

Series P28 Oil Pressure Cutout Differential Pressure Control With Built-In Time Delay Relay

Application

The P28 controls provide dependable and economical oil pressure cutout for pressure lubricated refrigeration compressors. The factory set pressure adjustment provides operation to the compressor manufacturer's specifications.

The P28 measures the net oil pressure available to circulate oil through the lubrication system. (Net oil pressure is the difference between the oil gage pressure and the refrigerant pressure in the crankcase.)

A built-in time delay relay, accurately compensated for ambient temperature, allows for pressure build-up on start and avoids nuisance shutdowns on short duration pressure losses during the running cycle. When supplied with terminal no. 3, the control may be wired to operate a runlight to indicate when sufficient net oil pressure is present. Terminal A is supplied when a shutdown alarm or signal is desired.

The P28 control is for use at normal room temperatures of 32 to 104°F (0 to 40°C) and in areas protected from the weather.

All Series P28 controls are designed for use only as operating controls. Where an operating control failure would result in personal injury and/or loss of property, it is the responsibility of the installer to add devices (safety, limit controls) or systems (alarm, supervisory systems) that protect against, or warn of, control failure.

Operation

When the compressor is started, the time delay heater is energized. If the net oil pressure does not build up to

the "heater off" valve within the required time limit, the time delay trips to stop the compressor.

If the net oil pressure rises to the "heater off" valve within the required time after the compressor starts, the time delay heater is automatically de-energized and the compressor continues to operate normally.

If the net oil pressure drops below the "heater on" valve (scale setting) during the running cycle, the time delay relay is energized. If the net oil pressure does not return to the "heater off" valve within the time delay period, the compressor will be shut down.

Time Delay Relay

The time delay relay is a "trip-free," thermal expansion device. Manual reset models and automatic reset models are available with factory set and sealed time delays of 30, 45, 60, 90 or 120 seconds. A time delay of 10 seconds is only available on automatic recycle models.

The time delay relay is compensated to minimize the effect of ambient temperature variations. Timing is affected by voltage variations.

Installation

Mounting

Mount the control in any position, directly to a wall or panel board, using the two mounting screw holes located on the back of the control case. Mount so the pressure connections on the bellows are above the crankcase liquid level of the equipment on which the control is being used.

If required, Part No. 271-51 universal mounting bracket is available.

NOTE: Use only mounting screws supplied with control to avoid damage to internal components.

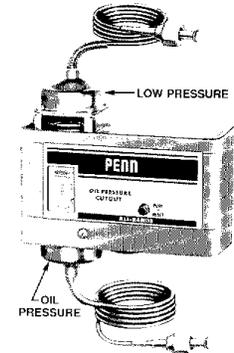


Fig. 1 — P28 Oil Pressure Cutout with 1/4" Flare Nut. Connections also available with 1/4" O.D. tubing for sweat connection, 1/4" male flare fitting or with 1/4"-18 FNPT connector.

CAUTION: The P28 control applied for ammonia service must be mounted separately from the electrical cabinet.

Pressure Connections

1. Avoid sharp bends or kinks in the capillary tubing.
2. Purge all tubing and lines before connecting the pressure controls. Connect the oil pressure line to the pressure connector labeled "OIL" and the crankcase line to the pressure connector labeled "LOW". (See Fig. 1.)

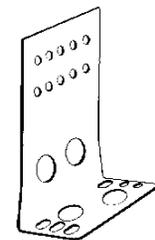


Fig. 2 — Universal mounting bracket.

- Coil and secure excess capillary to avoid vibration. Allow some slack in capillary to avoid “violin string” vibration which can cause tubing to break. Do not allow tubing to rub against metal surfaces where friction can damage the capillary.

CAUTION: With a ¼” male SAE flare fitting and 1/4” tubing a pulsation dampener must be used where there is a possibility of pulsation.

Wiring

CAUTION: Disconnect the power supply before the wiring connections are made to avoid possible electrical shock or damage to the equipment. On multiple circuit units, more than one circuit may have to be disconnected.

Make all wiring connections using copper conductors only, and in accordance with National Electrical Code and local regulations. For maximum electrical rating of the control, see the label inside the control cover.

NOTE: Use the terminal screws furnished in the Pennswitch (8-32 x ¼” binder head). Substitution of other screws may cause problems in making proper connections.

