8: DPST Electrical Ratings (P72A, B, C, and D Models)

	Standard Ratings					Hermetic Compressor Ratings	
	120 VAC 1Ø	208 VAC 1Ø	240 VAC 1Ø	208 VAC 3Ø	220 VAC 3Ø	208 VAC 1Ø	240 VAC 1Ø
Motor Horsepower	2	3	3	5	5	--	--
Motor Full-Load Amperes	24	18.7	17	15.9	15	24	24
Motor Locked-Rotor Amperes	144	112.2	102	95.4	90	144	144
AC Non-Inductive Amperes	24	24	24	24	24	--	--
DC Non-Inductive Amperes	3	0.5	0.5	0.5	0.5	--	--
Pilot Duty	125 VA at 120 to 600VAC; 57.5 VA at 120 to 300 VDC						

Specifications

Product	P70, P72, and P170 Controls for High Pressure Applications			
Switch Action	**P70, P170:** SPST; 4-wire/2-circuit; or SPDT PENN switch			**P72:** DPST
Pressure Connection	**P70, P72 Standard Models** Various connections available See Figure 10.	**P170 Standard Models** 1/4 in. SAE male flare See Figure 10.		**Ammonia Compatible Models** 1/4 in. stainless steel female NPT connection See Figure 10.
Maximum Working Pressure	For 0-150 psig range: 150 psig (1034 kPa)	For 50-300 psig range: 300 psig (2068 kPa)	For 100-400 psig range: 400 psig (2758 kPa)	For 50-500 psig range: 500 psig (3448 kPa)
Maximum Overpressure	For 0-150 psig range: 525 psig (3620 kPa)	For 50-300 psig range: 400 psig (2758 kPa)	For 100-400 psig range: 475 psig (3275 kPa)	For 50-500 psig range: 525 psig (3620 kPa)
Ambient Temperature	50 to 104°F (10 to 40°C)			
Case and Cover	NEMA 1 Enclosures: case is galvanized steel; cover is plated and painted steel. NEMA 3R Enclosures: case and cover are plated and painted steel.			
Dimensions (H x W x D)	NEMA 1 Enclosure: 3-1/4 x 4 x 2-1/16 in. (83 x 101 x 53 mm) NEMA 3R Enclosure: 4-11/16 x 4-1/16 x 2-15/16 in. (104 x 104 x 74 mm)			
Approximate Shipping Weight	Individual (NEMA 1): 2.4 lb (1.08 kg); Bulk pack (NEMA 1, multiples of 25 controls): 60 lb (27.2 kg)			
Agency Listings	For information on specific items, contact the Refrigeration Application Engineering Group at (414) 524-5535.			
Accessories	271-51 Universal Mounting Bracket (supplied with standard controls)			

The performance specifications are nominal and conform to acceptable industry standards. For application at conditions beyond these specifications, contact the Refrigeration Application Engineering Group at (414) 524-5535. Johnson Controls, Inc. shall not be liable for damages resulting from misapplication or misuse of its products.

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