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KYSOR//WARREN®

The Leading Edge of Technology

INSTALLATION & OPERATION MANUAL

MODEL: PARALLEL REFRIGERATION COMPRESSOR UNITS

KYSOR//WARREN®

DIVISION OF KYSOR INDUSTRIAL CORPORATION

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KYSOR//WARREN PARALLEL COMPRESSOR SYSTEMS

The operational advantages of using parallel refrigeration systems are well known and accepted in the industry for their past performances. The simplicity and compactness of the Kysor//Warren design make the addition of hot gas defrost and/or heat reclaim a simple and economical feature. The most important point in planning an installation of the Kysor//Warren Parallel System is the proper selection of the optimum system components for the particular application.

The selection and design of the system is based on the needs of the individual customer. This information must be passed on to the Application Engineer and must be complete and accurate. Due to the individuality of each customer and his needs, it is therefore impossible to categorize the Parallel System. The customer must make his needs known to the Regional Manager, and he in turn must be sure this information is passed on to the Application Engineer, who will in turn design the system.

Component parts have been selected for their dependability and availability to keep service problems to a minimum. Simplicity of design has also made the Kysor//Warren Parallel System one of the easiest to service and install.

RECEIPT AND INSPECTION OF EQUIPMENT

Inspect the Parallel System and any accessories shipped with them for damages or shortages before and during unloading. If there is any damage, the carrier should be notified immediately and an inspection requested. The delivery receipt must be noted that the equipment was received damaged. If damage is of a concealed nature you must contact the carrier immediately or no later than three (3) days following delivery. It is the responsibility of the consignee to file all claims for damage with the transportation company.

NOTE: Accessory items, such as drier cores, mounting pad, etc. are packaged in a separate carton. Be sure that you receive all items.

NOTE: The system is shipped with a holding charge of dry nitrogen. Check to see that pressure is still in the unit upon receipt. Report lack of pressure immediately to Service Department.

LIFTING INSTRUCTIONS

The Parallel System is a heavy piece of machinery and careful considerations for lifting should be made before the unit is lifted by any means. Only two parts of the unit are designed to carry any of the lifting load.

1) The unit may be lifted at the base with a forklift or by means of cables at the four corners of the base.
2) The unit may also be lifted by means of cables at the two lifting holes in the top channel.

If cables are used, the lifting cables should be prevented from contacting any of the unit piping or electrical components.

In the following pages will be found explanations of system components, wiring and piping diagrams, control settings, and operational guides. Any additional information may be obtained by calling the Regional Manager in your area or contacting the Kysor//Warren Application Engineering Department in Conyers, GA.

LOCATION OF EQUIPMENT

The Parallel Systems must be located so they are level and easily serviced. A 30 inch service clearance between units and any other walls or stationary equipment is recommended. For Parallel System units placed end to end 18 inches between units is adequate. The Parallel System is designed so that all pressure regulating valves can be adjusted from the rear of the unit. A minimum of 18 inches at the rear of the unit provides adequate service space.

VENTILATION REQUIREMENTS

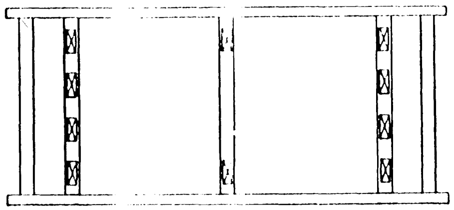
The machine room ventilation equipment should provide air flow of approximately 100 CFM per compressor horsepower. The air intake should be position so that air passes over the units.

VIBRATION MOUNTS

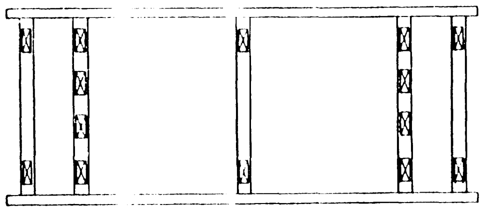
Vibration pads are supplied with each unit as standard. Isolator springs are optionally available. Quantities of vibration pads or isolator springs and the recommended placing is shown on the drawings in the drawings section of this manual.

PAD AND SPRING LOCATIONS

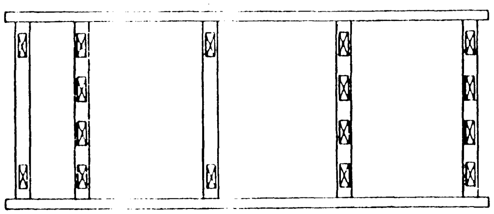
NARROW RACK



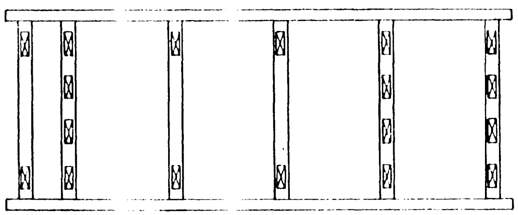
2 AND 3 COMPRESSORS
10 PADS REQUIRED



3 AND 4 COMPRESSORS
14 PADS REQUIRED

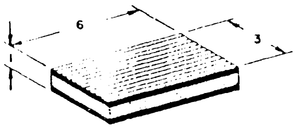


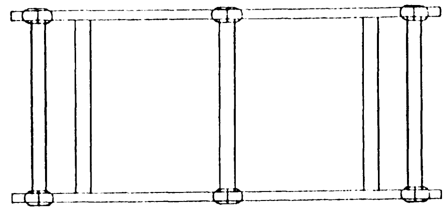
4 AND 5 COMPRESSORS
16 PADS REQUIRED



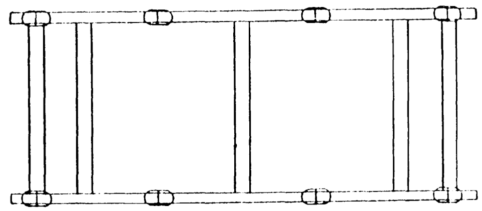
5 AND 6 COMPRESSORS
18 PADS REQUIRED

VIBRATION PAD

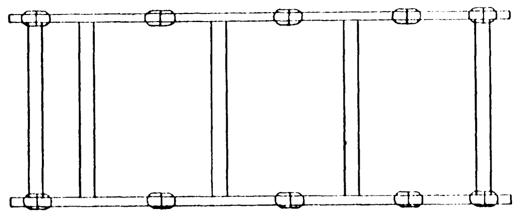




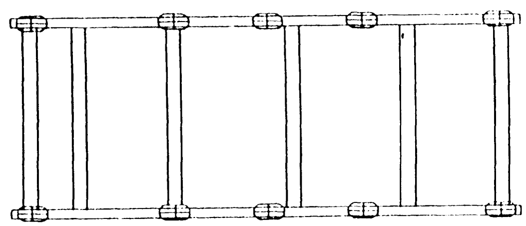
2 AND 3 COMPRESSORS
6 SPRINGS REQUIRED



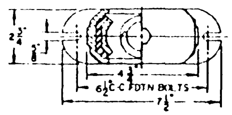
3 AND 4 COMPRESSORS
8 SPRINGS REQUIRED



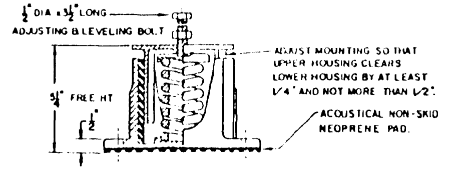
4 AND 5 COMPRESSORS
10 SPRINGS REQUIRED



5 AND 6 COMPRESSORS
10 SPRINGS REQUIRED



SPRING



UNIT DESIGNATION

Units are identified by letter (A, B, C, etc), refrigeration circuits and all field piping connections (including condenser and heat reclaim) are labeled. Unless otherwise requested by the customer all refrigeration circuits are numbered from one to the highest and from left to right facing the electrical panel.

Each Parallel System model contains the nominal compressor horsepower rating of the system. For even compressors this rating is the total horsepower of the main compressors. For uneven compressor systems this is the number of main compressors minus 1 times the horsepower of the largest main compressor.

Example Designation:

TD3 - 2005DC

Uneven Compressor Horsepower
Copeland Discus
3 Compressors
20 Nominal Horsepower
R22 Medium Temperature

Prefix Definition

Unit Prefix	Even or Uneven	No. of Main Comps.	Comp. Mfg.
ED2	Even	2	Copeland Discus
EC2	Even	2	Carlyle
TD3	Uneven	3	Copeland Discus
TC3	Uneven	3	Carlyle
ED3	Even	3	Copeland Discus
EC3	Even	3	Carlyle
ED4	Even	4	Copeland Discus
EC4	Even	4	Carlyle
TD4	Uneven	4	Copeland Discus
TC4	Uneven	4	Carlyle

Suffix Definition

Unit Suffix	Refrigerant	Application Temperature
RC	R502	Medium
RL	R502	Low
DH	R22	High
DC	R22	Medium
DL	R22	Low (2 Stage)
DD	R22	Low (Demand Cooling)

CONSTRUCTION

The basic construction of the Parallel System is made up of carefully selected over-the-counter items that can be readily obtained at refrigeration wholesalers. As previously mentioned, each system is custom-designed to meet the needs of each customer. The following is a description of a Parallel System containing all of the standard and optional components available.

ELECTRICAL

All solenoids, contactors, controls, time clocks, and crankcase heaters are installed and wired at the factory. Electrical connections to the Parallel System include three phase power and control circuits. These are made in the control panel. The control panel is located above the compressors and is serviced from the front of the system.

Parallel System units are available with compressors rated at 208/60/3 or 460/60/3. For 208 VAC systems a single power feed is required for the unit. For 460 VAC systems a separate 208/60/1 control circuit supply is required; if electric defrost is used a 208/60/3 supply is required, which may be combined with the control circuit supply. An optional transformer may be added to step down the 460 VAC for the control circuit on each unit.

All field wiring must in compliance with the National Electrical Code and local codes. Minimum unit wiring ampacity and maximum overcurrent protective device rating as calculated per the National Electric Code are shown on the Parallel System nameplate.

Typical 208 and 460 VAC wiring diagrams with typical circuit wiring for different types of circuits are included in the wiring diagram section of this manual. All types of defrost circuits may be intermixed in the panel depending on the individual store requirements. The wiring diagram sent with each Parallel System is the diagram for that particular unit and shows the circuit wiring as set up for that specific application.

Parallel System units with optional heat reclaim require two wires from the store environmental control panel supplying voltage requested by the customer.

PIPING

All refrigeration circuit piping leaving the unit is equipped with shut-off valves. Shut-off valves for condenser and heat reclaim lines can be added at the customer's request. The system is sealed and leak tested before leaving the factory, and is shipped with a holding charge. See general system piping arrangement below.

COMPRESSORS

The compressors, Copeland or Carlyle are solid mounted to the refrigerant receiver base frame assembly. All compressors incorporate AC & R oil floats. Crankcase heaters, if provided, will be installed and wired. Cylinder head cooling fans will be installed on all low temperature systems. These fans are optional on medium temperature units. High/Low pressure controls and oil failure controls are installed and wired for each compressor. The suction filter cores are factory installed while the liquid drier cores are supplied for field installation.

HOT GAS DEFROST

Due to the compactness of the Parallel System and the availability of hot gas at the unit, hot gas defrost can be readily incorporated into the total custom design. The hot gas header at the rear of the unit is installed between the liquid and suction headers on top liquid feed systems. It is between the liquid header and control panel on bottom feed systems. Manual shut-off and solenoid valves are factory installed and wired. The hot gas line is piped into the suction line up stream of the EPR or solenoid valve. Cases are equipped accordingly when ordered.

When defrost is initiated by the time clock the master liquid line solenoid or OLDR (a Normally Open valve that closes when energized) is energized. Circuit liquid line solenoid (if used) and suction stop are de-energized. The hot gas enters the suction line and travels to the evaporator (Reverse Cycle). As the hot gas condenses in the evaporator, it travels around the expansion valve through a check valve and back through the liquid line header. This returning liquid in turn feeds the circuits still calling for refrigeration. Should the returning liquid not be adequate for the demand, the pressure in the liquid header will start to drop. When a difference of twenty (20) pounds between the liquid header and main liquid line pressure occurs, a twenty (20) pound differential check valve (either piped in parallel with the main liquid line solenoid or as an integral part of the OLDR)will open and supply the required liquid.

A typical piping schematic for gas defrost can be found on in the drawings section.

HEAT RECLAMATION AND HEAD PRESSURE CONTROL

The basic concept of refrigeration is to transfer heat from one place to another. Heat is removed from the case and its contents and transferred to the outside or ambient air. By incorporating a multi-circuited coil in to the air handling system of the store, this heat can be diverted to heat the store.

HEAT RECLAIM

The diverting valve can be factory installed. Piping and wiring from the controls and the heat reclaim coil are field installed. Kysor//Warren requirements for piping are shown on Page 15 and are at the customer's choosing. The check valve required for series piping is normally field furnished, but can be supplied as an option. Standard valve coil voltage is 208/1/60. Other voltages can be furnished on request.

The heat reclamation coil is installed in the store duct system and is integrated with the heating and air-conditioning system. The coil must be downstream of the AC coil and upstream of any booster heaters. The air should enter the refrigerant outlet side of the coil, and the liquid outlet of the coil should be lower than the gas inlet.

Simply speaking, a diverting valve is installed in the discharge line of the compressor and is piped to the normal condenser and the heat reclaim coil. This valve is equipped with an electric solenoid that is activated by the environmental control panel.

HEAD PRESSURE CONTROL

There is an additional constant pressure valve installed on the discharge line from the compressor, Item 12 on Page 13. It should be noted that this valve is after the supply to the hot gas header and maintains a constant pressure to the hot gas header. The hot gas needed for defrosting is more critical that the reclaim, should it call for both at the same time. Kysor//Warren incorporates the series system of piping in heat reclaim, the gas passed from the heat reclaim coil to the condenser and back to the receiver.

Should the receiver pressure drop below the setting of the hot gas bypass valve, the valve will open to keep pressure on the liquid receiver.

SYSTEM OPERATION OF FLOATING HEAD with HOT GAS DEFROST

A typical piping arrangement for a refrigeration system incorporating heat reclaim, remote condenser, gas defrost and ambient liquid sub-cooling may be found in the drawing section of this manual.

The intent of this arrangement is to obtain maximum liquid sub-cooling in low ambient temperatures.

Components and Recommended Settings:

1) A7BL Differential Pressure Regulator - This valve is located in the main discharge line and is used to create the 20 to 25 psig differential required for gas defrost. The valve is adjusted during the defrost mode to maintain a 20 to 25 psig differential between the discharge and liquid header pressures.

2) A7 Pressure Regulator - Heat Reclaim Return - The A7 at this location is optional and is used to maintain a minimum head pressure when the system is in the heat reclaim mode. This valve is normally set to maintain 105 to 110°F condensing temperature in the heat reclaim coil.

3) A7 Pressure Regulator - Condenser Return - The A7 at this location is used to establish a minimum head pressure for floating head operation. Normally on R502 this valve would be set at 140 to 150 psig; on R22 set at 140 psig.

4) A9 Pressure Regulator - Receiver Pressure - The A9 valve is used to maintain a constant pressure on the receiver to insure adequate sub-cooling to prevent flashing and insure a constant liquid feed. This valve should be set at the same pressure as the A7 in the condenser return line.

NOTE: An alternative arrangement for an uncontrolled floating head would remove the A7 in the condenser return line and change the A9 to a Y894 pressure differential valve. The Y894 senses receiver pressure and liquid drop leg pressure. This insures a solid column of liquid under all pressure conditions.

5) Condenser Fan Controls - Condenser fans can be controlled on the basis of pressure or temperature; however, the most effective method is a combination of the two. To accomplish this, all fans except the last fan or bank of fans should be controlled by pressure. The fans controlled by pressure should operate in the 180 to 200 psig range. The last fan or bank of fans should be controlled by liquid drop leg temperature. These fans should be set to maintain 55°F.

CONDENSERS

All condensers should be located at an elevation higher than the Parallel System to assure liquid drainage from the condensers to the receiver. If the condenser has dual drop legs to a single unit, an elevation difference of a least six (6) feet is required. The dual drop legs should be dropped the six (6) feet before being joined together. This is to prevent the possibility of some of the condenser tubes being logged with liquid.

The remote air-cooled condensers must be located so as to receive free air flow through the coil. Exhaust heat from any source must not be allowed t interfere with condenser operations. Vertical air flow condensers must be cross-leveled (see Condenser Bulletin for recommended settings).

AC & R OIL CONTROL SYSTEM

The AC & R oil control system provides a method of regulating the oil level in each individual crankcase. It does not require that the compressors be the same make or model. The AC & R oil control system uses three basic components:

1. Oil Level Regulators
2. Oil Reservoir
3. Oil Separator

Each compressor has an oil level regulator attached to control the oil level in each individual compressor. The regulators are supplied oil by the common oil reservoir, which in turn is supplied by the oil separator.

The oil level regulator controls the oil level in each individual crankcase with a float operated valve. It holds back excess oil until the oil level in the compressor crankcase drops, lowering the float and opening the valve. Oil from the oil reservoir will then be admitted into the crankcase, raising the float. When the correct level is reached, the valve will close stopping the flow of oil to that particular crankcase.

As standad all oil level regulators are adjustable. Model S-9130 and S9133 are used when maximum crankcase pressure differential is below 30 psig. Model S-9190 and S-9193 are used with differential pressure up to 90 psig. The regulator is UL Listed at 450 psig working pressure and with a 2250 psig burst strength.

A reserve of oil is necessary for the operation of the AC & R oil control system. The oil reservoir is the holding vessel for this standby oil. It has two sight ports on the shell to observe the oil level inside the vessel. Oil is fed into the oil reservoir by the oil separator. Pressure in the reservoir is maintained at 5 psig above suction pressure by a differential check valve on top of the reservoir.

The valve on the top of the oil reservoir automatically receives oil from the oil separator (open position). To add oil to the oil reservoir manually, close the valve and fill the oil reservoir through the 1/4" flare connection on the side of the valve. Open valve after filling.

The valve on the bottom of the oil reservoir is the distribution valve to the oil level regulators (open position). To remove oil from the oil reservoir, close the valve and use the 1/4" flare connection on the side of the valve to drain the oil out. Open valve after draining.

On system start-up of a new parallel system, oil should be added to the reservoir until oil is visible in the upper sight glass port, NOT ABOVE IT. It is commonly accepted that in a new refrigeration system, some will be absorbed by the refrigerant as the system operates. After two hours of operation, the oil reservoir should again be filled to the upper sight glass and again after two days. The oil level in the reservoir must be observed on each service call. Oil should not be added again until the oil level falls below the lower sight glass port.

Do not add more than a total of 2 gallons of oil to each system.

SATELLITE COMPRESSOR

A compressor may be added to the Parallel System for ice cream or fresh meat cases. This compressor would maintain lower section pressure than the main suction header and provide several advantages over a remote unit. Hot gas defrost would be available to the ice cream circuits if desired, and the suction would be connected to the main header providing assistance on pull-down and standby protection should the satellite compressor fail.(see Satellite Piping Schematic in this manual).

PARALLEL SYSTEMS RECOMMENDED CONTROL SETTINGS

1) Set discharge pressure regulator at 170 psig with R502; 150 psig with R22. Gage should be on the compressor discharge service valve.

2) Set receiver pressure regulator at 160 psig with R502; 140 psig with R22. Gage should be on receiver outlet valve.

3) High-Pressure Controls:

    a) Single stage and high stage of two stage systems:
    R502 350 Cut-Out
    R22 250 Cut-Out

    b) Low stage of two stage systems:
    R22 100-125 Cut-Out

4) Low Pressure Controls:

The following settings apply to multi compressor systems with electronic suction pressure control. The system design suction temperature and the recommended control settings are indicated on the refrigeration legend. As a general rule, the control should be set to CUT-IN 2 psig above the design suction pressure and CUT-OUT 2 psig below the design pressure.

Also it is recommended that the rack controller be set up to FLOAT the suction based on TARGET case temperature. Typical TARGET cases would be Ice Cream Reach-In's, Dairy-Milk Cases and Fresh Meat Cases. DO NOT USE WALK-IN'S AS TARGET FIXTURES.

Typical Rack Control Settings:

R22	Cut-In	Cut-Out
-35	4.6	1.0
-30	6.9	2.9
-25	9.4	5.4
-20	12.1	8.1
-15	15.2	11.2
+10	34.8	30.8
+15	39.7	35.7
+20	45.0	41.0
+30	56.9	52.9
+40	70.5	66.5

R502	Cut-In	Cut-Out
-35	8.5	4.5
-30	11.2	7.2
-25	14.1	10.1
-20	17.3	13.3
-15	20.8	16.8
+10	43.0	39.0
+15	48.5	44.5
+20	54.4	50.4
+30	67.6	63.6

Single compressor satellites should be controlled by fixture temperature.

Note:

1. Kysor//Warren does not recommend cycling individual rack circuits to control fixture temperature. In some instances, this method can cause low load conditions which result in compressor short cycling and inadequate heat for gas defrost.
2. The fixture sensors should be used to monitor temperatures for alarm purposes and for control of suction pressure in the float mode of operation.

5) Defrost and EPR Settings:

(see Engineering Bulletin #90-130-7 in this manual).

6) Adjustable Time Delay Controls:

For satellite compressors a minimum setting of 3 minutes.

7) Condenser Fan Control:

Condenser fan operation can be controlled by several different methods. The preferred method is to use a rack controller that incorporates condenser control.

For condenser fans controlled electronically, fans can be cycled on the basis of pressure, drop leg temperature or a combination of temperature and pressure.

Refrigerant	Cut-In	Cut-Out
R22	175	160
R502	195	180

Note:

1. Do not set the fans to cut-out at a point lower than the setting of the hold back valve (if used) in the condenser drop leg. If this occurs, the condenser fans will not cycle.
2. If the control system uses condenser drop leg temperature, use a setting of 55°F.

If condenser fans are controlled by temperature from the condenser package, all fans are cycled on the basis of the temperature of the air leaving the condenser at the header end. Set the fan thermostat in accordance with the condenser bulletin.

HCFC-22 REFRIGERATION SYSTEMS

Kysor//Warren currently recognizes three types of R22 systems for low temperature applications:

1) Two Stage Stand Alone

This approach is a compound two stage system that uses a desuperheating expansion valve driven by the high stage compressors to cool the discharge gas from the low stage compressors. This is a low temperature system that does not affect the medium temperature systems.

2) Two Stage Mixed

This approach is a compound two stage system that uses the return gas from the medium temperature fixtures to desuperheat the discharge gas from the low stage compressors. The low stage discharge gas mixes with the return gas of the medium temperature fixtures. It is further cooled (if required) by a desuperheating expansion valve. The desuperheated gas then enters the high stage compressors, which provide the cooling for the medium temperature fixtures.

3) Single Stage Demand Cooling

This approach is a single stage system utilizing Copeland DISCUS compressors with the Demand Cooling feature. This method incorporates a precise metering device, solenoid and control unit on each compressor to inject refrigerant into the suction passages to keep the discharge temperatures below the critical 300°F point. The temperature probe, in the cylinder head, senses discharge temperature and activates only as necessary. With suction return gas temperatures in the +20 to +30°F range, compressor cooling would be satisfied. The Demand Cooling would then act only as a safety. See components section in the back of this manual.

Terminology and Settings:

1) Booster Compressors are the low temperature compressors in a two stage system.

2) High Stage Compressors are the high or medium temperature compressors in a two

stage system. In a stand alone system, the high stage would operate in the +30 to +40°F range. On mixed systems, the high stage would operate at a temperature equivalent to the coldest fixture on the medium temperature portion of the unit.

3) Air Cooled Desuperheater is a small air cooled condenser that is used to reduce the temperature of the discharge gas, from the booster compressors, before it reaches the desuperheating expansion valve. The fan(s) on this device is controlled by the rack controller and should be set to 100°F. The temperature is measured at the rack on the refrigerant line from the desuperheater before the CDA bypass.

4) Electronic Bypass Valve is a CDA valve piped in parallel with the air cooled desuperheater and bypasses discharge gas around the desuperheater to insure that the refrigerant does not condense. The CDA valve senses the refrigerant temperture from the air cooled desuperheater at a point on the rack below the bypass and before the Desuperheating Expansion Valve and is set at 65°F. A special electronic board is required to set this temperature.

5) Desuperheating Expansion Valve is a TXV that injects liquid into the suction line of the high stage compressors. This completes the cooling of the low stage discharge gas. The liquid solenoid valve that feeds the DEV is controlled by the rack controller and should be set for 55°F. THE TEMPERATURE OF THE GAS ENTERING THE HIGH STAGE COMPRESSORS MUST NOT EXCEED 75°F. The sensing bulb for the DEV is located on the system suction line before the suction filters. When a mechanical TXV is employed it has an L1 power element. This power element will not allow the valve to be adjusted outside the range of 30 to 40°F superheat.

6) Subcooler is a heat exchanger that cools the liquid refrigerant going to the circuits to 50°F. This process increases the system efficiency dramatically and helps balance the load on the high stage compressors. The liquid temperature can be controlled by the rack controller, EPR or a combination. The subcooler should be set to turn off when the liquid returning from the condenser is less than 50°F.

7) Start-Up Bypass Valve is a ball valve and check valve arrangement that connects the high and low stage suction headers to prevent a pressure build up in the low stage suction. The ball valve must be open at all times so that the check valve can relieve pressure as necessary. This arrangement also allows the high stage compressors to pull through the low stage at start up and on a restart after a power outage.

A detailed piping schematic for the Stand Alone system is included in the drawings section of this manual.

INITIAL CONTROL SETTINGS

See the Bulletin in the back of this manual.

KYSOR//WARREN PARALLEL SYSTEM UNIT CONTROL/ALARM PANEL

The Kysor//Warren Parallel System unit control/alarm panel combination provides a means of controlling multiple compressors on a parallel compressor rack and also provides indication of the mode of operation and transmission of alarm conditions.

Compressors are controlled by individual switches which indicate the presence of supply voltage to the compressors and compressor operation; additionally, individual refrigeration circuits are controlled by switches which also indicate the presence of supply voltage to the circuit and whether a circuit is in refrigeration or defrost.

Operating conditions of the compressors are controlled by an electronic pressure controller with separate cut-in and cut-out settings. The controller will bring compressors on and off line in accordance with refrigeration demand to maintain suction pressure in a range determined by the settings on the pressure controller.

An electronic alarm panel within the unit continuously monitors critical conditions of the system; these are oil failure, high discharge pressure, high suction pressure, phase loss, and refrigerant level. Internal time delays of 15 minutes for high suction and 60 minutes for liquid level prevent nuisance alarms. Oil failure is signalled by the presence of 208VAC signal from an oil switch contained in each compressor.

Similarly the presence of a contact closure from a pressure switch in the discharge and suction headers signals high discharge and/or high suction pressure alarm conditions. Phase loss indication is signalled by contact closure from a relay wired to a three phase power supply phase monitor.

Refrigerant liquid level is sensed by a sensor mounted in the receiver. An LED bar graph on the panel indicates percent liquid level within the receiver. The low refrigerant level alarm is energized at 15% liquid level and heat reclaim is locked out at 10%. Once locked out the liquid level must reach 20% before heat reclaim can again be energized.

The presence of any alarm condition will control the alarm relay which provides transmission of an alarm signal. A man/auto/off switch on the panel will automatically reset the alarm relay when all alarm conditions cease when in auto mode. In the manual mode the alarm reset switch must be depressed to remove the transmission of an alarm condition. In the off mode no alarm signal will be transmitted in the event of an alarm condition. In the off mode no alarm signal will be transmitted in the event of an alarm condition; however, the LED circuitry for each alarm condition will remain active.

There is an alarm hookup wiring diagram in the drawings section of this manual.

SPECIFICATIONS

Input specifications are as follows:

Input Voltage	208V single phase
Oil Alarm	208V from "A" terminal of oil pressure switch
Phase Alarm	Dry contact from phase monitor relay
Discharge Alarm	Dry contact from pressure switch
Suction Alarm	Dry contact from pressure switch
Refrigerant Level	"Liquicator" 3 wire sensor

Output specifications are as follows:

Alarm relay	DPDT 10 amp @ 240VAC
Heat Reclaim	SPDT 10 amp @ 240VAC

INITIAL RECOMMENDED ALARM PRESSURE SETTINGS (PSIG)

R22 Temperature	High Suction	High Discharge
-35	12	300
-30	14	300
-25	16	300
-20	19	300
-15	22	300
+10	39	300
+15	44	300
+20	49	300
+30	61	300
+40	75	300

R502 Temperature	High Suction	High Discharge
-35	15	325
-30	18	325
-25	21	325
-20	24	325
-15	28	325
+10	47	325
+15	52	325
+20	57	325
+30	71	325

Adjust these initial pressure settings as necessary.

INSTRUCTIONS FOR MOTORSAVER

After applying power to the MotorSaver, the output relay should close and the "RUN LIGHT" should come on. If the output relay does not close, perform the following tests:

A) Check the voltage between L1-L2, L1-L3, and L2-L3. These voltages should be approximately equal and within 10% of the rated 3 phase line to line voltage of the MotorSaver.

B) If these voltages are low, high, or widely unbalanced, check the power system to determine the cause of the problem.

C) If the voltages are good, turn off the power and interchange any two of the three leads L1, L2, and L3. This may be necessary as the MotorSaver is sensitive to phase reversal.

KYSOR//WARREN CASE WIRING IDENTIFICATION

115/1/60

Wire	Description
#1	Anti-sweat heater
#2	Anti-sweat heater
#3	Drain heater and fan motor
#4	Drain heater and fan motor
#5	Light circuit
#6	Light circuit
#15	Dual temperature (LM1AG only)
#16	Dual temperature (LM1AG only)

Note: All above to be wired to proper voltage that remains on at all times.

208/1/60

Wire	Description	Terminal
#7	Defrost heaters (Electric Defrost)	Defrost contactor
#8	Defrost heaters (Electric Defrost)	Defrost contactor
#7	Defrost relay coil (Air Defrost)	L
#8	Defrost relay coil (Air Defrost)	2
#9	Temperature control	T
#10	Temperature control	L
#17	Defrost termination	L
#18	Defrost termination	8
#19	Defrost relay circuit {I(L)V5H(F)1}	1

Note: The terminals designated above are in the Parallel System unit control panel.

KYSOR//WARREN WALK-IN COOLER WIRING IDENTIFICATION AND CONNECTIONS (HOT GAS AND ELECTRIC DEFROST ONLY)

208/1/60

Wire	Description	Terminal
L1-4	Evaporator fan motor (208 VAC)	Fan contactor
L2	Evaporator fan motor (208 VAC)	Fan contactor
F	Defrost termination control	F
N-L	Defrost termination control	L
X-8	Defrost termination control	8

Note: The terminals designated above are in the Parallel System unit control panel.

PARALLEL SYSTEM LEAK CHECKING, EVACUATION, AND START-UP

1) To check the systems for leaks, leave all valves closed on suction, liquid and hot gas manifolds (the system is shipped with a holding charge of dry nitrogen). Add refrigerant to each circuit through access port in the suction line at EPR valves or suction stop. Build up the pressure to a maximum of 150 psig using dry nitrogen and the appropriate refrigerant. Each circuit can be leak checked in this way, one at a time.

2) After each circuit has been checked, open all valves to allow the pressure into the unit assembly. Check to be sure pressure is throughout the assembly. Check all connections and accessories for leaks.

3) After the system is leak checked, evacuate the system to 1500 microns for the first evacuation, install drier cores (suction filter cores are factory installed) between first and second evacuation, then evacuate to 500 microns. After each evacuation, the system should be pressurized to 2 psig with refrigerant before starting the next evacuation. A triple evacuation is recommended.

4) With the system in a vacuum, liquid charge the system by putting refrigerant into the liquid outlet of the receiver with the inlet valve closed and the liquid line shut-off closed. **Add as much refrigerant to the receiver as possible** (the amount depends on the size of the receiver). Now you are ready to start the system.

5) Set all low pressure controls as recommended elsewhere in this manual. Recheck all hand valves and shut-off valves to be sure they are open (receiver inlet and liquid line valves were closed in step 4).

6) Add refrigerant oil to oil reservoir until oil is shown in upper glass (see procedure under AC & R Oil Control System in this manual).

7) Remove all time trippers, remove program from all defrost modules, or put all circuits on refrigeration only (no defrosts should occur during start-up of equipment).

8) Check and be sure the condenser fan motors are running and will not cycle. All case fans and cooler fans must be running or operational if controlled by temperature.

9) With all compressor and control breakers and toggle switches off, apply power to the unit. If unit is using a MotorSaver (or other power monitoring device) the red running light must come on before going any further (see Instructions for MotorSaver in this manual). Check with a volt meter to see if correct voltage is connected to unit.

10) Now, turn on the circuit breaker for the control circuit. If the unit is equipped with an Electronic Pressure Control, you can adjust the cut-in and cut-out at this time (see PARALLEL SYSTEM UNIT CONTROL/ALARM PANEL, and INITIAL RECOMMENDED PRESSURE SETTINGS in this manual or review the program installed in the controller at the time of manufacture).

11) Check the actual suction header pressure with an accurate gauge and see if the Electronic Pressure Control is displaying the same pressure (the pressure must be below 65 psig before this can be done). Calibrate as necessary. Refer to the correct Electronic Pressure Control manual from the control manufacturer **(the manual for the controller is included in the instructions envelope)**.

12) All rocker switches (both compressor and circuit) on center panel must be off. Turn on circuit breakers to all compressors.

13) Close control panel doors before actually starting compressors.

14) You will find it necessary to open the manual stems on the EPR valves during start-up to lower the case temperatures and keep the compressors running.

> ***The bypass shut off valve in the piping between the high stage and low stage suction header must be open before starting any compressors on two stage systems.***

15) Now, with a low side gauge and high side gauge installed, turn on the rocker switch to the **smallest compressor in the highest suction pressure group**. Allow the compressor to pull the suction down to the operating pressure of the system. As the pressure lowers, turn on one circuit rocker switch at a time starting with the highest suction group. Try to maintain no more than 20 psig above the Electronic Pressure Control cut-in pressure. Once the suction pressure stays high, turn on the rocker switch for compressor #2. Continue turning on circuits and compressors as necessary until all are on. Repeat for next lower suction pressure group.

> ***If this is low stage of two stage unit, turn on circuit controlling liquid injection desuperheating valve before starting this compressor group.***

16) Now that the system is operating, it is time to set the pressure regulating valves (see PARALLEL SYSTEMS RECOMMENDED CONTROL SETTINGS in this manual). Once they are set, recheck again as these settings are important.

17) Set and check expansion valve superheat on each case and cooler (EPR valve must be open prior to adjusting superheat on expansion valves). The TXV superheat can not be properly set if the EPR is in control.

18) Set each EPR valve (manual stem closed) as needed (see INITIAL CONTROL SETTINGS in this manual). Suction header pressure must be lower than the EPR setting before valve can be set correctly.

19) Check each fixture temperature and adjust EPR valves as necessary to maintain proper temperature. Check expansion valve superheat and adjust as necessary.

20) Readjust Electronic Pressure Control as needed to maintain necessary suction header pressure.

21) Set condenser fan controls as recommended to maintain head pressure and liquid level in receiver. Recommended settings are in the condenser manufacturer's installation manual.

22) Check refrigerant level in receiver and add as necessary. Minimum level is 20% in the coldest weather for area.

23) Add defrost pins or tripper to time clock or remove overrides on Electronic Pressure Controller and set defrost fail-safe. Check defrost timer and temperature at which cases terminate.

24) Set the time delay on satellite compressor(s) to 3 minutes (on units with

optional adjustable time delay). This delay allows the satellite compressor to wait after defrost of the circuit for the main higher suction compressors to lower the circuit pressure so as to not overload the satellite compressor motor. It also allows for a faster pull down of fixture temperature after a defrost.

25) If the unit is equipped with an Alarm Status panel, check to see that the operating switch is either in Manual or Auto depending on desired operation (see Alarm Status Instructions in this manual).

26) Check oil reservoir after two (2) days of operation and add oil as necessary.

> ***Do not add more than a total of 2 gallons of oil to each system.***

If more than this is needed, recheck piping etc., as oil is not returning to the unit properly (see AC & R Oil Control System in this manual).

27) After all adjustments have been made, check all valves for proper stem position and replace valve caps.

28) Recheck all capillary tubes on all pressure controls to be sure that they are properly secured and free of vibration.

RECOMMENDED PIPING PRACTICES FOR KYSOR//WARREN CASES

1) Proper size refrigeration lines are essential to good refrigeration performance. Suction lines are more critical that liquid or discharge lines. Oversized suction lines may prevent proper oil return to the compressor. Undersized lines can rob refrigeration capacity and increase operating cost. Consult the technical manual or legend sheet for proper line sizes.

2) Refrigeration lines in cases in line-ups can be reduced. However, the lines should be no smaller than the main trunk lines in at least 1/3 of the cases and no smaller than one size above the case lines to the last case. Reductions should not exceed one line size per case. It is preferred to bring the main trunk lines in at the center of the line-up. Liquid lines on systems on hot gas defrost must be increased one line size above the main trunk line for the entire line-up. Individual feed lines should be at the bottom of the liquid header.

3) Do not run refrigeration lines from one system through cases on another system.

4) Use dry nitrogen in lines during the brazing to prevent scaling and oxidation.

5) Insulate suction lines from the cases to the compressor with 3/4" wall thickness Armaflex or equal on low temperature cases to provide maximum of 65°F superheated gas back to the compressor and prevent condensation in exposed areas. Insulate suction lines on medium temperature cases with 1/2" thick insulation in exposed areas to prevent condensate dropping.

6) Suction and liquid lines should never be taped or soldered together. Adequate heat exchanger is provided in the case.

7) Refrigeration lines should never be placed in the ground unless they are protected against moisture and electrolysis attack.

8) Always slope suction lines down toward the compressor, 1/2 inch each 10 feet. Do not leave dips in the line that would trap oil.

9) Provide "P" traps at the bottom of suction line risers, 4 feet or longer. Use a double "P" trap for each 20 foot of riser. "P" traps should be the same size as the horizontal line. Consult the technical manual or legend sheet for proper size risers.

10) Use long radius ells and avoid 45° ells.

11) Provide expansion loops in suction lines on systems on hot gas defrost (see EXPANSION LOOPS - GAS DEFROST in this manual).

12) Strap and support tubing to prevent excessive line vibration and noise.

13) Brazing of copper to copper should be with a minimum of 10% silver solder. Copper to brass or copper to steel should be with 45% silver solder.

14) Avoid the use of "bull head" tees in suction lines. An example is where suction gas enters both ends of the tee and exits the center. This can cause a substantial increase in pressure drop in the suction lines.

15) When connecting more than one suction line to a main trunk line, connect each branch line with an inverted trap.

EXPANSION LOOPS - GAS DEFROST

See the Bulletin in the back of this manual.

KYSOR//WARREN®
DIVISION OF KYSOR INDUSTRIAL CORPORATION

INITIAL CONTROL SETTINGS

Reprinted from ENGINEERING BULLETIN: #90-130-7 dated 7/26/90

NOTE: The following recommended settings are based upon 75°F/55% RH store conditions and properly loaded cases. Some adjustments may be required in both case temperature and defrost frequency after initial opening dates, and store settles down to usual traffic and environment.

GENERAL CONTROL RECOMMENDATIONS

1) Thermostats are recommended as the primary control with Mastermetic units except on service meat cases.
2) Low pressure controls may require different settings if cases are controlled by thermostats.
3) EPR valves should only be used on Parallel System units on cases requiring higher temperature evaporators than the system design level. EPR valves are not recommended for ice cream applications.
4) Service meat cases should always have EPR as primary control and temperature thermostat as secondary control for peak performance.
5) All reach-in's must have a positive temperature control by thermostat or EPR. Control settings indicated are for safety only and are not intended for temperature control.