See the label inside the control cover or in the manufacturer’s specifications for typical wiring diagram.

For external wiring diagrams, see Figs. 4 through 11.

For applications using a 208 volt control circuit, it is suggested that one leg of the 208 volt circuit and a neutral or ground wire be used as a 120 volt source to power the time delay heater.

When a P28 control is installed on a 440 or 550 VAC system, use an external step-down transformer to provide either 120 or 240 volts to the pilot and time delay relay circuits. The transformer must be of sufficient volt-ampere capacity to operate the motor starter and the P28’s time delay relay.

Electrical Power Required for Time Delay Relay

Timing in Seconds	Voltage	
	12, 24 or 120 V	240 V*
10	30 VA	60 VA
30, 45, 60, 90 or 120	15 VA	30 VA

*Includes dropping resistor wattage.

Adjustment

Factory setting may be changed in the field. Standard stock setting is:

Cutout 9 PSI (62 kPa) pressure difference. (“Heater off” pressure is about 5 PSI [34 kPa] higher than cutout.)

NOTE: When the controls are shipped as an accessory to the compressor unit, time delay and pressure are set to manufacturer’s specifications. Replacement controls should duplicate the manufacturer’s specifications for time delay and pressure settings.

When manufacturer’s settings are not known, call the nearest distributor or proceed as follows:

- With the compressor running, read
 - Oil pressure.
 - Crankcase pressure.
- Subtract the crankcase pressure from the oil pressure gage reading. This is net oil pressure to the bearings.
- Set the cutout pointer 6 to 8 PSI (41 to 55 kPa) below the established running net oil pressure.

CAUTION: Obtain the compressor manufacturer’s net oil bearing pressure specifications as soon as possible, and reset the cutout pointer if it is not in accordance with the manufacturer’s specifications.

To raise the cutout setting, turn adjusting disk “C” (Fig. 3) to the left as viewed from the front of the control. Turn the disk to the right to lower the cutout setting.

EXAMPLE: Suppose the minimum lube oil pressure required to the bearings is 9 PSI (62 kPa) (oil pump pressure minus crankcase pressure). The control scale setting should be 9 PSI (62 kPa). Upon an initial start of the compressor, or if the oil pressure drops during the running cycle, the time delay heater is energized. If the lube oil pressure does not build up to the scale setting, plus 5 PSI (34 kPa) for switch differential or total of 14 PSI (97 kPa), during the timing period, the control breaks the circuit to the compressor. If this pressure of 14 PSI (97 kPa) is reached during the timing period, the time delay heater is de-energized and the compressor is permitted to continue normal operation.

Pressure Specifications

Time Delay Shutdown Range (Pressure Difference)*	Maximum Allowable Overrun Pressure
8 to 70 PSI (55 to 480 kPa)	325 PSIG (2240 kPa)

*The time delay heater is de-energized at 5 PSI (34 kPa) pressure difference above scale setting.

Test For Shutdown

Immediately after installing, and at regular intervals thereafter, the time delay relay should be tested to be sure that all circuits are operating correctly. Proceed as follows:

Pull the disconnect switch and remove the cover from the P28 control. Connect a jumper between terminals 1 and 2. (See Fig. 3 for terminal location.) Close the line switch to start the compressor running. The time delay relay will stop the compressor after the time delay interval.

NOTE: If the control is mounted on a condensing unit where air from auxiliary equipment, such as blowers or fans, may strike the control, the cover should be replaced before the test. After testing the time delay relay, again pull the disconnect switch and remove the jumper between terminals 1 and 2. Place the cover on the control and close the disconnect switch. Manually reset the time delay relay.

Checkout Procedure

Before leaving the installation, observe at least three complete operating cycles to be sure that all components are functioning correctly.

Repairs and Replacement

The time delay relay assembly (timer and terminal board) may be replaced or interchanged in the field. Field repairs must not be made except for replacement of the time delay relay control or time delay relay assembly, contact the nearest Johnson Controls wholesaler.

