

P70, P72, and P170 Series Controls for High Pressure Applications

Application

P70, P72, and P170 Series Controls for High Pressure Applications provide high-side pressure control on commercial refrigeration and air conditioning applications.

They may also be used on air, water and other noncorrosive fluid applications. Ammonia compatible models are also available.

IMPORTANT: Except for those models listed as *Refrigeration Pressure Limiting Controls*, use the P70, P72, and P170 Series Controls for High Pressure Applications only as an operating control. Where failure or malfunction of a P70, P72, or P170 pressure control could lead to personal injury or property damage to the controlled equipment or other property, additional precautions must be designed into the control system. Incorporate and maintain other devices such as supervisory or alarm systems or safety or limit controls intended to warn of, or protect against, failure or malfunction of the P70, P72, or P170 pressure control.

CAUTION: Risk of Property Damage. Mount the pressure control separately from the electrical cabinet and seal all electrical piping to prevent ammonia from migrating to electrical components. Where there may be exposure to ammonia, use only ammonia compatible control modules and pressure connections. System shutdown due to improper adjustment may cause property damage.

- **P70C, P70D, P170C, and P170D type models** with Single-Pole Single-Throw (SPST) Open-High switch action are the most popular models and are typically used as high pressure Cutout controls. The **C type models** are automatic reset controls. The **D type models** have a manual reset lockout mechanism. Some **P70C, P70D, P170C, and P170D type models** are UL Listed as refrigeration pressure limiting controls. See Table 2 for standard models available.
- **P70A and P170A type models** feature SPST Open-Low switch action and typically are used for condenser-fan cycling control.
- **P70 and P170 Series 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 Series models** have a Double-Pole Single-Throw (DPST) switch with load-carrying contacts that can provide direct control of 208-240 VAC single-phase motors up to 3 hp, 480 and 600 VAC single-phase noncompressor motors, and 208-220 VAC 3-phase motors up to 5 hp. See Table 6.

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

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

Dimensions

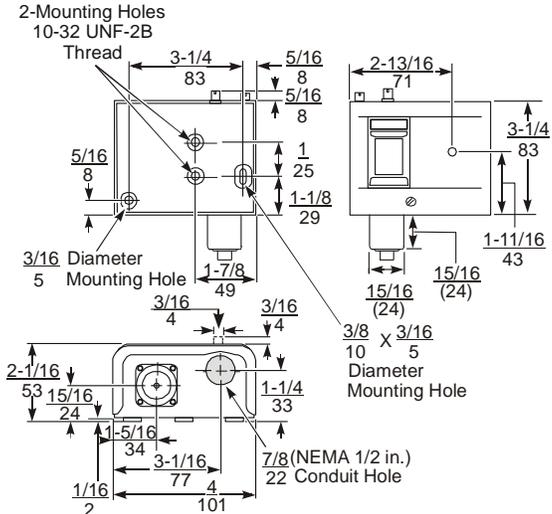


Figure 1: Dimensions for P70, P72, and P170 Pressure Controls with NEMA 1 Enclosures, in. (mm)

Controls are available in several pressure ranges and are compatible with most common refrigerants.

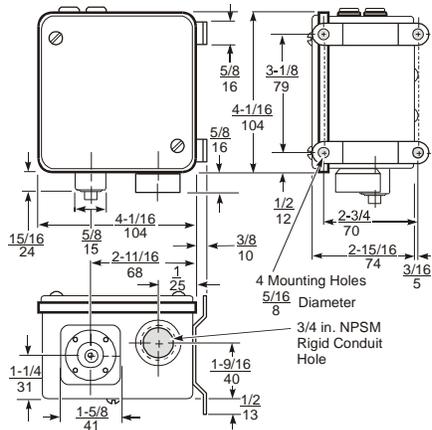


Figure 2: Dimensions for P70, P72, and P170 Pressure Controls with NEMA 3R Enclosures, in. (mm)

Mounting

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

Mount the pressure control upright and level. Position the pressure connection line to allow drainage away from control bellows. Locate pressure tap points on the top side of the refrigerant lines to reduce the possibility of oil, liquids, or sediment accumulating in the bellows, which could cause control malfunction.