1600 Industrial Blvd., P.O. Box C, Conyers, GA 30207-0019
Phone: (404) 483-5600 FAX: (404)-929-4379

Defrost Control Settings

Application	Case Model	F/S-AD	F/S-E	F/S-OC	F/S-HG	Def/Day
Beverage	DV5H1		44			3
Dairy	BQD/BRQD		30	40	20	4
	C1W(all)			40		4
	D61		30	40	20	4
	D6(R)L		30	40	20	6
	WALK-IN			60		3
Deli	D61		30	40	20	4
	M4(A)(G)1	45		50	18	6
	S3 - Blower			60		1
	WALK-IN			60		3
Frozen Food	BILA/EBILA	60	60		46	1
	ILA	60	60		46	1
	L5(F)(A)	60	30		30	6
	LM1A(G)	54			46	4
	LV5H1		70		34	1
	WALK-IN		34		18	2-4
	WIL		60		46	1
	WTLA/EWTLA	40	40		36	1
	XLA	60	60		46	1
Ice Cream	BILA/EBILA		60		46	1-2
	I5F		34		18	6
	ILA		60		46	1-2
	IV5H1		70		34	1
	WALK-IN		34		18	2-4
	WTLA/EWTLA		60		46	1-2
	XLA		60		46	1-2
Meat	M1A(G)1	45		50	18	3
	M4A(G)1	45		50	18	6
	S3-Gravity			80		1-2
	WALK-IN		34		18	2-4
	WIL		60		46	1
Meat Prep	WALK-IN			60		1
Produce	HZV1,ZV1,TZP			32		4
	P1W(all)			32		4
	WALK-IN		60		3	

CONTROL SETTINGS R12

Application	Case Model	AIR TEMP	EPR	LP C/I	LP C/O
Beverage	DV5H1	34/38	22	20	5
Dairy	BQD/BRQD	24/28	15	28	15
	C1W(all)	28/32	19	28	15
	D61	28/32	19	28	15
	D6(R)L	28/32	15	28	12
	WALK-IN	35/39	22	28	20
Deli	D61	24/28	15	28	12
	M4(A)(G)1	25/29	16	27	13
	S3-Blower	28/32	22	20	5
	WALK-IN	33/38	21	28	18
Frozen Food	BILA/EBILA	-10/0	N/A	N/A	N/A
	ILA	-10/0	N/A	N/A	N/A
	L5(F)(A)	-5/0	N/A	N/A	N/A
	LM1A(G)	-10/0	N/A	N/A	N/A
	LV5H1	-5/0	N/A	N/A	N/A
	WALK-IN	-10/-5	N/A	N/A	N/A
	WIL	-10/0	N/A	N/A	N/A
	WTLA/EWTLA	-10/0	N/A	N/A	N/A
	XLA	-10/0	N/A	N/A	N/A
Ice Cream	BILA/EBILA	-28/-24	N/A	N/A	N/A
	I5F	-22/-12	N/A	N/A	N/A
	ILA	-28/-24	N/A	N/A	N/A
	IV5H1	-15/-12	N/A	N/A	N/A
	WALK-IN	-15/-10	N/A	N/A	N/A
	WTLA/EWTLA	-28/-24	N/A	N/A	N/A
	XLA	-28/-24	N/A	N/A	N/A
Meat	M1A(G)1	20/24	16	27	11
	M4A(G)1	20/24	16	27	11
	S3-Gravity	34/38	22	20	5
	WALK-IN	28/32	20	28	20
	WIL	20/24	12	27	11
Meat Prep	WALK-IN	45/50	28	35	25
Produce	HZV1,ZV1,TZP	38/42	20	35	20
	P1W(all)	38/42	20	35	20
	WALK-IN	35/39	24	28	20

CONTROL SETTINGS R502

Application	Case Model	AIR TEMP	EPR	LP C/I	LP C/O
Beverage	DV5H1	34/38	52	30	10
Dairy	BQD/BRQD	24/28	43	60	46
	C1W(all)	28/32	50	60	46
	D61	28/32	52	60	46
	D6(R)L	28/32	43	60	40
	WALK-IN	35/39	54	65	51
Deli	D61	24/28	43	60	40
	M4(A)(G)1	25/29	42	63	42
	S3-Blower	28/32	54	50	24
	WALK-IN	33/38	52	63	49
Frozen Food	BILA/EBILA	-10/0	12	16	9
	ILA	-10/0	12	16	9
	L5(F)(A)	-5/0	14	10	4
	LM1A(G)	-10/0	12	16	9
	LV5H1	-5/0	18	15	5
	WALK-IN	-10/-5	15	16	9
	WIL	-10/0	12	16	9
	WTLA/EWTLA	-10/0	12	16	9
	XLA	-10/0	12	16	9
Ice Cream	BILA/EBILA	-28/-24	N/A	8	2
	I5F	-22/-12	N/A	12	5
	ILA	-28/-24	N/A	8	2
	IV5H1	-15/-12	N/A	8	1
	WALK-IN	-15/-10	12	N/A	N/A
	WTLA/EWTLA	-28/-24	N/A	8	2
	XLA	-28/-24	N/A	8	2
Meat	M1A(G)1	20/24	47	63	37
	M4A(G)1	20/24	47	63	37
	S3-Gravity	34/38	54	50	24
	WALK-IN	28/32	51	65	51
	WIL	20/24	41	63	37
Meat Prep	WALK-IN	45/50	65	N/A	N/A
Produce	HZV1,ZV1,TZP	38/42	50	68	52
	P1W(all)	38/42	50	68	52
	WALK-IN	35/39	54	65	51

CONTROL SETTINGS R22

Application	Case Model	AIR TEMP	EPR	LP C/I	LP C/O
Beverage	DV5H1	34/38	43	22	7
Dairy	BQD/BRQD	24/28	38	54	34
	C1W(all)	28/32	38	50	38
	D61	28/32	43	54	34
	D6(R)L	28/32	38	54	29
	WALK-IN	35/39	44	54	34
Deli	D61	24/28	38	54	34
	M4(A)(G)1	25/29	38	54	30
	S3-Blower	28/32	43	42	17
	WALK-IN	33/38	41	50	34
Frozen Food	BILA/EBILA	-10/0	8	8	1
	ILA	-10/0	8	8	1
	L5(F)(A)	-5/0	8	8	1
	LM1A(G)	-10/0	8	8	1
	LV5H1	-5/0	13	8	1
	WALK-IN	-10/-5	10	8	1
	WIL	-10/0	8	8	1
	WTLA/EWTLA	-10/0	8	8	1
	XLA	-10/0	8	8	1
Ice Cream	BILA/EBILA	-28/-24	N/A	4	1
	I5F	-22/-12	N/A	4	1
	ILA	-28/-24	N/A	4	1
	IV5H1	-15/-12	8	4	1
	WALK-IN	-15/-10	7	4	1
	WTLA/EWTLA	-28/-24	N/A	4	1
	XLA	-28/-24	N/A	4	1
Meat	M1A(G)1	20/24	38	50	29
	M4A(G)1	20/24	38	50	29
	S3-Gravity	34/38	43	42	17
	WALK-IN	28/32	41	50	29
	WIL	20/24	33	50	28
Meat Prep	WALK-IN	45/50	55	N/A	N/A
Produce	HZV1,ZV1,TZP	38/42	43	65	42
	P1W(all)	38/42	43	65	42
	WALK-IN	35/39			

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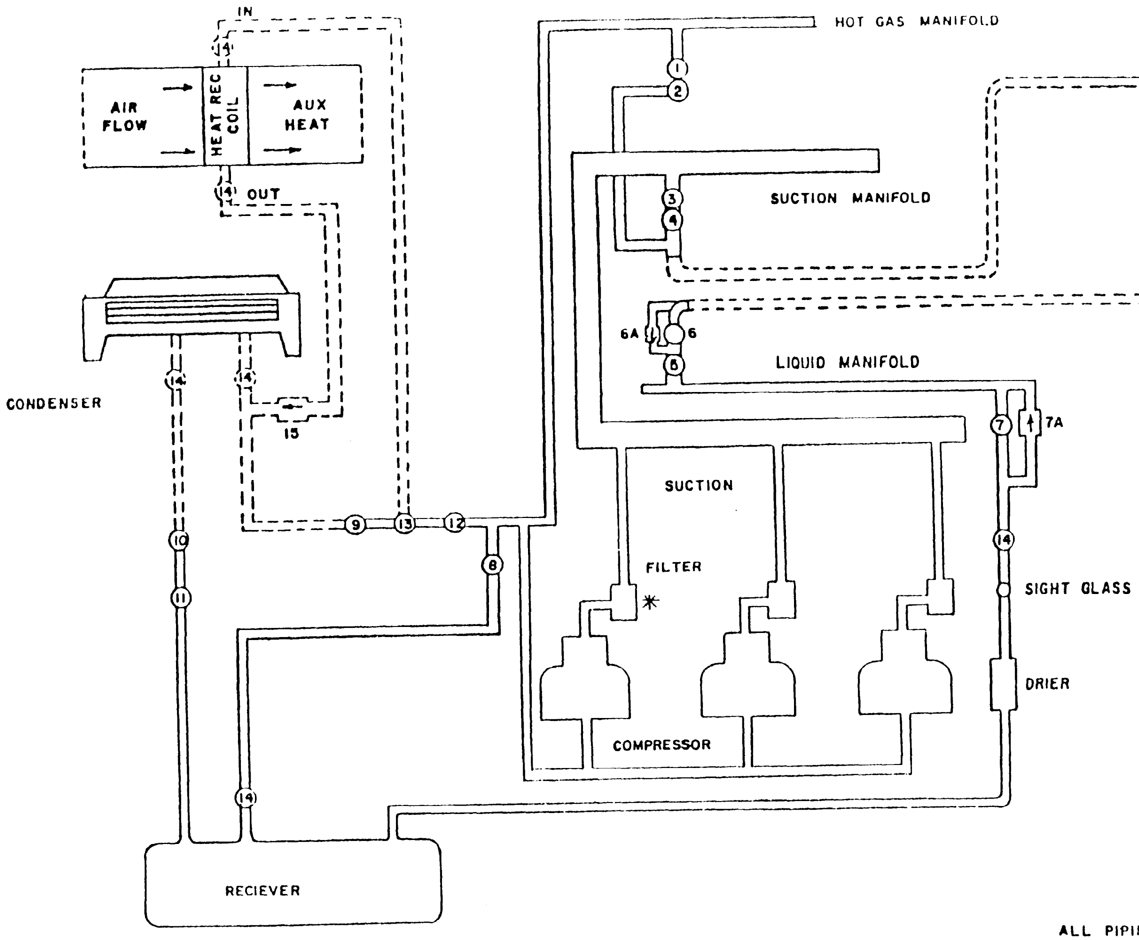
DEFROST SCHEDULE

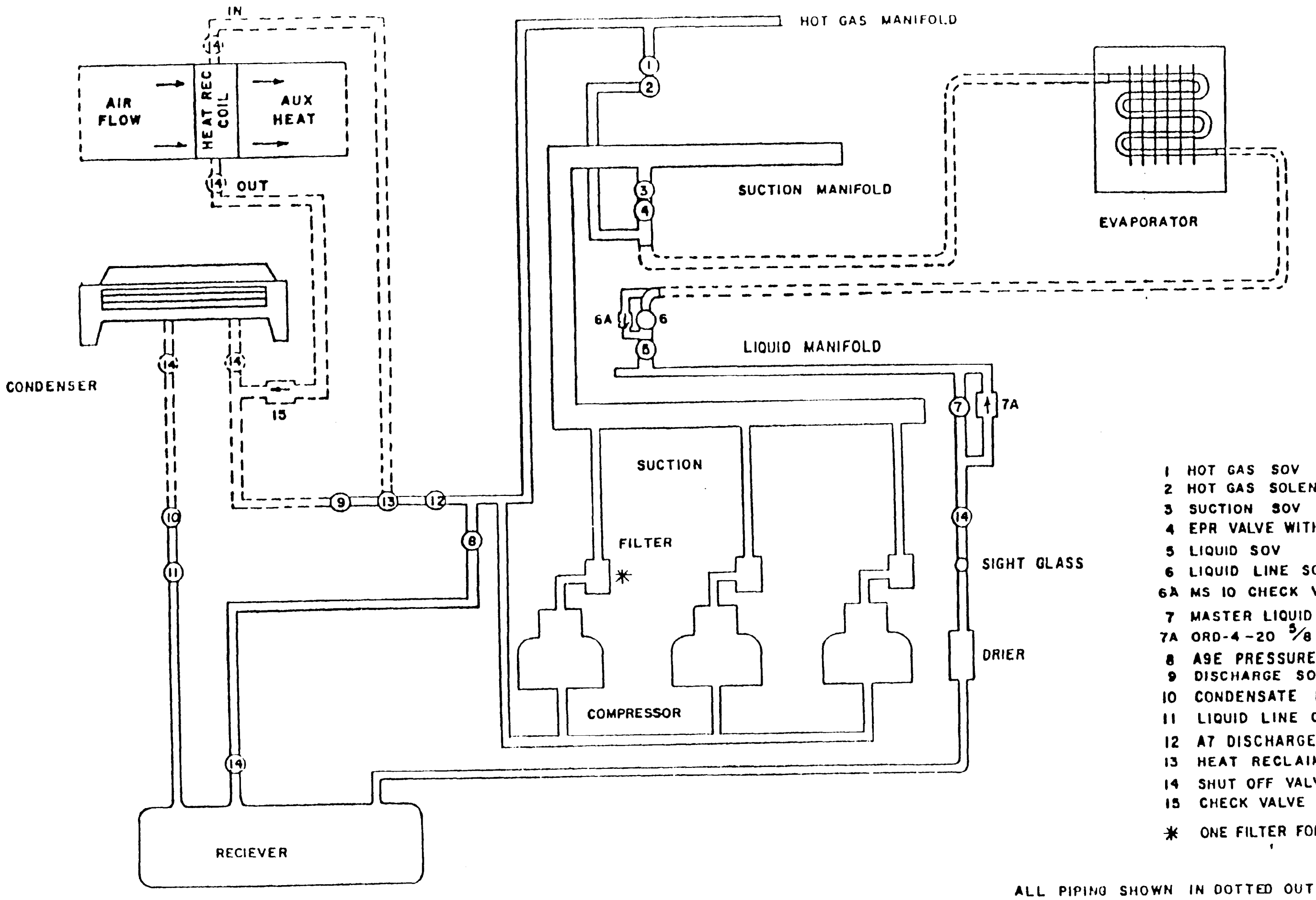
NO.	CKT DESCRIPTION	DURATION	00:30	01:00	01:30	02:00	02:30	03:00	03:30	04:00	04:30	05:00	05:30	06:00	06:30	07:00	07:30	08:00	08:30	09:00	09:30	10:00	10:30	11:00	11:30	12:00	12:30	13:00	13:30	14:00	14:30	15:00	15:30	16:00	16:30	17:00	17:30	18:00	18:30	19:00	19:30	20:00	20:30	21:00	21:30	22:00	22:30	23:00	23:30	24:00



1 HOT GAS SOV
2 HOT GAS SOLENOID VALVE
3 SUCTION SOV
4 EPR VALVE WITH SUCTION STOP
5 LIQUID SOV
6 LIQUID LINE SOLENOID VALVE
6A MS 10 CHECK VALVE
7 MASTER LIQUID LINE SOLENOID VALVE
7A ORD-4-20 5/8 CHECK VALVE
8 A9E PRESSURE REGULATOR
9 DISCHARGE SOV
10 CONDENSATE RETURN SOV
11 LIQUID LINE CHECK VALVE
12 A7 DISCHARGE PRESSURE REGULATOR
13 HEAT RECLAIM DIVERTING VALVE
14 SHUT OFF VALVE
15 CHECK VALVE
* ONE FILTER FOR EACH COMPRESSOR

ALL PIPING SHOWN IN DOTTED OUTLINE ARE FIELD INSTALLED AS PER CUSTOMER SPECIFICATIONS.

GENERAL PARALLEL SYSTEM LAYOUT OF PIPING



1 HOT GAS SOV
2 HOT GAS SOLENOID VALVE
3 SUCTION SOV
4 EPR VALVE WITH SUCTION STOP
5 LIQUID SOV
6 LIQUID LINE SOLENOID VALVE
6A MS 10 CHECK VALVE
7 MASTER LIQUID LINE SOLENOID VALVE
7A ORD-4-20 5/8 CHECK VALVE
8 A9E PRESSURE REGULATOR
9 DISCHARGE SOV
10 CONDENSATE RETURN SOV
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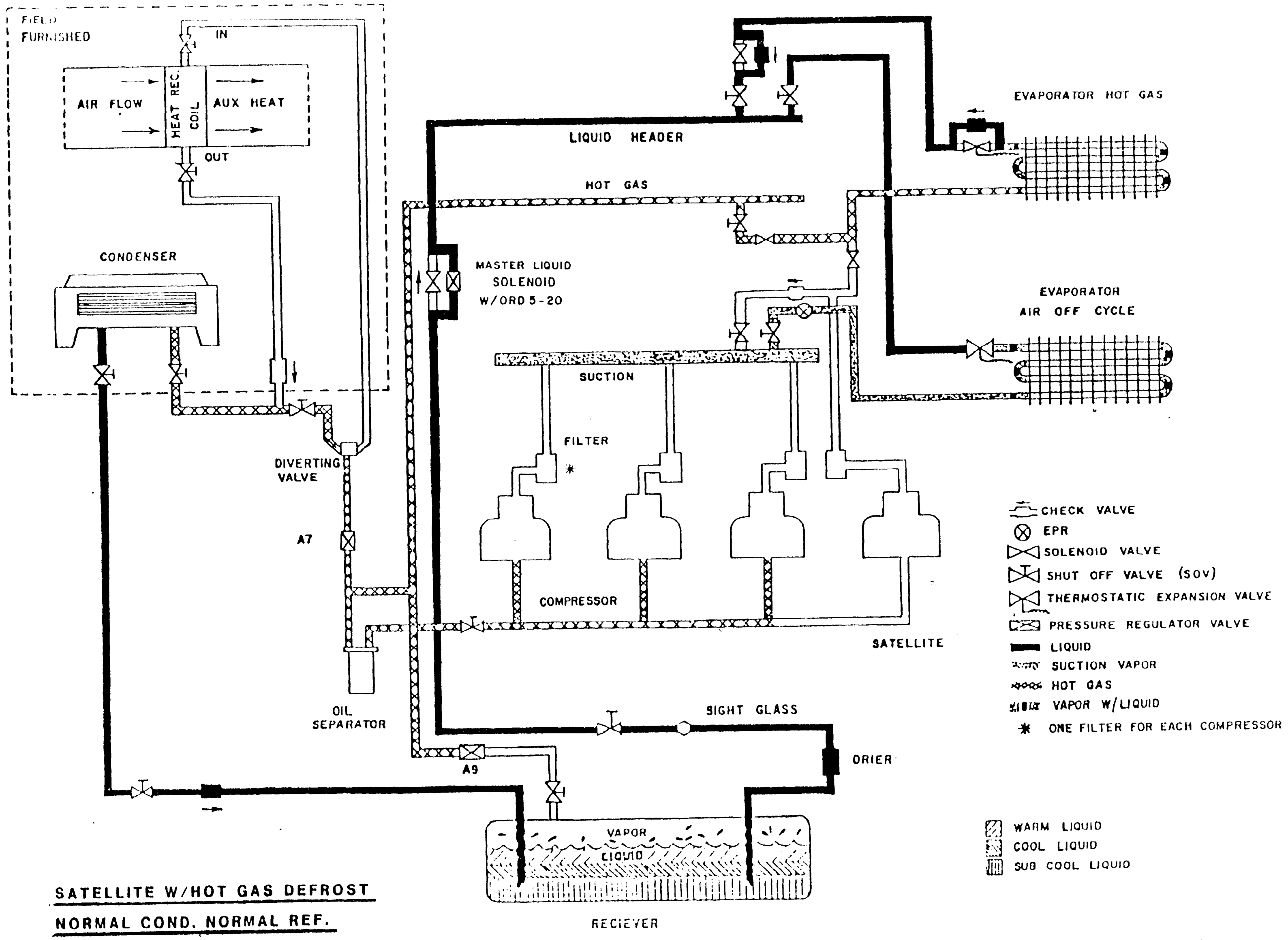
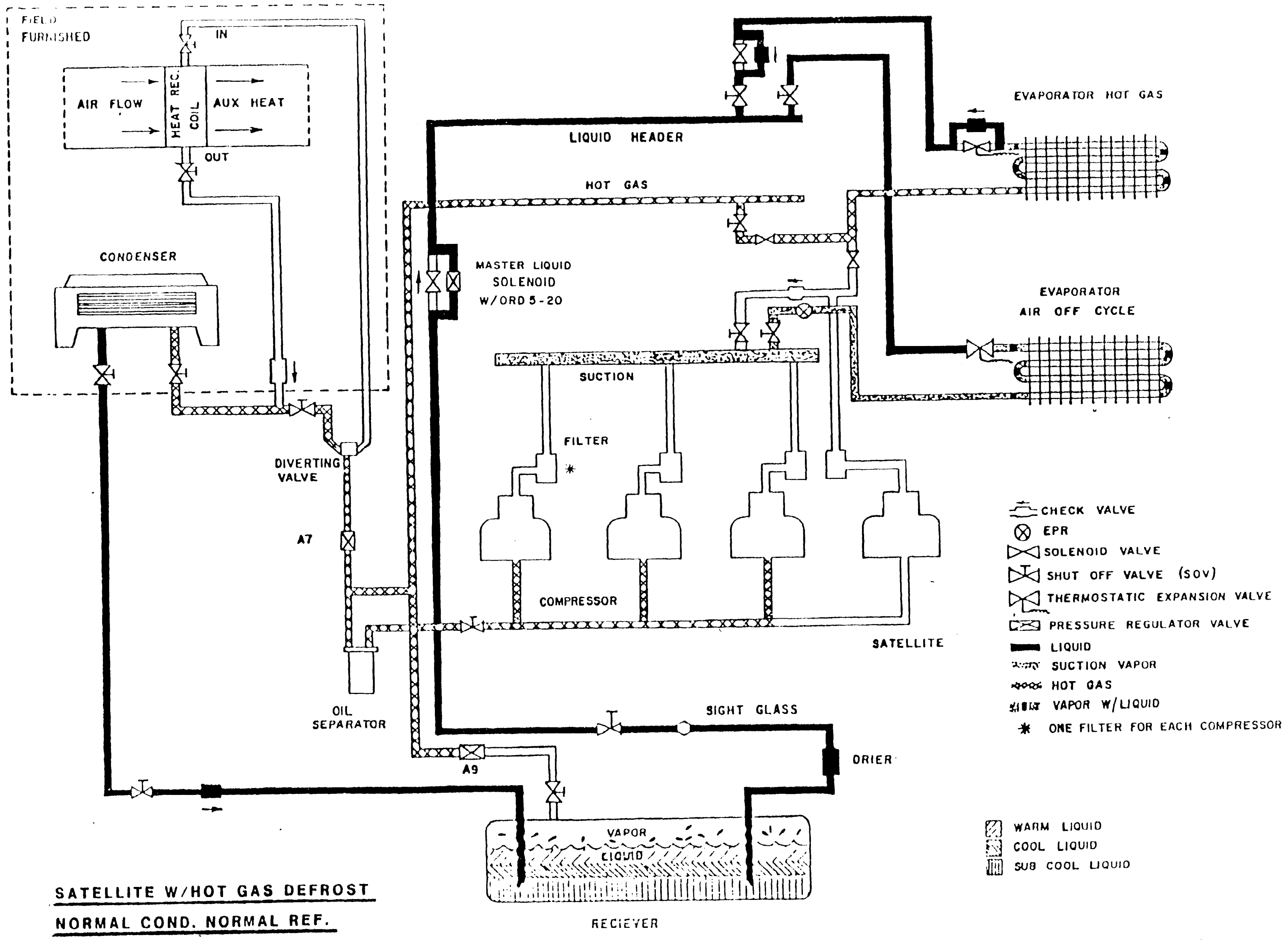


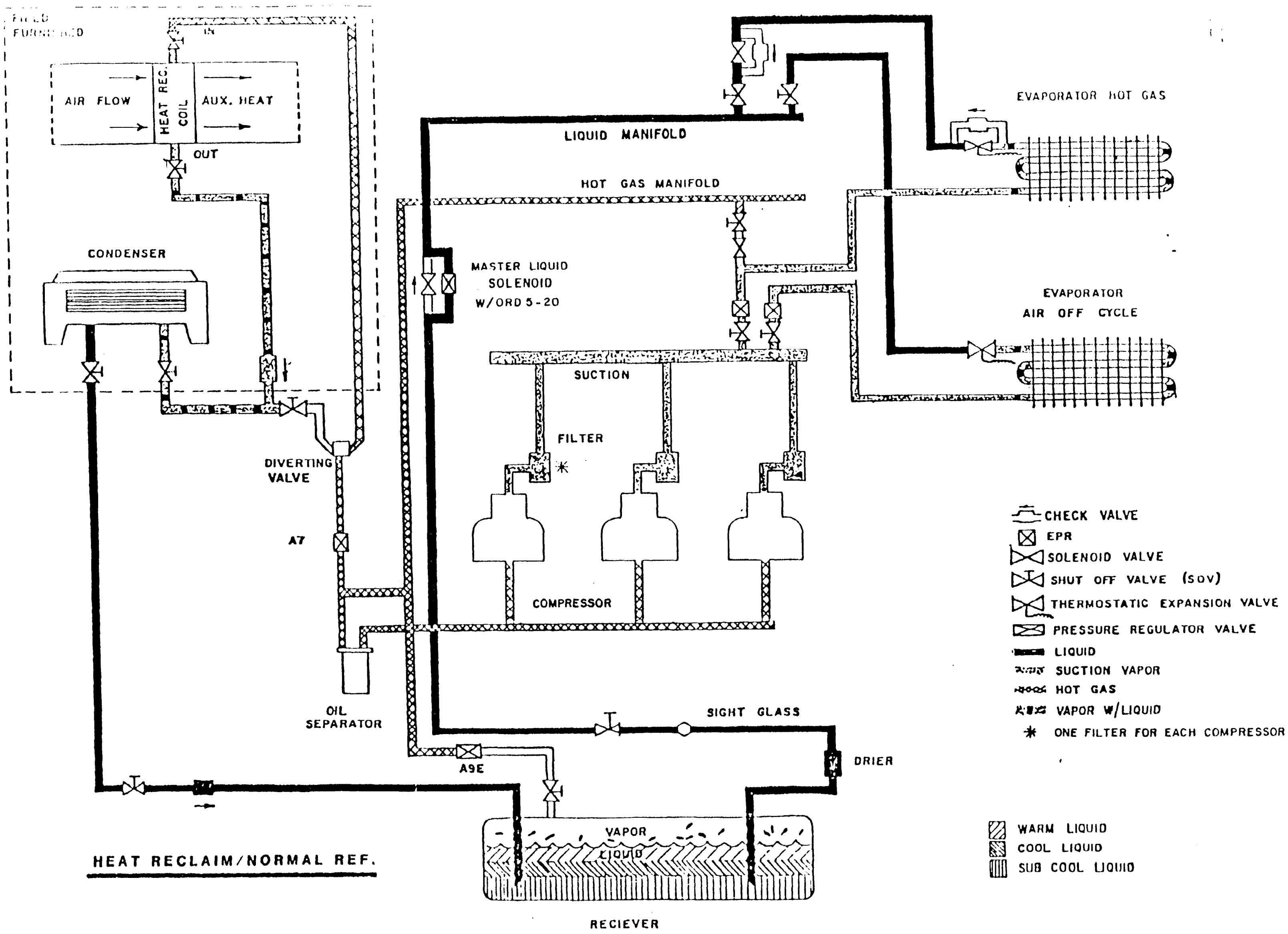
SATELLITE W/HOT GAS DEFROST

NORMAL COND. NORMAL REF.

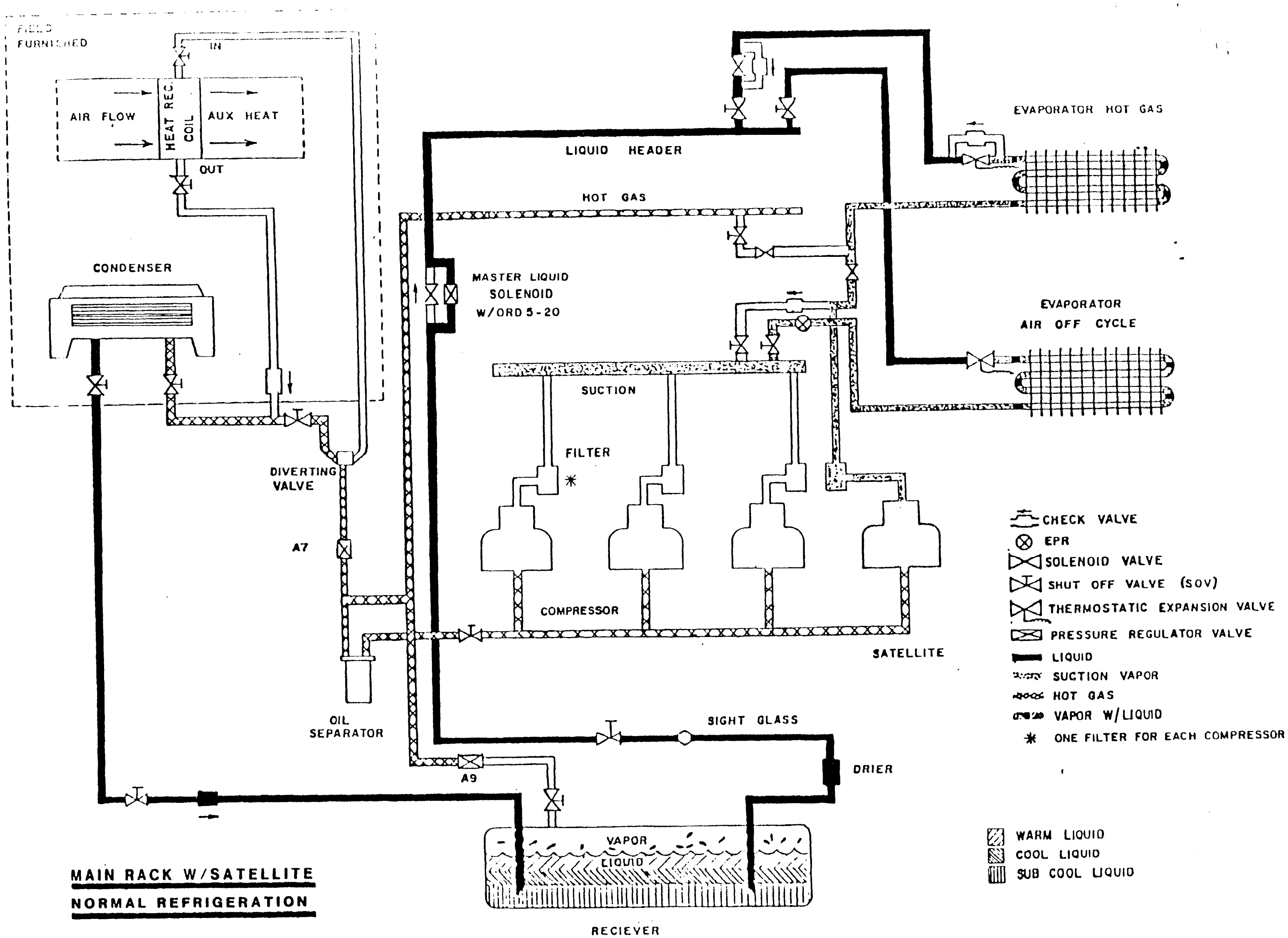


SATELLITE W/HOT GAS DEFROST

NORMAL COND. NORMAL REF.

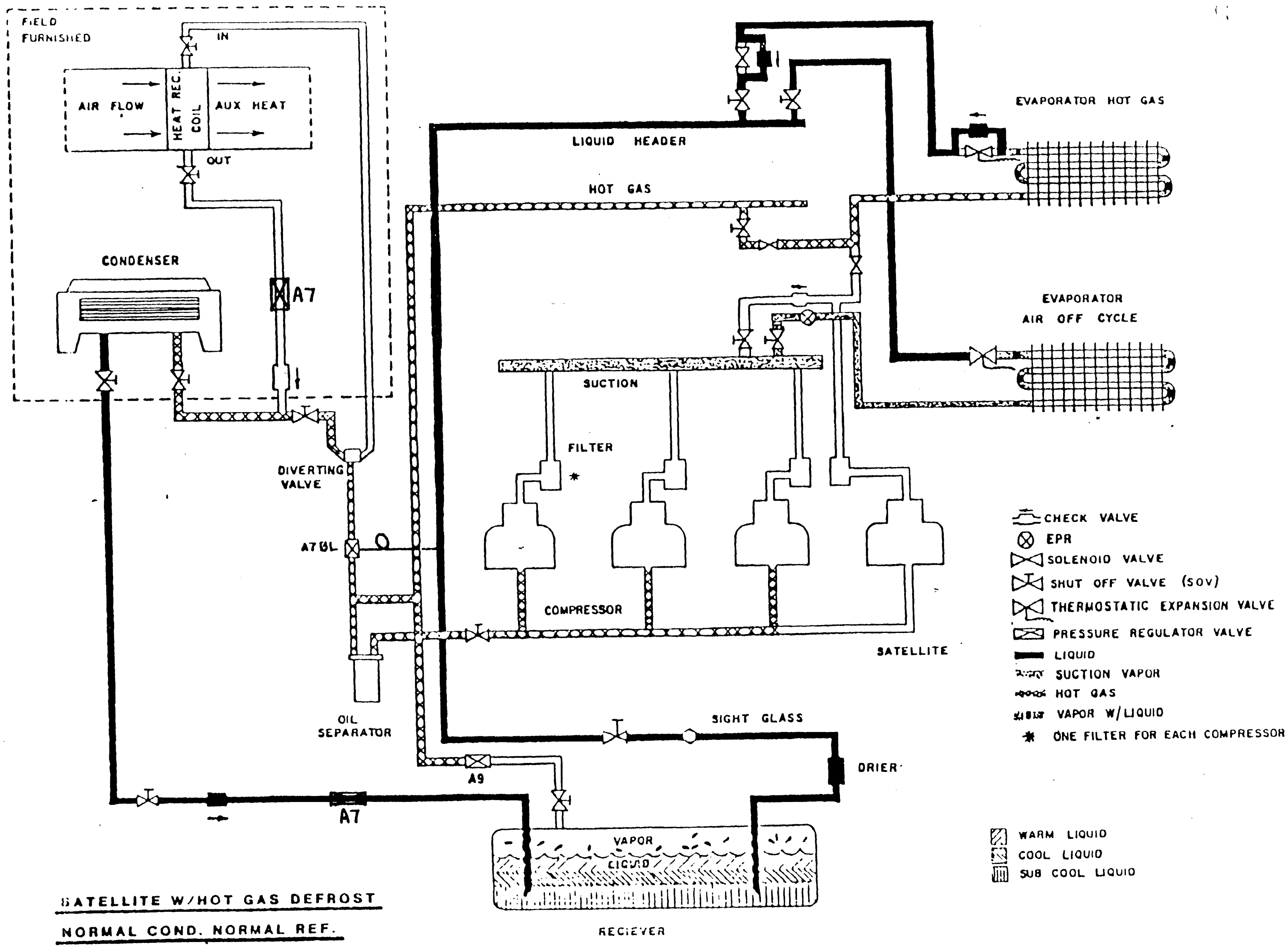


HEAT RECLAIM/NORMAL REF.



MAIN RACK W/SATELLITE

NORMAL REFRIGERATION



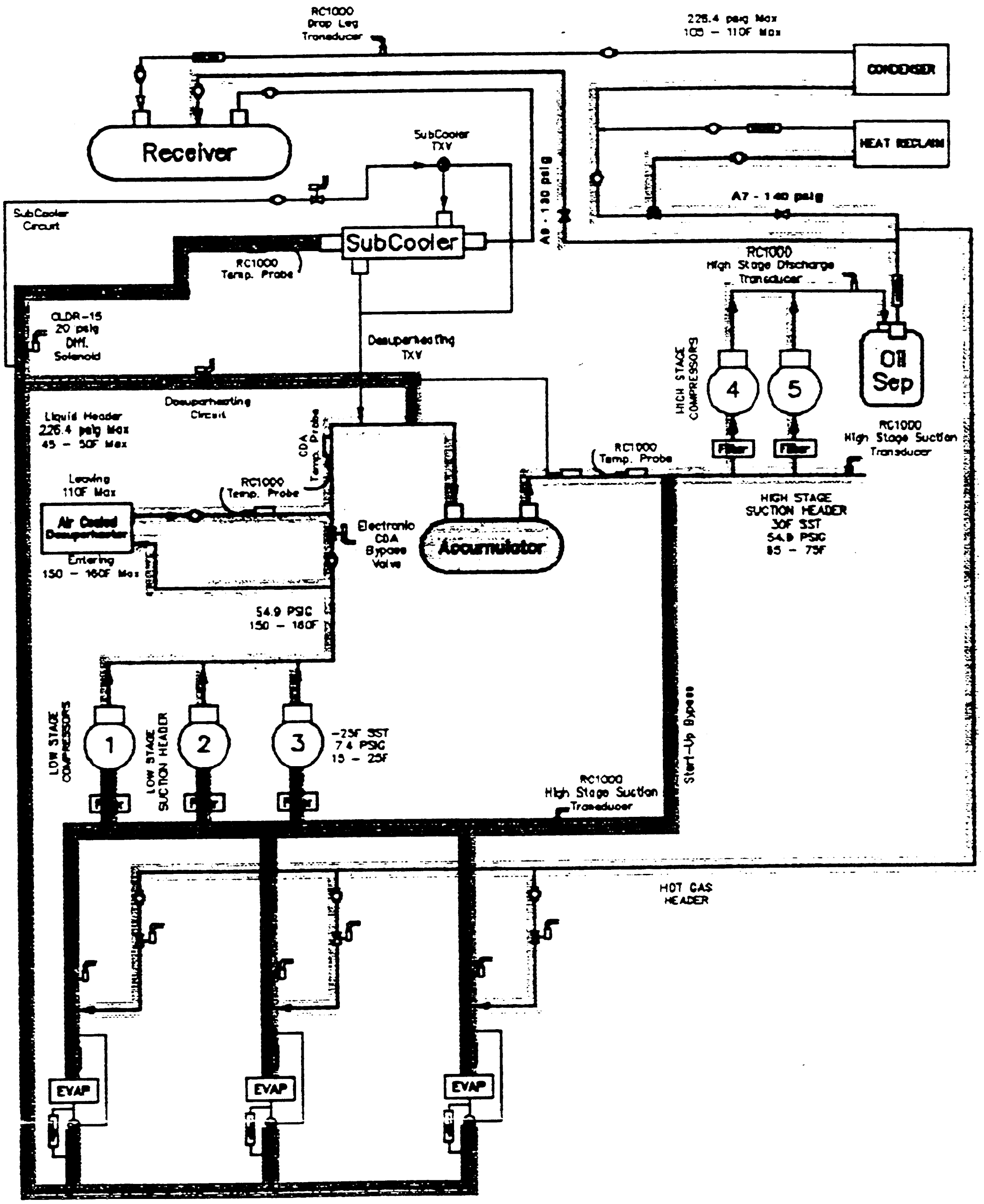
SATELLITE W/HOT GAS DEFROST

NORMAL COND. NORMAL REF.

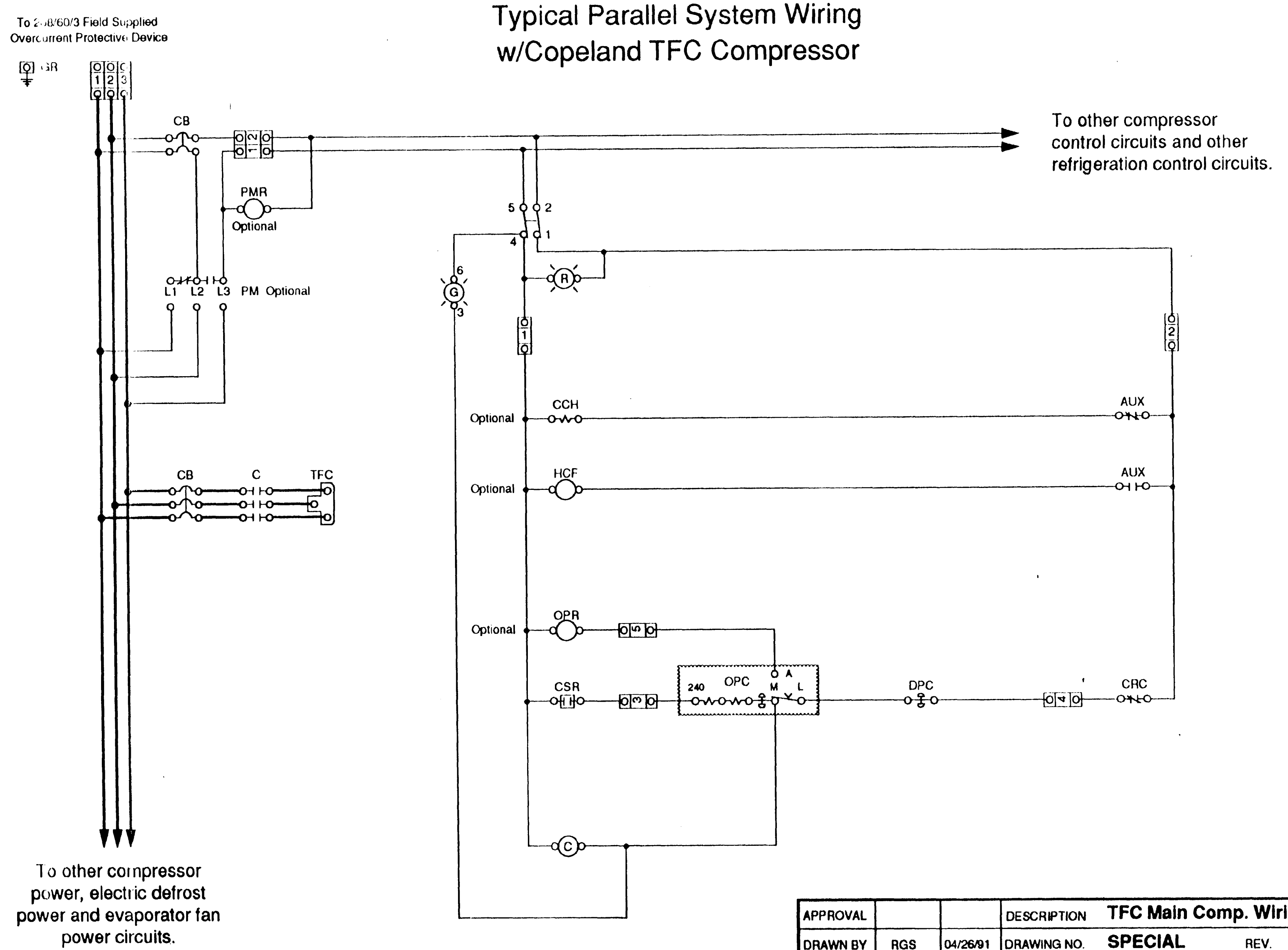
KYSOR//WARREN

DETAIL PIPING SCHEMATIC

HCFC-22 TWO STAGE



Typical Parallel System Wiring w/Copeland TFC Compressor



APPROVAL			DESCRIPTION	TFC Main Comp. Wiring
DRAWN BY	RGS	04/26/91	DRAWING NO. SPECIAL	REV. NEW
ACTIVITY	NAME	DATE	DO NOT SCALE THIS PRINT	CAD CHANGE ONLY

USE COPPER CONDUCTORS ONLY

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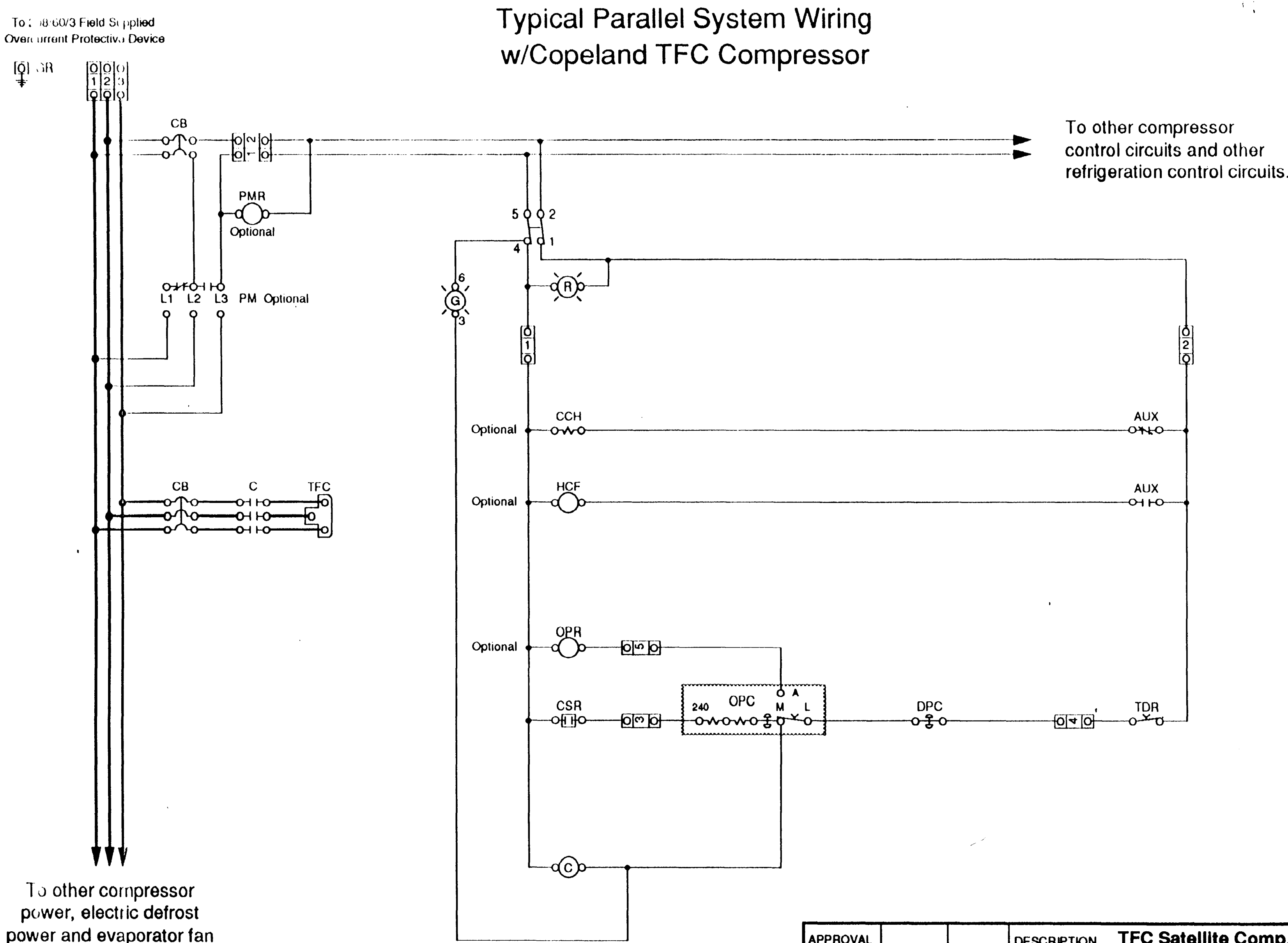
Typical Parallel System Wiring w/Copeland TFC Compressor