Replacement Time Delay Relay Assemblies

Part Number	Voltage	Type of Reset	Timing in Seconds	Alarm Circuit
RLY13A-600R	120/240 VAC	Manual	60	No
RLY13A-602R	120/240 VAC	Manual	90	No
RLY13A-603R	120/240 VAC	Manual	90	Yes
RLY13A-608R	120/240 VAC	Automatic	90	No
RLY13A-609R	24 VAC/DC	Manual	120	No
RLY13A-610R	120/240 VAC	Manual	30	No
RLY13A-616R	120/240 VAC	Manual	120	No
RLY13A-617R	120/240 VAC	Manual	45	No

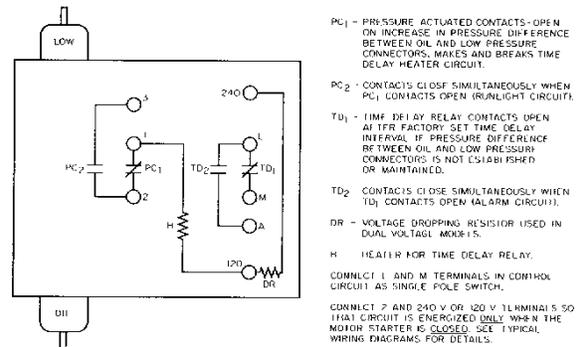


Fig. 4 — Internal wiring circuit for 120/240 VAC P28 control showing shutdown alarm circuit A and runlight terminal no. 3.

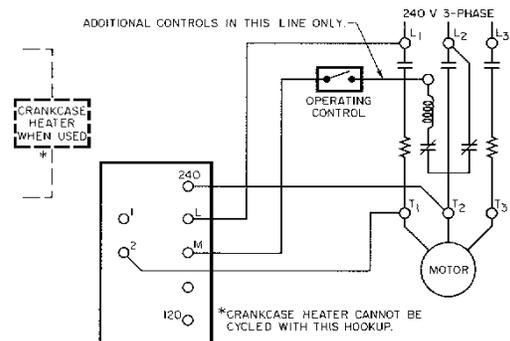


Fig. 5 — Typical wiring diagram for a P28 when used on 240 volt system with 240 volt magnetic starter coil. *Crankcase heater cannot be cycled with this hookup, see Fig. 6.

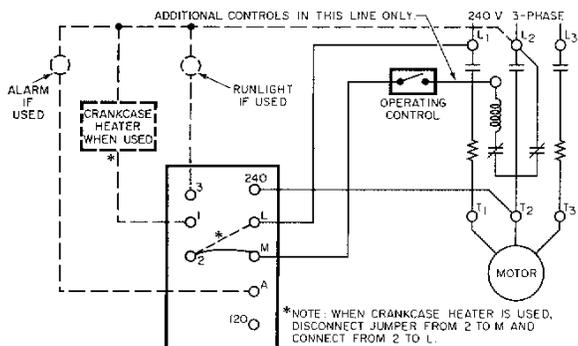


Fig. 6 — Wiring diagram for a P28 illustrating wiring necessary where 3-wire control is desired instead of 4-wire control shown in Fig. 5. Jumper between 2 and M (or L) must be installed in the field. Shutdown alarm circuit A wiring and runlight terminal no. 3 wiring are shown.

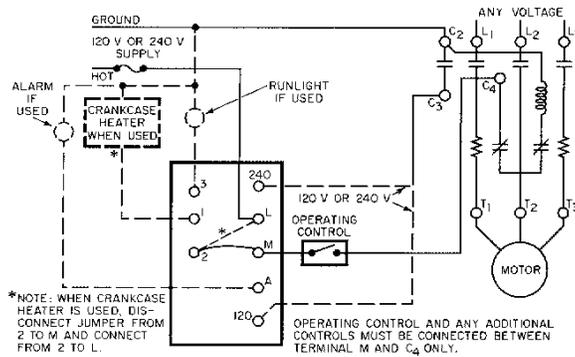


Fig. 7 — Wiring diagram for a P28 where separate supply is provided for control circuit. Magnetic coil in starter must be same voltage as control circuit supply. Jumper between 2 and M (or L) must be installed in the field. Shutdown alarm circuit A wiring and runlight terminal no. 3 wiring are shown. NOTE: Be sure to connect operating control and any additional controls between terminal M and C₄ only.