Mount controls with NEMA 1 enclosures on horizontal or vertical flat surfaces.

Use two screws or bolts through the two outer holes on the back of the control case to mount the 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. See Figure 3.

Mount controls with NEMA 3R enclosures in a level, upright position with the bellows and conduit connection facing down. Ensure that all gaskets are 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.

IMPORTANT: Use only the mounting screws supplied with the Universal Mounting Bracket to avoid damaging internal components. Be careful not to distort or bend the control case when mounting the control to an uneven surface. Using other screws or bending the control case will void the warranty.

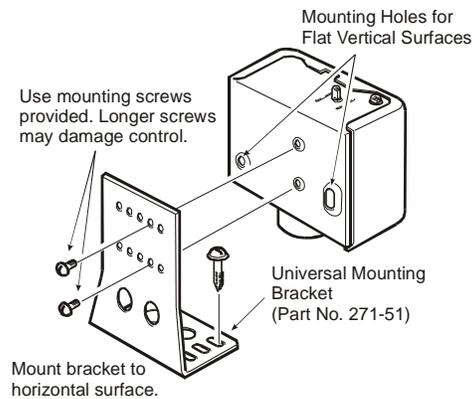


Figure 3: Mounting the P70, P72, and P170 Pressure Controls with NEMA 1 Enclosures, in. (mm)

Pressure Connections

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

Follow these guidelines when installing pressure connection lines:

IMPORTANT: If these controls are installed on equipment that contains hazardous or regulated materials, such as refrigerants or lubricants, you must comply with all standards and regulations governing the containment and handling 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 2 to 3 in. [50 to 75 mm] 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 the control, evacuate pneumatic and pressure connection lines to remove air, moisture and other contaminants in a manner consistent with applicable environmental regulations and standards.

Wiring

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 Table 1 for switch actions and models. See *Electrical Ratings*.

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 each of multiple power supplies before making electrical connections. More than one disconnect may be required to completely de-energize equipment. Contact with components carrying hazardous voltage can cause electric shock and may result in severe personal injury or death.

IMPORTANT: Use only the terminal screws that are supplied with the switch-block. Using other screws may cause damage to the switch-block and will void the warranty.

IMPORTANT: Use copper conductors only. Make all wiring connections in accordance with local, national, and regional regulations. Do not exceed the controls.

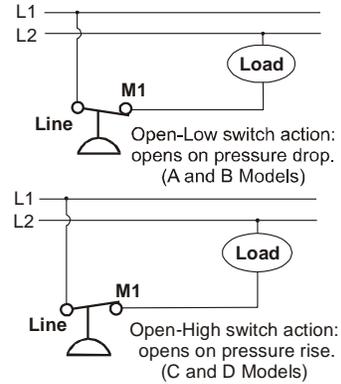


Figure 4: Typical Wiring for SPST Switch (P70A, B, C, D and P170A, C, D Type Models)

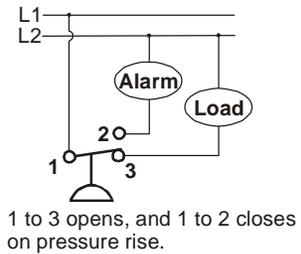


Figure 5: Typical Wiring for SPDT Switch (P70E and F Type Models)

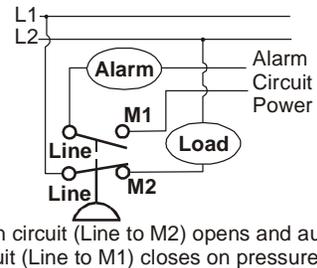


Figure 6: Typical Wiring for 4-Wire, 2-Circuit Switch (P70J, K and P170K Type Models)