APPROVAL			DESCRIPTION	TFC Satellite Comp. Wiring	
DRAWN BY	RGS	04/26/91	DRAWING NO.	SPECIAL	REV. NEW
ACTIVITY	NAME	DATE	DO NOT SCALE THIS PRINT		CAD CHANGE ONLY

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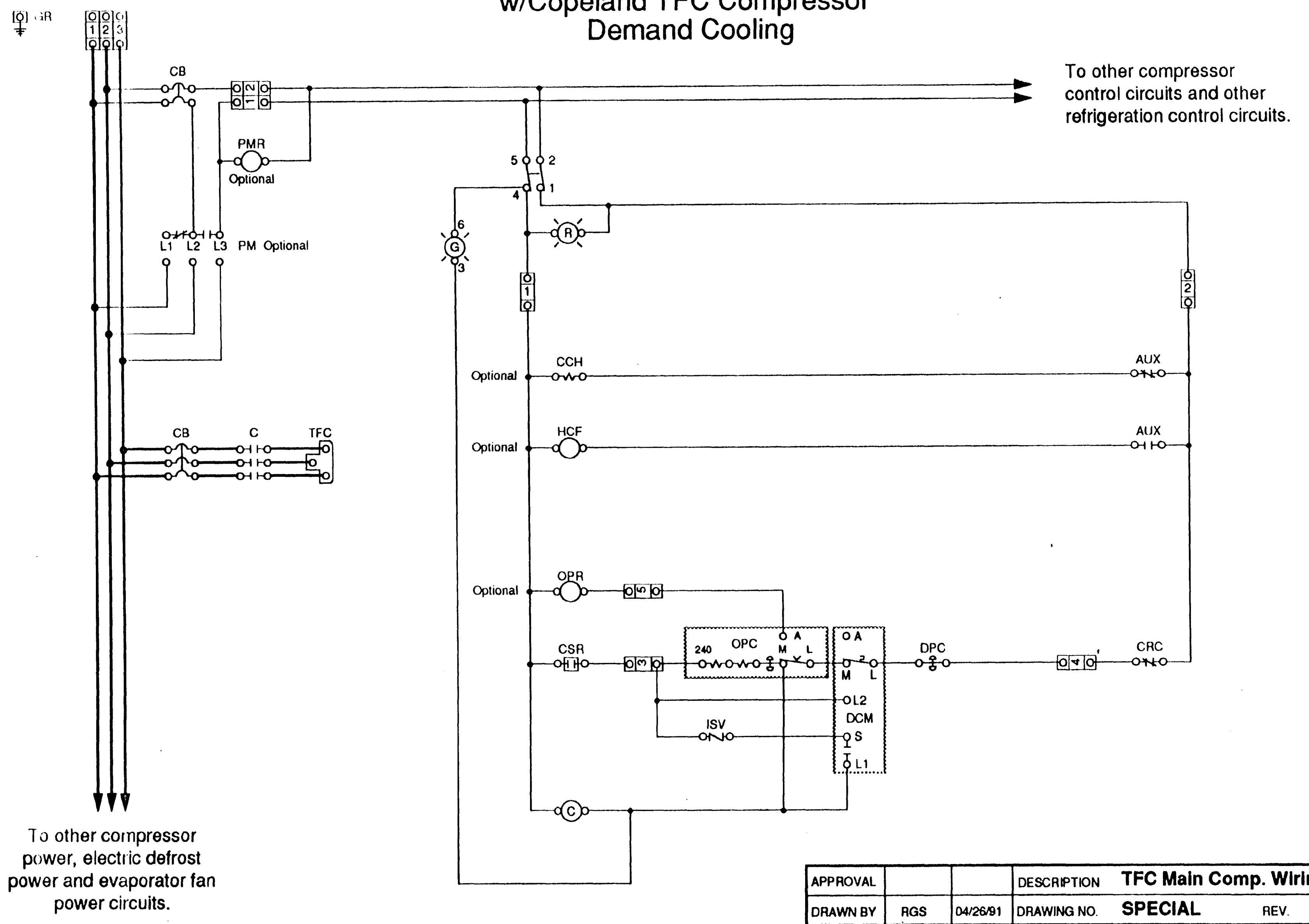
Typical Parallel System Wiring w/Copeland TFC Compressor Demand Cooling



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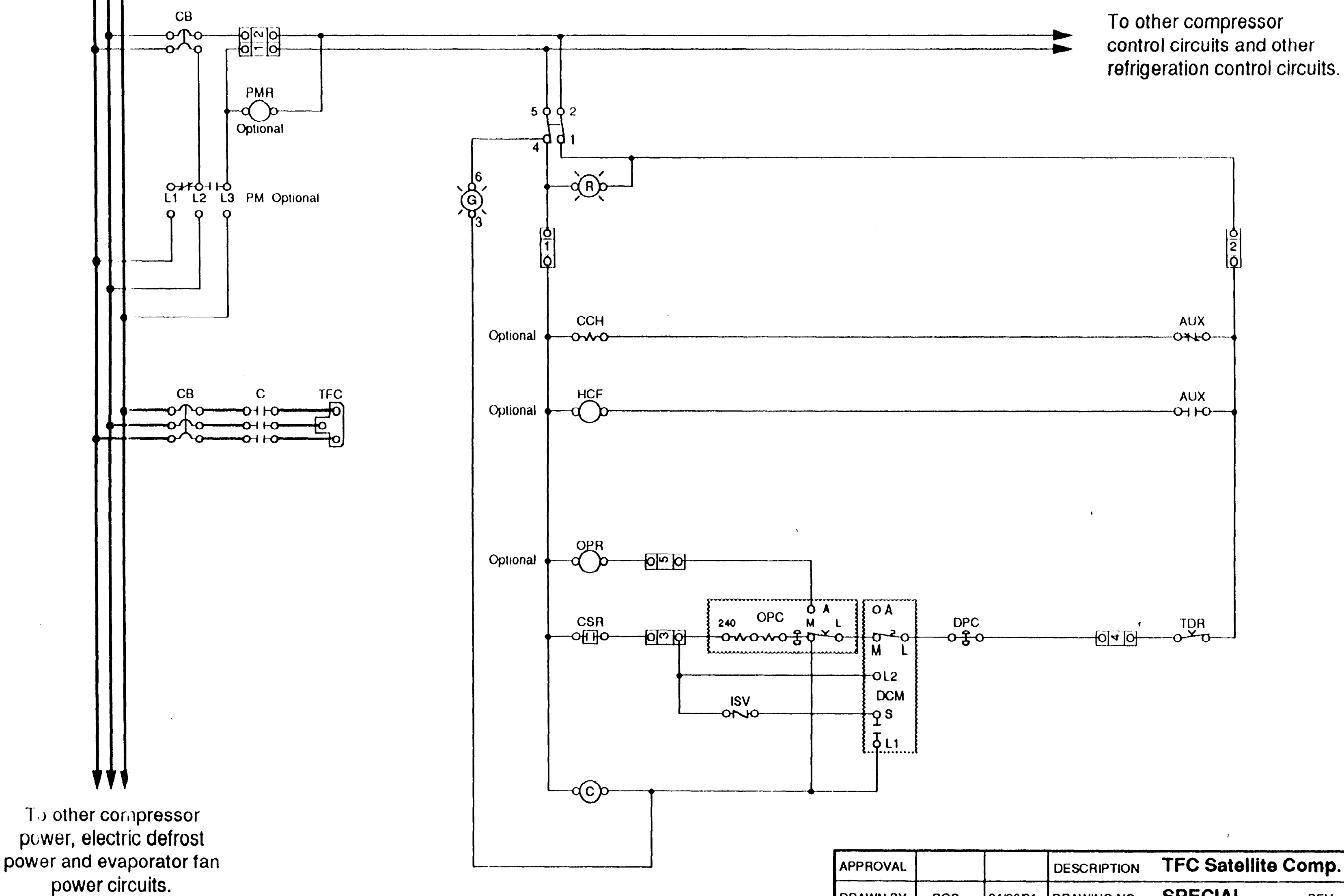
Typical Parallel System Wiring w/Copeland TFC Compressor Demand Cooling



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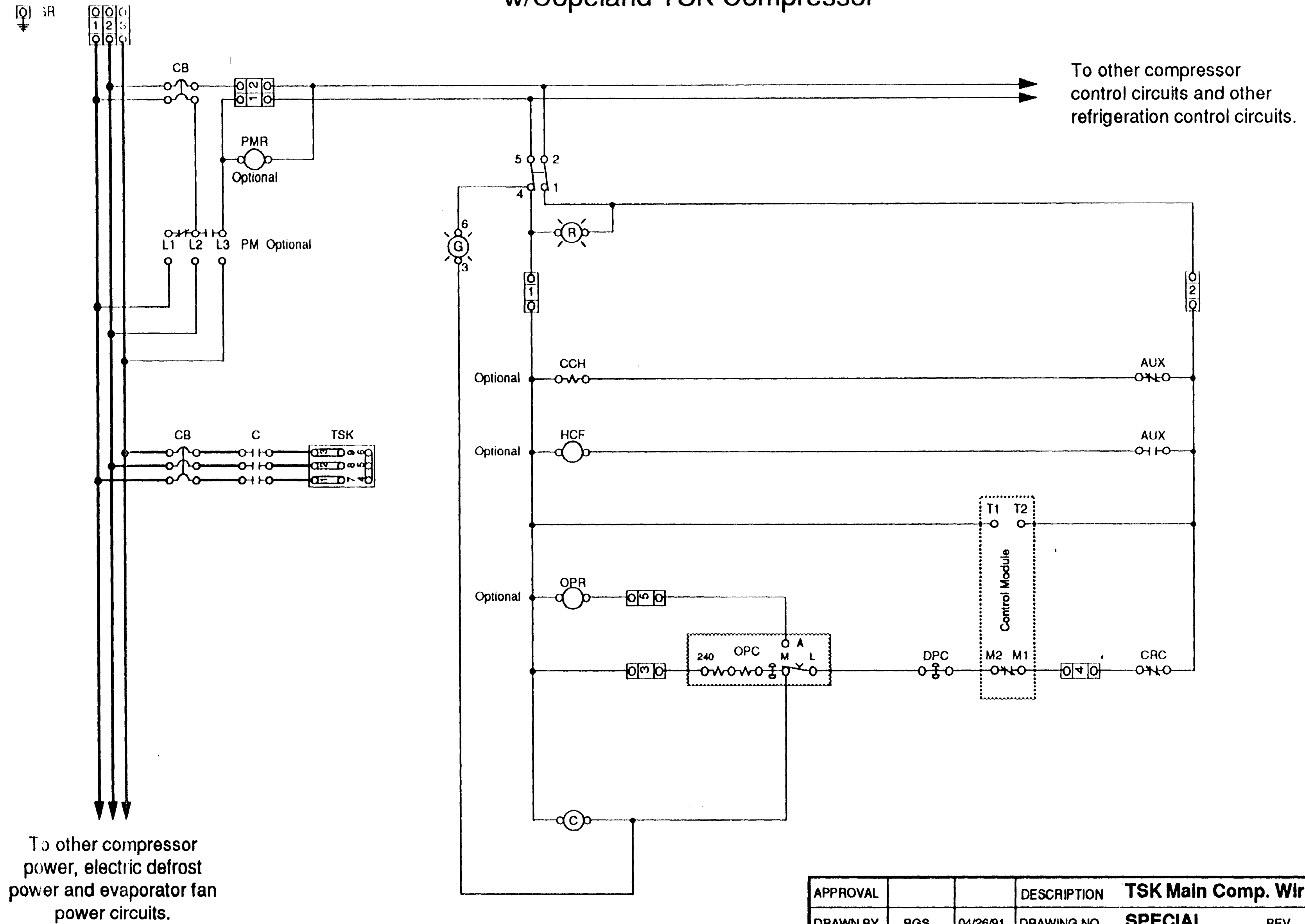
Typical Parallel System Wiring
w/Copeland TSK Compressor



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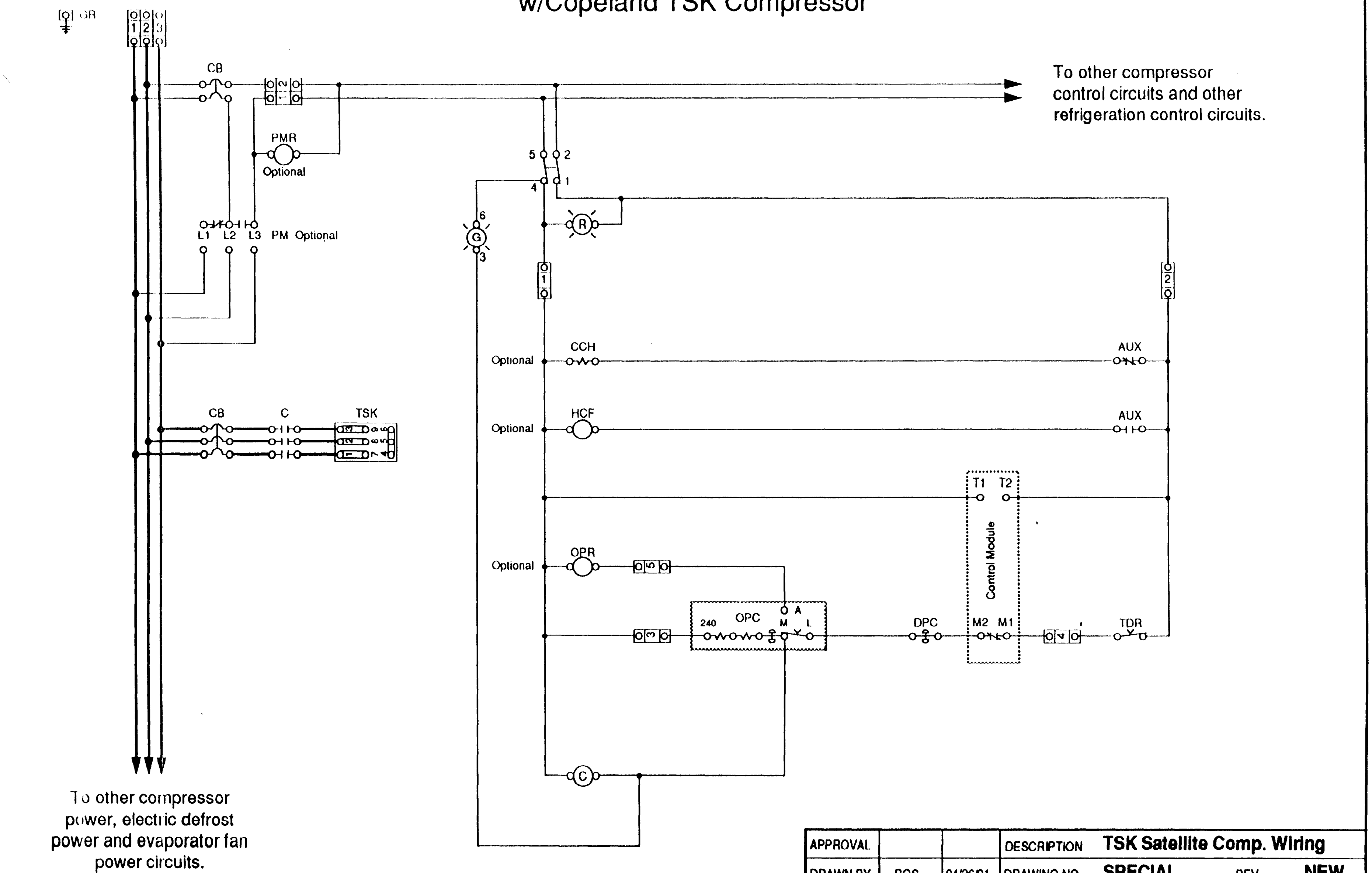
USE COPPER CONDUCTORS ONLY			KYSOR//WARREN® DIVISION OF KYSOR INDUSTRIAL CORPORATION	

Typical Parallel System Wiring w/Copeland TSK Compressor



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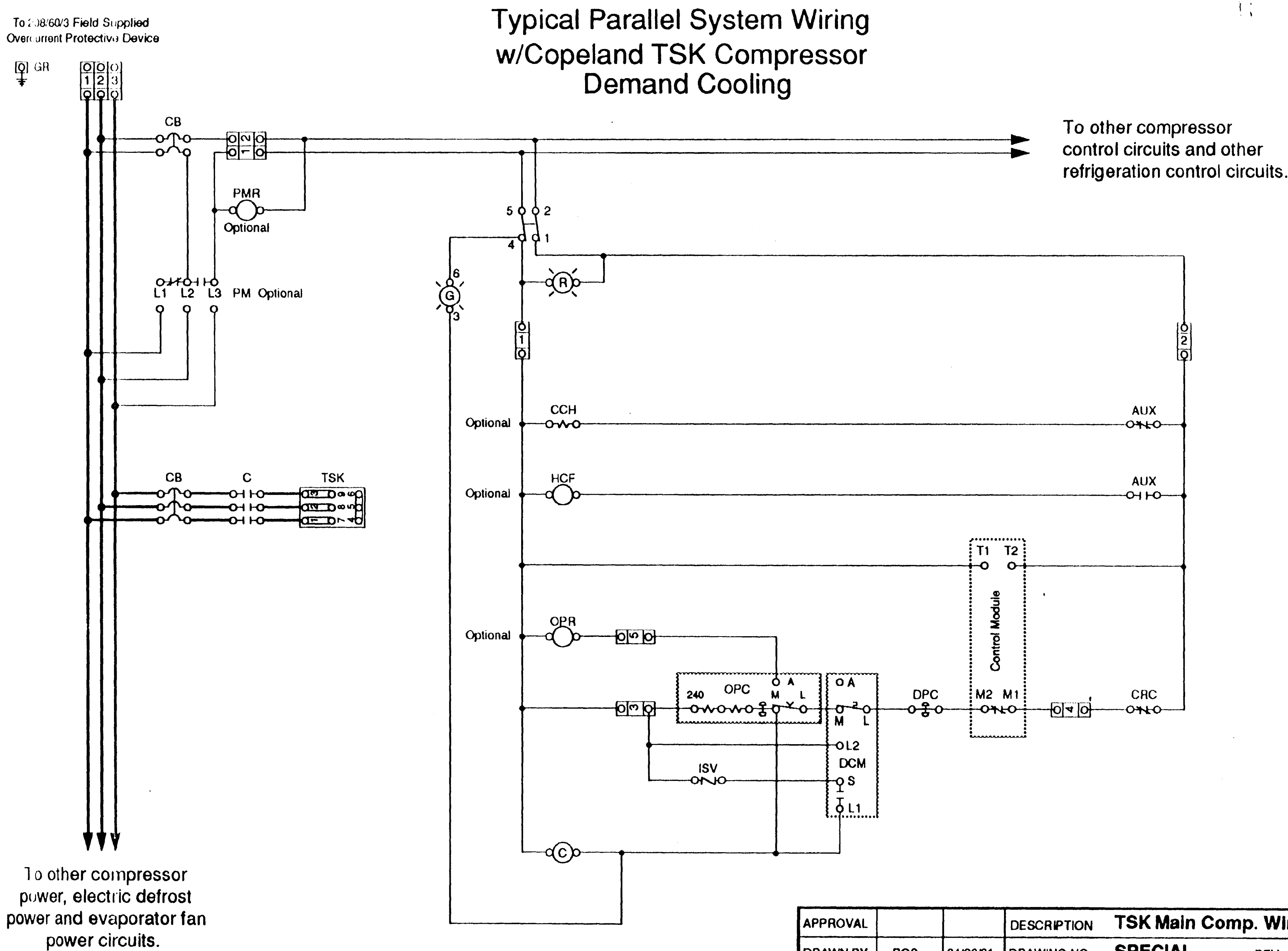
Typical Parallel System Wiring w/Copeland TSK Compressor Demand Cooling



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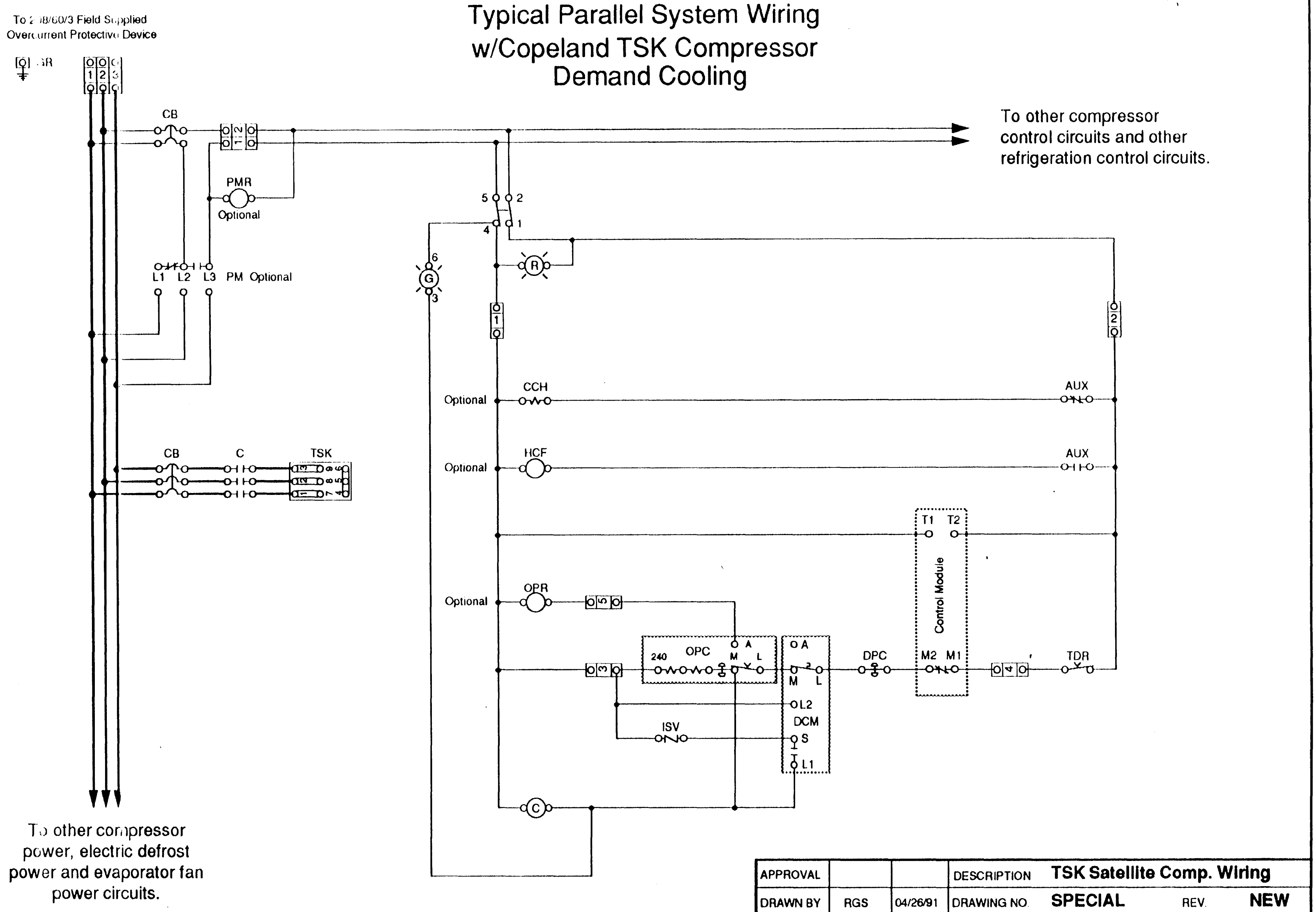
Typical Parallel System Wiring w/Copeland TSK Compressor Demand Cooling



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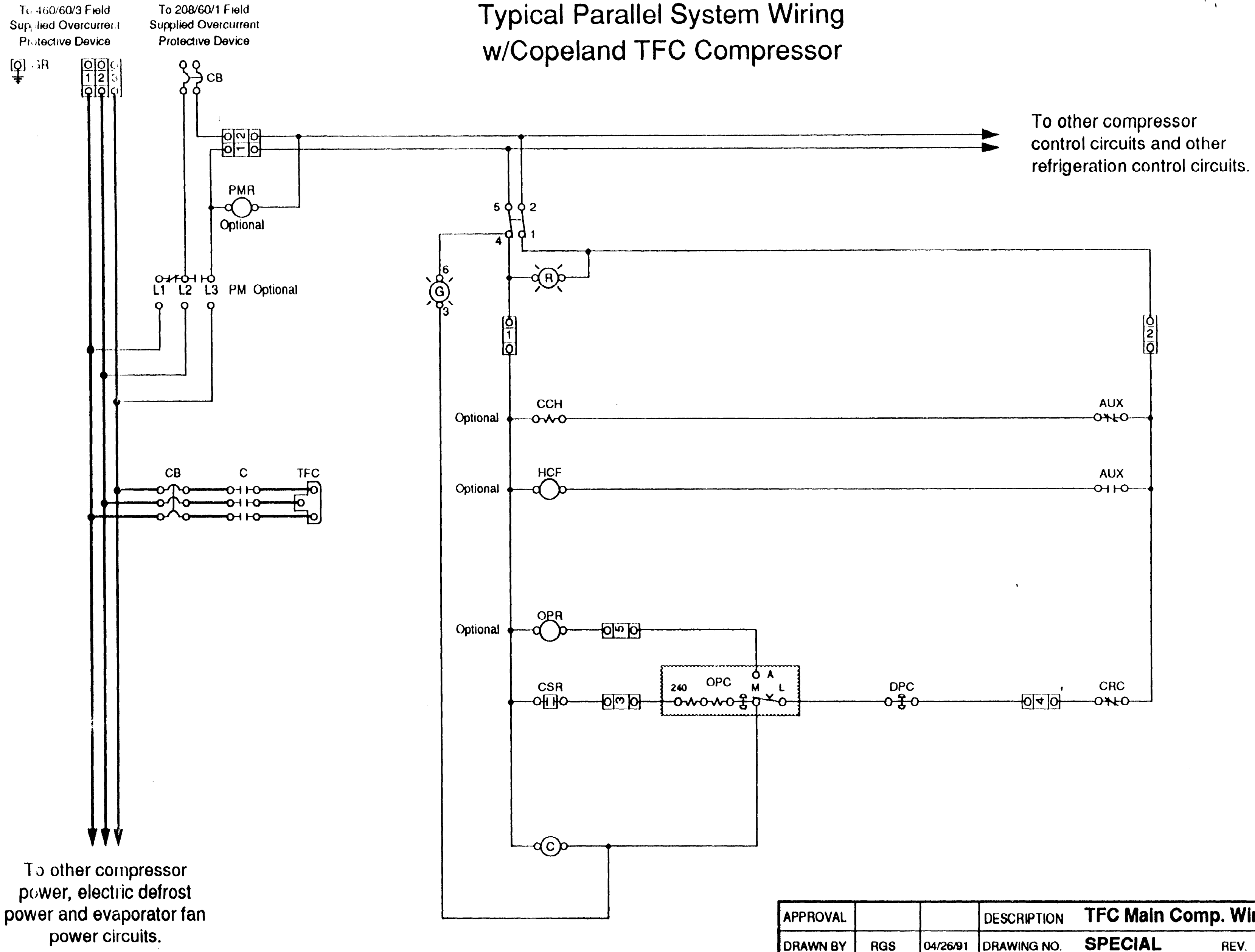
Typical Parallel System Wiring w/Copeland TFC Compressor



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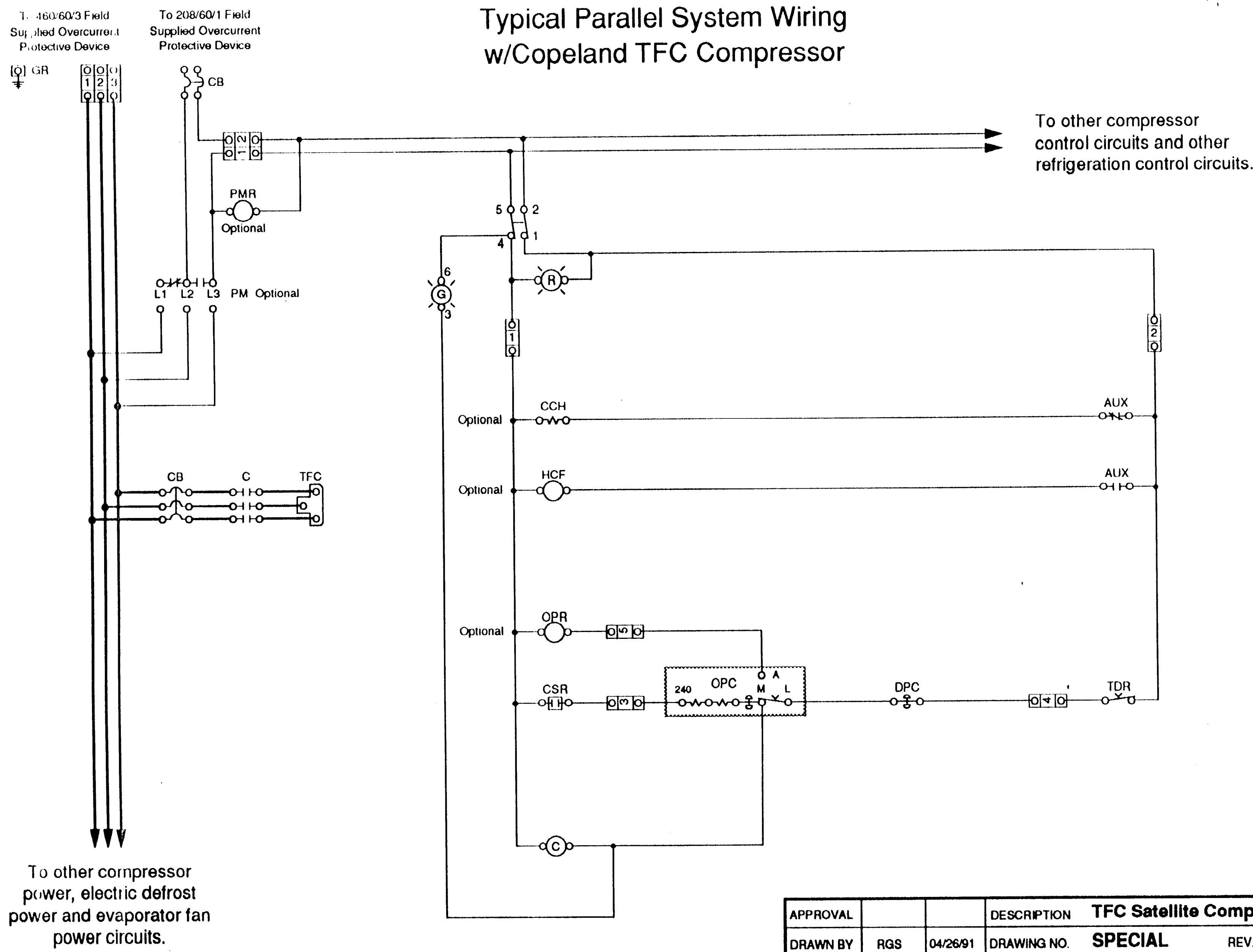

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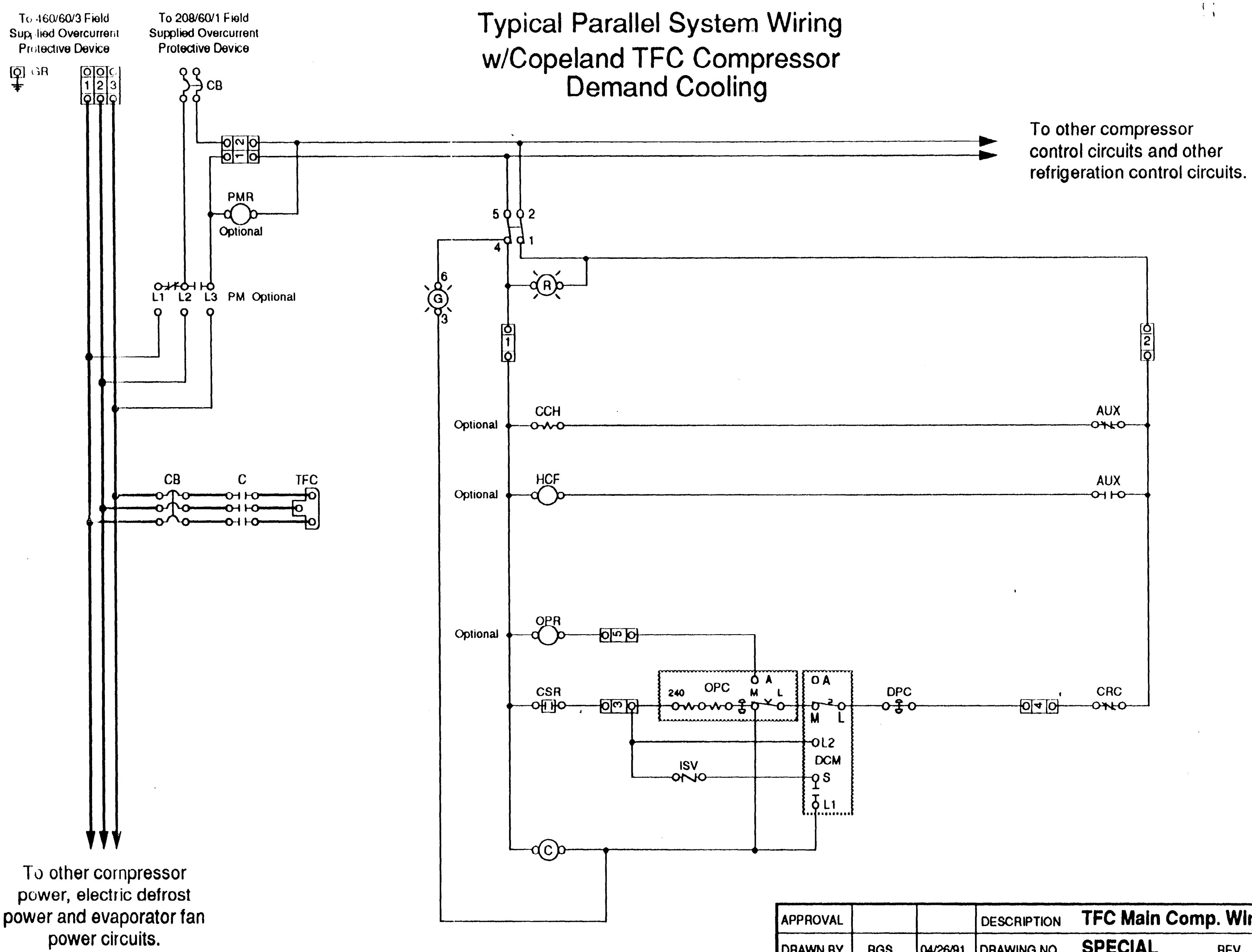

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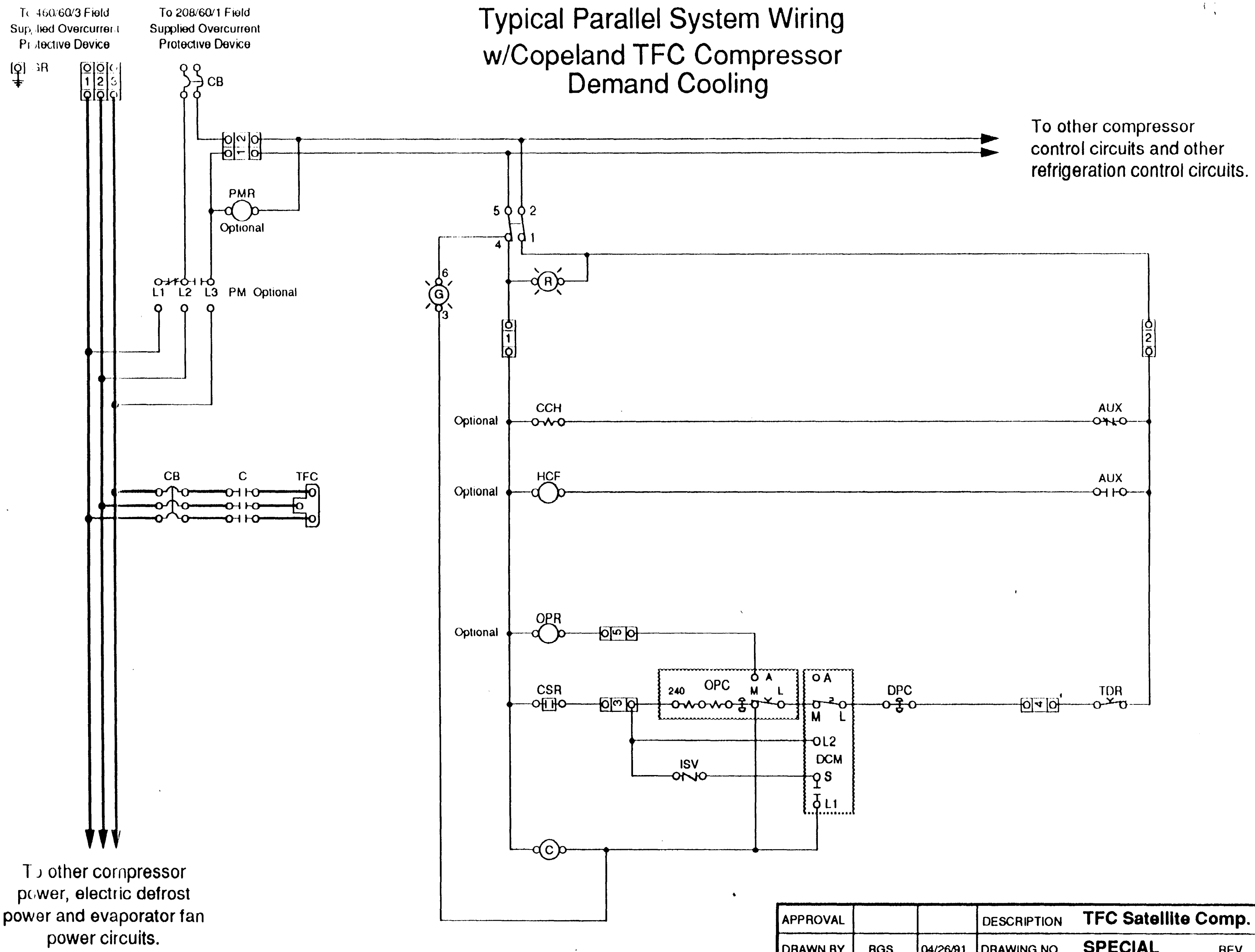

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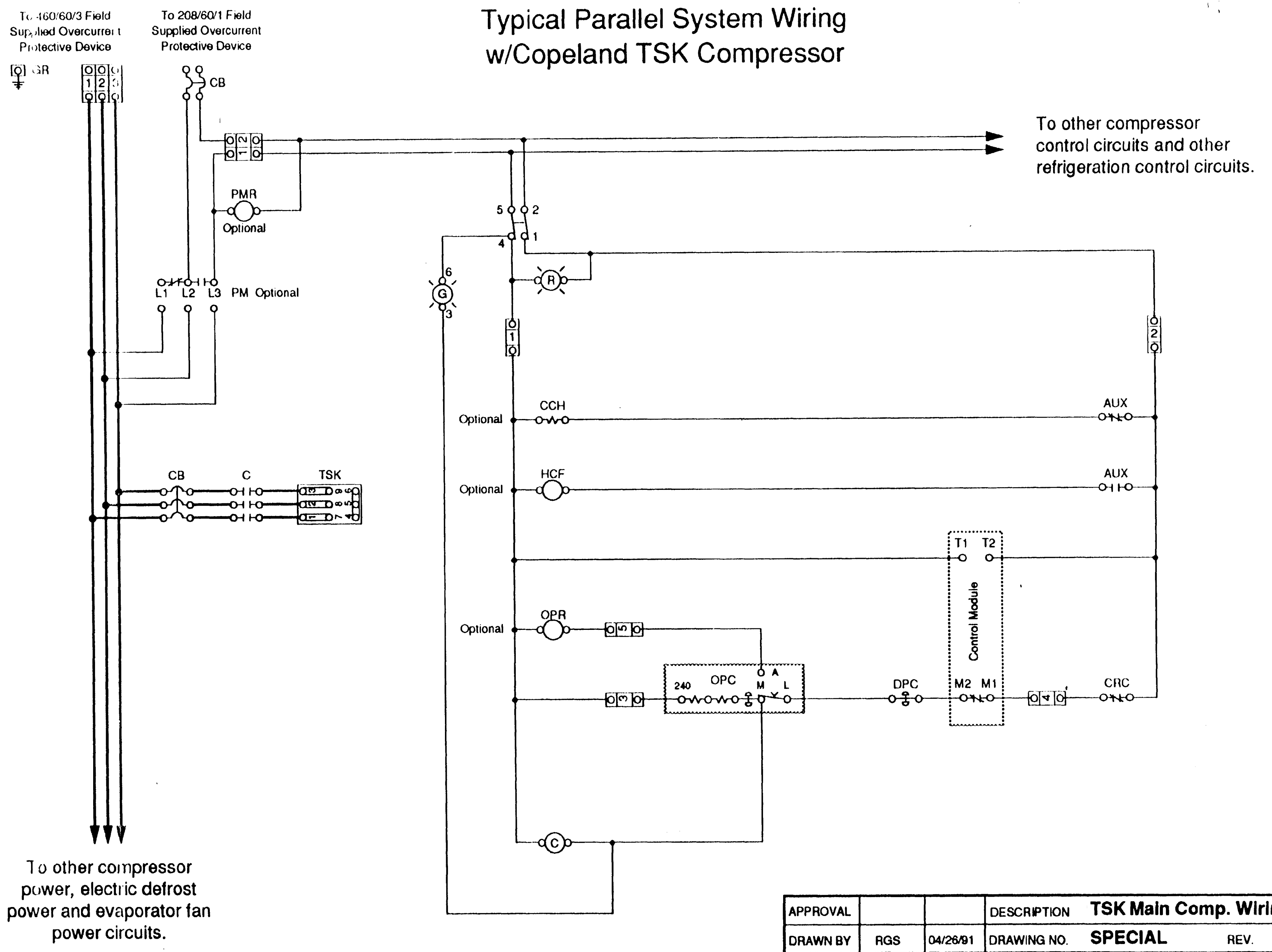