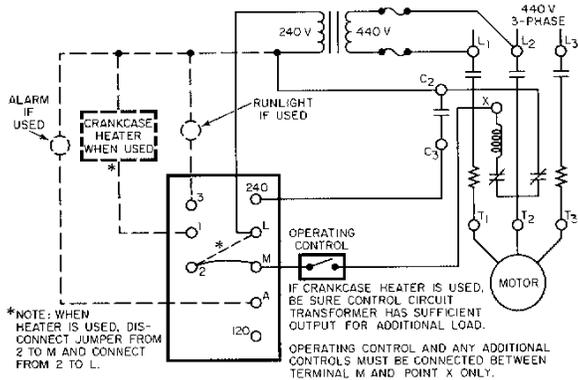


Fig. 8 — Wiring for a P28 for 440 volt supply and 240 volt magnetic starter coil. Also for 550 volt using proper transformer. Jumper between 2 and M (or L) must be installed in the field. Shutdown alarm circuit A wiring and runlight terminal no. 3 wiring are shown. NOTE: If crankcase heater is used, be sure control circuit transformer has sufficient output for additional load. Be sure to connect operating control and any additional controls between points X and M only.

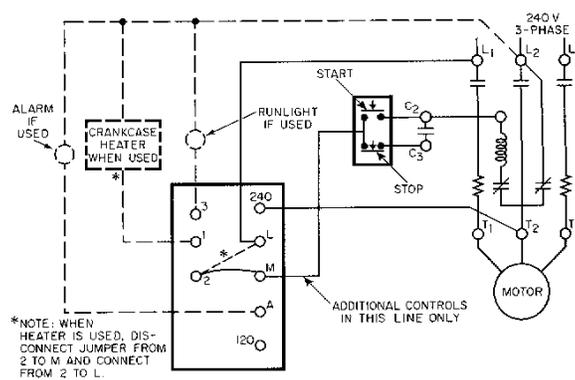


Fig. 9 — Typical wiring for a P28 where manual "Start-Stop" push button station is used. Additional controls could be high pressure cutout or low pressure or temperature control. Jumper between 2 and M (or L) must be installed in the field. Shutdown alarm circuit A wiring and runlight terminal no. 3 wiring are shown.

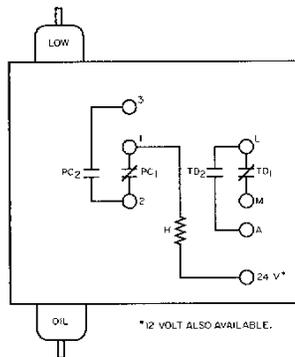


Fig. 10 — Internal wiring circuit for all low voltage P28 controls.

PC₁ - PRESSURE ACTUATED CONTACTS - OPEN ON INCREASE IN PRESSURE DIFFERENCE BETWEEN OIL AND LOW PRESSURE CONNECTORS. MAKES AND BREAKS TIME DELAY HEATER CIRCUIT.
 PC₂ - CONTACTS CLOSE SIMULTANEOUSLY WHEN PC₁ CONTACTS OPEN (RUNLIGHT CIRCUIT).
 TD₁ - TIME DELAY RELAY CONTACTS OPEN AFTER FACTORY SET TIME DELAY INTERVAL IF PRESSURE DIFFERENCE BETWEEN OIL AND LOW PRESSURE CONNECTORS IS NOT ESTABLISHED OR MAINTAINED.
 TD₂ - CONTACTS CLOSE SIMULTANEOUSLY WHEN TD₁ CONTACTS OPEN (ALARM CIRCUIT).
 H - HEATER FOR TIME DELAY RELAY.
 CONNECT L AND M TERMINALS IN CONTROL CIRCUIT AS SINGLE POLE SWITCH.
 CONNECT TERMINAL L SO THAT CIRCUIT IS ENERGIZED ONLY WHEN THE OPERATING CONTROL AND OVERLOAD TERMINALS ARE CLOSED. SEE TYPICAL WIRING DIAGRAM FOR DETAILS.

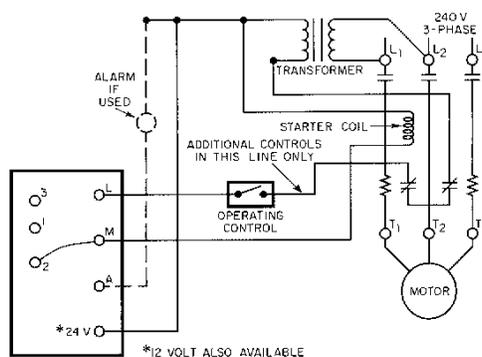


Fig. 11 — Wiring for a P28 where 24 volt control circuit power is obtained from a step-down transformer. Jumper between 2 and M must be installed in the field.