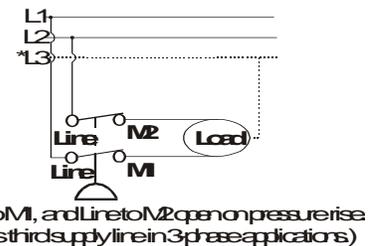


Figure 7: Typical Wiring for DPST Switch (P72C and D Type Models)

Table 1: Pressure Control Switch Action, Low Events, High Events, Model Types, and Electrical Ratings Tables References

Switch and Action	Low Event	High Event	Model Types - Electrical Rating Table References
Single-Pole Single-Throw (SPST) Open-Low	Cutout (Opens Line to M1)	Cut In (Closes Line to M1)	P70A, P70B, P170A See Table 3.
Single-Pole Single-Throw (SPST) Open-High	Cut In (Closes Line to M1)	Cutout (Opens Line to M1)	P70C, P70D, P170C, P170D See Table 3.
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 See Table 4.
4-Wire, 2-Circuits, 1-NO, 1-NC Open-Low	Cutout (Opens M2 to Line and Closes M1 to Line)	Cut In (Closes M2 to Line and Opens M1 to Line)	P70G, P70H See Table 5.
4-Wire, 2-Circuits, 1-NO, 1-NC Open-High	Cut In (Closes M2 to Line and Opens M1 to Line)	Cutout (Opens M2 to Line and Closes M1 to Line)	P70J, P70K, P170K See Table 5.
Double-Pole Single-Throw (DPST) Open-Low	Cutout (Opens M1 to Line and M2 to Line)	Cut In (Closes M1 to Line and M2 to Line)	P72A, P72B See Table 6.
(DPST) Open-High	Cut In (Closes M1 to Line and M2 to Line)	Cutout (Opens M1 to Line and M2 to Line)	P72C, P72D See Table 6.

Adjustments

Adjustments 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 Cutout setpoints. (See the visible scale on the control.) Turn the range screw to adjust the Cut In and Cutout setpoints up or down simultaneously, while maintaining a constant pressure differential. Turn the differential screw to adjust (only) the low event on the left side of the scale (which changes the differential pressure value).

High Pressure Cutout - Manual Reset Lockout

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

Turn the range screw to adjust the Cutout setpoint on the right side of the scale. There is no differential

screw on Manual Reset Lockout models. The differential pressure value is fixed.

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.) Turn the range screw to adjust the Cut In setpoint on the right side of the scale. Turn the differential screw to adjust the Differential setting on the left side of the scale (which changes the Cutout pressure value).

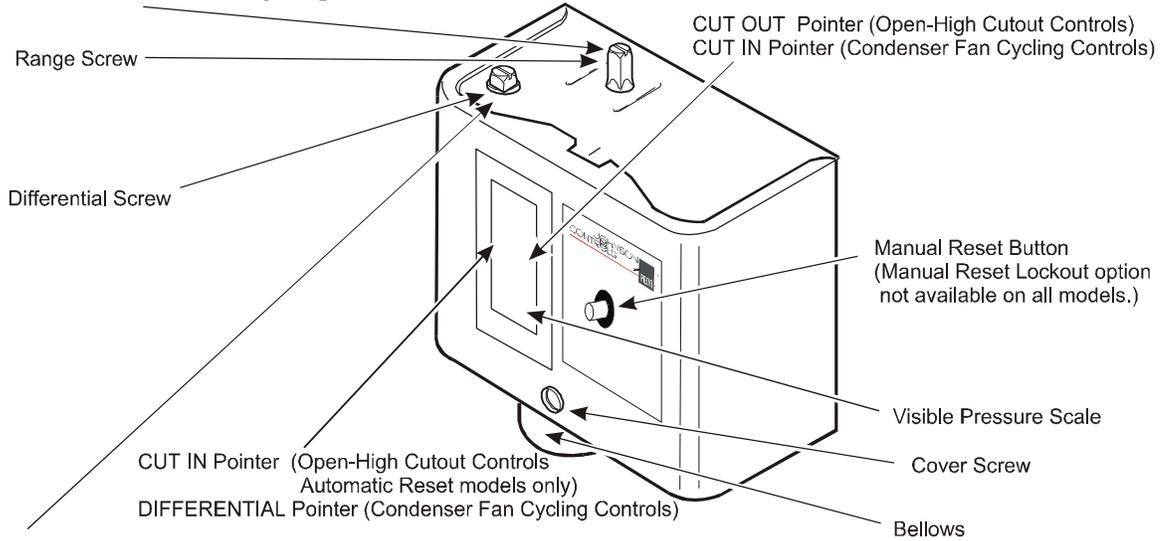
IMPORTANT: Do not adjust pointers beyond the highest or lowest indicator marks on the control's pressure scale. Adjusting pointers beyond indicator marks may damage screw threads, may cause inaccurate control operation, and will void the warranty.