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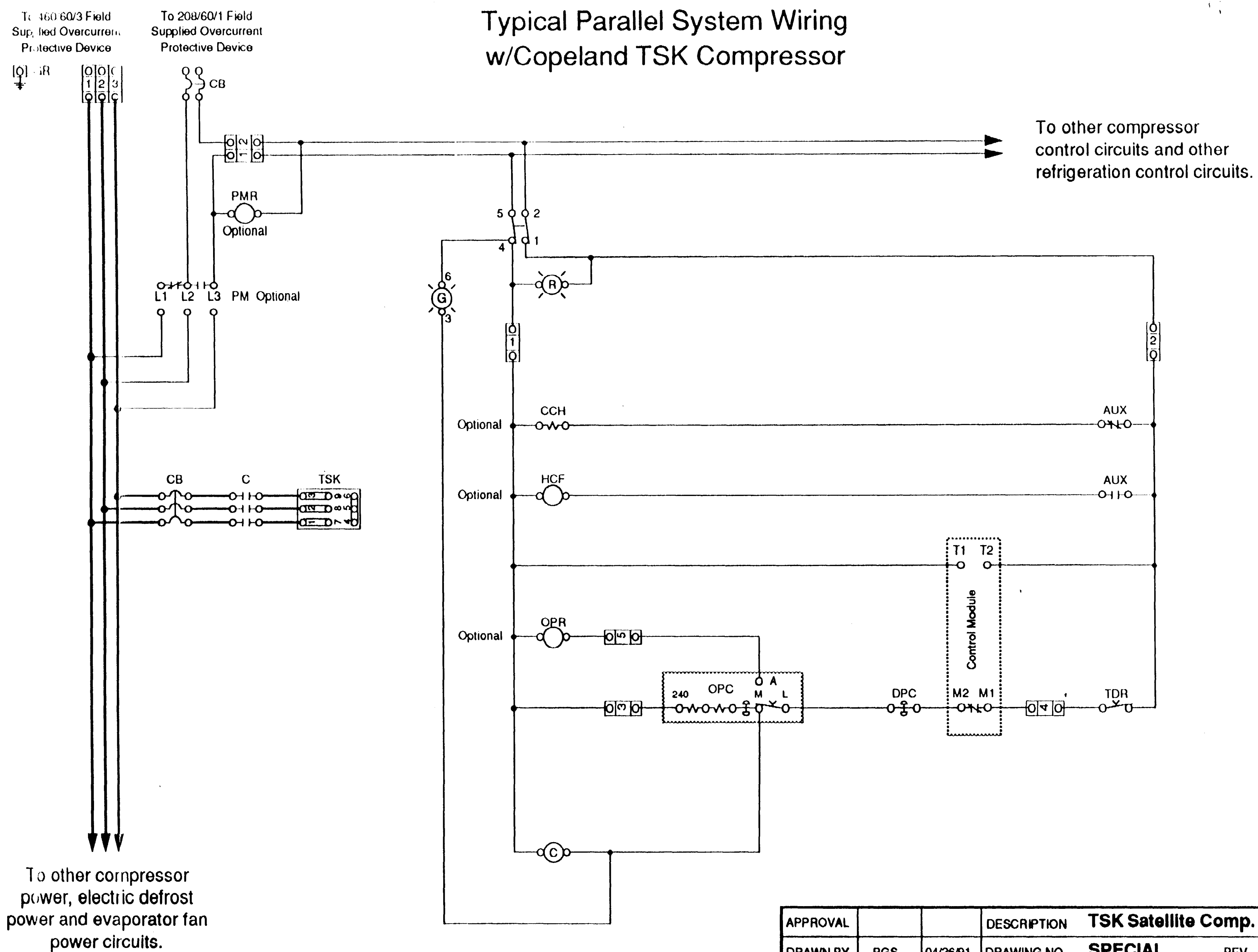

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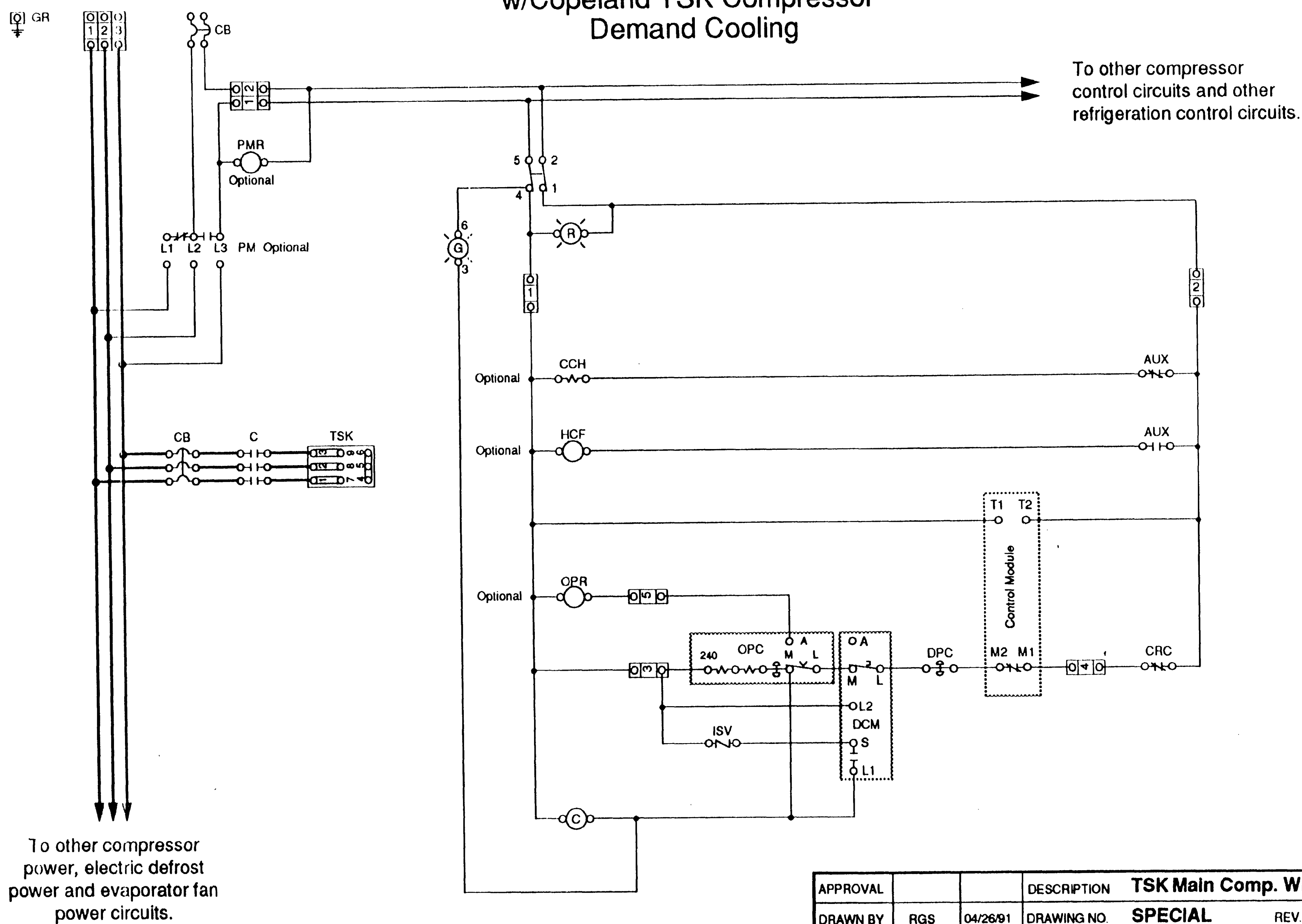

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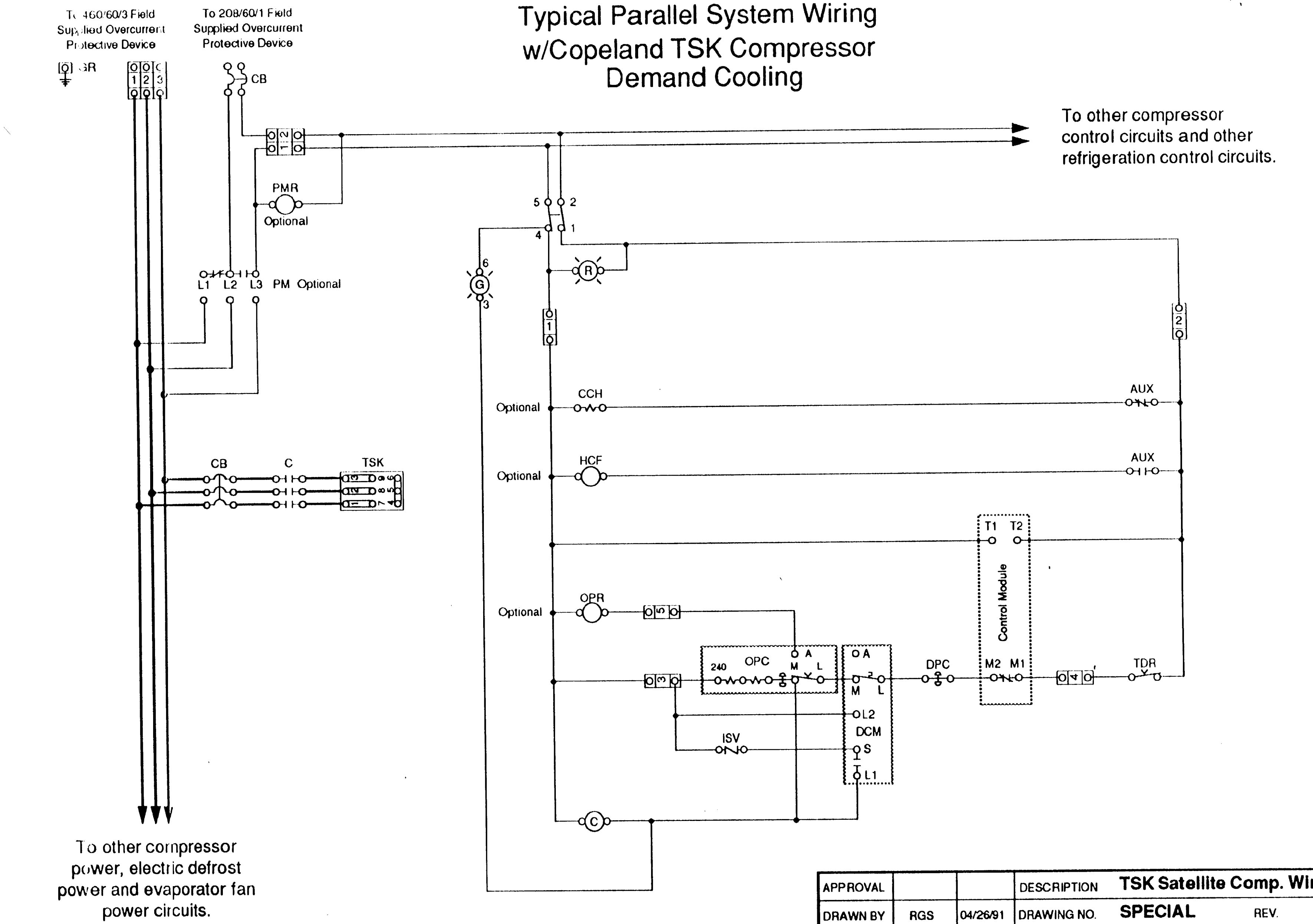
Typical Parallel System Wiring w/Copeland TSK Compressor Demand Cooling



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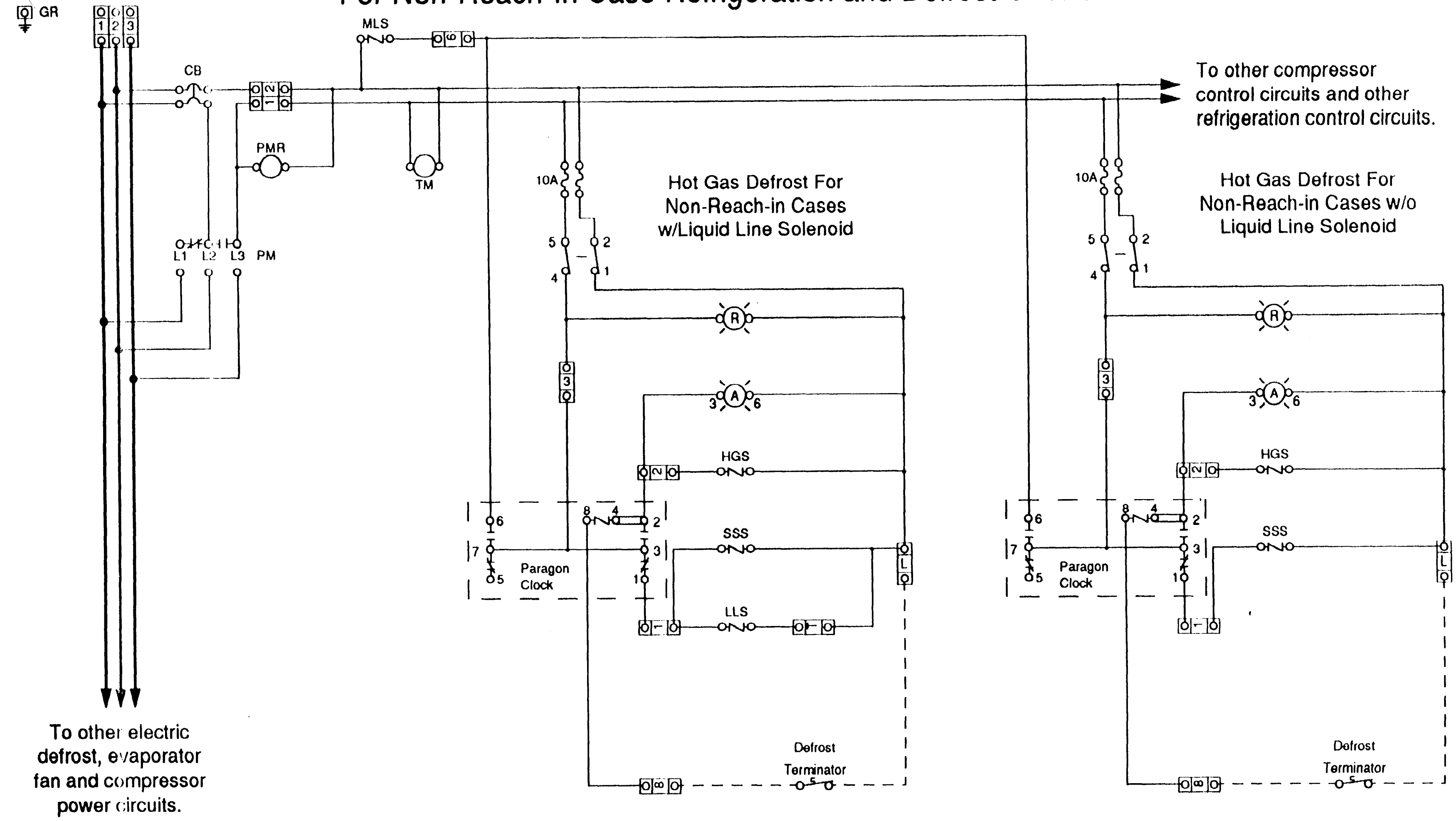
Typical Parallel System Wiring w/Paragon Defrost Clock
For Non-Reach-In Case Refrigeration and Defrost Circuits



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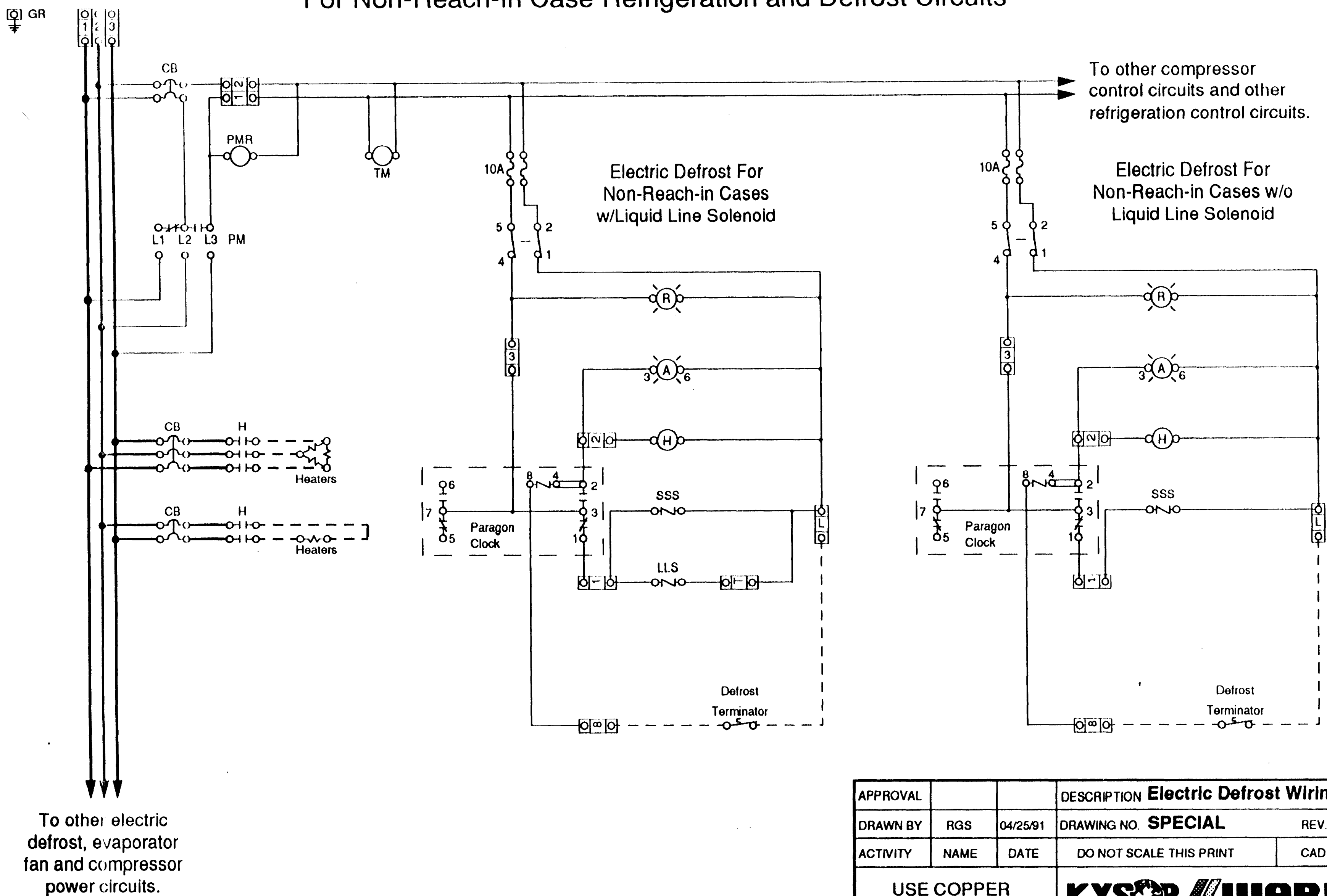
For Non-Reach-In Case Refrigeration and Defrost Circuits



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ACTIVITY	NAME	DATE	DO NOT SCALE THIS PRINT	CAD CHANGE ONLY
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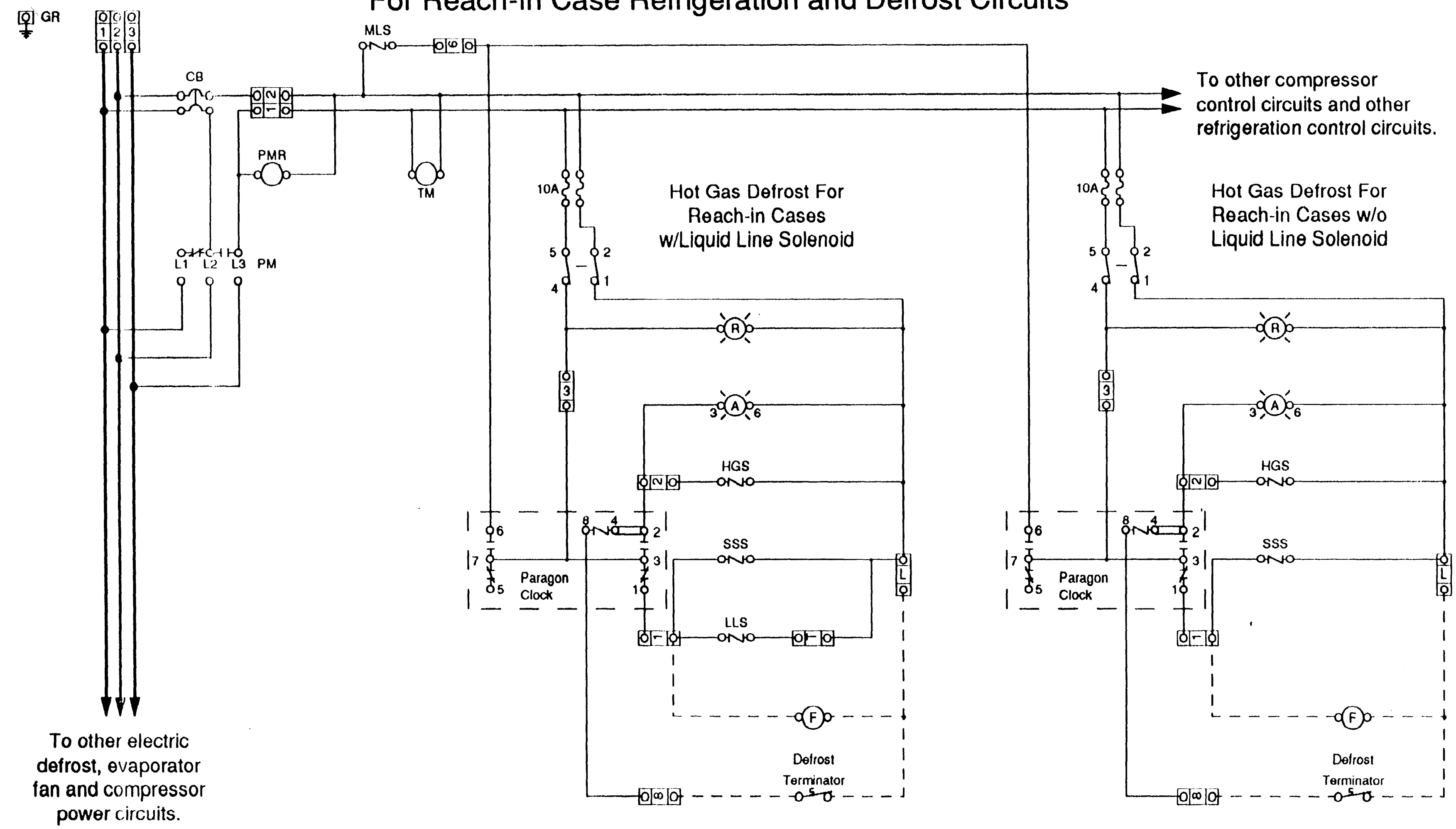
Typical Parallel System Wiring w/Paragon Defrost Clock For Reach-In Case Refrigeration and Defrost Circuits



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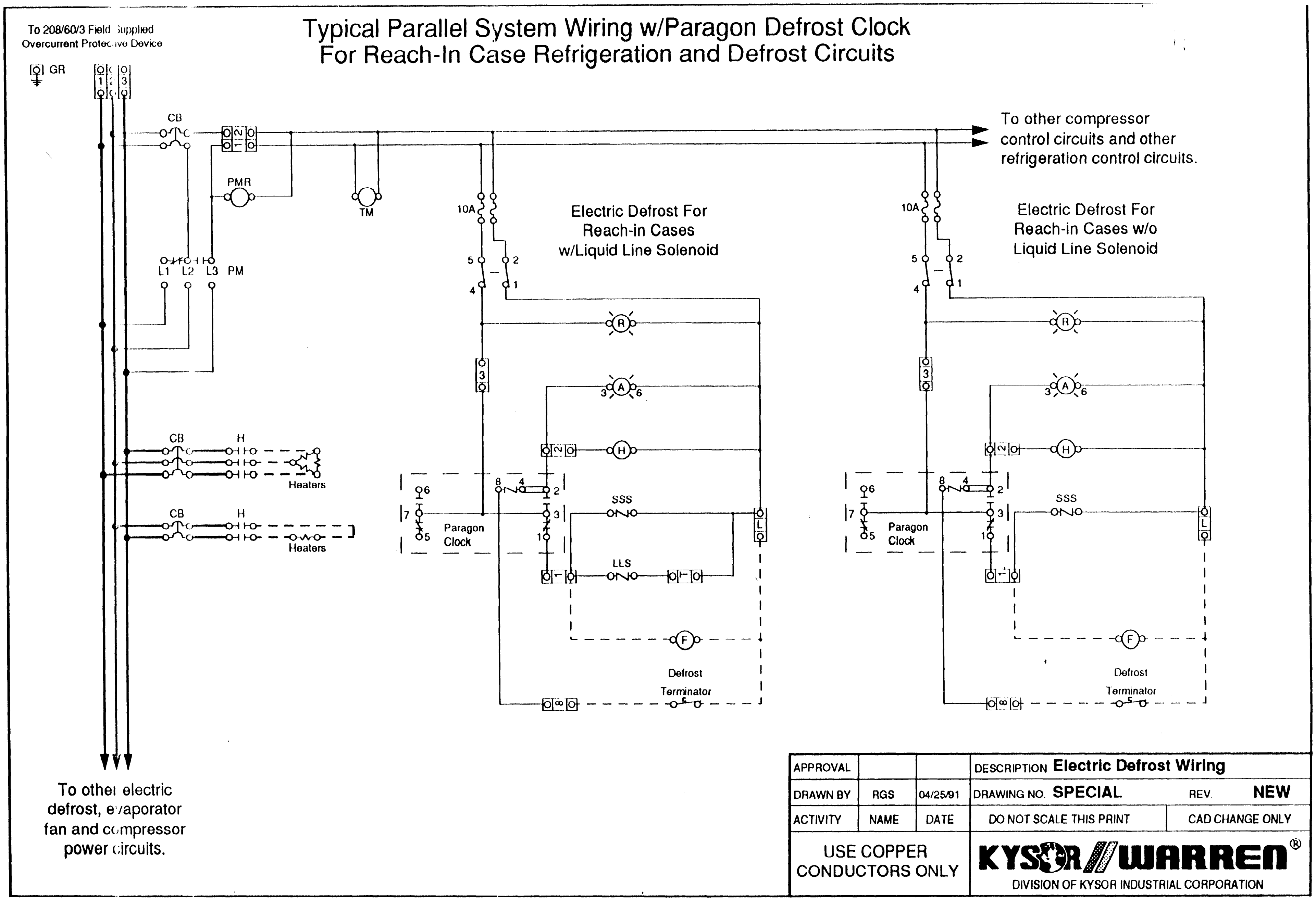
Typical Parallel System Wiring w/Paragon Defrost Clock
For Reach-In Case Refrigeration and Defrost Circuits



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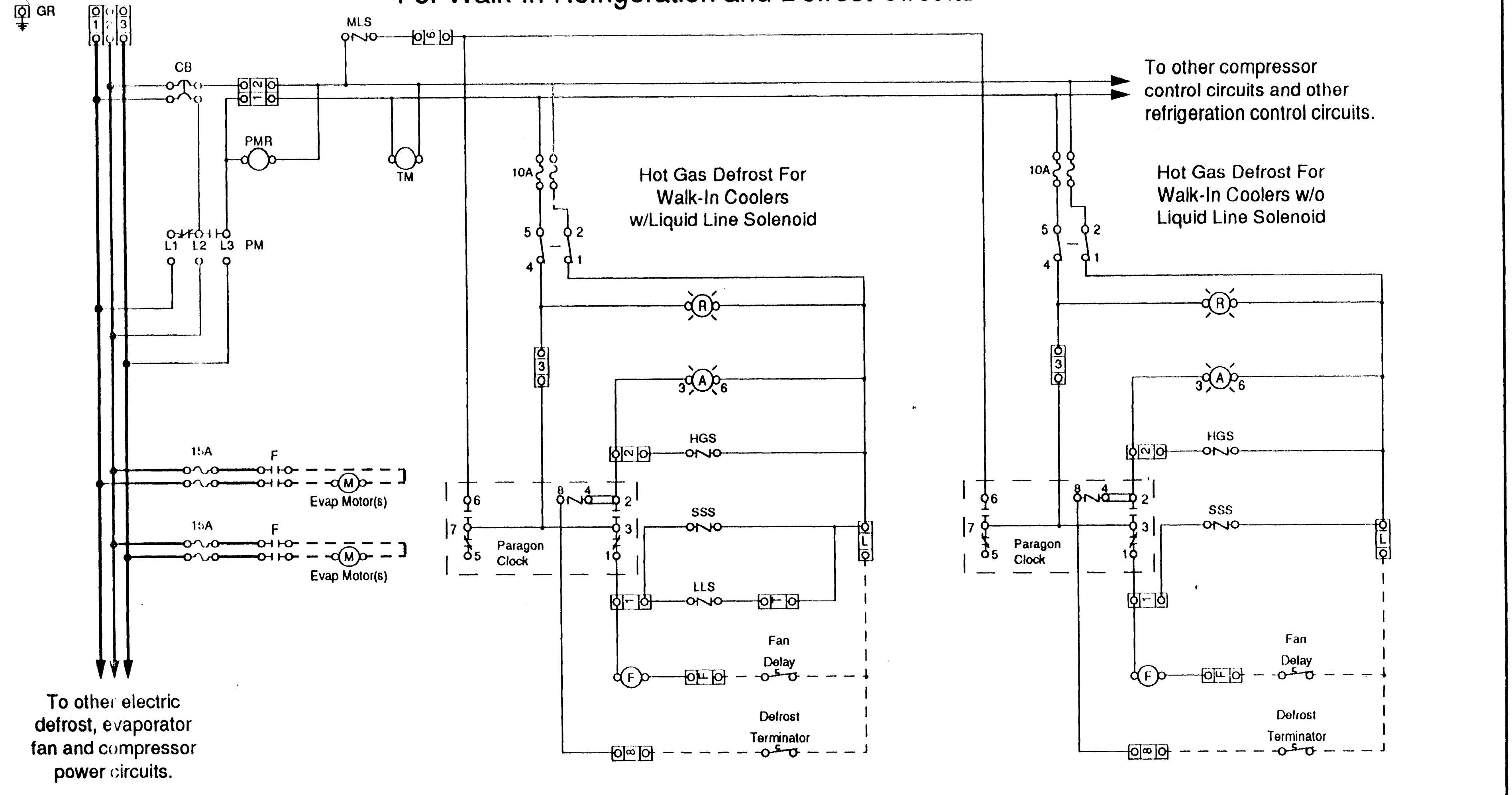
Typical Parallel System Wiring w/Paragon Defrost Clock
For Walk-In Refrigeration and Defrost Circuits



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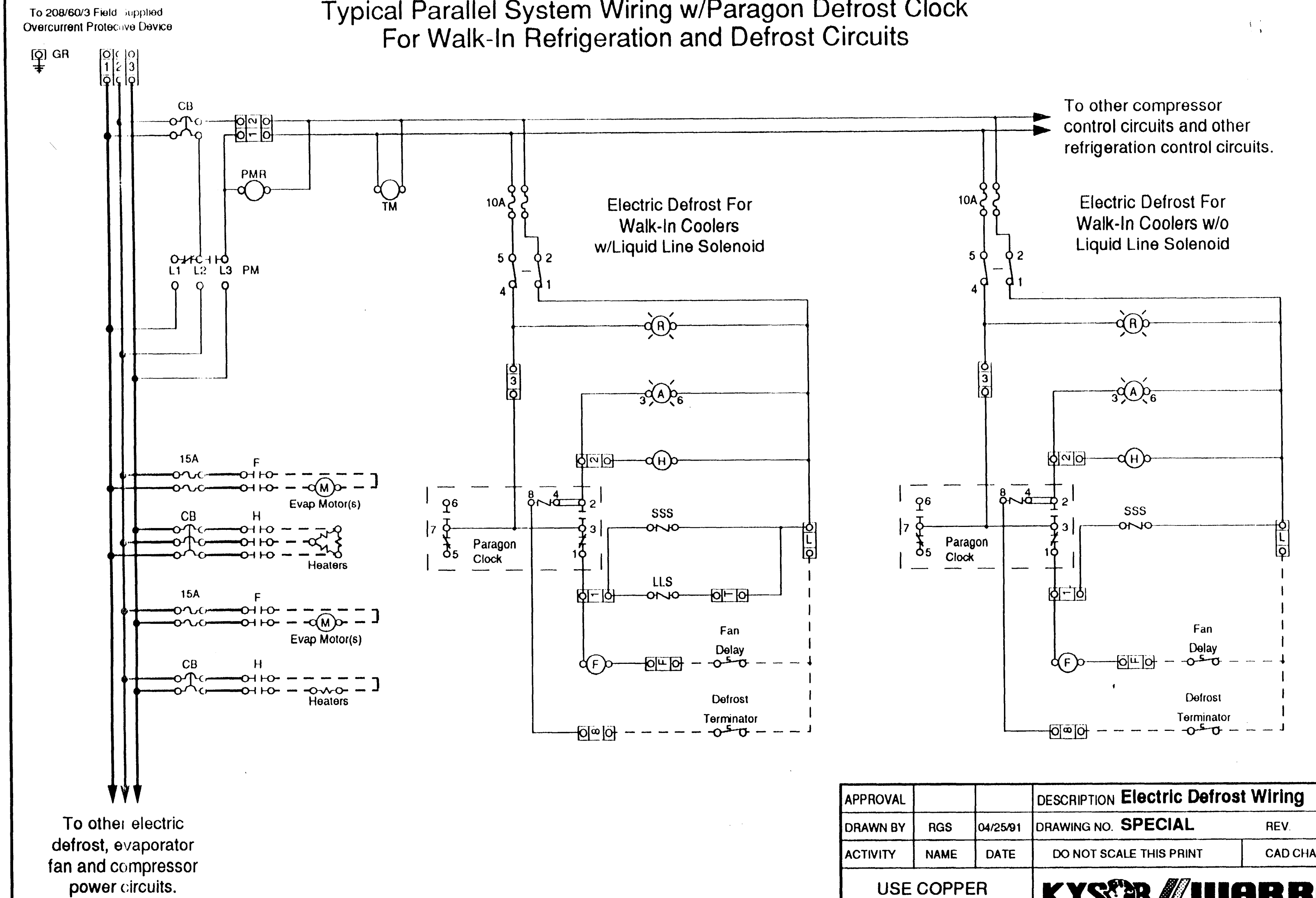
For Walk-In Refrigeration and Defrost Circuits



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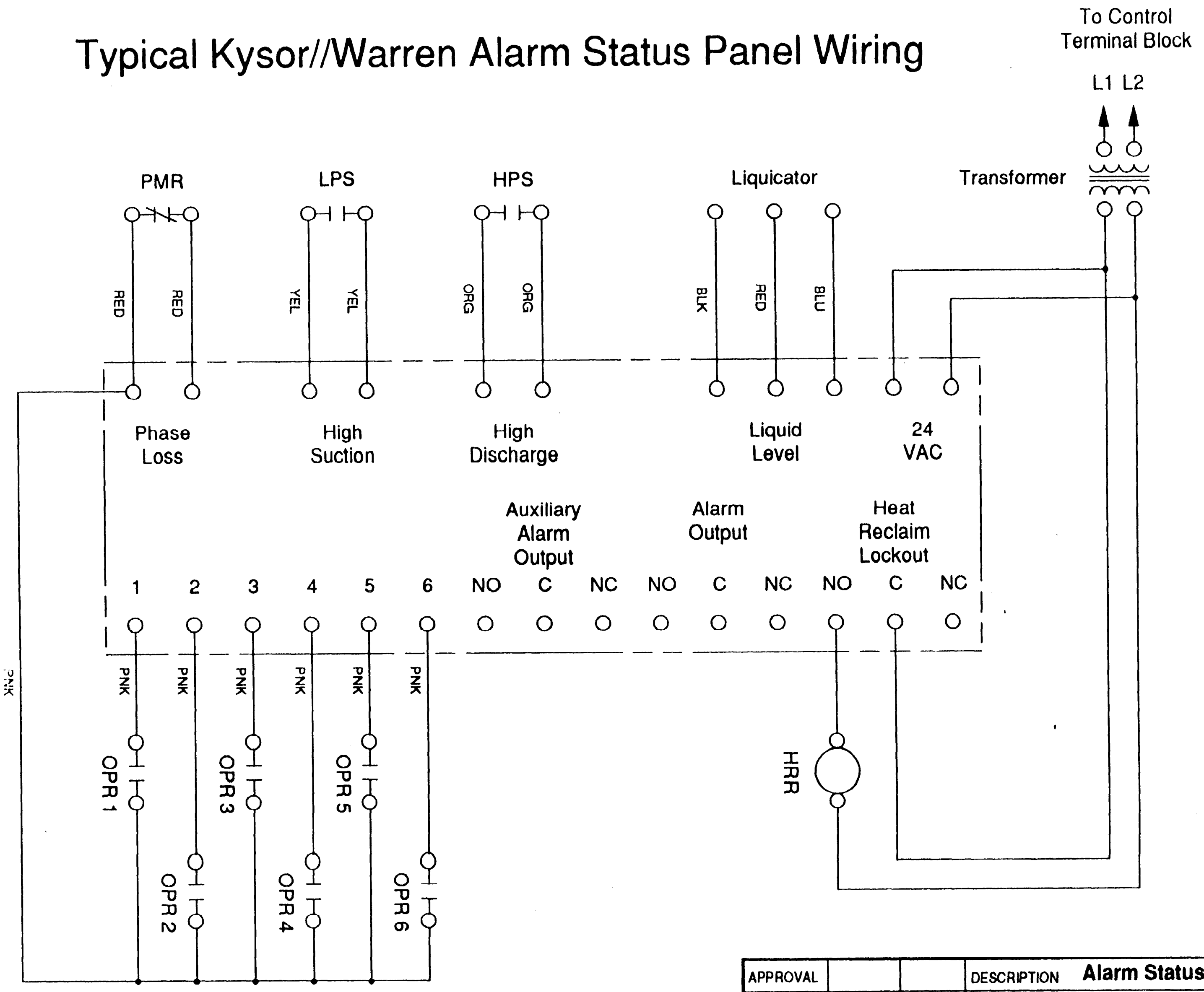
Typical Kysor//Warren Alarm Status Panel Wiring



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RECOMMENDED PIPING PRACTICES FOR KYSOR//WARREN CASES

7/25/80
Rev. 4/16/91

1. Proper size refrigeration lines are essential to good refrigeration performance. Suction lines are more critical than liquid or discharge lines. Oversized suction lines may prevent proper oil return to the compressor. Undersized lines can rob refrigeration capacity and increase operating cost. Consult the technical manual or legend sheet for proper line sizes.

2. Refrigeration lines in cases in line-ups can be reduced. However, the lines should be no smaller than the main trunk lines in at least 1/3 of the cases and no smaller than one size above the case lines to the last case. Reductions should not exceed one line size per case. It is preferred to bring the main trunk lines in at the center of line-up. Liquid lines on systems on hot gas defrost must be increased one line size above the main trunk line for the entire line-up. Individual feed lines should be at the bottom of the liquid header.

3. Do not run refrigeration lines from one system through cases on another system.

4. Use dry nitrogen in lines during the brazing to prevent scaling and oxidation.

5. Insulate suction lines from the cases to the compressor with 3/4" wall thickness Armaflex or equal on low temperature cases to provide maximum of 65 Degree superheated gas back to the compressor and prevent condensation in exposed areas. Insulate suction lines on medium temperature cases with 1/2" thick insulation in exposed areas to prevent condensate droppage.

6. Suction and liquid lines should never be taped or soldered together. Adequate heat exchanger is provided in the case.

7. Refrigeration lines should never be placed in the ground unless they are protected against moisture and electrolysis attack.

8. Always slope suction lines down toward the compressor, 1/2" each 10'. Do not leave dips in the line that would trap oil.

9. Provide "P" traps at the bottom of suction line risers, 4' or longer. Use a double "P" trap for each 20' of risers. "P" traps should be the same size as the horizontal line. Consult the technical manual or legend sheet for proper size risers.

10. Use long radius ells and avoid 45 Degree ells.

11. Provide expansion loops in suction lines on systems on hot gas defrost. See Engineering Bulletin #85-204-3 for detail.

12. Strap and support tubing to prevent excessive line vibration and noise.

13. Brazing of copper to copper should be with a minimum of 10% silver. Copper to brass or copper to steel should be with 45% silver.

14. Avoid the use of "bull head" tees in suction lines. An example is where suction gas enters both ends of the tee and exits the center. This can cause a substantial increase in pressure drop in the suction lines.

15. When connecting more than one suction line to a main trunk line, connect each branch line with an inverted trap.

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EXPANSION LOOPS - GAS DEFROST

Reprinted from Kysor//Warren Technical Bulletin #85-204-3 dated 9/11/90

On a refrigeration system with gas defrost, the refrigerant lines expand and contract with temperature changes. The suction line will normally have the greatest movement since it has the largest temperature change during defrost.

If this expansion and contraction is not planned for during the installation of refrigeration lines, kinking and breaking of the lines could occur.

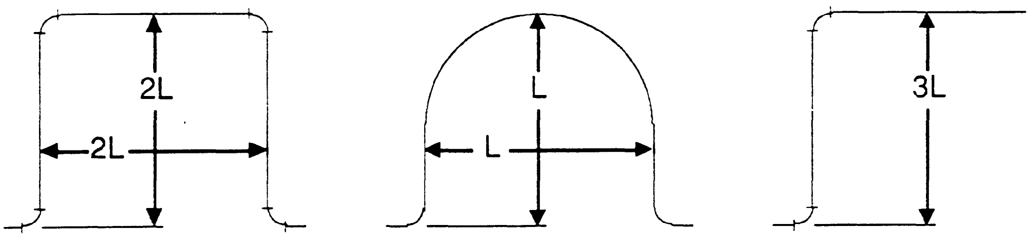
In order to compensate for the expansion of the tubing, it is necessary to estimate the amount of expansion and then provide offsets or loops in the refrigerant piping. As a general rule, medium temperature lines will expand approximately 1-1/2 inches for each 100 feet and low temperature lines approximately 2 inches for each 100 feet of tubing.

Normally, in a supermarket, the area to be most concerned with is the straight line distance from the fixture to the main access pit in or near the motor room.

In compensating for expansion and contraction, two items are very important.

1) Liquid and suction lines can not be joined together and should not touch at any point.
2) Pipe hangers must be located and installed in such a manner as not to restrict the expansion and contraction of the tubing. All tubing clamps should have an insulation material (ie Hydra Sorb bushing) to prevent metal to metal contact.

TYPICAL EXPANSION CONTROL METHODS



Loop With Fittings   Formed Loop   Off Set

1600 Industrial Blvd., P.O. Box C, Conyers, GA 30207-0019
Phone: (404) 483-5600 FAX: (404)-929-4379

EXPANSION CHART

Ref Line O.D.	Length - L (inches) Amount of Expansion								
	1/2	1	1-1/2	2	2-1/2	3	4	5	6
7/8	10	15	19	22	25	27	30	34	38
1-1/8	11	16	20	24	27	29	33	38	42
1-3/8	11	17	21	26	29	32	36	42	47
1-5/8	12	18	23	28	31	35	39	46	51
2-1/8	14	20	25	31	34	38	44	51	57
2-5/8	16	22	27	32	37	42	47	56	62

EXAMPLE: Expansion Loop Calculation

Medium Temperature
Line Length 225 Feet
Line Size 1-5/8 Inches

Amount of expansion = 200/100 x 1.5"/100ft = 3"

Based on 3" expansion and 1-5/8" tubing, the legs of the loop would be 2 times L value or 2 x 35 = 70" each.

Low temperature lines would be calculated in a similar manner.

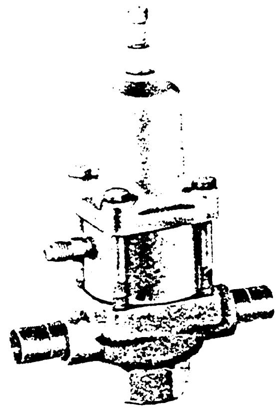
By utilizing proper methods to allow for expansion and contraction of refrigerant lines, the reliability of systems with gas defrost is enhanced greatly.

Paul F. Renaud

3/13/85
rev. 9/11/90

Hot Gas Bypass Regulator

BULLETIN 25-95C
TYPE A9



A9E

December, 1980
Installation Service and Parts Information

HOT GAS BYPASS REGULATORS FOR SYSTEM CAPACITY CONTROL
TYPES A9, A9E, A9S and A9SE for R-12, R-22 and R-502

FEATURES—

- Controls Outlet Pressure at Sensing Point
- Pilot Operated for Close Regulation
- Few Sizes Cover Entire Capacity Range
- External or Internal Equalizer
- Available With Integral Electric Shut-Off
- Tight Seating • Simple Adjustment
- Sweat End Design Solders into Line Without Disassembly
- Cleanable in Line • Nominal Capacities 1.3 to 24 Tons
- UL Listed • 400 PSIG Safe Operating Pressure
- CSA Certified

DESCRIPTION—

These ductile iron bodied regulators with brazed copper couplings are used to modulate the flow of refrigerant gas to maintain a nearly constant outlet pressure at the sensing point. The regulators are pilot operated. The unique design allows the regulators to be soldered into the line without disassembly, yet allows disassembly of the valve for cleaning and maintenance without removing the regulator from line.

NOMINAL CAPACITIES

mm	inches	Type	Shipping Wt.†		Nominal Capacity*					
					Tons			1000 kcal/hr		
			lbs.	kg.	R-12	R-22	R-502	R-12	R-22	R-502
15 Red.	5/8" Red.	A9E	3.0	1.4	1.3	2.2	2.2	4.2	7.4	6.7
15	5/8"	A9E	3.0	1.4	4	7	7	13	23	21
22	7/8"	A9E	3.3	1.5	8	15	14	21	48	44
28	1-1/8"	A9E	3.3	1.5	13	24	22	40	75	68

*Capacities for 40°C (100°F) Cond'g. Temp. and 70°C (160 °F) Disch. Temp. See also Bulletin BYG.
†Add 0.5 lbs. (0.2 kg) for A9S and A9SE.

WHEN YOU ORDER—

Please give valve size and type, and pressure range. If internally equalized is required specify the Type A9, otherwise externally equalized A9E will be supplied as standard. Standard outlet pressure Range A, 10" Hg. vacuum to 120 psig will be furnished unless otherwise specified. Range B, 80 to 220 psig is available at no extra charge. Pilot electric shut-off is available: specify A9S or A9SE and coil voltage and cycles.

PURPOSE—

The A9 Hot Gas Bypass Regulators modulate the flow of refrigerant gas to maintain a nearly constant pressure at the sensing point at the outlet of the regulator. The regulator allows loading of the system to eliminate short cycling of the compressors, provide required humidity control, and proper oil return.

OTHER USES—

- Booster Suction Control to Prevent Deep Vaccum
- Air Cooled Condenser Control
- Hot Gas Defrost Control • Liquid Pressure Control
- Contact Factory for Special Uses

SELECTION INFORMATION—

Above table gives nominal capacities. Please see page 4 for typical applications, and Bulletin BYG for detailed application and selection information.

INTERNALLY EQUALIZED—

This regulator is normally furnished as A9E externally equalized. The outlet pressure being controlled is that pressure at the external equalizer connection. In many applications where it is acceptable to control the pressure at the outlet of the regulator, an internally equalized regulator should be used. In this instance, the A9 should be ordered.

NOTE: A9E or A9SE can not be converted to A9 or A9S without replacing the #22 adapter.

ELECTRIC SHUT-OFF—

For pump-down control the regulator must be electrically shut-off. Specify A9S or A9SE "with pilot electric shut-off" and specify voltage and frequency. Alternately, a separate full size solenoid valve can be used upstream of the regulator for shut-off.

INSTALLATION—

The regulator can be mounted in a horizontal or vertical line with the flow in the direction of the arrow on the valve body. The adjusting stem should not be located below the centerline of the valve. The valve should be installed in a manner that avoids trapping condensed refrigerant in the valve.

Protect the inside of the regulator from moisture, dirt and chips during installation. These regulators may be soldered into the line without disassembly. A wet cloth should be wrapped around the valve and the soldering flame should be directed away from the valve body.

PARTS LIST A9, A9E, A9S, A9SE

Description	Part No.	Qty.	Description	Part No.	Qty.	Description	Part No.	Qty.
1. Spring Rest	24-1048-03	1	13. Spring, Piston Plug	90-1000-05	1	24. Bonnet Bolts A9, A9E	90-1000-56	4
2. Bonnet Spring Range A	90-1001-08	1	14. Diaphragm Range A	24-1088-00	2	A9S, A9SE	90-1001-63	4
Range B	90-1001-09	1	Range B	24-1083-00	3	25. Valve Body Assem. 5/8"	24-0108-00	1
3. Diaphragm Follower	24-1018-02K	1	15. Gasket, Bonnet	81-1001-33	1	7/8"	24-0109-00	1
4. Pilot Seat	24-1016-00	1	16. 'O' Ring, Diaphragm	93-1000-64	1	1-1/8"	24-0110-00	1
5. Pilot Plug	24-1015-00	1	17. Adjusting Stem	90-1000-77	1	26. Bottom Cap	24-1013-02K	1
6. 'O' Ring, Pilot Seat	93-1000-58	1	18. Seal Nut	90-1000-15	1	27. Operator Repair Kit	83-1000-77	1
7. External Equalizer Fitting	92-1000-64	1	19. Bonnet	24-1085-11K	1	28. Cover Retaining Clip	83-1000-76	1
8. Pilot Spring	90-1000-54	1	20. Label	24-1114-00	1	29. Coil 120/60 †	83-1000-25	1
9. Gasket, Adapter	81-1001-22	1	21. Label	24-1115-00	1	Coil 240/60	83-1000-26	1
10. Piston	24-1034-00K	1	22. Adapter A9	24-1011-22	1			
11. 'O' Ring, Bottom Cap	93-1000-52	1	A9E	24-1011-21	1	* For other Coils specify voltage and cycles		
12. Piston Plug 5/8" Reduced	24-1017-04K	1	A9S	24-0157-02	1			
5/8"	24-1017-03K	1	A9SE	24-0157-00	1	NOTE: When ordering parts specify valve type		
7/8"	24-1017-01K	1	23. Label	24-1041-01	1	- and size		
1-1/8"	24-1017-02K	1						

PRINCIPLES OF OPERATION —

Control pressure is transmitted through #7 Fitting to space A under #14 Diaphragm. When this pressure is lower than the setting of the #2 Spring, this spring force pushes against the #5 Pilot Plug moving it off the #4 Pilot Seat and the inlet pressure is transmitted from area X through passage N, pilot seat, and passage D to the chamber on top of #10 Piston. The difference in this pressure and the pressure in space M causes the Piston to move the #12 Piston Plug off its seat allowing flow from inlet space X to outlet space B, increasing the control pressure.

As the control pressure increases, the #14 Diaphragm moves against the force of #2 Spring, allowing the #5 Pilot Plug start to close and reduce the flow to the top of #10 Piston. The pressure on top of the piston bleeds to the space M and the force of #13 Spring causes the #12 Piston Plug to move towards closed position, thus reducing the flow through the valve and correcting the control pressure.

In case of the internally equalized A9 the control pressure is sensed at the valve outlet and transmitted through passage P.

When a solenoid shut-off feature is used, the passage N is open only when the solenoid is energized.

During operation, the Main Valve will assume an intermediate or throttling position with respect to the regulator setting. A properly sized A9E Hot Gas Bypass Regulator will control to within 1/2 to 5 pounds of the pressure setting depending on the system operating characteristics and the sizing of the regulator.

ADJUSTMENT —

Install an accurate pressure gauge at the control (sensing) point at the outlet side of the valve.

To adjust the valve, loosen #18 Seal Nut and turn the #17 Adjusting Stem clockwise to raise the pressure or counterclockwise to lower the pressure. For Range A one turn equals approximately 16 psi (1.1 kg/cm²); for Range B one turn equals approximately 25 psi (1.8 kg/cm²).

The regulator should be set under actual operating conditions. For hot gas bypass this condition occurs under minimal system load conditions. The regulator should be adjusted to maintain minimum desired suction pressure. Hot gas flow through the valve can be detected by listening to the gas flow through the regulator or by feeling the outlet pipe for warmth. When it is not possible to simulate minimum load conditions, an approximate setting may be obtained by adjusting the valve until gas flow begins, observing the gauge reading, and then turning the adjusting stem counterclockwise for the required number of turns to obtain the desired minimum pressure. This setting should be checked and readjusted as needed under actual conditions.

SERVICE POINTERS —

1. Failure to regulate: (a) #10 Piston may be jammed due to excessive dirt. This is the most likely cause of any regulator difficulties even when the regulator is preceded by a strainer. Remove #24 Bolts. Remove #22 Adaptor. Push down on #10 Piston against the returning #13 Plug Spring Force. Piston should move freely down and should be returned by the #13 Plug Spring Force. If jammed or sticky, remove #26 Bottom Cap and push up #12 Piston Plug from the bottom with the blunt end of a wood pencil or similar tool. #10 Piston should now pop free from #25 Body. Remove #12 Piston Plug by pushing from top to remove from the bottom. Clean all removed parts thoroughly. If jamming has occurred, remove all burrs from #10 Piston, #12 Piston Plug and Cylinder Wall with fine crocus cloth. Reassemble the regulator with a light coating of refrigeration oil on all parts. (b) #5 Pilot Plug may be dirty or eroded (inspect and replace if necessary). Remove #5 Pilot Plug by removing #4 Pilot Seat with a 5/8" socket. (c) #14 Diaphragm may be broken or eroded (inspect and replace if necessary). (d) #14 Diaphragm may not be receiving downstream pressure. In the case of an A9E external equalized regulator, the pipe leading to a downstream source may be blocked by dirt or a closed valve. In the case of an A9 internally equalized regulator, passage P may be blocked by dirt.

2. Failure to open: (a) #10 Piston or #12 Piston Plug may be jammed due to excessive dirt. This is the most likely cause of not opening; to correct, see 1 (a) above. (b) #17 adjusting stem may be turned out so far that a lower downstream pressure may be required to open the regulator than can be created by the system. (Turn in the #17 adjusting stem.) (c) #2 Diaphragm Range Spring may be the improper range for the pressure setting desired. This is most likely to occur when range B regulator is supplied. To correct, change #2 Spring. (d) In case of regulator with electric shut-off the solenoid may not be energized or coil may be burned out. Check electrical circuit to make sure the solenoid is energized. Replace #29 Coil if necessary.

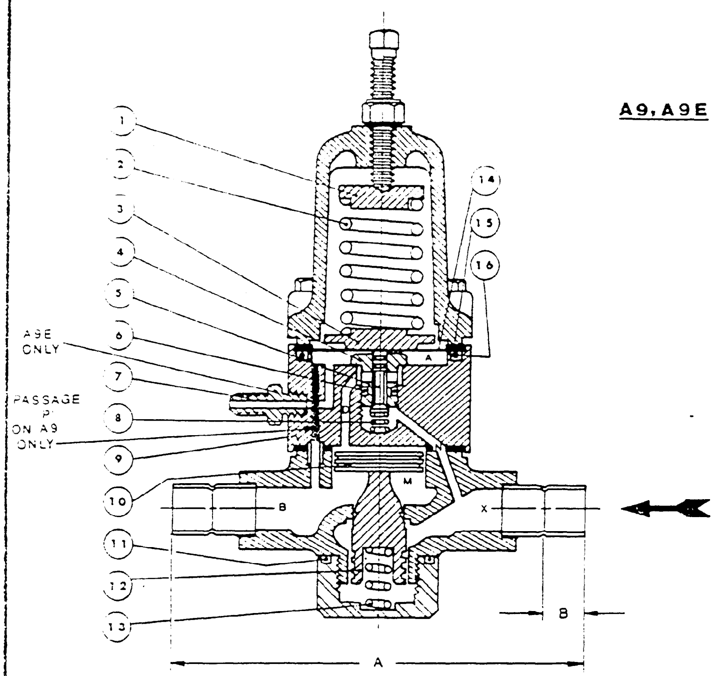
3. Failure to close: (a) #10 Piston or #12 Piston Plug may be jammed due to excessive dirt. This is the most likely cause of not closing; to correct, see 1 (a) above. (b) #17 adjusting stem may be turned in so far that a higher pressure is opening the regulator than is desired in the system. (Turn out #17 adjusting stem) until the regulator closes at the desired pressure.) (c) #2 Diaphragm Range Spring may be the improper range for the pressure desired. (Change #2 Diaphragm Spring.) (d) #5 Pilot Plug may be dirty or eroded (inspect and replace if necessary); see 1 (b). (e) #14 Diaphragm may be broken or eroded (inspect and replace if necessary); see 1 (c). (f) In case of regulator with solenoid shut-off the regulator should close when the solenoid coil is de-energized. Check electrical circuit to make sure no power is applied to the solenoid coil. Remove solenoid tube and check teflon seat for damage. Replace internal parts using #27 Operator Repair Kit if necessary.

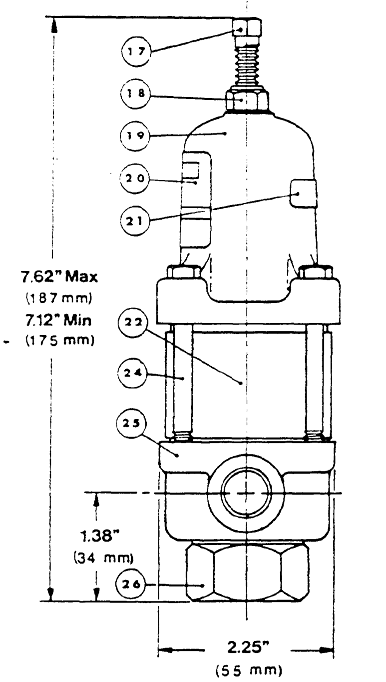
4. Hunting: Under light load conditions, a system may hunt. Unless the hunting is adversely affecting temperatures or bothering the performance of the equipment, the hunting itself should be ignored. If very serious, the matter should be looked into further.

The Hot Gas Bypass Regulator is sometimes blamed if the system seems to hunt. The A9E regulator was especially designed with a characterized plug to give controlled flow over its entire hot gas flow range. For this reason, we suggest that the other elements and control valves in the system be critically examined if there appears to be intolerable hunting.

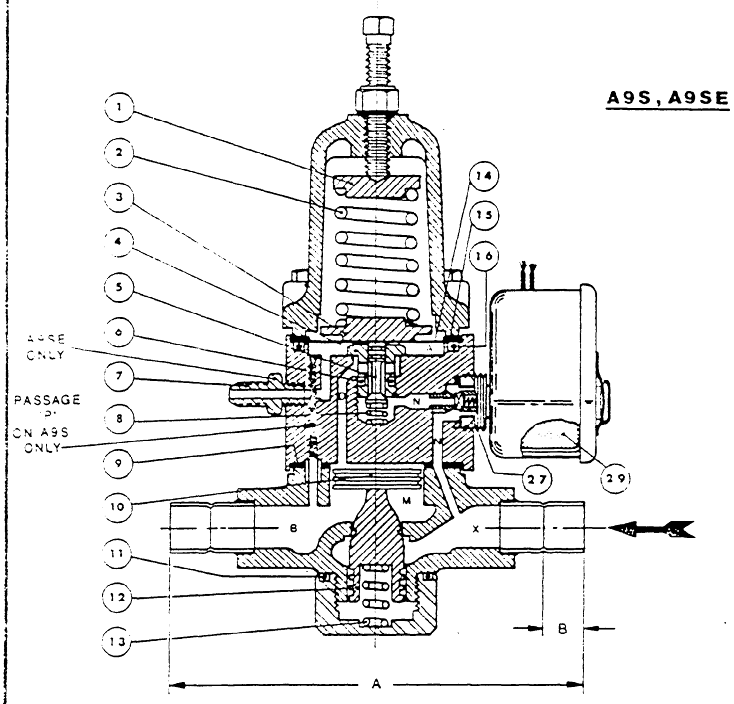
The following action is recommended: (a) If bypass with liquid injection is used, refer to BYG Bulletin for correct TXV size. (b) Examine TXV's: are they operating below 50% of capacity? If so, use one of the methods recommended

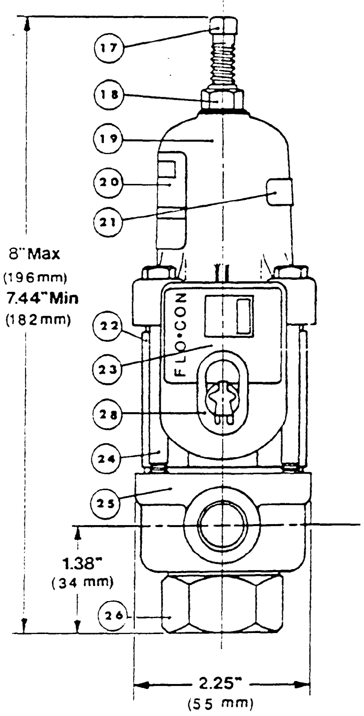
A9, A9E





A9S, A9SE





Size	DIM A		DIM B		Net Weight*	
	Inches	MM	Inches	MM	Lbs.	Kg.
5/8 Red.	5.25	133	0.5	13	2.5	1.1
5/8	5.25	133	0.5	13	2.5	1.1
7/8	6.19	157	0.75	19	2.75	1.2
1-1/8	6.87	175	0.94	24	3	1.3

*Add 0.5Lb(.2Kg) for A9S .A9SE

INSTALLATION OF VALVE:

IN A HORIZONTAL LINE, LOCATE ADJUSTING STEM 17 AT TOP OR SIDE BUT NOT BELOW CENTERLINE.

TO RAISE PRESSURE SETTING.

LOOSEN SEAL NUT 18 AND TURN ADJUSTING STEM 17 CLOCKWISE.

REV B 7/74

FOR R-12, R-22 and R-502

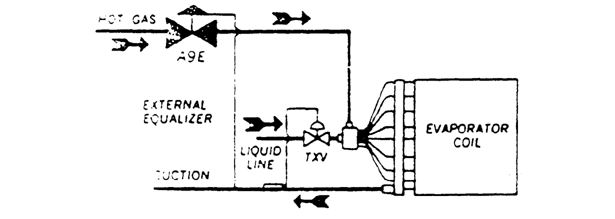
Refrigerating Specialties Division
2445 S. 25TH Ave., Broadview, Il USA

HOT GAS BY-PASS REGULATOR

DRAWN BY Schultz	TYPE A9, A9E, A9S, A9SE	
APPROVED [signature]	DATE 9-74	DWG NO 4075

by TXV manufacturers for this type operation. (c) Increase superheat of TXV liquid injection valve by adjusting, or installing new charge. (d) Wrap bulb to dampen action of TXV liquid injection valve. (e) Check location of entrance of external equalizer connection to suction line in relation to TXV liquid injection bulb location. (f) If hot gas side inlet type of distributor is used, determine whether it is properly selected. (g) If "T" is used between main TXV and distributor for hot gas input, limit bypass tonnage to one-third of capacity of distributor. (h) Check with TXV manufacturer for proper TXV charge. (i) Determine if the A9E used for the job is oversized for the actual maximum load conditions; if so, use a smaller capacity plug. Piston plugs #12 are interchangeable on all sizes of A9 type regulators.

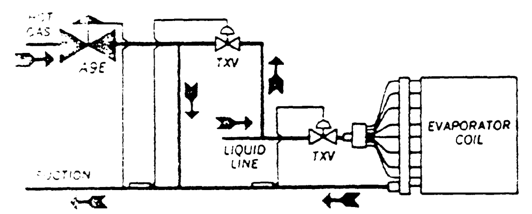
APPLICATION — (See Bulletin BYG)



HOT GAS BYPASS TO ENTRANCE OF EVAPORATOR

Figure 1

As the load decreases, the suction pressure decreases slightly. The Type A9E regulator, sensing the decrease through the external equalizer line, opens slightly to meter hot gas through the side inlet of the distributor into the evaporator coil. The desired suction pressure is thereby maintained within several psi without short cycling.



HOT GAS BYPASS TO SUCTION LINE

Figure 2

As the load decreases, the suction pressure decreases slightly. The Type A9E regulator, sensing the decreased outlet pressure, opens slightly to meter hot gas through the regulator to the suction. To remove the superheat from the bypassed gas, a liquid injection valve should be installed opposite the A9E regulator.

HELPING THE EPR —

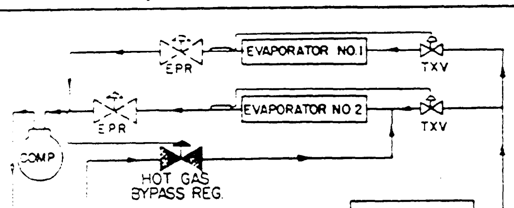


Figure 3

In many applications, an evaporator pressure regulator (EPR) does an excellent job of maintaining evaporator temperature control as loads are reduced. In other cases, the use of an EPR, either preset, compensated by air, by an electric motor, or by a temperature bulb, causes, or may encounter a greatly reduced evaporator load. Below the compressor unloader steps or when unloaders are not used, reduced evaporator loads cause the EPR to throttle, resulting in lower compressor suction pressures. This lowered pressure reduces compressor capacity at a rate of about 2% per psi drop. Unfortunately, such reduction is only practical over a limited range because of possible oil pumping, short cycling and erratic EPR performance at the excessive pressure drops. Frequently an EPR can be used satisfactorily by itself until suction pressure drops by more than 20 psi; below this a Hot Gas Bypass Regulator should be added through an evaporator or direct to the suction line with TXV liquid injection. The external equalizer of the Hot Gas Bypass Regulator must be on the suction side of any EPR which might be used. A typical arrangement is shown below in FIG. 3.

SPECIFICATIONS —

Design Pressure: 400 psig (28 kg/cm²).

Adjustment range: 10" Hg vac. to 120 psig (506 mm Hg to 8.4 kg/cm²) and 80 psig (4.2 kg/cm²) to 220 psig (15.5 kg/cm²).

Minimum pressure drop to open valve completely: 10psi (0.7 kg/cm²)

Maximum pressure change from valve closed to completely open: 5 psi (0.35 kg/cm²)

Minimum Refrigerant Temperature: −50° F (−45° C)

Maximum Refrigerant Temperature: 200° F (93° C)

Materials: Body: Ductile iron with silver brazed copper couplings; Piston, Piston Plug, Pilot Seat, Pilot Plug: Stainless Steel; Springs: Steel or Stainless Steel; Diaphragms: Steel; Bonnet: Aluminum; Bottom Cap: Plated Steel; "O" Rings: Synthetic Rubber; Cap Screws: Plated Steel; Other Parts: Plated Steel.

SAFE OPERATION (See Bulletin RSB)

People doing any work on a refrigeration system must be qualified and completely familiar with the system and the valves involved, or all other precautions will be meaningless. This includes reading and understanding pertinent product bulletins and the current Bulletin RSB prior to installation or servicing work.

WARRANTY—

All Refrigerating Specialties Products are warranted against defect in workmanship and materials for a period of one year from date of shipment from the factory. This warranty is in force only when products are properly installed, maintained and operated in use and service as specifically stated in Refrigerating Specialties Catalogs or Bulletins for normal refrigeration applications, unless otherwise approved in writing by Refrigerating Specialties Division. Defective products, or parts thereof, returned to the factory with transportation charges prepaid and found to be defective by factory inspection will be replaced or repaired at Refrigerating Specialties' option, free of charge, F.O.B. factory. Warranty does not cover products which have been altered or repaired in the field; damaged in transit, or have suffered accidents, misuse, or abuse. Products disabled by dirt, or other foreign substances will not be considered defective.

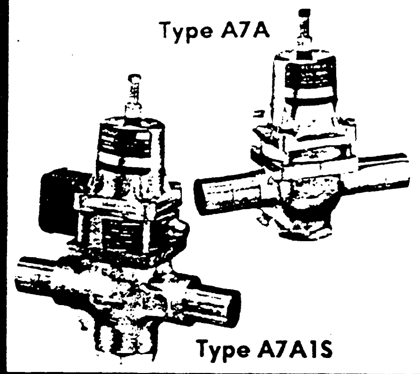
THE EXPRESS WARRANTY SET FORTH ABOVE CONSTITUTES THE ONLY WARRANTY APPLICABLE TO REFRIGERATING SPECIALTIES PRODUCTS, AND IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, WRITTEN OR ORAL, INCLUDING ANY WARRANTY OF MERCHANTABILITY, OR FITNESS FOR A PARTICULAR PURPOSE. No employee, agent, dealer or other person is authorized to give any warranties on behalf of Refrigerating Specialties, nor to assume, for Refrigerating Specialties, any other liability in connection with any of its products.

PRESSURE REGULATORS

BULLETIN 25-91F
TYPE A7

COMPACT WIDE-RANGE PRESSURE REGULATORS FOR EVAPORATOR, HEAT RECLAIM, AND HEAD PRESSURE CONTROL

TYPE
A7A, A7A1, A72
15 mm (5/8")
to
66 mm (2 5/8")



March 1980
Installation, Service and Parts Information

FEATURES

- Dual spring for wide range pressure set-points
- Pilot operated for close control at desired set-point
- V-port design means excellent regulation
- Disc piston • Teflon seat
- Low pressure drop • Few moving parts
- Long-life diaphragms; no bellows to fail
- Variations available for pilot electric shut-off, pilot electric wide-opening, and differential pressure control
- UL Listed • CSA Certified
- Manual opening feature on A7A1 and A72

SPECIFICATIONS

- Design pressure: 28 kg/cm² (400 psig)
- Range: 250 mm hg to 28 kg/cm² (10" hg to 400 psig)
- Nominal capacity: 1500 to 121,000 kcal/h (.5 to 40 tons)

DESCRIPTION

These ductile iron bodied regulators with brazed copper couplings are used to modulate the flow of refrigerant gas to maintain a constant inlet pressure. The unique design allows the regulators to be soldered into the line without disassembly, yet allows disassembly for cleaning and maintenance without removing from the line.

The A7 Series of Regulators is available with the following variations: Electric Shut-off ("S"), Electric Wide-opening ("B"), Differential Pressure Regulation ("L") and combination Electric Wide-opening and Differential Pressure Regulation ("BL"). The "BL" variation is available in the A7A1 and A72 Series only.

All A7 Regulators (except "L" and "BL") feature the wide range pressure setting, Range A/D, 250 mm to 28 kg/cm² (10" hg to 400 psig). The "L" and "BL" versions feature a *differential* pressure setting of 0 to 6.3 kg/cm² (0 to 90 psig).

PURPOSE

The A7 Series Compact Wide Range Pressure Regulator modulates flow of refrigerant to maintain a constant inlet (evaporator, condenser, heat reclaim coil, or discharge line) pressure as set-for, despite fluctuations in load. The regulator will open when the inlet pressure begins to rise above its setting and will close when the inlet pressure begins to fall below its setting. The regulator cannot lower inlet (evaporator) pressure below the outlet (compressor suction) pressure. Outlet pressure, of course, depends upon the capacity of the compressor.

Types A7A, A7A1 and A72 control inlet pressure according to a field adjustable set-point.

Types A7AS, A7A1S and A72S control inlet pressure when pilot solenoid is energized or shut off when de-energized.

Types A7AB, A7A1B and A72B control inlet pressure when pilot solenoid is de-energized or are wide-open when energized.

Types A7AL, A7A1L and A72L control pressure difference across regulator.

Types A7A1BL and A72BL control pressure difference across regulator when pilot solenoid is de-energized or are wide-open when energized.

INSTALLATION

On the Types A7A and A7A1 Series Regulators, the proper direction of flow is designated by an arrow cast into the side of the valve body, pointing from inlet to outlet. On the Type A72 Series Regulators, the proper direction of flow is designated by words "in" and "out" cast into the side of the body flange adjacent to #27 Valve Cover. The proper direction of flow is also shown by a red arrow on the Valve Bottom Cap of all A72 regulators.

The regulator should be mounted in a horizontal or vertical pipe line with direction of flow as described above. As with all pressure regulators, these compact regulators can control flow in this normal direction only. If a change in system operating conditions causes the outlet pressure to rise sufficiently above the inlet pressure, the #18 (#28 on A72) Main Valve Assembly will be blown down from its seat and reverse flow will occur. This is often accompanied by a clicking noise.

Protect the inside of the regulator from moisture, dirt, chips and solder beads during installation. These compact regulators may be soldered into the line without disassembly if reasonable precautions are taken. The flame from the soldering torch should be directed away from the valve body to avoid excessive heat build-up which could possibly damage some of the internal parts. As an additional precaution, a wet cloth should be wrapped around the regulator body to dissipate some of the heat during the soldering operation.

ADJUSTMENT

Before adjusting, connect an accurate gauge to the gauge port of the regulator or at the evaporator. A gauge at the regulator is usually more convenient. The adjustment of a regulator with the L or the BL variation will also require a gauge to measure the pressure connected to the Bonnet. It is desirable to install either a gauge valve or a Schrader type valve in some of the ¼" regulator gauge ports before the system is charged with refrigerant.

Fully charge the system and operate near the normal design conditions. To lower the control pressure, loosen the Seal Nut #2 or #18 then turn the #1 or #16 Adjusting Stem out (counter-clockwise).

Between 0 and 6.3 kg/cm² (90 psig), one complete turn of the Adjusting Screw will change the inlet pressure approximately 4.9 kg/cm² (20 psi). Between 6.3 kg/cm² (90 psig) and 28 kg/cm² (400 psi), one complete turn of the Adjusting Screw will change the inlet pressure 4.9 kg/cm² (70 psi).

Caution: Regulators with B or BL variations can be adjusted only with the pilot solenoid de-energized.

(continued on last page)

A7A, A7AS, A7AB and A7AL Parts List—Range A/D

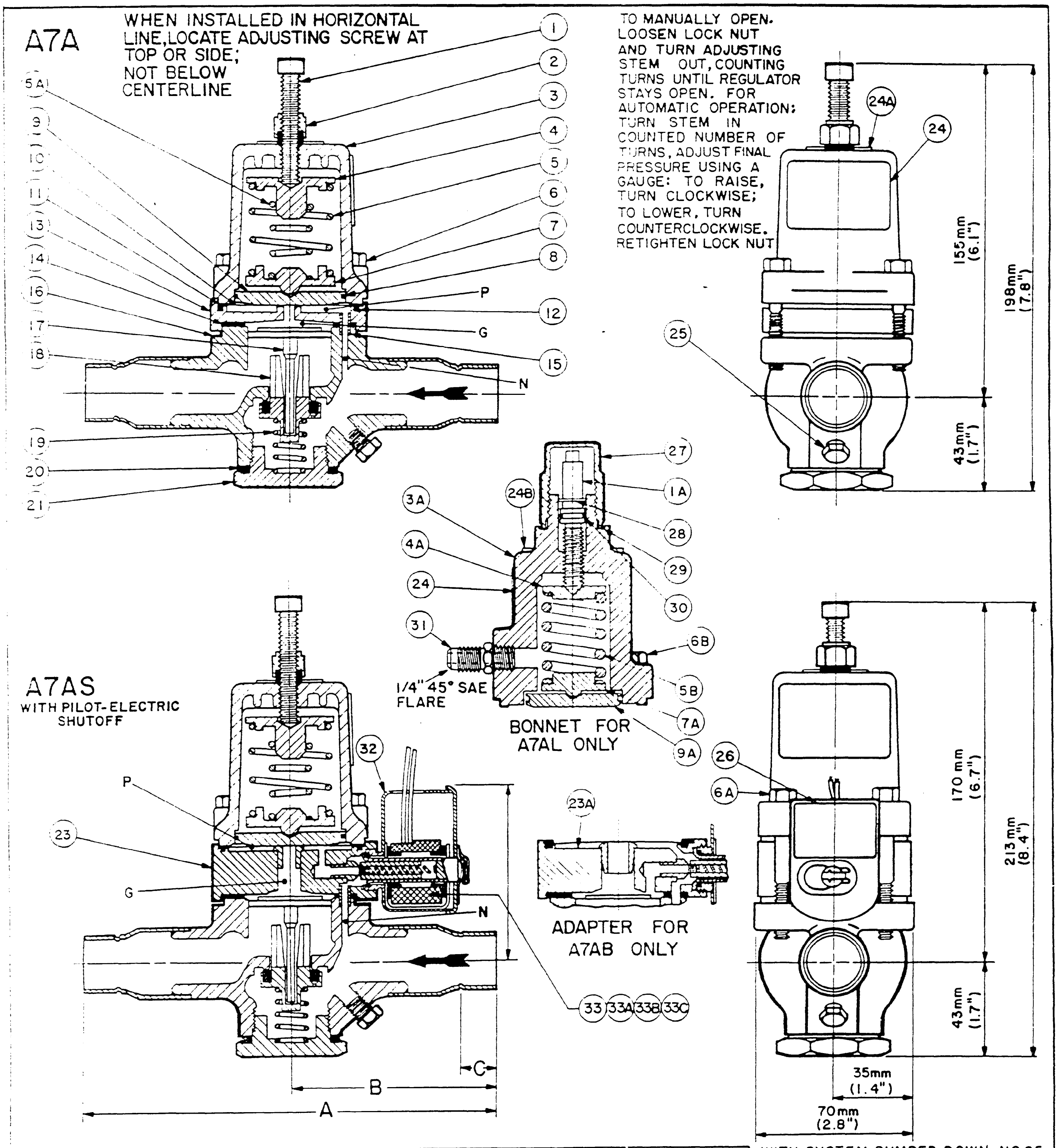
Note: A7AL available in Range A only

Item	Description	Qty	Used On A7A	S	B	L	Part Numbers 15 mm (⅜")	22 mm (⅞")	28 mm (1⅛")
1	Adjusting Stem, Range A/D	1	X	X	X		90-1002-14	90-1002-14	90-1002-14
1A	Adjusting Stem, Range A	1				X	24-1111-00K	24-1111-00K	24-1111-00K
2	Seal Nut	1	X	X	X		90-1000-15	90-1000-15	90-1000-15
3	Valve Bonnet	1	X	X	X		24-1126-11K	24-1126-11K	24-1126-11K
3A	Valve Bonnet	1				X	24-1110-11K	24-1110-11K	24-1110-11K
4	Spring Rest, Upper, Range A/D	1	X	X	X		24-1131-00	24-1131-00	24-1131-00
4A	Spring Rest, Upper, Range A	1				X	24-1048-01	24-1048-01	24-1048-01
5	Diaphragm Spring (Outer)	1	X	X	X		80-1001-57	80-1001-57	80-1001-57
5A	Diaphragm Spring (Inner)	1	X	X	X		80-1001-58	80-1001-58	80-1001-58
5B	Diaphragm Spring, Range A	1				X	80-1000-25	80-1000-25	80-1000-25
6	Bonnet Screws	4	X				90-1001-67	90-1001-67	90-1001-67
6A	Bonnet Screws	4		X	X		90-1001-78	90-1001-78	90-1001-78
6B	Bonnet Screws	4				X	90-1001-79	90-1001-79	90-1001-79
7	Spring Rest, Lower, Range A/D	1	X	X	X		24-1130-00	24-1130-00	24-1130-00
7A	Spring Rest, Lower, Range A	1				X	40-1026-00	40-1026-00	40-1026-00
8	"O" Ring, Follower ①	1	X	X	X		93-1000-64	93-1000-64	93-1000-64
9	Diaphragm Follower	1	X	X	X		24-1132-00K	24-1132-00K	24-1132-00K
9A	Diaphragm Follower	1				X	22-1032-00K	22-1032-00K	22-1032-00K
10	Diaphragm ②	1	X	X	X	X	21-1007-04	21-1007-04	21-1007-04
11	Gasket, Bonnet ①②	1	X	X	X	X	81-1001-33	81-1001-33	81-1001-33
12	"O" Ring, Bonnet ①②	1	X	X	X	X	93-1000-57	93-1000-57	93-1000-57
13	Adapter	1	X			X	24-1074-02K	24-1074-02K	24-1074-02K
14	Gasket, Body ②	1	X	X	X	X	81-1001-59	81-1001-59	81-1001-59
15	Location Tube	1	X	X	X	X	24-1116-00	24-1116-00	24-1116-00
16	Valve Body Assembly	1	X	X	X	X	24-0132-02	24-0132-00	24-0132-04
17	Valve Stem & Disc Assembly	1	X	X	X	X	24-0123-00K	24-0123-00K	24-0123-00K
18	Main Valve Assembly	1	X ③	X ③	X	X	24-0122-01K	24-0122-00K	24-0122-00K
19	Closing Spring	1	X	X	X	X	80-1000-70	80-1000-70	80-1000-70
20	Gasket, Bottom Cap ①	1	X	X	X	X	81-1001-28	81-1001-28	81-1001-28
21	Bottom Cap	1	X	X	X	X	24-1053-00K	24-1053-00K	24-1053-00K
23	Adapter Assembly	1		X			24-0164-00K	24-0164-00K	24-0164-00K
23A	Adapter Assembly	1			X		24-0164-01K	24-0164-01K	24-0164-01K
24	Nameplate	1	X	X	X	X	24-1127-00	24-1127-00	24-1127-00
24A	Nameplate, Adjustment	1	X	X	X		24-1128-00	24-1128-00	24-1128-00
24B	Nameplate, Adjustment	1				X	24-1129-00	24-1129-00	24-1129-00
25	Pipe Plug ⅛" NPT Hex Head	1	X	X	X	X	92-1001-21	92-1001-21	92-1001-21
26	Solenoid Nameplate	1		X	X		24-1041-01	24-1041-01	24-1041-01
27	Seal Cap	1				X	30-1173-00K	30-1173-00K	30-1173-00K
28	Retaining Ring	1				X	91-1000-34	91-1000-34	91-1000-34
29	Gasket, Seal Cap	1				X	81-1000-65	81-1000-65	81-1000-65
30	"O" Ring, Adjusting Stem	1				X	93-1000-58	93-1000-58	93-1000-58
31	¼" SAE Connection	1				X	92-1000-64	92-1000-64	92-1000-64
32	Solenoid Operator, Coil & Housing Assy. 120 V, 60 Hz (110 V, 50 Hz)	1		X	X		83-1000-74	83-1000-74	83-1000-74
32A	Solenoid Operator, Coil & Housing Assy. 240 V, 60 Hz (220 V, 50 Hz)	1		X	X		83-1000-75	83-1000-75	83-1000-75
33	Solenoid Coil 120 V, 60 Hz (110 V, 50 Hz)	1		X	X		83-1000-25	83-1000-25	83-1000-25
33A	Solenoid Coil 240 V, 60 Hz (220 V, 50 Hz)	1		X	X		83-1000-26	83-1000-26	83-1000-26
33B	Solenoid Coil 208 V, 60 Hz	1		X	X		83-1000-65	83-1000-65	83-1000-65
33C	Solenoid Coil 24 V, 60 Hz	1		X	X		83-1000-28	83-1000-28	83-1000-28

① Included in "O" Ring and Gasket Replacement Kit Part No. 24-0169-01K for Range A/D

② Included in Diaphragm-Gasket Replacement Kit Part No. 24-0166-00K for Range A/D

③ 49% reduced capacity Main Valve Assembly available as standard on A7A and A7AS. Replacement kit number is 24-0122-04K.



REGULATOR SIZE		NET WT. *	DIMENSIONS					
			A		B		C	
inch.	mm.		inch.	mm.	inch.	mm.	inch.	mm.
5/8	15	4 lbs. 1.8 kg.	7.3"	186	3.7"	93	0.5"	13
7/8	22	4 lbs. 1.8 kg	7.3"	184	3.6"	92	0.8"	19
1-1/8	28	4 lbs. 1.8 kg.	7.3"	186	3.7"	93	1.0"	25

* ADD 1.8 lbs. (.8 kg.) FOR "S" & "B" VARIATION

REV E 2-22-80

WITH SYSTEM PUMPED DOWN, NO.25 N.P.T. PIPE PLUG CAN BE REMOVED AND OPTIONAL GAUGE OR SCHRADER TYPE GAUGE VALVE INSTALLED FOR INLET PRESSURE READING.