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.

Step 1. Set high event by adjusting range screw.

High Pressure 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.

High Pressure Cutout Controls: Turning the differential screw changes CUT IN setpoint.
(Auto-Reset models only) Turn screw clockwise to lower CUT IN setpoint.

Condenser Fan Cycling Controls: Turning the differential screw changes the differential setting.
Turn screw clockwise to increase DIFFERENTIAL.

Figure 8: Adjusting P70, P72, and P170 Controls for High Pressure Applications

IMPORTANT: After mounting and wiring control, attach a reliable set of gauges to the controlled equipment, and operate the equipment (at least) three cycles at the pressures necessary to verify control setpoints and proper equipment operation.

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 Cutout setpoint. Then, press and release the reset button on the front of the control to restore operation of the controlled equipment.

Manual Reset Operation

Pressure controls with the Manual Reset option lock out when they reach Cutout 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.

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

Model Number	Switch Action	Range Psig (kPa)	Differential Psi (kPa)	Pressure Connection	Maximum Working Pressure (MWP) Psi (kPa)	
Condenser Fan Cycling Control Models (for Noncorrosive Refrigerants)						
P70AA-118	SPST Open-Low	100 to 400 psig (690 to 2758)	Minimum 35 (241) Maximum 200 (1379)	36 in. Capillary with 1/4 in. Flare Nut	475 (3275)	
P72AA-27	DPST Open-Low	100 to 400 psig (690 to 2758)	Minimum 35 (241) Maximum 200 (1379)	1/4 in. Male Flare Connector		
P170AA-118	SPST Open-Low					
All-Range Control Models (for Noncorrosive Refrigerants)						
P70CA-2*	SPST Open-High	50 to 500 (345 to 3448)	Minimum 60 (414) Maximum 150 (1034)	1/4 in. Male Flare Connector	525 (3620)	
P70CA-3*			Manual Reset Lockout	36 in. Capillary with 1/4 in. Flare Nut		
P70DA-1*						
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)			36 in. Capillary with 1/4 in. Flare Nut
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	Minimum 20 (138) Maximum 120 (827)	1/4 in. SS Female NPT	525 (3620)	
P70CA-5*	SPST Open-High	50 to 500 (345 to 3448)	Minimum 60 (414) Maximum 150 (1034)			
P70DA-2*			Manual Reset Lockout			
Continued on next page . . .						