FOR R-12, R-22, R-502

COMPACT WIDE RANGE PRESSURE REGULATOR		
DRAWN BY J.E. BROWN	A7A, A7AS, A7AB & A7AL	
APPROVED BY	DATE 12-13-76	DWG NO. 4052

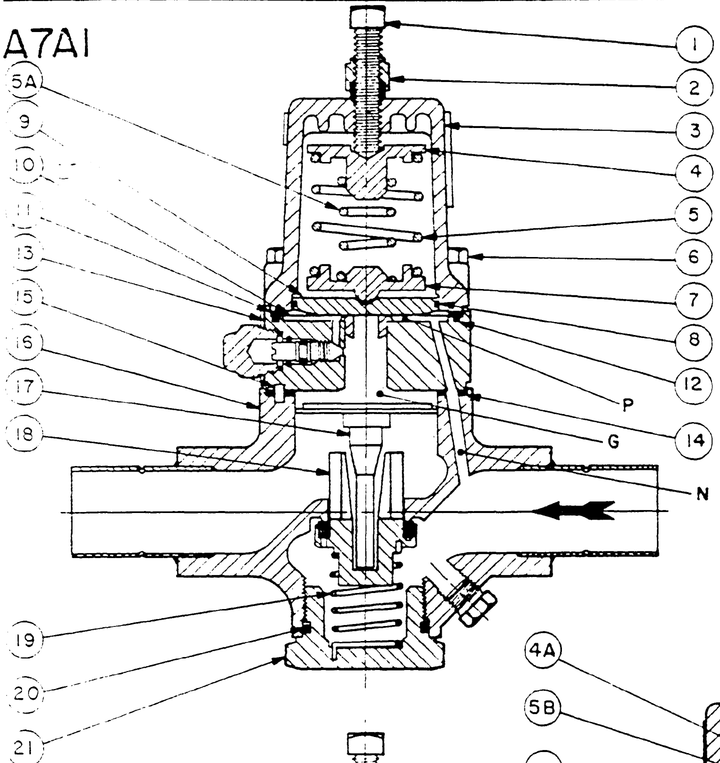
A7A1, A7A1S, A7A1B, A7A1L and A7A1BL Parts List—Range A/D

Note: A7A1L & A7A1BL available in Range A only

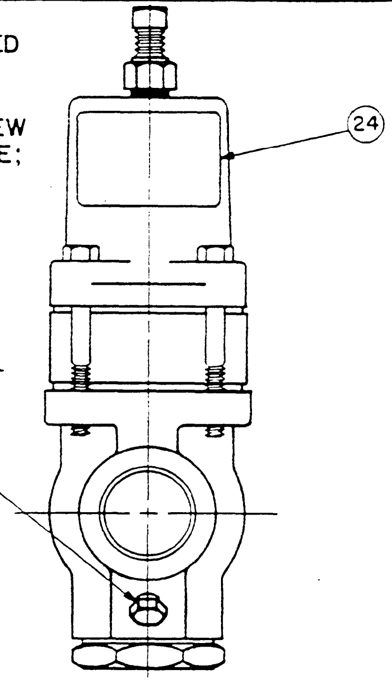
Item	Description	Qty	Used On					Part Numbers		
			A7AI	S	B	L	BL	28 mm (1⅛")	35 mm (1⅜")	42 mm (1⅝")
1	Adjusting Stem, Range A/D	1	X	X	X			90-1002-14	90-1002-14	90-1002-14
1A	Adjusting Stem, Range A	1				X	X	24-1111-00K	24-1111-00K	24-1111-00K
2	Seal Nut	1	X	X	X			90-1000-15	90-1000-15	90-1000-15
3	Valve Bonnet	1	X	X	X			24-1126-11K	24-1126-11K	24-1126-11K
3A	Valve Bonnet	1				X	X	24-1110-11K	24-1110-11K	24-1110-11K
4	Spring Rest, Upper, Range A/D	1	X	X	X			24-1131-00	24-1131-00	24-1131-00
4A	Spring Rest, Upper, Range A	1				X	X	24-1048-01	24-1048-01	24-1048-01
5	Diaphragm Spring (Outer)	1	X	X	X			80-1001-57	80-1001-57	80-1001-57
5A	Diaphragm Spring (Inner)	1	X	X	X			80-1001-58	80-1001-58	80-1001-58
5B	Diaphragm Spring, Range A	1				X	X	80-1000-25	80-1000-25	80-1000-25
6	Bonnet Screw	4	X	X	X	X	X	90-1001-78	90-1001-78	90-1001-78
7	Spring Rest, Lower Range A/D	1	X	X	X			24-1130-00	24-1130-00	24-1130-00
7A	Spring Rest, Lower, Range A	1				X	X	40-1026-00	40-1026-00	40-1026-00
8	"O" Ring, Follower ①	1	X	X	X			93-1000-64	93-1000-64	93-1000-64
9	Diaphragm Follower	1	X	X	X			24-1132-00K	24-1132-00K	24-1132-00K
9A	Diaphragm Follower	1				X	X	22-1032-00K	22-1032-00K	22-1032-00K
10	Diaphragm ①	1	X	X	X	X	X	21-1007-04	21-1007-04	21-1007-04
11	Gasket, Bonnet ① ②	1	X	X	X	X	X	81-1001-33	81-1001-33	81-1001-33
12	"O" Ring, Bonnet ① ②	1	X	X	X	X	X	93-1000-57	93-1000-57	93-1000-57
13	Adapter Assembly	1	X			X		24-0170-00K	24-0170-00K	24-0170-00K
14	Gasket, Body ①	1	X	X	X	X	X	81-1001-60	81-1001-60	81-1001-60
15	Locating Pin	1	X	X	X	X	X	91-1000-52	91-1000-52	91-1000-52
16	Valve Body Assembly	1	X	X	X	X	X	24-0102-03	24-0103-03	24-0112-03
17	Valve Stem & Disc Assembly	1	X	X	X	X	X	24-0147-01K	24-0147-01K	24-0147-01K
18	Main Valve Assembly	1	X ③	X ③	X	X	X	24-0105-00K	24-0117-00K	24-0117-00K
19	Closing Spring	1	X	X	X	X	X	80-1001-38	80-1001-38	80-1001-38
20	"O" Ring, Bottom Cap ①	1	X	X	X	X	X	93-1000-63	93-1000-63	93-1000-63
21	Bottom Cap	1	X	X	X	X	X	24-1003-02K	24-1003-02K	24-1003-02K
23	Adapter Assembly	1		X				24-0171-00K	24-0171-00K	24-0171-00K
23A	Adapter Assembly	1			X		X	24-0171-01K	24-0171-01K	24-0171-01K
24	Nameplate	1	X	X	X	X	X	24-1114-01	24-1114-01	24-1114-01
24A	Nameplate—UL	1	X	X	X	X	X			
24B	Nameplate—Bypass	1	X	X	X	X	X	24-1134-00	24-1134-00	24-1134-00
25	Pipe Plug ⅛" NPT Hex Head	1	X	X	X	X	X	92-1001-21	92-1001-21	92-1001-21
26	Solenoid Nameplate	1		X	X		X	24-1041-01	24-1041-01	24-1041-01
27	Seal Cap	1				X	X	30-1173-00K	30-1173-00K	30-1173-00K
28	Retaining Ring	1				X	X	91-1000-34	91-1000-34	91-1000-34
29	Gasket, Seal Cap	1				X	X	81-1000-65	81-1000-65	81-1000-65
30	"O" Ring, Adjusting Stem	1				X	X	93-1000-58	93-1000-58	93-1000-58
31	¼" SAE Connector	1				X	X	92-1000-64	92-1000-64	92-1000-64
32	Solenoid Operator, Coil & Housing Assy. 120 V, 60 Hz (110 V, 50 Hz)	1		X	X		X	83-1000-74	83-1000-74	83-1000-74
32A	Solenoid Operator, Coil & Housing Assy. 240 V, 60 Hz (220 V, 50 Hz)	1		X	X		X	83-1000-75	83-1000-75	83-1000-75
33	Solenoid Coil 120 V, 60 Hz (110 V, 50 Hz)	1		X	X		X	83-1000-25	83-1000-25	83-1000-25
33A	Solenoid Coil 240 V, 60 Hz (220 V, 50 Hz)	1		X	X		X	83-1000-26	83-1000-26	83-1000-26
33B	Solenoid Coil 208 V, 60 Hz	1		X	X		X	83-1000-65	83-1000-65	83-1000-65
33C	Solenoid Coil 24 V, 60 Hz	1		X	X		X	83-1000-28	83-1000-28	83-1000-28
34	Gasket, Seal Cap ①	1	X	X	X	X	X	81-1001-79	81-1001-79	81-1001-79
35	Seal Cap	1	X	X	X	X	X	24-1137-00K	24-1137-00K	24-1137-00K

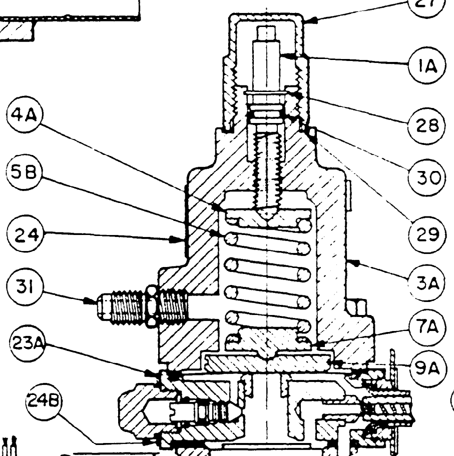
① Included in "O" Ring and Gasket Replacement Kit Part No. 24-0168-01K for Range A/D
② Included Diaphragm-Gasket Replacement Kit Part No. 24-0166-00K
③ 35% reduced capacity Main Valve Assembly available as standard on A7A1 and A7A1S. Replacement kit number is 24-0113-01K.

A7AI



WHEN INSTALLED IN HORIZONTAL LINE, LOCATE ADJUSTING SCREW AT TOP OR SIDE; NOT BELOW CENTERLINE.

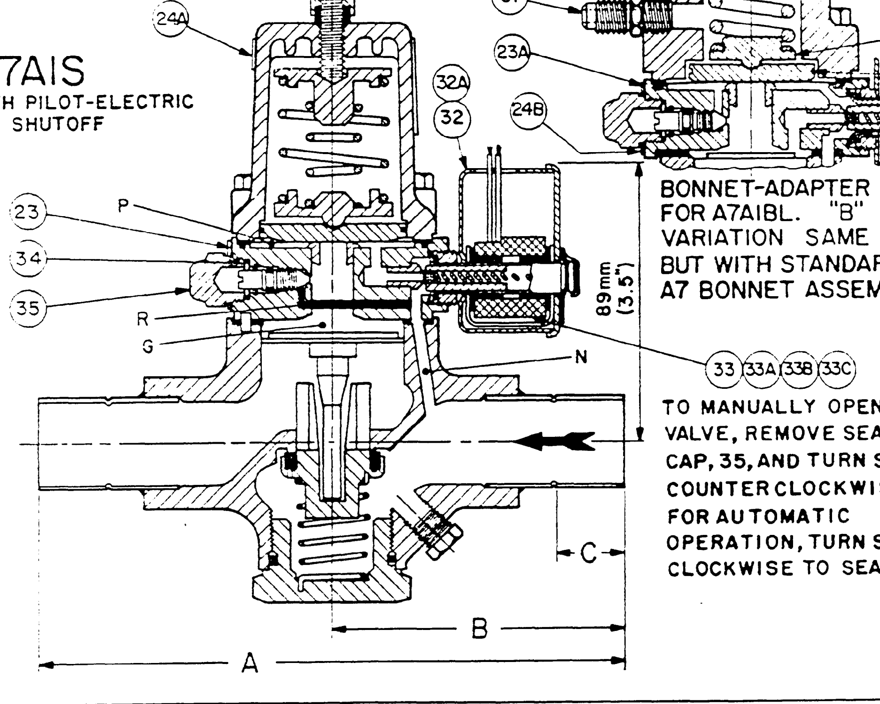




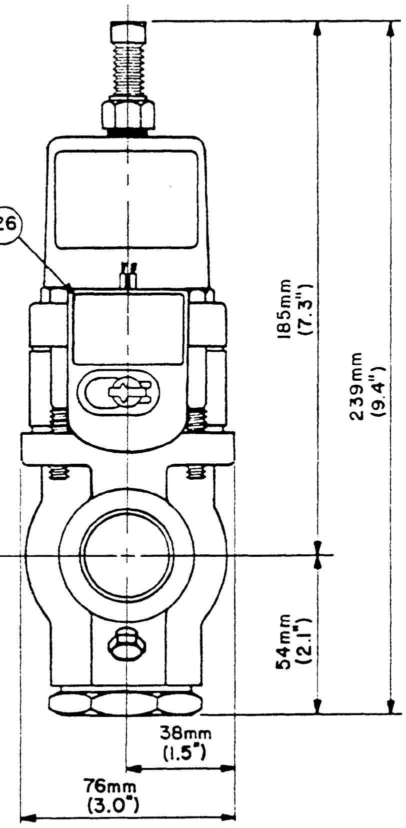
BONNET-ADAPTER FOR A7AIBL. "B" VARIATION SAME BUT WITH STANDARD A7 BONNET ASSEMBLY.

A7AIS

WITH PILOT-ELECTRIC SHUTOFF



TO MANUALLY OPEN VALVE, REMOVE SEAL CAP, 35, AND TURN STEM COUNTERCLOCKWISE. FOR AUTOMATIC OPERATION, TURN STEM CLOCKWISE TO SEAT.



REGULATOR SIZE		NET. WT. *	DIMENSIONS					
			A		B		C	
inch	mm		inch	mm	inch	mm	inch	mm
1-1/8	28	6.0 lbs. 2.7 kg.	7.5	190	3.7	95	1.0	25
1-3/8	35	6.0 lbs. 2.7 kg.	8.0	202	4.0	101	1.0	25
1-5/8	42	6.0 lbs. 2.7 kg.	8.8	224	4.4	112	1.1	29

* ADD 0.5 lbs. (.2 kg) FOR "S", "B" OR "BL" VARIATION

WITH SYSTEM PUMPED DOWN, NO. 25 N.P.T. PIPE PLUG CAN BE REMOVED AND OPTIONAL GAUGE OR SCHRADER TYPE GAUGE VALVE INSTALLED FOR INLET PRESSURE READING.

FOR R-12, R-22, R-502

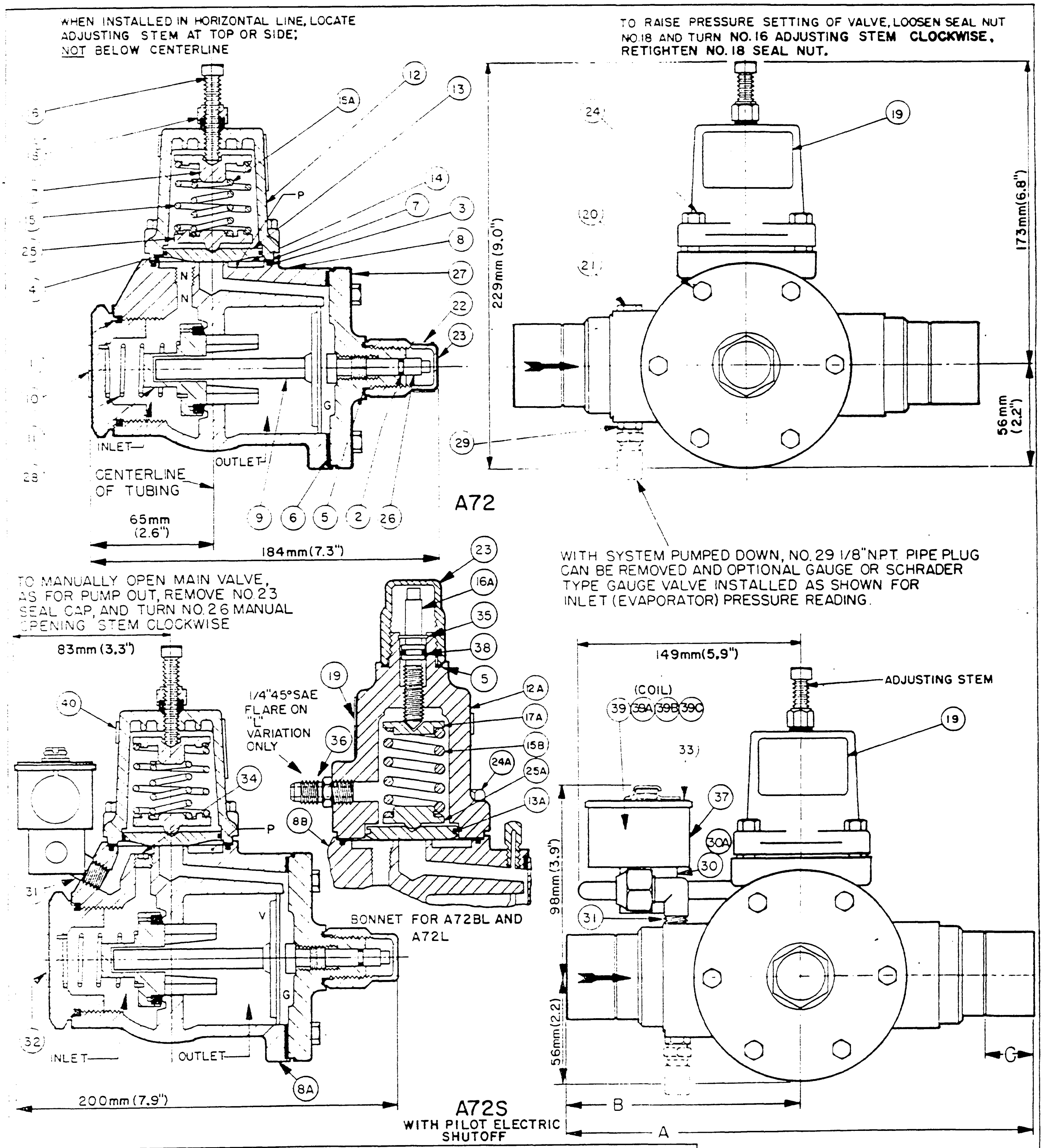
COMPACT WIDE RANGE PRESSURE REGULATOR		
DRAWN BY J. KLERMAN	A7AI, A7AIS, A7AIB, A7AIL, A7AIBL	
APPROVED BY J. YENCHO	DATE 1-29-80	DWG. NO. 4095

A72, A72S, A72B, A72L and A72BL Parts List—Range A/D

Note: A72L & A72BL available in Range A only

Item	Description	Qty	Used On A72	S	B	L	BL	Part Numbers 42 mm (1⅝")	54 mm (2⅛")	66 mm (2⅝")
1	"O" Ring, Bottom Cap ①	1	X	X	X	X	X	93-1000-69	93-1000-69	93-1000-69
2	"O" Ring, Mnl. Operating stem ①	1	X	X	X	X	X	93-1000-70	93-1000-70	93-1000-70
3	"O" Ring, Bonnet ①	1	X	X	X	X	X	93-1000-57	93-1000-57	93-1000-57
4	"O" Ring, Diaphragm Follower ①	1	X	X	X			93-1000-64	93-1000-64	93-1000-64
5	Gasket, Seal Cap ①	1	X	X	X	X	X ②	81-1000-65	81-1000-65	81-1000-65
6	Gasket, Valve Cover ①	1	X	X	X	X	X	81-1001-29	81-1001-29	81-1001-29
7	Gasket, Diaphragm ①③	1	X	X	X	X	X	81-1001-33	81-1001-33	81-1001-33
8	Valve Body Assembly	1	X			X		24-0127-00	24-0128-00	24-0145-00
8A	Valve Body Assembly	1		X				24-0127-02	24-0128-02	24-0145-02
8B	Valve Body Assembly	1			X		X	24-0127-04	24-0128-04	24-0145-04
9	Power Disc & Stem Assembly	1	X	X	X	X	X	24-0126-00K	24-0126-00K	24-0126-00K
10	Valve Bottom Cap	1	X	X	X	X	X	24-1060-00K	24-1060-00K	24-1060-00K
11	Valve Closing Spring	1	X	X	X	X	X	80-1001-39	80-1001-39	80-1001-39
12	Valve Bonnet	1	X	X	X			24-1126-11K	24-1126-11K	24-1126-11K
12A	Valve Bonnet	1				X	X	24-1110-11K	24-1110-11K	24-1110-11K
13	Diaphragm Follower	1	X	X	X			24-1132-00K	24-1132-00K	24-1132-00K
13A	Diaphragm Follower	1				X	X	22-1032-00K	22-1032-00K	22-1032-00K
14	Diaphragm ③	1	X	X	X	X	X	21-1007-04	21-1007-04	21-1007-04
15	Diaphragm Spring (Outer)	1	X	X	X			80-1001-57	80-1001-57	80-1001-57
15A	Diaphragm Spring (Inner)	1	X	X	X			80-1001-58	80-1001-58	80-1001-58
15B	Diaphragm Spring, Range A	1				X	X	80-1000-25	80-1000-25	80-1000-25
16	Adjusting Stem	1	X	X	X			90-1002-14	90-1002-14	90-1002-14
16A	Adjusting Stem, Range A	1				X	X	24-1111-00K	24-1111-00K	24-1111-00K
17	Spring Rest, Upper	1	X	X	X			24-1131-00	24-1131-00	24-1131-00
17A	Spring Rest, Upper, Range A	1				X	X	24-1048-01	24-1048-01	24-1048-01
18	Seal Nut	1	X	X	X			90-1000-15	90-1000-15	90-1000-15
19	Nameplate	1	X	X	X	X	X	24-1114-01	24-1114-01	24-1114-01
20	Valve Cover Screw	6	X	X	X	X	X	90-1000-76	90-1000-76	90-1000-76
21	Pipe Plug, ¼" NPT, Hex Head	1	X			X		92-1000-13	92-1000-13	92-1000-13
22	Nametag, Mnl. Opening Stem	1	X	X	X	X	X	24-1040-00	24-1040-00	24-1040-00
23	Seal Cap	1	X	X	X	X	X ②	30-1173-00K	30-1173-00K	30-1173-00K
24	Bonnet Screw	4	X	X	X			90-1001-70	90-1001-70	90-1001-70
24A	Bonnet Screw	4				X	X	90-1000-55	90-1000-55	90-1000-55
25	Spring Rest, Lower	1	X	X	X			24-1130-00	24-1130-00	24-1130-00
25A	Spring Rest, Lower, Range A	1				X	X	40-1026-00	40-1026-00	40-1026-00
26	Manual Opening Stem	1	X	X	X	X	X	24-1006-00K	24-1006-00K	24-1006-00K
27	Valve Cover	1	X	X	X	X	X	24-1058-11K	24-1058-11K	24-1058-11K
28	Main Valve Assembly	1	X	X	X	X	X	24-0124-01K	24-0124-00K	24-0124-00K
29	Pipe Plug ⅛" NPT Hex Head	1	X	X	X	X	X	92-1001-21	92-1001-21	92-1001-21
30	Solenoid Body & Tubing Assy.	1		X				24-0152-00	24-0152-00	24-0152-00
30A	Solenoid Body & Tubing Assy.	1			X		X	24-0152-03	24-0152-03	24-0152-03
31	¼" NPT x ⅜" SAE Elbow	2		X	X		X	92-1000-42	92-1000-42	92-1000-42
32	Flow Arrow	1	X	X	X	X	X	82-1000-09	82-1000-09	82-1000-09
33	Solenoid Nameplate	1		X	X		X	24-1041-01	24-1041-01	24-1041-01
34	Pipe Plug, ⅛" NPT	1		X				92-1000-17	92-1000-17	92-1000-17
35	Retaining Ring	1				X	X	91-1000-34	91-1000-34	91-1000-34
36	¼" SAE Connection	1				X	X	92-1000-64	92-1000-64	92-1000-64
37	Solenoid Coil & Housing Assy. 120 V, 60 Hz (110 V, 50 Hz)	1		X	X		X	83-1000-21	83-1000-21	83-1000-21
37A	Solenoid Coil & Housing Assy. 240 V, 60 Hz (220 V, 50 Hz)	1		X	X		X	83-1000-22	83-1000-22	83-1000-22
38	"O" Ring, Adjusting Stem	1				X	X	93-1000-58	93-1000-58	93-1000-58
39	Solenoid Coil 120 V, 60 Hz (110 V, 50 Hz)	1		X	X		X	83-1000-25	83-1000-25	83-1000-25
39A	Solenoid Coil 240 V, 60 Hz (220 V, 50 Hz)	1		X	X		X	83-1000-26	83-1000-26	83-1000-26
39B	Solenoid Coil 208 V, 60 Hz	1		X	X		X	83-1000-65	83-1000-65	83-1000-65
39C	Solenoid Coil 24 V, 60 Hz	1		X	X		X	83-1000-28	83-1000-28	83-1000-28
40	U.L. Label	1	X	X	X	X	X			

① Included in "O" Ring and Gasket Replacement Kit Part No. 24-0149-01K for Range A/D
② 2 required on A72BL
③ Included in Diaphragm-Gasket Replacement Kit Part No. 24-0166-00K



REGULATOR SIZE		NET WT. *	DIMENSIONS					
			A		B		C	
inch	mm		inch	mm	inch	mm	inch	mm
1-5/8	42	13.3 lbs. 6.0 kg	10.5"	267	5.3"	133	1.2"	30
2-1/8	54	13.3 lbs. 6.0 kg	11.5"	292	5.8"	146	1.4"	35
2-5/8	66	13.5 lbs. 6.1 kg	12.5"	318	6.3"	159	1.4"	37

* ADD 1.5 lbs. (.7 kg) FOR "S", "B" OR "BL" VARIATION

FOR R-12, R-22, & R-502

REV. D 2-27-80
REV. C 1-21-77
REV. B 1-27-75
REV. A 10-19-70

COMPACT WIDE RANGE PRESSURE REGULATOR			
R.D.H.	A72, A72S, A72B, A72L, A72BL		
G.K.	3-10-67	4051	

FLO-CON

Parker

One suggested procedure for setting an evaporator pressure regulator is: Turn Adjusting Stem all the way out (counter-clockwise), allowing the regulator to open wide. Operate the refrigeration system to bring the cooled medium almost down to temperature. Gradually turn the Adjusting Stem in (clockwise) until the evaporator pressure rises to the desired point. Final adjustment will normally be required after the system has run through several complete cycles.

MANUAL OPENING

All A7 Series Regulators can be manually opened during system operation. Type A7A Regulator is manually opened using the following procedure: (Refer to drawing on Page 3)

Loosen Seal Nut (#2)—except on "L" variations which have a Seal Cap (#27) to remove—and turn Adjusting Stem (#1 or #1A) out (counter-clockwise) counting turns until the regulator stays open. To return to normal operation, turn adjusting stem in (clockwise) the same counted number of turns. Adjust final pressure using a pressure gauge. Always tighten lock nut (or seal cap) after adjustment.

Type A7A1 Regulators use a manual by-pass to open the main valve. The operation is as follows: (Refer to drawing on Page 5) Remove Seal Cap (#35) and turn by-pass stem out (counter-clockwise) until the regulator opens (normally, one turn is sufficient to throw main valve wide open). The refrigerant is allowed to bypass the regulator pilot section and feed pressure directly to the top of the piston (passageway "R"), thereby opening the main valve. To return to automatic operation, turn bypass stem in (clockwise) until it seats tightly. Always replace seal cap after adjustment.

Type A72 Regulators use a manual opening stem to push the main valve off its seat. The operation is as follows: (Refer to drawing on Page 7) Remove Seal Cap (#23) and turn Manual Opening Stem (#26) in (clockwise) until the stem contacts the Power Disc and Stem Assembly (#9) and pushes the Main Valve Assembly (#28) off its seat. To return to automatic operation, turn stem out (counter-clockwise) until stem backseats against Valve Cover (#27). Always replace seal cap after adjustment.

PRINCIPLES OF OPERATION

Starting with a closed regulator and an inlet (evaporator) pressure initially below the set-for pressure, the operation of the valve is as follows:

The inlet pressure flows through passage N to the lower side of #10 or #14 Diaphragm in Chamber P. As the inlet pressure rises, the Diaphragm exerts a force upward against #5 or #15 Diaphragm Spring. As the inlet pressure rises above the set-for pressure (determined by the position of Adjusting Stem), the Diaphragm rises from the Pilot Seat, permitting pressure from Chamber P to enter Chamber G on top of #9 or #17 Power Disc and gradually opening the #18 or #28 Main Valve Assembly against #11 or #19 Valve Closing Spring to keep the inlet pressure down to the set-for pressure.

Whenever the inlet pressure drops below the set-for pressure, the Diaphragm moves downward to close the Pilot Seat passage. As the pressure in Chamber G escapes around the Power Disc to the downstream side of the regulator, the Valve Closing Spring gradually returns the Main Valve Assembly toward the closed position. Refrigerant flow is thereby reduced and the inlet (evaporator) pressure is brought back up to the set-for pressure.

When the Pilot Electric Shut-off variation (A7AS, A7A1S or A72S) is used, the flow of pilot gas is routed from the valve inlet through the pilot solenoid valve before entering Chamber P under #10 or #14 Diaphragm. As long as the normally closed solenoid valve is energized (open), the pilot gas flow is uninterrupted and normal regulator operation occurs as described above. When the solenoid valve is de-energized (closed), the flow of pilot gas is interrupted and the regulator closes. Just as with solenoid valves, however, the pilot electric shut-off cannot prevent backward flow through the regulator if the outlet pressure sufficiently exceeds the inlet pressure.

The Electric Wide-opening variation (A7AB, A7A1B and A72B) operates, generally, in a manner opposite to that of the Electric Shut-off variation. When the pilot solenoid valve is de-energized, the valve is regulating at its set-for pressure. Energization of the solenoid allows inlet pressure to flow directly into Chamber G causing the main valve assembly to go wide-open.

The Differential Pressure variation (A7AL, A7A1L and A72L) controls the difference between inlet pressure and the external pressure (usually outlet pressure) connected to a ¼" SAE flare fitting in the bonnet.

The Electric Wide-opening and Differential Pressure variations are combined in Types A7A1BL and A72BL. With the pilot solenoid energized the Main Valve Assembly is in the wide open position. When de-energized, the valve is regulating difference between inlet pressure and the external pressure connected to the Valve Bonnet.

SERVICE POINTERS

Symptom	Probable Cause	Correction
Failure to open, close or regulate properly.	Power disc jammed due to excessive dirt.	Clean power disc and regulator body.
	Valve manually open (A7A1, A72)	Close manual bypass (A7A1) Turn manual opening stem out (counter-clockwise) (A72)
	Adjusting stem improperly positioned: a. Turned in too far—does not open. b. Not turned in far enough—does not close.	Position adjusting stem properly.
	Passage N clogged.	Clean passage N.
	Pilot piping obstructed (A72S, A72B or A72BL).	Clean pilot piping.
	Pilot seat dirty or eroded.	Clean and smooth pilot seat. If diaphragm is removed replace with new gasket and "O" Ring.
	Regulator installed backwards.	Re-install regulator in proper position.
	Cover gasket not properly positioned. (A72 sizes only)	Be sure cutout in gasket is aligned with hole in valve body. (A72 sizes only)
System control can not be maintained.	Improper Regulator selection: a. Actual load is much lower than regulator capacity. b. Actual pressure drop across valve higher than design. c. Combinations of a and b.	Replace with suitable regulator.

SAFE OPERATION (See Bulletin RSB)

People doing any work on a refrigeration system must be qualified and completely familiar with the system and the valves involved, or all other precautions will be meaningless. This includes reading and understanding pertinent product bulletins and the current Bulletin RSB prior to installation or servicing work.

WARRANTY

All Refrigerating Specialties Products are warranted against defect in workmanship and materials for a period of one year from date of shipment from the factory. This warranty is in force only when products are properly installed, maintained and operated in use and service as specifically stated in Refrigerating Specialties Catalogs or Bulletins for normal refrigeration applications, unless otherwise approved in writing by Refrigerating Specialties Division. Defective products, or parts thereof, returned to the factory with transportation charges prepaid and found to be defective by factory inspection will be replaced or repaired at Refrigerating Specialties' option, free of charge, F.O.B. factory. Warranty does not cover products which have been altered or repaired in the field; damaged in transit, or have suffered accidents, misuse, or abuse. Products disabled by dirt, or other foreign substances will not be considered defective.

THE EXPRESS WARRANTY SET FORTH ABOVE CONSTITUTES THE ONLY WARRANTY APPLICABLE TO REFRIGERATING SPECIALTIES PRODUCTS, AND IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, WRITTEN OR ORAL, INCLUDING ANY WARRANTY OF MERCHANTABILITY, OR FITNESS FOR A PARTICULAR PURPOSE. No employee, agent, dealer or other person is authorized to give any warranties on behalf of Refrigerating Specialties, nor to assume, for Refrigerating Specialties, any other liability in connection with any of its products.

SUBJECT: DDR-20 DISCHARGE DIFFERENTIAL REGULATING VALVES

LIMITED: M

The DDR-20 is an adjustable pilot operated differential pressure regulating valve designed to control a differential pressure between the discharge line and the receiver on Supermarket refrigeration systems which utilize hot gas defrost. When defrost is initiated, hot gas flows back through the evaporators being defrosted. This defrost gas condenses in the evaporators and flows in reverse around the TEV and liquid line solenoid valve through check valves. This liquid refrigerant then flows to the liquid header where it is used by the evaporators that are not in defrost. In order for this reverse flow of hot gas to occur, the pressure of the discharge gas (defrost header) must be greater than the pressure of the receiver (liquid header). This pressure differential is created by the DDR-20 valve which is located in the discharge line before the condenser.

Valve Operation

The DDR-20 valve is designed to create a differential pressure between its inlet pressure and the receiver pressure. The pilot part of the valve senses receiver pressure through a field installed pilot line from the pilot differential valve to the receiver. Pressure from the valve's inlet enters the pilot through a tube from the inlet connection. This inlet pressure bleeds through a fixed restrictor to the top of the main valve piston. Pressure on top of the main piston is bled off through the pilot differential valve. The pilot differential valve reacts to the difference in pressure between the valve's inlet pressure and the receiver pressure. As this differential pressure increases and decreases it causes the pilot differential valve to open and close which in turn increases and decreases the pressure on top of the main piston. As this pressure on top of the main piston increases and decreases it causes the main piston to modulate closed and open.

A solenoid bypass feature is incorporated in the valve so that the valve can be made to go full open when there is no need for a differential to be created. Energizing this solenoid coil will open the valve fully. De-energizing this solenoid coil will allow the valve to modulate to maintain a differential.

Differential Operation - Coil De-energized (See Figure 1)

When the solenoid is de-energized the kick-off spring forces the pin and plunger down, closing Port A and opening Port B. Discharge gas enters the chamber on top of the piston through Port B and is bled out through the pilot differential valve.

When the differential pressure between the discharge line and the receiver is below the setting of the pilot valve, the pilot valve modulates closed. This allows pressure to build on top of the main piston. As this pressure (P1) approaches the inlet pressure (P3) the force combined with the force from the spring (P2) pushes the piston down, modulating the valve closed.

As the differential pressure rises above the pilot valve setting, the pilot valve modulates open. This bleeds refrigerant from the chamber on top of the piston at a faster rate than it is entering so the pressure decreases. As this pressure (P1) plus the pressure from the spring (P2) falls below the inlet pressure (P3), the inlet pressure pushes the piston up, modulating the valve open. The valve will open only as far as necessary to maintain the pilot valve setting. The pilot valve will then modulate the piston from partially open to partially closed to maintain its setting.

Full-Open Operation - Coil Energized (See Figure 2)
When the solenoid is energized, the pin and plunger are pulled up, opening Port A. The discharge gas entering the valve then forces the small ball up to close Port B.

Discharge gas can no longer enter the chamber on top of the main piston. The pilot differential valve closes and refrigerant from the top of the piston bleeds to the suction line through Port A and Fitting C. This decreases pressure in the chamber (P1) so the inlet pressure (P3) moves the piston up and the valve opens.

Valve Location And Installation
These valves can be installed in horizontal or vertical lines, whichever best suits the application and permits easy accessibility of the valves. However, consideration should be given to locating these valves so they don't act as oil traps or so that solder cannot run into the internal parts during brazing. Care should also be taken to install the valves with the flow in the proper direction.

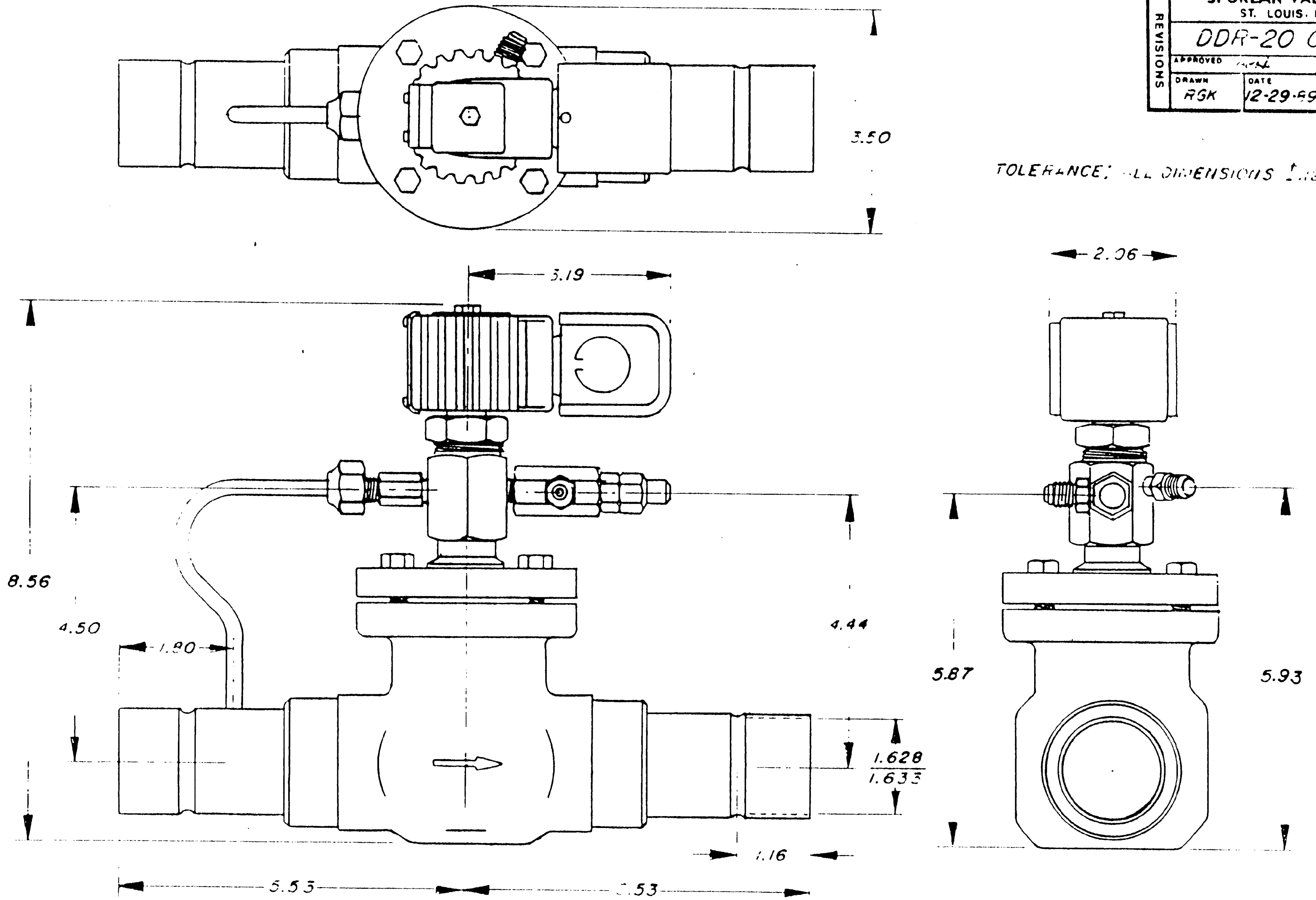
Any of the commonly used brazing alloys for high side usage are satisfactory. However, when soldering or brazing, it is very important that the internal parts be protected by wrapping the valve with a WET cloth to keep the body temperature below 250°F. Also, when using high temperature solders, the torch tip should be large enough to avoid prolonged heating of the copper connections. And, always direct the flame away from the valve body.

IMPORTANT:

The two field installed pilot lines, one to the receiver and one to the suction line, must be connected in order for the valve to operate properly. The pilot line to suction is not a constant high to low side bleed. It only bleeds the small amount of refrigerant from the top of the valve's main piston to open the valve when the solenoid coil is energized. Once the valve is open and at all other times there is no high to low side bleed. The bleed thru the pilot differential valve, that occurs when the valve is modulating, is to the receiver.

SPECIFICATIONS

Valve Type	Port Size (In.)	Adjustment Range (Psig)	Connections (ODF) Inlet	Connections (ODF) Outlet	Dimensions
DDR-20	1-5/16	5/50	1-5/8	1-5/8	See Drawing Page 5



TOLERANCE: ALL DIMENSIONS ± .12

REVISIONS	SPORLAN VALVE COMPANY ST. LOUIS, MO. 63143	
	DDR-20 OUTLINE	
	APPROVED	DRAWING NO.
	DRAWN RGK / DATE 12-29-69	B(S)2400

DDR-20 CAPACITIES - TONS OF REFRIGERATION

Pressure Drop Across Valve (Psig)	Refrigerant		
	12	22	502
0.5	7.1	10.2	8.4
1	10.1	14.4	11.8
2	14.3	20.4	16.7
3	17.5	24.9	20.5
4	20.2	28.8	23.7
5	25.6	32.2	26.5

Capacities are based on 40°F evaporator temperature, 100°F condenser temperature, 25°F superheated return gas, discharge gas temperature 50°F above isentropic compression. For capacities at other evaporator temperatures use multipliers in table below:

Evaporator Temperature Correction Factors

Evaporator Temperature - °F.		40°	30°	20°	10°	0°	-10°	-20°	-30°	-40°
Multiplier	R-12	1.0	.97	.95	.93	.91	.88	.86	.83	.81
	R-22	1.0	.98	.96	.94	.92	.90	.87	.85	.83
	R-502	1.0	.98	.95	.92	.90	.87	.84	.82	.79

Setting Procedures

The DDR-20 is set by turning the adjusting stem located under the cap on the pilot differential valve. Turning the stem clockwise increases the setting, counterclockwise decreases the setting. Adjustments must be made with the valve de-energized and no cases in defrost. Once the valve is set it will control to maintain this differential setting during defrost. However, when a defrost is initiated the head pressure may fall. It can take several minutes for the differential to be created while the discharge pressure increases above the liquid header pressure.

Pricing

For price and minimum order requirements contact Sporlan Valve Company.

DISTRIBUTION: S

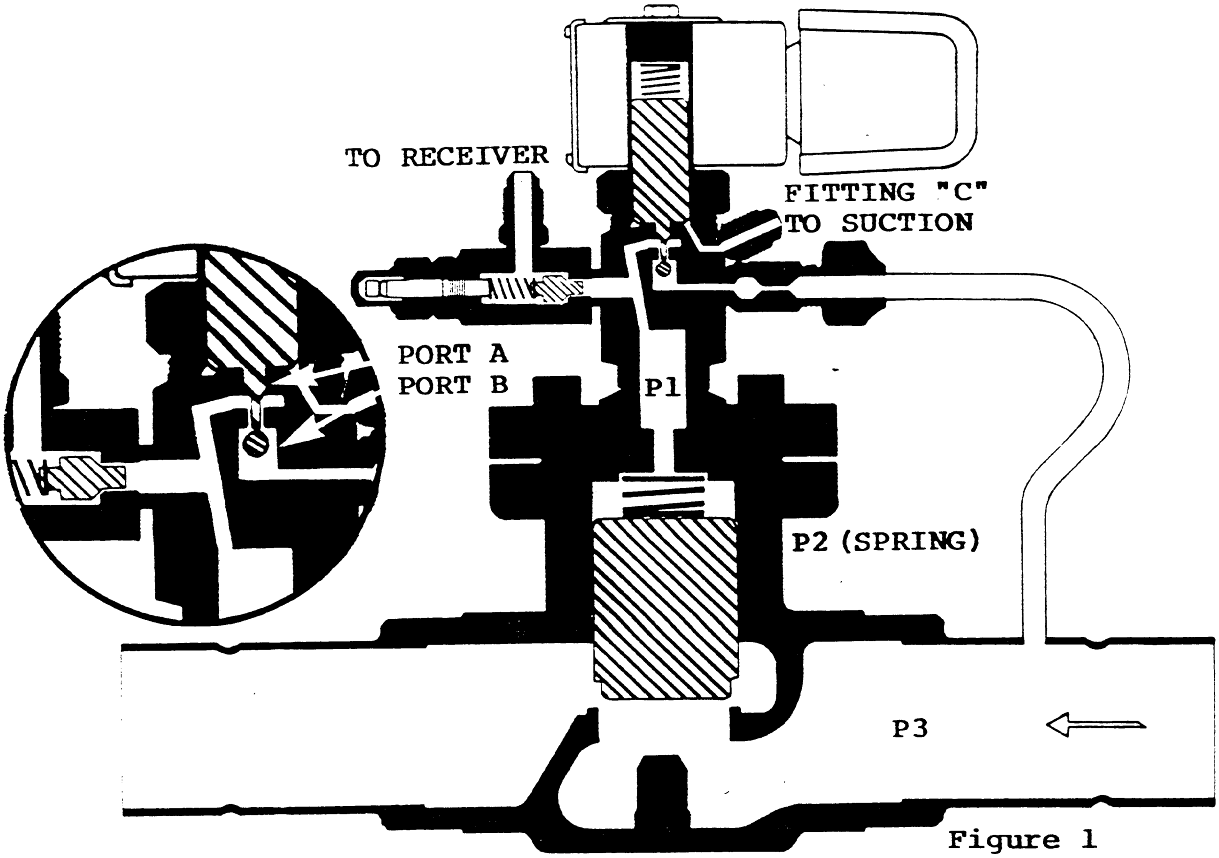


Figure 1
Coil De-Energized
Valve Modulating

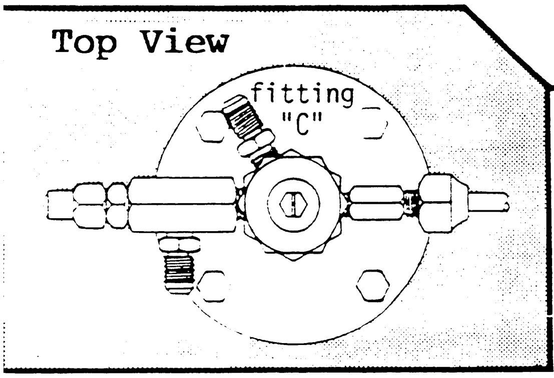
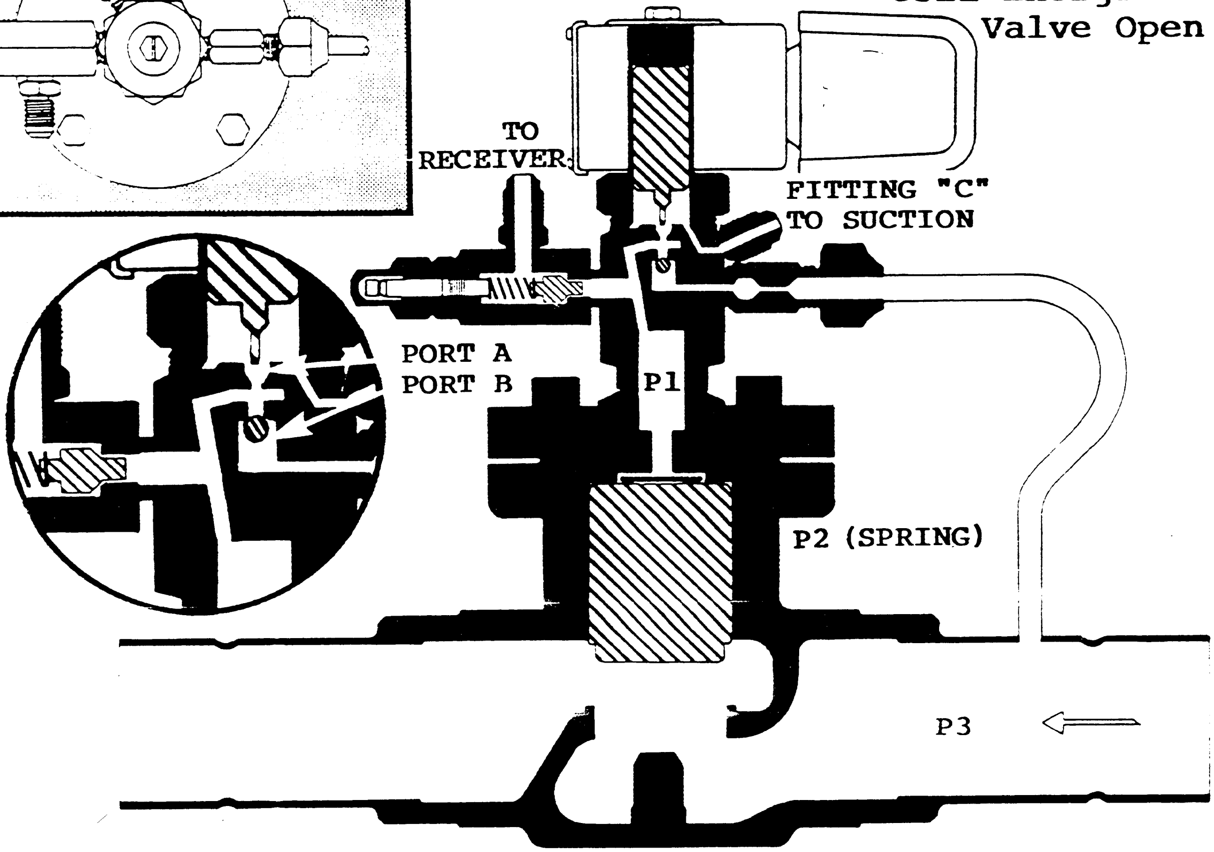
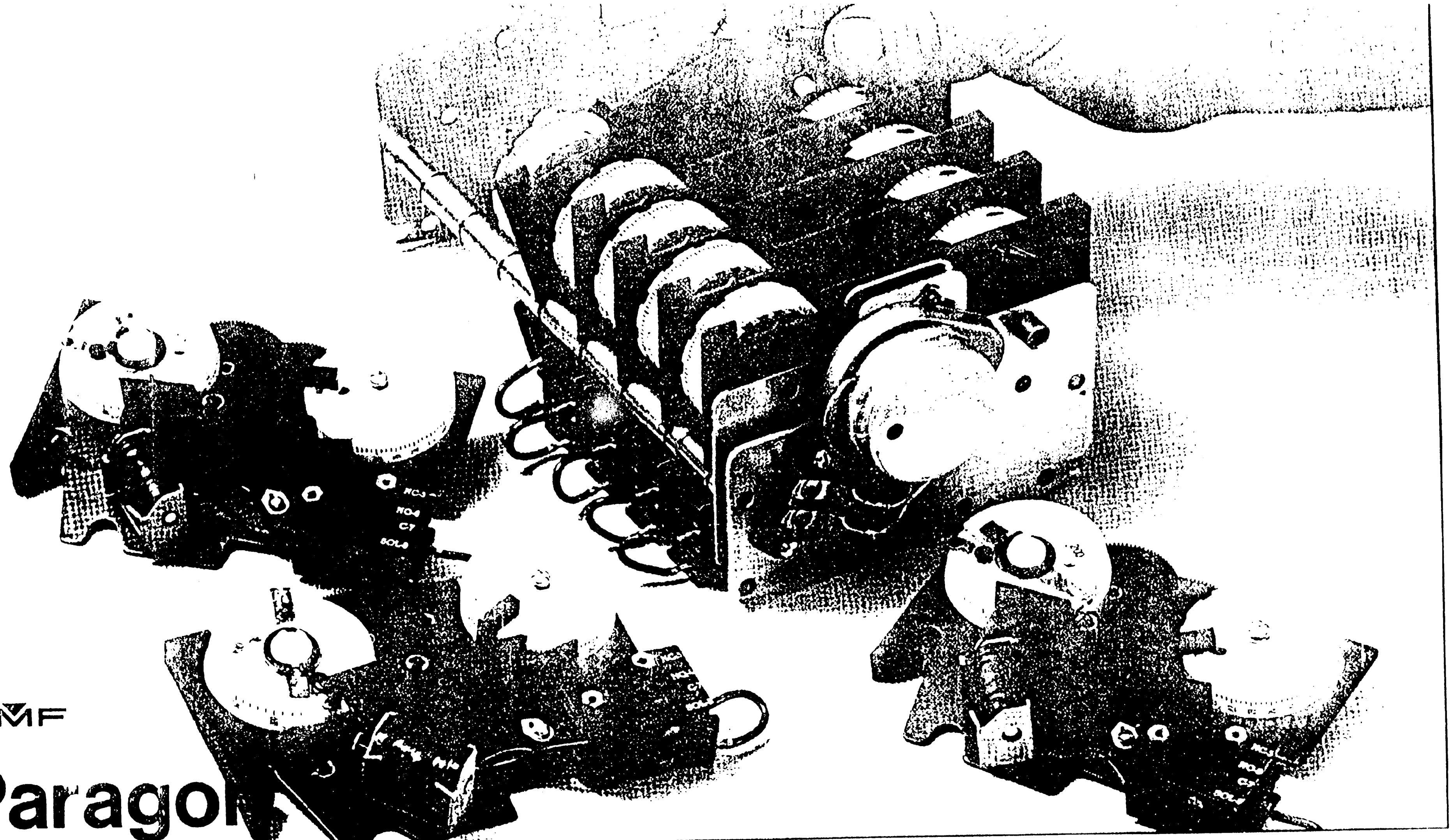


Figure 2
Coil Energized
Valve Open





Paragon
RM Series
Installation Instructions

I. Installing to Panel

1. Drill holes in panel to accept #12 screws. Follow the dimensional diagram enclosed. (See back page.)

2. Install all brackets to panel with #12 screws. Arrow on side of bracket must point upward on a vertical panel surface.

3. Hang non-slotted frame rod of Master Unit (unit with motor module) on upper hooks of first two brackets.

4. If Slave Units are to be used, install coupling on circuit #8 of Master Unit.

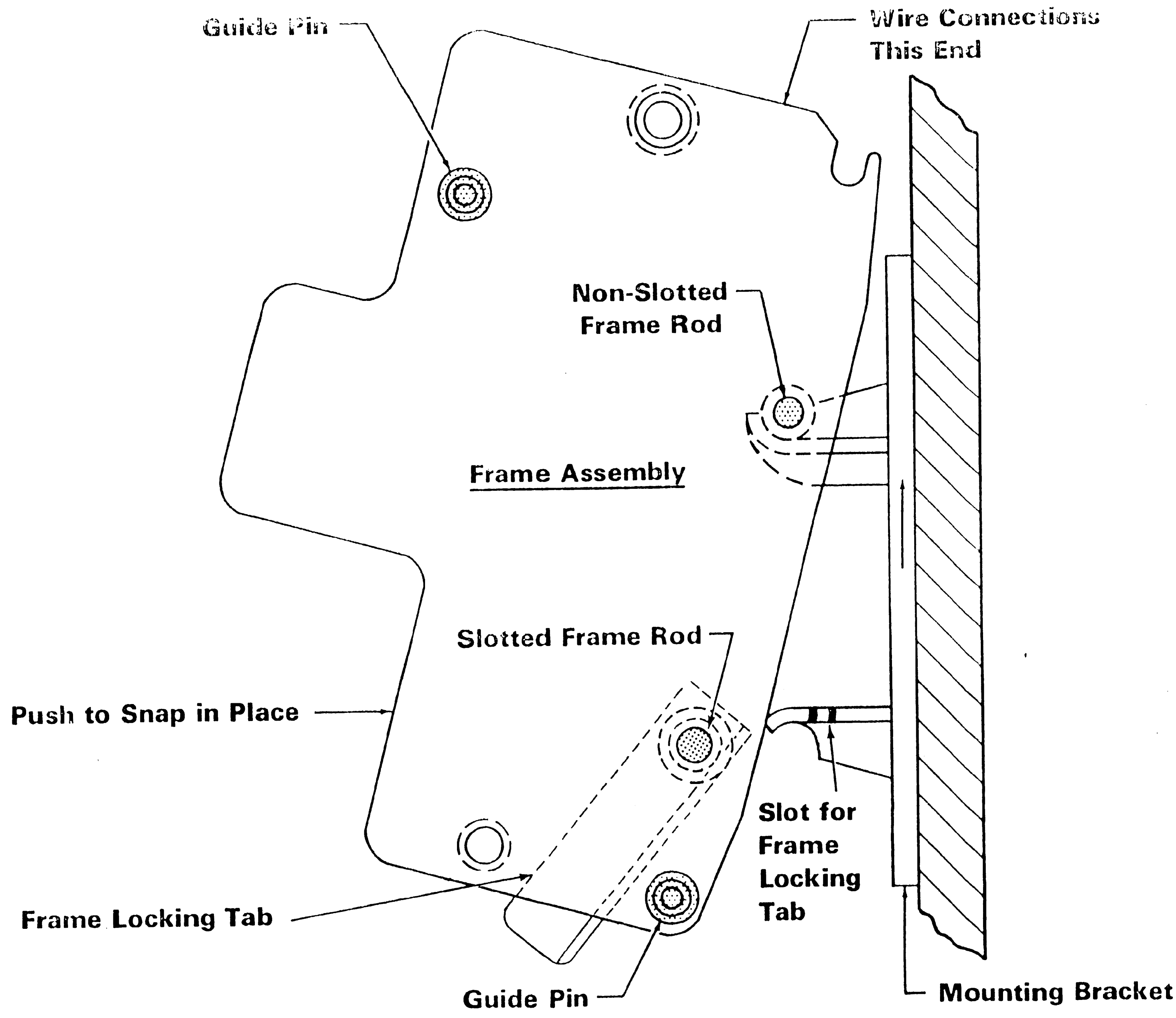
5. Position non-slotted frame rod of Slave Unit on upper hooks of brackets. Be certain that the Frame Locking Tab is in the up position and does not interfere with the mounting feet. Be sure Slave Unit guide pins engage on the Master Unit. Be sure the tongue on Slave Circuit #1 engages the groove on the coupling. Be sure the black numbers on the 24-hour dials line up on both units. (See Instructions on Alignment of Program Modules, page 6.)

6. Push down evenly on all frames and snap the slotted frame rods over the lower bracket hooks.

7. Rotate the Frame Locking Tab so that it's lower edge enters the slot in the side of the mounting bracket and the top edge has snapped in place below the lower guide pin.

8. Check entire unit for operation by rotating the black reduction gear on the Motor Module. (See page 7.) Be sure all Module dials turn together when this gear is turned by hand.

FRAME AND BRACKET



II. Wiring

1. Each Program Module is equipped with two SPDT snap switches. Units equipped with integral solenoids have two additional terminals for the solenoid, one of which is factory-bridged to the Normally Open contact on one of the switches.

2. Wire line voltage to the Motor Module terminal block. (See page 6.)

3. Wire line to Common terminals of all switches.

4. Wire loads to N.O. or N.C. switch contacts in accordance with the Cabinet Manufacturer's wiring diagrams.

5. On solenoid-terminated units, wire the cycle limit switch for each Program Module in accordance with the Cabinet Manufacturer's wiring diagrams.

III. Programming

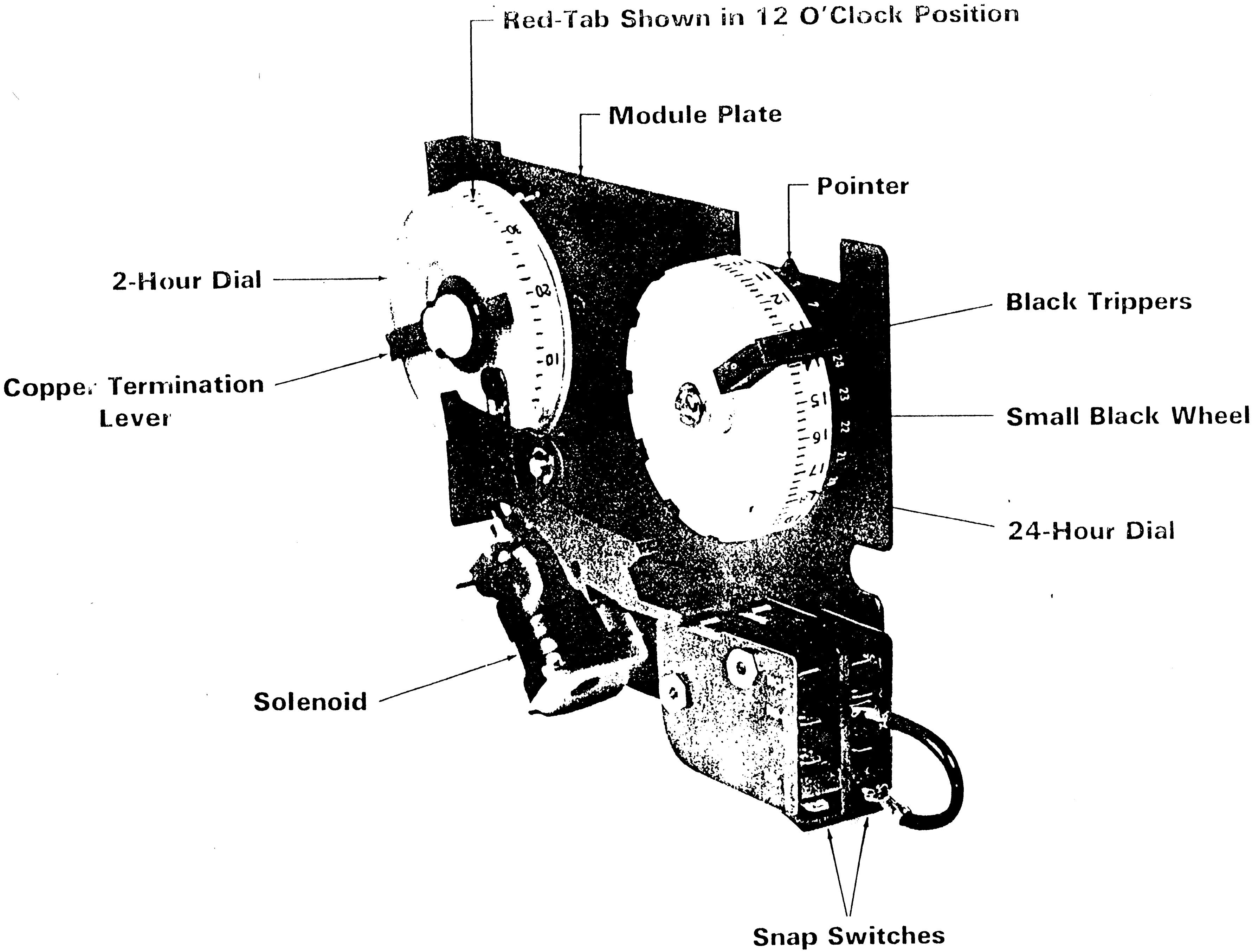
1. For each circuit (Program Module) insert black trippers into the slots in the 24-hour dial at the times of day (indicated by the black numbers) when a defrost cycle is to occur.

2. For each circuit, rotate the copper termination lever around the 2-hour dial to set the duration of each defrost cycle. NOTE: To rotate the terminating lever counter-clockwise, it must be pulled slightly away from the dial teeth with finger pressure. Do not bend the lever away from the teeth any farther than is necessary to disengage it from the dial teeth.

3. Set each Program Module per #1 and #2 above.

4. Use the black reduction gear on the Motor Module, see page 6, to rotate the entire assembly until the current time of day (indicated on the smaller black wheel behind each 24-hour dial) lines up with the pointer stamped behind it as part of the Module Plate.

5. The unit is now ready for application of line voltage to the Motor terminal block.



Red-Tab Shown in 12 O'Clock Position
Module Plate
Pointer
2-Hour Dial
Black Trippers
Copper Termination Lever
Small Black Wheel
24-Hour Dial
Solenoid
Snap Switches

IV. Removal and/or Installation and Alignment of Individual Program Modules

1. To remove a Program Module, rotate the black reduction gear on the Motor Module until the Red Tabs on all the two hour program dials are in line with the spring mounting hole for the Module latching lever on the Module plate.

2. To re-install a Program Module, follow #1 above and rotate the trailing Modules by hand until all Red Tabs are in line with the spring mounting hole for the Module latching lever on the Module plate. Check to be sure that the black numbers on all the 24 hour dials are lined up. Rotate the 2 hour dial sections until this line up is obtained. Rotate the 2 hour dial of the Module to be installed until the Red Tab is in line with the spring mounting hole for the Module latching lever on the Module plate and the black numbers on the 24 hour dial are in the same position as those on Modules already in the frame. Then fit the Module cutout (located above the switches) into the slotted frame rod, align the tongue/groove on either side of the Module, and snap the Module down over the non-slotted frame rod. Check to be sure all Red Tabs line up and all 24 hour dial numbers line up.

V. Installation/Removal of Drive Module

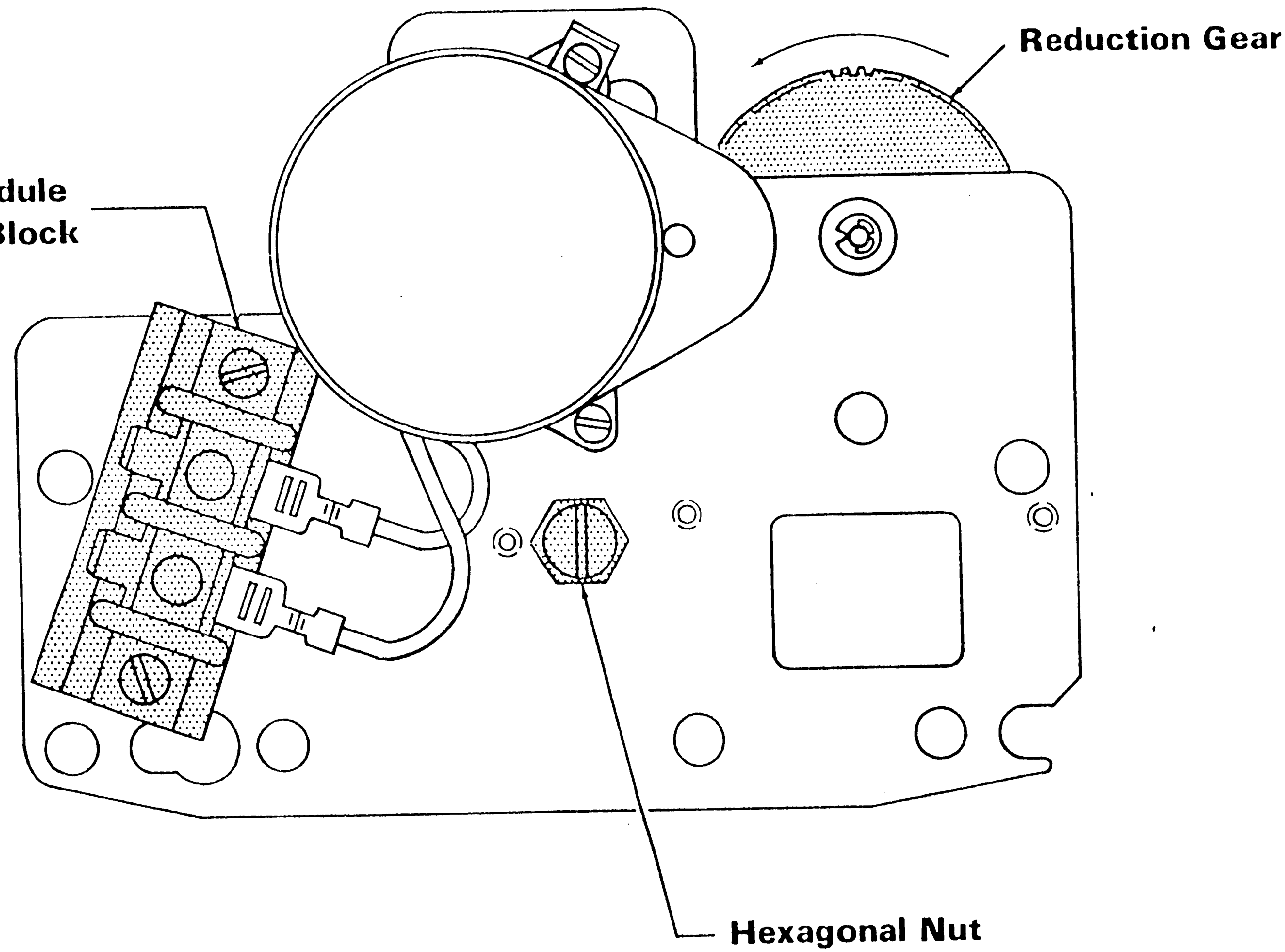
1. To remove Drive Module, rotate black reduction gear until tongue/groove with Program Module #1 is parallel to mounting surface.

2. Loosen hex nut fully.

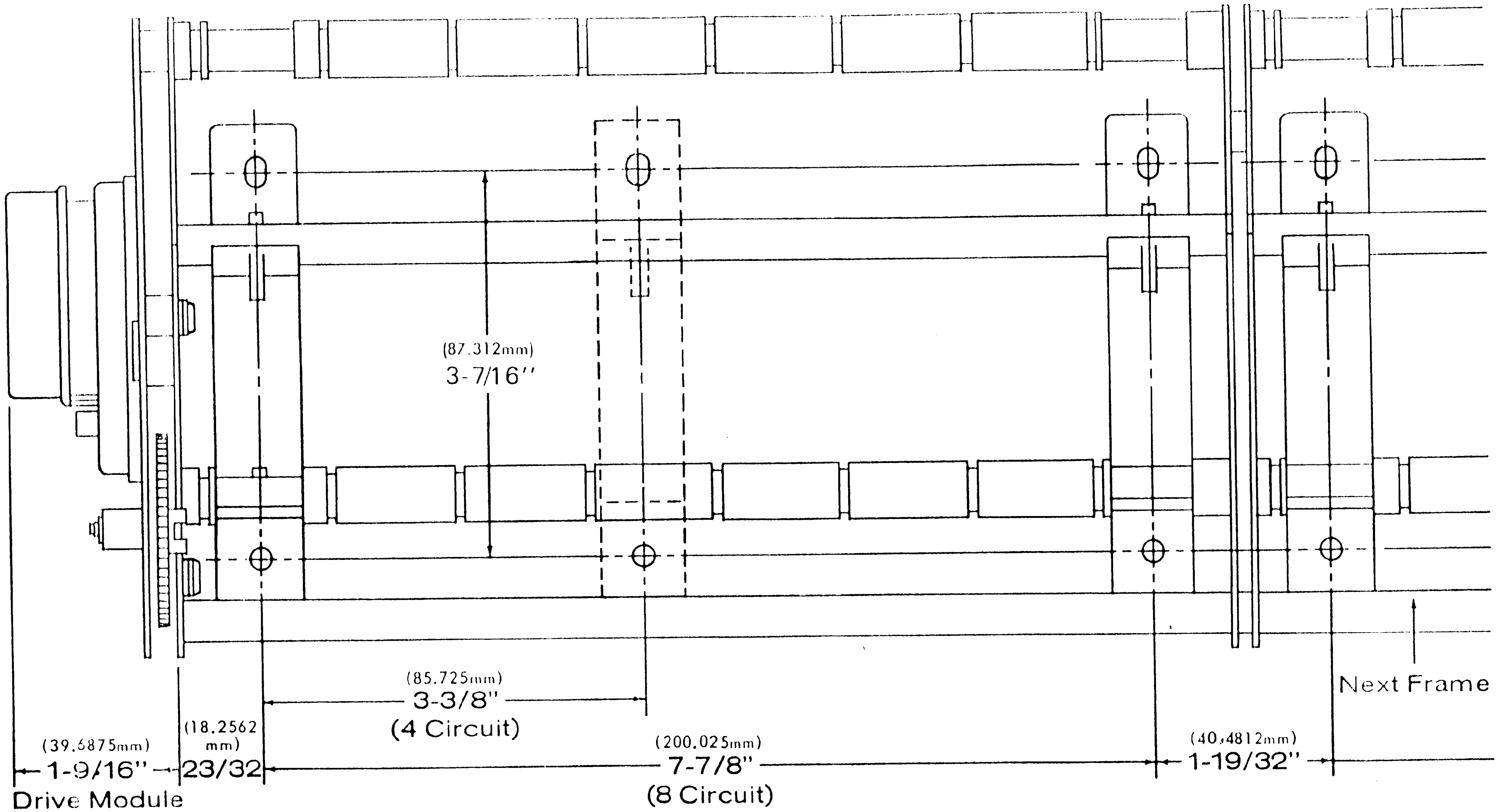
3. Slide complete Motor Module parallel to mounting surface and toward the 24-Hour Dials until the three locator studs clear their keyslots, then remove the Module.

4. To reinstall, reverse steps above.

MOTOR MODULE



DIMENSIONAL DIAGRAM



AMF Paragon

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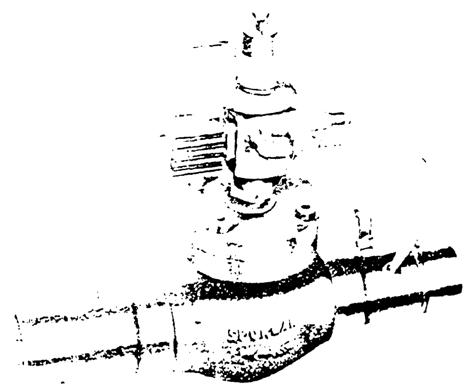
IN CANADA: PARAGON ELECTRIC P.O. Box 3620 Guelph, Ontario N1H 7H1
Telephone 519 822-1570 Division of AMF CANADA LIMITED

Part No. 22922, 6 1 79

Printed in U.S.A.

SPORLAN

EVAPORATOR PRESSURE REGULATING VALVES



Installation & Service Instructions

(S) ORIT-12, (S) ORIT-15, (S) ORIT-20

INSTALLATION INSTRUCTIONS

To insure optimum performance, evaporator pressure regulating valves must be selected and applied correctly. This is covered thoroughly in Bulletin 90-20-1. However, proper installation procedures are equally as important. All of the information in the Application Section should be reviewed before installing ORIT valves.

VALVE LOCATION — The ORIT-12, -15, and -20 must be installed upstream of any other suction line controls or accessories. They may be installed in the horizontal or vertical position . . . whichever best suits the application and permits easy adjustment and accessibility. However, consideration should be given to locating these valves so they don't act as an oil trap, or so solder cannot run into the internal parts during brazing in the suction line. Reverse flow is not recommended. Therefore a high side to low side hot gas defrost line must be connected upstream of the ORIT-12, -15, and -20.

INSTALLATION and BRAZING PROCEDURES — It is not necessary to disassemble the valve when soldering to the connecting lines. Any of the commonly used types of solder (such as 50-50, 95-5, Easy-Flo, Phos-Copper, or equivalents) are satisfactory. It is important — regardless of the solder used — to direct the flame away from the valve body and avoid excessive heat on the diaphragm of the pilot valve. As an extra precaution, a damp cloth may be wrapped around the diaphragm during the soldering operation.

IMPORTANT: The pilot valve high pressure source is the primary valve port closing force, so this connection must be made for proper performance. There are several precautions to observe when making this connection.

1. Generally the high pressure connection is made either to the discharge line or the top of the receiver. If hot discharge gas is used for defrost, the ORIT pilot supply line must originate from the same location as that of the hot gas defrost line. However, equipment manufacturers sometimes select other locations that are compatible with their specific design requirements. Care should always be taken so this line does not serve as an oil trap. It is also recommended that a hand valve or solenoid valve (Sporlan A3) be installed in this line so the pilot can be isolated should servicing become necessary. The hand valve or solenoid valve is mandatory if it is necessary to pump out an evaporator for service or for a pumpdown system. Closing the hand valve or solenoid valve will cause the main piston to shift to the full open position for rapid evacuation of the evaporator. The positive closure of the pilot supply line is also necessary on pumpdown systems to eliminate the high side to low side equalization path.

The ORIT-12, -15, and -20 are normally open and therefore by closing off the pilot supply pressure (closing pressure), the ORIT main piston will shift to the full open position.

2. To insure proper performance, the high pressure source supplied to the inlet of the pilot valve must be at least 50 psi above the outlet suction pressure of the ORIT evaporator pressure regulator.

TEST PRESSURES and DEHYDRATION TEMPERATURES — For better leak detection, an inert dry gas such as nitrogen or CO_2 may be added to an idle system to supplement the refrigerant pressure.

CAUTION: Inert gases must be added to the system carefully through a pressure regulator. Unregulated gas pressure can seriously damage the system and endanger human life. Never use oxygen or explosive gases.

Excessive pressure can shorten the life of the pilot regulator valve diaphragm. The maximum low side test pressure that can safely be applied is 450 psig. This maximum pressure is well above the minimum field leak test pressures for low side listed in the ANSI/ASHRAE Standard 15-1978.

The maximum dehydration temperature to which the valve body can be subjected without danger is 250°F.

FOR USE ON REFRIGERATION and or AIR CONDITIONING SYSTEMS ONLY

Bulletin 90-21-1 April 1985 supersedes Bulletin 90-21-1 dated August 1982 and all prior publications

VALVE SETTING and ADJUSTMENT — The standard factory setting for the 0/75 psig range is 30 psig. The main function of an ORIT valve is to keep the evaporator pressure above some given point at minimum load conditions. Therefore, even though the valves are selected on the basis of pressure drop at full load conditions, they should be adjusted to maintain the minimum allowable evaporator pressure under the actual minimum load conditions.

When adjusting both evaporator pressure regulating valves and thermostatic expansion valves, the following procedure is recommended.

With the expansion valve at the Sporlan factory setting, or at a manufacturer's predetermined setpoint, and under the actual minimum load condition, the evaporator pressure regulating valve should be adjusted to the desired setting. Finally, if necessary, the thermostatic expansion valve or valves can be adjusted to the desired superheat setting while under the normal operating load condition.

When an evaporator pressure regulating valve has been operating for a period of time at a given setting and an increase in the setting is required, as much as 30 minutes may be required for the new balance to take place after an adjustment is made. If the valve is being adjusted to a lower setting an immediate response to an adjustment should be observed.

To adjust the ORIT valves, turn the adjustment screw with a 3/8" hex wrench. A clockwise rotation increases the valve setting, while a counterclockwise rotation decreases the setting. To obtain the desired setting, a pressure gauge should be utilized on the inlet side of the valve so the effects of any adjustments can be observed.

When ORITs are installed in parallel, each should be adjusted the same amount to obtain optimum performance. If one valve has been adjusted more than the other, both valves should be adjusted all the way in before resetting them an equal amount.

SERVICE INSTRUCTIONS

The ORIT-12, -15, and -20 can be easily disassembled for inspection and cleaning, or for replacement of the pilot assembly. The pilot assembly is available with (Kit number K-Y896) or without (Kit number K-Y819) the solenoid stop valve. **The solenoid stop valve is neither available separately and should not be removed from the pilot regulator, nor should a standard solenoid valve be added to the pilot assembly to achieve the stop feature.** The pilot port is critically sized with an orifice in the outlet of the pilot assembly. The pilot kits contain: 1 pilot assembly; 2 gaskets (tetraseal for (S)ORIT-12 and -15; composition gasket for (S)ORIT-20), and 1 copper flare gasket for the (S)ORIT-20.

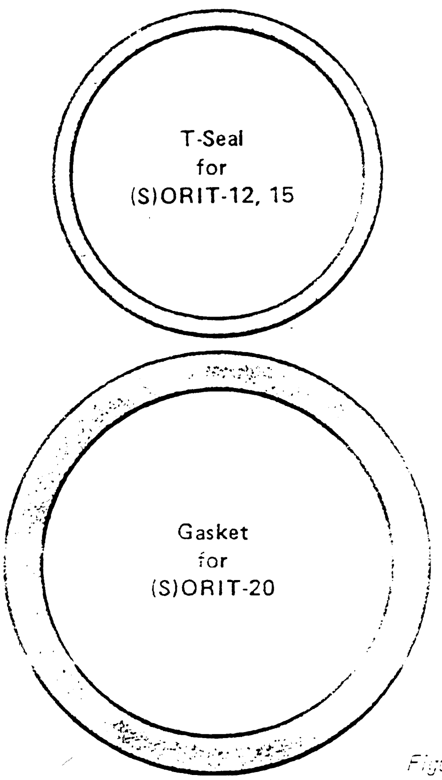


Figure 1

CAUTION: Before removal the pilot assembly should be isolated from the high pressure power source, and the main valve body should be isolated from inlet and outlet pressures. The ORIT-12, -15, and -20 are normally open and therefore by closing off the pilot supply pressure (closing pressure), the ORIT main piston will shift to the full open position.

(S)ORIT-12 and -15 PILOT REPLACEMENT INSTRUCTIONS

1. Disconnect the three connections of the pilot valve. They are:
   - —inlet (high pressure source)
   - —outlet
   - —and external equalizer

2. With the locknut or body flange still intact, place a wrench on the body of the pilot valve, turn counterclockwise and remove the pilot assembly from the adapter.

3. Using the appropriate tool (chain wrench, Rigid #E-110 or a monkey wrench for (S)ORIT-12 and 1/4" allen wrench for (S)ORIT-15) remove the locknut ((S)ORIT-12) or flange ((S)ORIT-15) and adapter.

4. The pilot assembly for the (S)ORIT-12, -15, and -20 is identical except the bottom fitting is not necessary for the (S)ORIT-12 or -15 and should be removed as follows.

Using appropriate wrenches or a vise, properly support the new pilot valve body in the inverted position so the internal parts do not fall out when the bottom fitting is removed. Turn the bottom fitting counterclockwise and remove. Replace the bottom fitting with the adapter and turn clockwise until handtight.

NOTE: The lockring ((S)ORIT-12) or flange ((S)ORIT-15) should now be between the pilot valve body and the adapter.

(CONTINUED ON PAGE 4)

REPLACEMENT PARTS AND PARTS KITS

★Included in Parts Kit

ITEM	DESCRIPTION		(S) ORIT-12 PART NO.	(S) ORIT-12 K-Y896	(S) ORIT-12 K-Y819	(S) ORIT-12 KS-ORI-12	(S) ORIT-15 PART NO.	(S) ORIT-15 K-Y896	(S) ORIT-15 K-Y819	(S) ORIT-15 KS-ORI-15	(S) ORIT-20 PART NO.	(S) ORIT-20 K-Y896	(S) ORIT-20 K-Y819	(S) ORIT-20 KS-ORI-20
1	Pilot Valve Assembly	With Solenoid	Y896	★			Y896	★			Y896	★		
		Without Solenoid	Y819		★		Y819		★		Y819		★	
2	Inlet Strainer Screen		2445	★	★		2445	★	★		2445	★	★	
3	Copper Flare Gasket		—				—				JP-543-2	★	★	
4	Cap Screw		—				507				509			
5	Body Flange		—				2420				2423			
6	Adaptor		2433			★	2421				2422			
7	Gasket or T-Seal		641-6	★	★	★	641-6	★	★	★	938	★	★	★
8	Piston Assembly		2432			★	2410			★	2251			★
9	Body Sleeve		—				2419			★	2250			★
10	Sleeve "O" Ring		—				621-28			★	621-31			★
11	Bottom Spring		2434			★	2416			★	2295			★
12	Lock Nut		13681				—				—			

The pilot valve is available with or without the solenoid stop valve. The solenoid stop valve is not available separately and should not be removed from the pilot regulator.

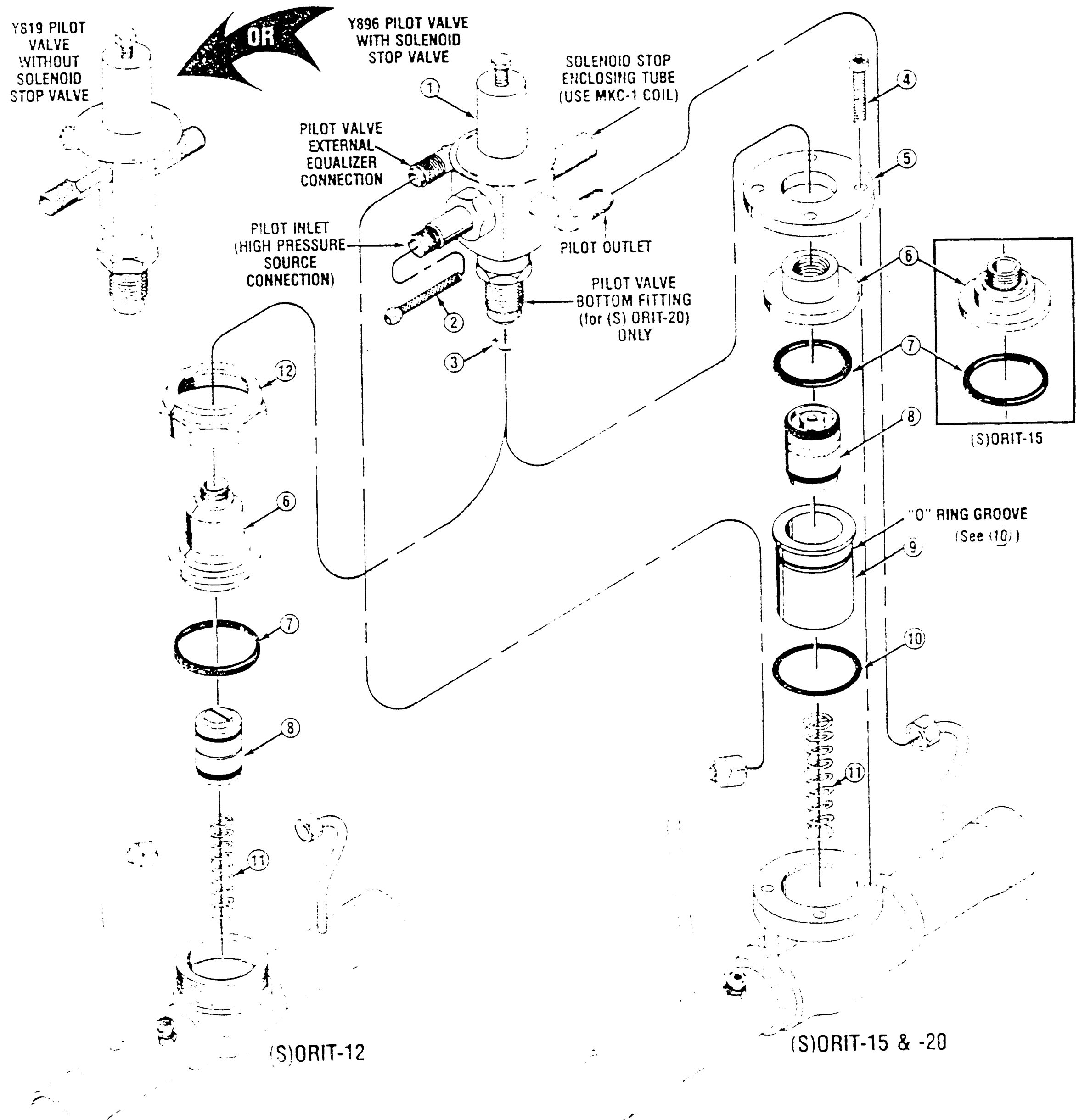


Figure 2

5. With the old tetraseal still in place, mount the complete pilot assembly to the main valve body. Tighten the locknut to [illegible] ft. lbs or the cap screws uniformly. Do not yet attempt to align the pilot connections. Placing an appropriate wrench on the pilot valve body, turn clockwise to further tighten the [illegible] valve to the adapter.

6. Remove the locknut or cap screws and pilot assembly from the main valve body and replace the tetraseal in the mating groove of the adapter. Two gaskets are supplied with each pilot assembly kit. The correct gasket for the (S)ORIT-12 and -15 is the tetraseal. See Figure 1 for actual dimensions of the tetraseal.

7. Again mount the complete pilot assembly to the main valve body. Properly align the three pilot connections and tighten the locknut to 30 ft/lbs. Excessive tightening is not required on the (S)ORIT-15, but uniformity of compression from the four cap screws is important. Complete the installation by joining the three pilot connections.

[illegible] REPLACEMENT [illegible]

1. Disconnect the three connections of the pilot valve. They are:
   - —inlet (high pressure source)
   - —outlet
   - —and external equalizer

2. With the flange still intact, place a wrench on the bottom fitting of the pilot valve. Turn counterclockwise and remove the pilot assembly.

3. Replace the copper flare gasket and install the new pilot assembly. (At this point the flange is still securely bolted to the valve body.) Again place a wrench on the bottom connection of the pilot valve. Turn clockwise until the pilot assembly is firmly in place. Do not attempt to align the three pilot valve connections.

4. Remove the four cap screws with a 1/4" Allen wrench and replace the flange adapter gasket. See Figure 1 for actual dimensions of the gasket.

5. Reassemble the flange and cap screws. Before completely tightening the cap screws, rotate the pilot valve to properly align the inlet, outlet, and external equalizer connections. Join these connections and tighten the cap screws. The (S)ORIT-20 gasket is a composition gasket and, therefore, a torque value is not recommended but the flange must be bolted down evenly and firmly. The pilot replacement is now complete.