Model Number (Cont.)	Switch Action	Range Psig (kPa)	Differential Psi (kPa)	Pressure Connection	Maximum Working Pressure (MWP) Psi (kPa)
High Pressure Control Models for High Pressure Non-corrosive Refrigerants					
P70AA-400	Condenser Fan Cycling	100 to 470 (689 to 3241)	Adjustable 35 to 200 (241 to 1379)	36 in. Capillary with 1/4 in. Flare Nut	690 (4757)
P170AA-400	SPST Opens Low			1/4 in. Male Flare Connector	
P70CA-400*	SPST Opens High	200 to 610 (1379 to 4206)	Adjustable 60 to 150 (413 to 1034)	36 in. Capillary with 1/4 in. Flare Nut	
P170CA-400*				1/4 in. Male Flare Connector	
P70DA-400*		200 to 610 (1379 to 4206)	Manual Reset Lockout	36 in. Capillary with 1/4 in. Flare Nut	
P170DA-400*				1/4 in. Male Flare Connector	

* Models that are UL Listed as refrigeration pressure limiting controls. For models not included in this table, contact the Refrigeration Application Engineering Group at 1-800-275-5676 for details and availability.

Note: See *Dimensions* and *Technical Specifications* for additional model information including Maximum Working Pressure.

Electrical Ratings

Table 3: SPST Electrical Ratings (P70A, B, C, D, and P170A, B, C, D Models)

	Standard Single-Phase Ratings					Hermetic Compressor Single-Phase Ratings
	120 VAC	208 VAC	240 VAC	*480 VAC	*600 VAC	208/240 VAC
Motor Full-Load Amperes	24	18.7	17	5	4.8	24
Motor Locked-Rotor Amperes	144	112.2	102	30	28.8	144
Non-Inductive Amperes	22	22	22	--	--	--
Pilot Duty	125 VA at 120 to 600 VAC; 57.5 VA at 120 to 300 VDC					

* Not for compressor motor loads

Table 4: SPDT Electrical Ratings Standard Differential 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	16.0	16.0	16.0
Pilot Duty	125 VA at 120 to 600 VAC			125 VA at 24 to 600 VAC

* Rating for P70EC models only

Table 5: 4-Wire, 2-Circuit Electrical Ratings (P70G, H, J, K, and P170K Models)

	Standard Single-Phase Ratings									
	Line-M2 (Main Contacts)						Line-M1 (Auxiliary Contacts)			
	120 VAC	208 VAC	240 VAC	277 VAC	*480 VAC	*600 VAC	120 VAC	208 VAC	240 VAC	277 VAC
Motor Full Load Amperes	16.0	9.2	8.0	--	5	4.8	6.0	3.3	3.0	--
Motor Locked Rotor Amperes	96.0	55.2	48.0	--	30	28.8	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									

* Not for compressor motor loads

Table 6: DPST Electrical Ratings (P72A, B, C and D Type Models)

	Standard Ratings							Hermetic Compressor Ratings	
	120 VAC 1Ø	208 VAC 1Ø	240 VAC 1Ø	208 VAC 3Ø	220 VAC 3Ø	*480 VAC 1Ø	*600 VAC 1Ø	208 VAC 1Ø	240 VAC 1Ø
Motor Full-Load Amperes	24	18.7	17	15.9	15	5	4.8	24	24
Motor Locked-Rotor Amperes	144	112.2	102	95.4	90	30	28.8	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 600 VAC; 57.5 VA at 120 to 300 VDC								

* Not for compressor motor loads

Technical 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	P170 Standard Models 1/4 in. SAE male flare	Ammonia Compatible Models 1/4 in. stainless steel female NPT connection
Ambient Temperature	P70E and P70F: 50 to 104°F (10 to 40°C) All Other Models: -40 to 140°F (-40 to 60°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: 4-1/16 x 4-1/16 x 2-15/16 in. (104 x 104 x 74 mm)		
Approximate Shipping Weight	Individual Pack (NEMA 1): 2.4 lb (1.08 kg); Bulk Pack (NEMA 1, multiples of 25 controls): 60 lb (27.2 kg)		
Compliance	For information on specific models, contact the Refrigeration Application Engineering Group at 1-800-275-5676.		
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 1-800-275-5676. Johnson Controls shall not be liable for damages resulting from misapplication or misuse of its products.

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