[illegible] EMENT

Remove the complete pilot assembly as described in step 3 of the "Pilot Replacement Instructions". The piston assembly is housed by the adapter and can be pulled out by the center cap screw head in the bottom of the piston with a needle nose pliers. Inspect all other internal parts for wear or dirt.

[illegible] -20:

Remove the four cap screws with a 1/4" Allen wrench. The complete pilot assembly, adapter, and body flange can now be lifted off the main valve body. Inspect all internal parts for wear or dirt.

SERVICE TIPS

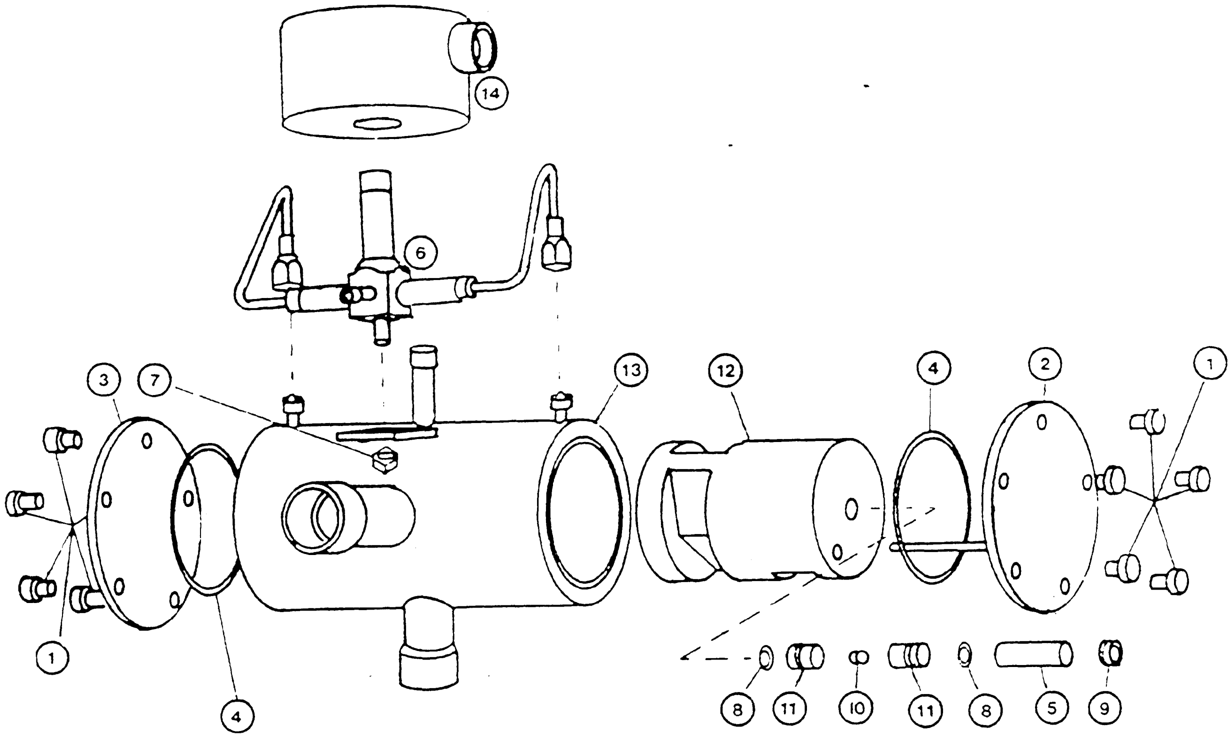
MALFUNCTION	CAUSE	REMEDY
Failure to open	1. Dirt or foreign material holding pilot port open. 2. Pilot solenoid valve coil failure.	1. Disassemble and clean pilot port. 2. Replace solenoid valve coil. Use the MKC-1 coil of proper voltage.
Does not regulate or regulates sluggishly	1. The high pressure source supplied to the inlet of the pilot valve must be at least 50 psi above the outlet suction pressure of the (S)ORIT. 2. If the pilot supply line is of considerable distance, condensing may occur.	1. Relocate pilot valve power source. 2. Insulate pilot supply line or if supply line originates from the top of the receiver move it to the top of the discharge line.
Failure to close for defrost	1. High pressure supply line pinched shut or plugged. 2. T-seal or gasket between adaptor and valve body does not seal. If this should occur pressure can bleed out of the chamber faster than can be supplied by the pilot valve. 3. Dirt or foreign material either lodged between piston and sleeve causing hang-up or excessive scoring in the sleeve or the piston allowing the high pressure to bleed out of the chamber above the piston. 4. Inlet strainer to pilot plugged with foreign material. 5. Refrigerant flow through pilot is restricted by oil in the pilot supply line either due to a trapped supply line or too much oil in the system. 6. Pilot supply pressure originates from a lower pressure source than is used for defrost.	1. Replace or clean high pressure supply line. 2. Replace T-seal or gasket. These should be replaced any time the pilot assembly is removed from the valve body. 3. Clean or if necessary replace the piston and the sleeve. 4. Clean or replace strainer. 5. Check the pilot supply line to be sure that it is [illegible] and that it does not serve as an oil trap. 6. If the pilot pressure source originates from the top of the receiver and the valve is not closing for defrost move the pilot supply pressure source to the discharge line.

Product Engineering Corporation

Installation & Service Instructions

Sizes 06 — 12

THIS VALVE IS INTENDED FOR USE WITH R12, R22, R500, and R502, AT A MAXIMUM FLUID TEMPERATURE OF 149° C. FOR OTHER REFRIGERANTS, PLEASE CONSULT THE MANUFACTURER.

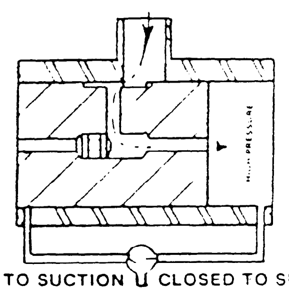


NO		DESCRIPTION	QTY	-06-	-07-	-090-	-12-
*#+	1	CAP SCREWS	[illegible]	(10) 40-06	(10) 40-07	(12) 40-09	(12) 40-12
	2	PIN CAP	1	60-06	60-07	60-09	60-12
	3	END CAP	1	61-06	61-07	61-09	61-12
*#+	4	'O' RING	2	50-06	50-07	50-09	50-12
+	5	SLAVE SPACER	1	06-1-9	07-1-9	09-1-9	12-1-9
#	6	PILOT ASSEMBLY	1	P200-2- (VALVE NUMBER)			
+	7	PILOT NUT	1	P200-2-3	SAME FOR ALL VALVES		
+	8	SLAVE 'O' RING	2	P200-50	SAME FOR ALL VALVES		
+	9	LOCKING SCREW	1	P200-1-4	SAME FOR ALL VALVES		
+	10	SLAVE PILOT PISTON	1	P200-1-5	SAME FOR ALL VALVES		
+	11	SLAVE PILOT SEAT	2	P200-1-6	SAME FOR ALL VALVES		
	12	SPOOL	1	NOT AVAILABLE			
	13	BODY	1	NOT AVAILABLE			
	14	COIL	1	AP100-1-16- (CONSULT COIL CATALOG FOR VOLTAGE AND LEAD LENGTH REQ'D)			

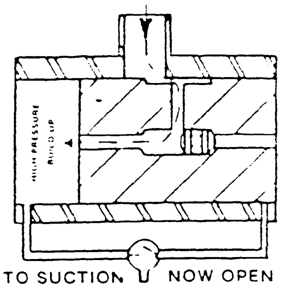
* These items included in Inspection Kit
\# These items included in Pilot Kit
\+ These items included in Slave Pilot Kit

--OPERATION--

With the valve in the de-engerized position (Fig 1), high pressure gas is being directed to end 'B' of the valve through the slave pilot inside the spool. If the solenoid pilot is then energized, end 'B' of the valve will become open to the suction side of the system through the solenoid pilot valve, allowing the high pressure gas to escape. The drop in pressure will pull the slave pilot piston toward end 'B', thereby routing the high pressure gas to end 'A' of the valve and push the spool toward the lower pressure at end 'B' (Fig 2)



(FIGURE 1)



(FIGURE 2)

INSTALLING A P.E. VALVE

Do not disassemble the valve before, during or after installing. Disassembly is not necessary while brazing, but overheating of the connections will make brazing more difficult. A thick consistency flux is required to ensure no flux enters the valve. Use silver solder only on steel stub valves. DO NOT USE WET RAGS FOR COOLING, as steam will be drawn into the valve and will cause rusting.

It is important that the tubing be formed accurately so that strain will not be exerted on the stubs and the valve body. DO NOT MOUNT OR SUPPORT THE VALVE BY CONNECTIONS AROUND THE BODY OR THE STUBS, but around the system tubing only, otherwise the valve could bind.

FUNCTION TESTING AND SERVICING

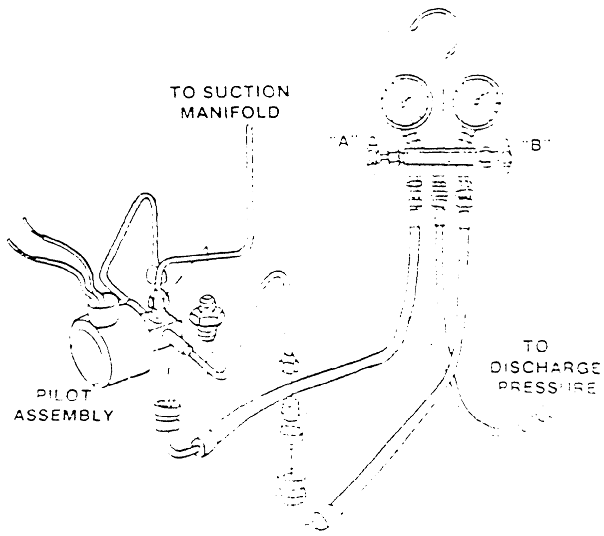
A. Check valve and stubs for binding, valve installed in a bind will not function.
B. Check connections on main valve body and pilot assembly and tighten or solder any leaks.
C. Check both end caps for leaking and tighten if necessary, if leak persists, replace 'o' ring. (Refer to G)

D. CHECK THE SOLENOID COIL

The only way to check the solenoid is to take it off the armature, turn it on and test the magnetic pull with a metal rod. CAUTION: Leaving the coil 'ON' for more than one minute when it is removed from the armature will burn it out.

E. CHECK THE PILOT ASSEMBLY

1. Pilot should be de-energized.
2. Referring to Figure 3, connect a refrigeration gage set to the flare nuts of the pilot assembly tubing.
3. Open shut-off valve on suction manifold, connecting pilot assembly to suction pressure.
4. Connect gage center hose to a discharge connection such as the discharge service valve of a compressor. Gage valves A & B to be closed.
5. Crack gage valves A & B to allow a pressure reading on both gages. One gage should read discharge pressure, one should read lower than discharge pressure as the pressure is flowing through the pilot assembly into the suction manifold.
6. Energize the pilot solenoid, the two gage pressure readings should reverse indicating the pilot is working properly.
7. If both gages read high or low, the pilot is either dirty or stuck. Two highs mean the pilot assembly needs cleaning and or replacing.



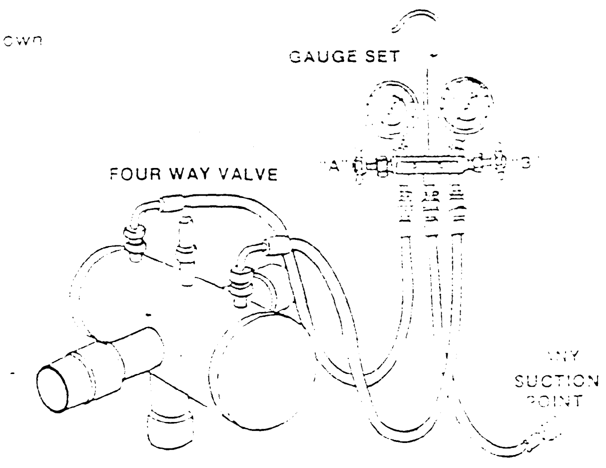
NOTE: TO CLEAN THE PILOT ASSEMBLY

With gages connected as in Figure 3, shut off pressure source to center gage hose and open hose to atmosphere. Open both gage hand valves and energize and de-energize the solenoid several times. Then recheck for proper operation.

F CHECK MAIN VALVE

P E. valves can be checked for operation in the system without the unit shut down

1. Close the hand shut-off valve for the pump-out line
2. Close the shut-off valve for the pilot valve to suction connection
3. Disconnect the lines from pilot assembly to main valve body. One connection will continue to bleed vapor, this is normal
4. Connect gage set to ¼" SAE flares in main body (Fig 4) Hand valves A & B should be closed
5. Connect the center nose of the gage set to any suction connection, such as a compressor suction service valve.
6. Open hand valve A of gage set. The spool will shift to the end where nose A is connected. The A gage will read suction pressure, the B gage will read discharge pressure.
7. Close gage A and open gage B. The spool will shift to the end where nose B is connected. Now gage B will read suction pressure and gage A will read discharge pressure.
8. Repeat steps 6 & 7 several times. If no shift occurs, the main valve or the slave pilot has contamination.



(FIGURE 4)

G. TO DISASSEMBLE THE VALVE

The unit must be completely shut down. Be extremely careful with the inner parts, which are not interchangeable. Each spool is a [illegible] with its own body.

To disassemble the valve, loosen all the end cap screws between ⅛" and ¼" and tap end caps lightly. If there is any vapor still remaining in the valve, this will release it. (CAUTION: If the removing of the caps is not done in this way and one cap is removed, any vapor still in the valve will cause the spool to shoot out the open end, resulting in possible injury to service personnel and likely damage to the spool.) When there is no more vapor in the valve remove end caps and carefully slide the spool out. If the spool is too tight to remove by hand, DO NOT HAMMER IT. A piece of nylon or soft, clean wood may be used. When the spool is out, clean the spool and body with a lint free towel. It is not recommended that the slave pilot be removed because it is factory seated, but if something is protruding from either end hole, remove the pilot, clean it and carefully replace it in the exact order it came apart.

TO REASSEMBLE THE VALVE

Use the drawing on the white sticker (on the non-pin end cap) to check which end of the valve that cap goes on. The spool will accordingly be oriented with the pin hole toward the other end. The shallow lengthwise groove in the spool which connects two of the crosswise slots [illegible] into the discharge stub. Once you have determined the general orientation of the spool, oil it and align it so that it will enter the [illegible]. Again, DO NOT USE A HAMMER to force it in. Do not attempt to loosen the spool by sanding it, as this will make it leak internally. C[illegible] grooves in ends of the body. Replace index pin cap first, making sure the pin is locating properly in the spool. The screw holes are [illegible] the end cap will only match in the correct radial position. Replace other cap and tighten screws. When replacing end caps to be sure to [illegible] screws and 'o' rings as furnished in P E. inspection kits. Repeat function test of valve; if it will not operate replace it.

PRODUCT ENGINEERING CORP.

MAILING: P.O. Box [illegible]
Asheville, NC 28813

SHIPPING: [illegible]
Asheville, NC 28803

PHONE: (704) 274-1286

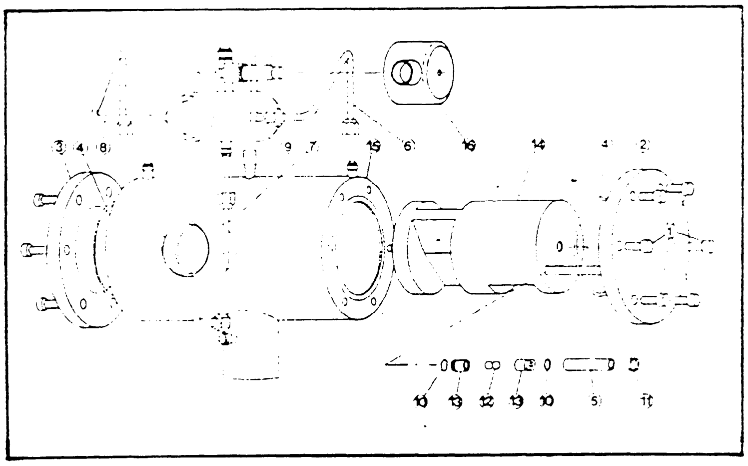
TELEX: 510-933-0158 PRODENGCO AVL

Product Engineering Corporation

Installation & Service Instructions

Sizes 15 — 21

THIS VALVE IS INTENDED FOR USE WITH R12, R22, R500, and R502, AT A MAXIMUM FLUID TEMPERATURE OF 149° C. FOR OTHER REFRIGERANTS, PLEASE CONSULT THE MANUFACTURER



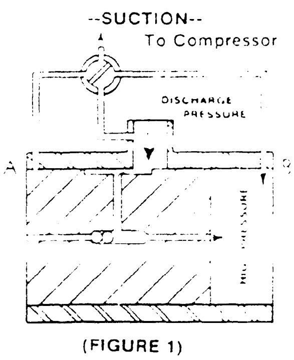
	NO	DESCRIPTION	QTY	15	18	21
• +	1	CAP SCREWS	12	40-15	40-18	40-21
	2	PIN CAP	1	60-15	60-18	60-21
	3	END CAP	1	61-15	61-18	61-21
• +	4	'O'-RING	2	50-15	50-18	50-21
+	5	SLAVE SPACER	1	15-1-9	18-1-9	21-1-9
	6	HIGH PILOT LINE	1	15-1-14	18-1-14	21-1-14
	7	MID PILOT LINE	1	15-1-15	18-1-15	21-1-15
	8	LOW PILOT LINE	1	15-1-13	18-1-13	21-1-13
#	9	PILOT VALVE	1	P300	SAME ON ALL VALVES	
+	10	SLAVE 'O'-RING	2	P200-50		
+	11	LOCKING SCREW	1	P200-1-4		
+	12	SLAVE PILOT PISTON	1	P200-1-5		
+	13	SLAVE PILOT SEAT	2	P200-1-6		
	14	SPOOL	1	NOT AVAILABLE		
	15	BODY	1			
	16	COIL	1	AP100-1-16-	(CONSULT COIL CATALOG FOR VOLTAGE AND LEAD LENGTH REQ'D.)	

• These items included in the Inspection Kit
This item constitutes the Pilot Assembly.
+ [illegible] included in the Slave Pilot Kit

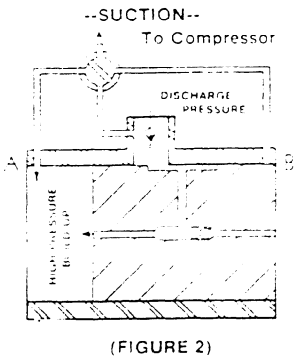
--OPERATION--

With the valve in the de-engerized position (Fig. 1), high pressure gas is being directed to end 'B' of the valve through the slave pilot and [illegible]

If the remote pilot valve is then energized, end 'B' of the main valve will open to suction and move the slave pilot ball to its opposite [illegible] pressurizing end 'A' of the valve and starting the spool moving toward end 'B'. When the spool clears the pilot connection at end 'A' [illegible] pressure gas will flow into that end, and will accelerate the shift of the spool toward end 'B' (Fig. 2)



(FIGURE 1)



(FIGURE 2)

--INSTALLATION--

INSTALLING A P.E. VALVE

[illegible] the valve [illegible] during [illegible] after installing. Disassembl[illegible] when brazing, but overheating the connect[illegible] the brazing more difficult. A thick consistency flux is required [illegible] enters the valve. Use silver solder only when brazing [illegible] valves. DO NOT USE WET RAGS FOR COOLING: steam will [illegible] into the valve and cause rusting. It is suggested that one play [illegible] torch more on the system tubing than on the valve connect[illegible].

[illegible] that the tubing be formed accurately so that strain will [illegible] the stubs and the valve body. DO NOT MOUNT OR [illegible] THE VALVE BY CONNECTIONS AROUND THE BODY OR THE STUBS [illegible] the system tubing only, otherwise the valve could [illegible]

FUNCTION TESTING AND SERVICING

A. [illegible]k the valve for binding. Because the body and spool are a precision fit, any [illegible] tension applied to the valve or stubs can keep the spool [illegible] shifting. In installation, do not support the valve by connections [illegible] the stubs. Avoid long runs of straight pipe leading [illegible] the valve, which in expanding or contracting could compress the [illegible]

[illegible] any tension on the valve, anneal the lines 12" to 18" away from the [illegible] by heating the lines with a torch until they are red hot.

[illegible] the connections on the main valve body and the pilot assembly [illegible] solder any leaks.

[illegible] end caps for leaking and tighten if necessary. If leak persists [illegible] the neoprene o-rings. Unit must be shut down [illegible] pressure [illegible] all end cap screws [illegible] to [illegible] and tap [illegible] something soft (a piece of nylon or soft clean w[illegible] vapor [illegible] the valve. (CAUTION: If the removing of the [illegible] this way, the vapor in the valve could cause the [illegible] out the opened end, resulting in possible injury to service [illegible] damage to the spool.) When there is no vapor in the [illegible] remove end caps and replace the o-rings.

CHECK THE SOLENOID COIL

[illegible] way to check the solenoid coil is to take it off the armature, turn it [illegible] the magnetic pull with a metal rod. CAUTION: [illegible] ON for more than one minute when it is removed from the armature will burn it out.

CHECK THE PILOT ASSEMBLY

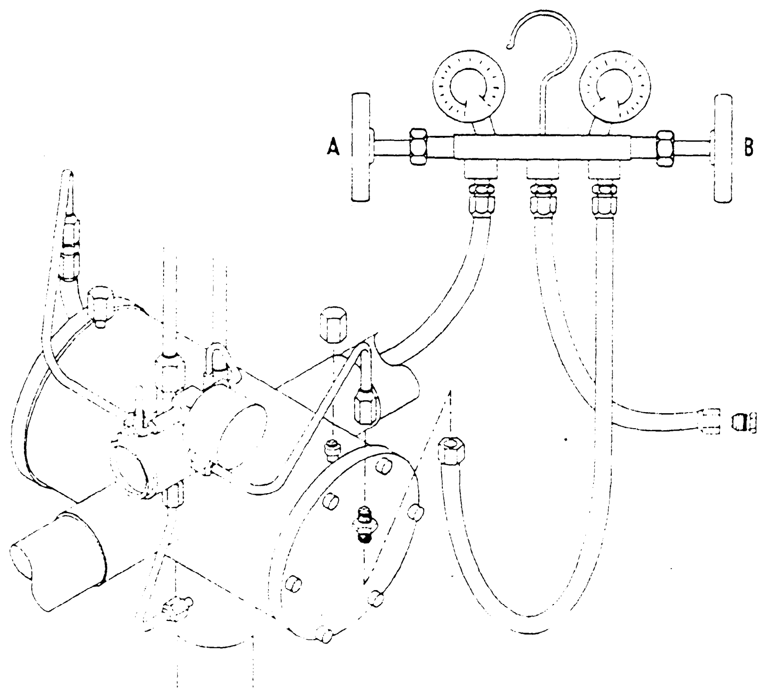
[illegible] Equipment
[illegible] gage set with hoses
[illegible] SAE Unions
[illegible] SAE Flare Cap
[illegible] SAE Plug

[illegible] the unit shut down, attach the gage set hoses [illegible] the pilot lines as shown in Fig. 3. Use the Flare [illegible] main-valve-body-to-pilot connections [illegible] plug the gage set middle hose.

[illegible] hand valves fully open and the valve de-[illegible], gage A should read discharge pressure and gage B should read suction pressure.

[illegible] the coil is energized, gage B should read [illegible] pressure and gage A should read suction pressure.

4. Repeat steps 3 and 4 several times. If the pilot valve [illegible] cleaned or repaired, and [illegible] replaced with the appropriate P.E. Pilot Assembly.



(FIGURE 3)

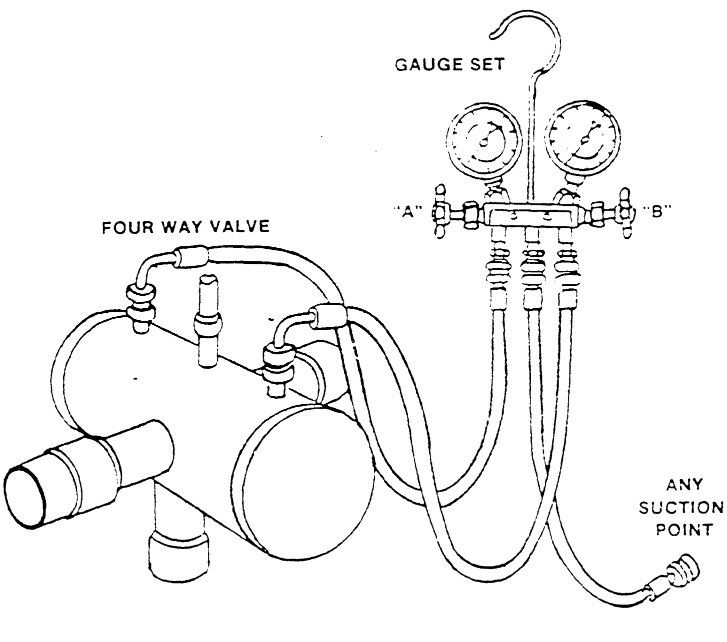
F. **CHECK THE MAIN VALVE**

To check the main valve for malfunction DO NOT REMOVE FROM SYSTEM. Heat reclaim valves can be completely checked for operation in the system.

Required Equipment:

(1) Serviceman's gage set with hoses
(2) ¼ SAE Plugs
(1) ¼ SAE Flare Cap

1. Close the hand shut-off valve for the pump-out line.
2. Close the shut-off valve for the pilot-valve-to-suction connection.
3. Disconnect the lines from the pilot assembly to the main valve body, plug the pilot lines, and cap the SAE ¼ flare connection on the side of the Discharge stub.
4. Connect the gage set to the ¼ SAE connections of the main valve body. (Fig. 4) Hand valves A and B should be closed.
5. Connect the center hose of the gage set to any suction connections, such as a compressor suction service valve.
6. Open hand valve A of the gage set. The spool will shift to the end of the valve where A is connected. The A gage will display suction pressure; B will show discharge pressure.
7. Close gage A and open gage B. The spool should shift to the end where hose B is connected. Now gage B will indicate suction pressure; and gage A will show discharge pressure.
8. Repeat steps 6 & 7 several times. If no shift occurs the main valve or the slave pilot has contamination, and may be disassembled and cleaned, following carefully the instructions given.



(FIGURE 4)

G. **TO DISASSEMBLE THE VALVE**

The unit must be completely shut down. Be extremely careful with the inner parts, which are not interchangeable. Each spool is a hone fit with its own body.

To disassemble the valve, loosen all the end cap screws between ⅛" and ¼", and tap the end caps lightly. If there is any vapor still remaining in the valve, this will release it. (CAUTION: If the removing of the end caps is not done in this way, any vapor still in the valve will cause the spool to shoot out the opened end, resulting in possible injury to service personnel and damage to the spool.) When there is no more vapor in the valve, remove the caps and carefully slide the spool out. If the spool is too tight to remove by hand, DO NOT HAMMER IT. A piece of nylon or soft, clean wood can be used. When the spool is out, clean the spool and body with a lint-free towel.

It is not recommended that the slave pilot be removed because it is factory seated, but if something is protruding from either end hole, remove the slave pilot, clean it and carefully replace it in the exact order it came apart.

H. **TO REASSEMBLE THE VALVE**

Use the drawing on the white sticker (on the non-pin end cap) to check which end of the valve that cap goes on. The spool will accordingly be oriented with the pin hole toward the other end. The shallow lengthwise groove in the spool which connects two of the crosswise slots must face into the discharge stub. Once you have determined the general orientation of the spool, oil it and align it so that it will enter the valve body. Again, DO NOT USE A HAMMER to force it in. Do not attempt to loosen the spool by sanding it, as this will make it leak internally. Oil the 'o'-ring grooves in the ends of the body. Replace index pin cap first, making sure the pin is locating properly in the spool. The screw holes are drilled so that the end cap will only match in the correct radial position. Replace other cap and tighten screws. When replacing end caps, be sure to use new screws and 'o'-rings as furnished in P.E. Inspection Kits.

Repeat function test of valve; if it will not function, replace it.

PRODUCT ENGINEERING CORP.

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Asheville, NC 28803

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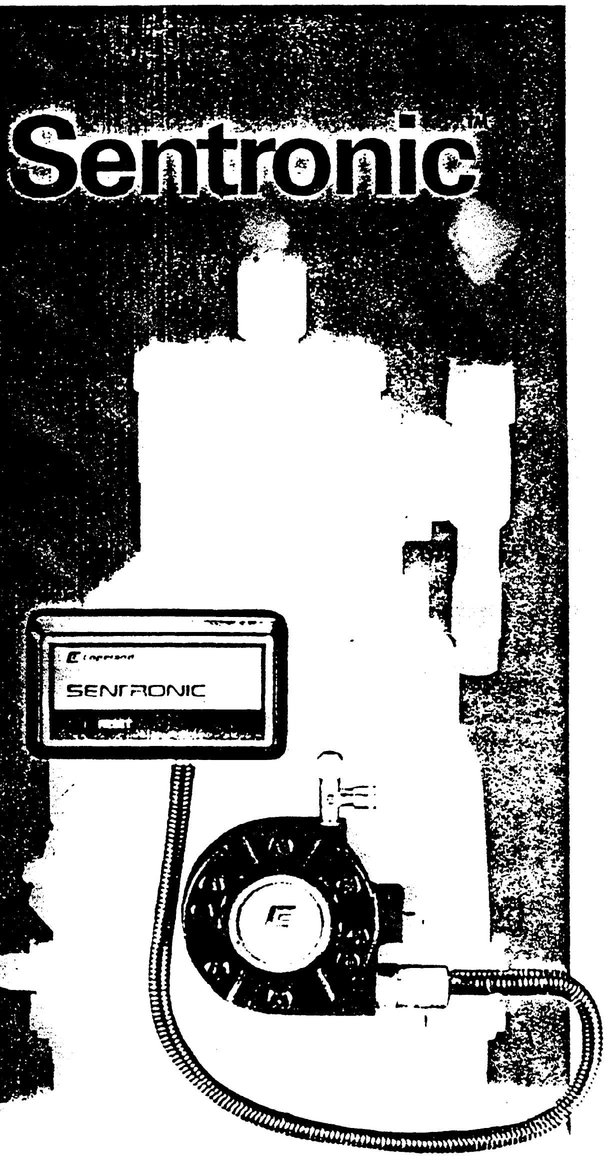
TELEX: 510-933-0158 PRODENGCO AVL

The Copeland Sentronic Oil Pressure Control

- The Copeland Sentronic Oil Pressure Control With Alarm Contact
- The Drop-in Replacement for Mechanical Switches
- How the Sentronic Operates
- How to Install the New Sentronic
- How to Check the New Sentronic Installed on a System
- How to Bench Test The New Sentronic Module



Copeland

Copeland Corporation has introduced a new version of the Sentronic with an alarm contact and mechanical reset. This version replaces the original Sentronic, and when used with a Sentronic compatible oil pump and differential pressure sensor, it is an exact drop in replacement for mechanically operated oil pressure safety controls.

Mounting dimensions and the electrical connections of the new Sentronic have been designed so that replacing an older oil pressure safety control is a simple matter. There are no complicated instructions and wiring changes are not necessary. Sentronics are directly interchangeable.

The new Sentronic can be distinguished externally from Sentronic controls presently in the field by its bright steel base plate. The base plate of the original Sentronic is black. Internally, terminals have been added marked; "A" for the added alarm contact and "2" for remote wiring.

All Sentronics use an identical sealed differential pressure sensor to precisely measure oil pump differential pressure. The main advantage of Sentronic over mechanically operated oil pressure safety controls is the elimination of traditional capillary tubes, bellows and mechanical fittings which can cause system refrigerant loss.

A second advantage of the Sentronic is the use of an electronic clock in the two minute timing circuit. Traditional mechanical controls use resistance heaters to provide timing in the event of low oil pressure. 208 volt systems or brown-out conditions cause the resistor heat input to be reduced, thus increasing the time out period and the danger of compressor damage when low oil pressure conditions exist.

Leak source elimination and precise timing that is repeatable under any ambient or voltage change, gives Sentronic greatly improved reliability, better overall protection, and fewer nuisance trips for any refrigeration system.

How Sentronic™ Operates

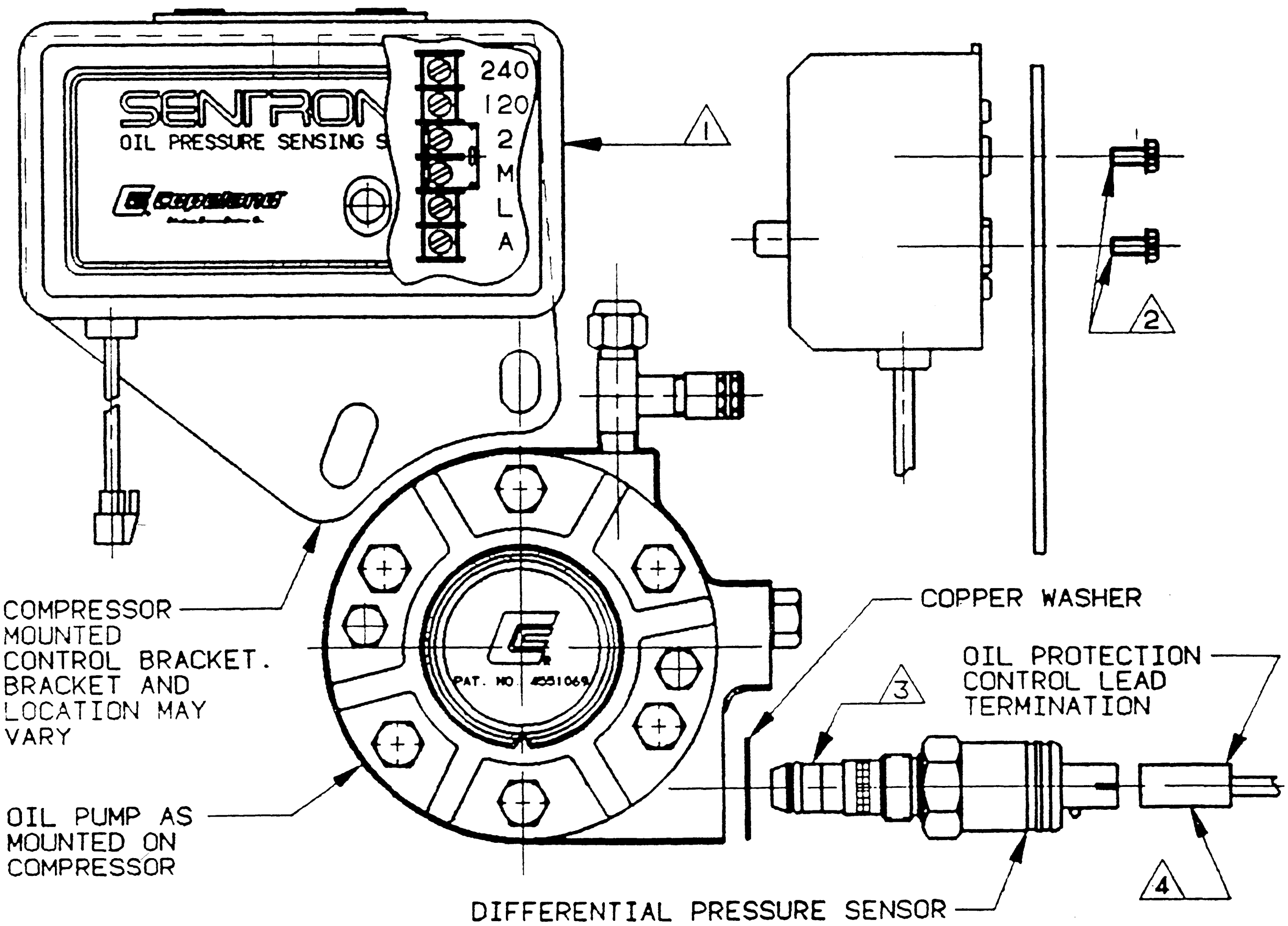
The Sentronic oil differential pressure sensor mounts directly into the oil pump. **The same sensor is used for all model Sentronics.** The sensor measures oil pump differential pressure, i.e., the difference between oil pump outlet pressure and crankcase pressure. The sensor sends an operating signal to the Sentronic module. Should oil pump differential pressure, measured between the crankcase and the oil pump outlet, fall below 7-9 psid (pounds per square inch differential), for a period of two minutes, the module will open the contact of its heavy duty control relay and stop the compressor. The new Sentronic has a SPDT (Single-Pole-Double-Throw) contact. The Normally-Closed (N.C.) half of the contact is used for shutdown on oil failure, while the Normally-Open (NO) half of the contact may be used in an optional alarm circuit.

A compressor will be damaged if it continues to run without sustained oil flow. The Sentronic is designed to protect against this. When a system cycles between safe and unsafe oil pressure, the Sentronic activates a special circuit that compares the percentage of time with good oil pressure to the time with low oil pressure. Sentronic counts the seconds the compressor has low oil pressure and stores the count. As soon as the compressor has good oil pressure for four continuous minutes, the count will be entirely erased. If not, and the net oil pressure continues to cycle, the stored count will continue to rise until Sentronic trips the compressor.

Although Sentronic is an electronic device, the latest version has been designed so that it can be reset without electric power applied. The reset button of Sentronic contains a permanent magnet. If the Sentronic control relay has tripped because of low net oil pressure and its N.C. relay contact has opened, depressing the reset button will cause the magnet in the button to pull the relay's movable contact back to its normal position. With the relay contact reclosed, Sentronic is returned to normal operation.

Temporary losses of power or short cycling are no problem to Sentronic . Its power supply has been designed to hold its memory intact for up to a minute without applied voltage.

A trip of the oil pressure safety control is a warning that the system has been running without proper lubrication. Repeated trips of the oil pressure safety control are a clear indication that something in the system requires immediate attention and corrective action. On a well designed and maintained system, there should be no trips of the oil pressure safety control. Repeated trips should never be accepted as a normal part of the system operation.



How to Check Sentronic™ Installed in a System

'his page describes an electrical check for the Copeland Sentronic oil pressure module and sensor installed in an ir-conditioning or refrigeration system.

his test must only be performed y qualified service personnel (see ext page for further information nd a bench test procedure for the ;entronic module).

nportant! Before energizing this ystem, make sure the Sentronic is vired correctly. Refer to the wiring liagrams in the Sentronic brohure. Failure to do so may result 1 a damaged control unit.

'his test is to be performed with he Sentronic oil pressure module ınd sensor connected to the sysem, and the system energized at he start of the test.

f at any time during this test sequence the Sentronic module appears to be malfunctioning, it should be bench tested.

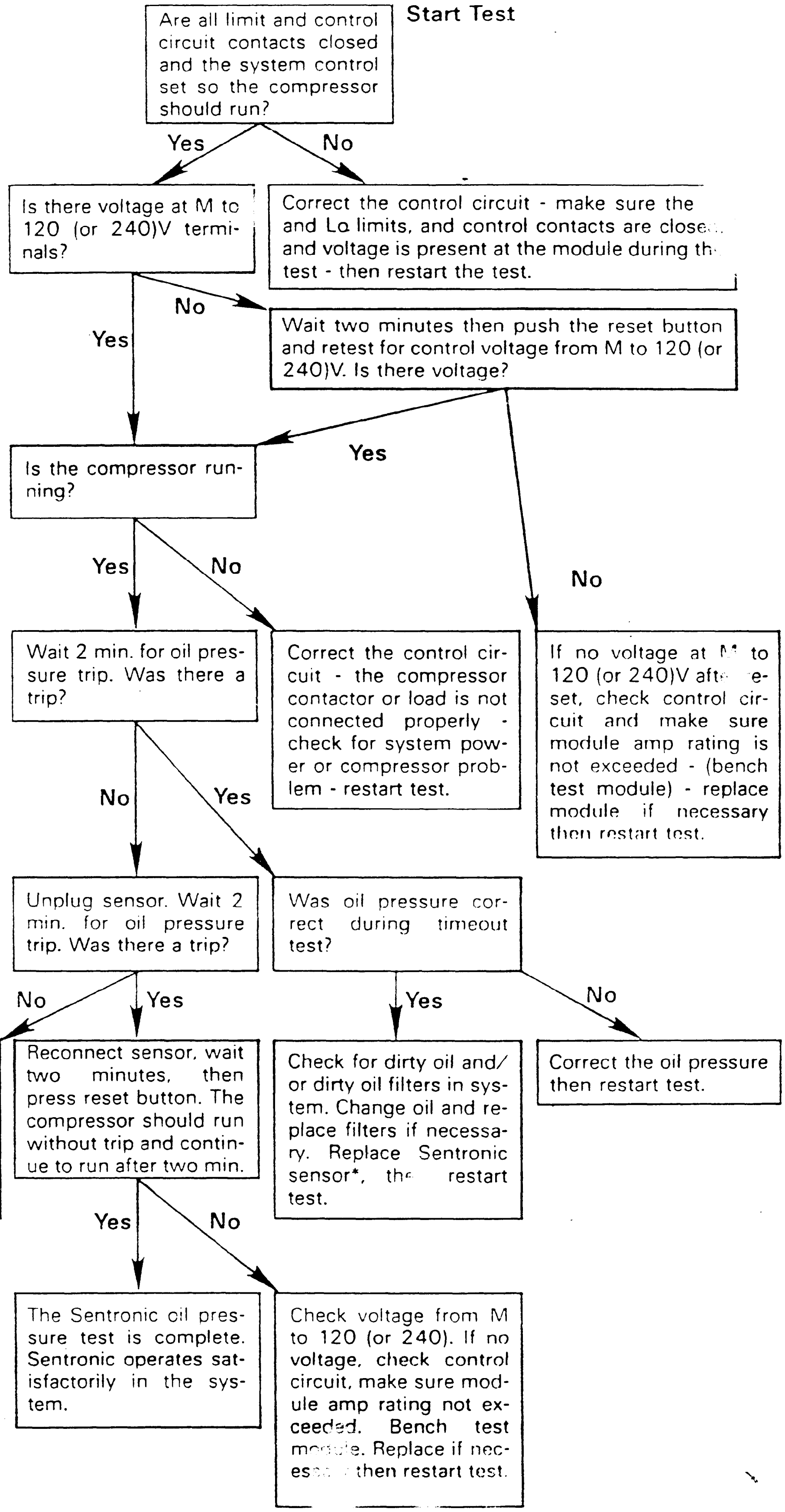
Sentronic Specifications:

Cut-in pressure 12-14 PSID
Cut-in pressure (Sensor contact closes)

Cut-out pressure 7 - 9 PSID
(Sensor contact opens)

Time Delay = 120 sec. ± 15 sec.

Maximum Allowable Controlled Load for the normally open and normally closed contacts =
120V, 6 Amps or
240V, 2.5 Amps.



* The Sentronic sensor differential pressure switch contacts should be closed when the compressor is running and open when the compressor is off or oil pressure is too low.

The switch contacts can be checked by removing the module connector from the sensor and using an ohmmeter on the sensor terminals.

Control Using an Alarm Circuit

The normally-open (N.O.) half of the SPDT (single pole double throw) Sentronic contact brings L2 voltage to the alarm load (A) when the control circuit is energized, the Sentronic has tripped, and its alarm contact has closed.

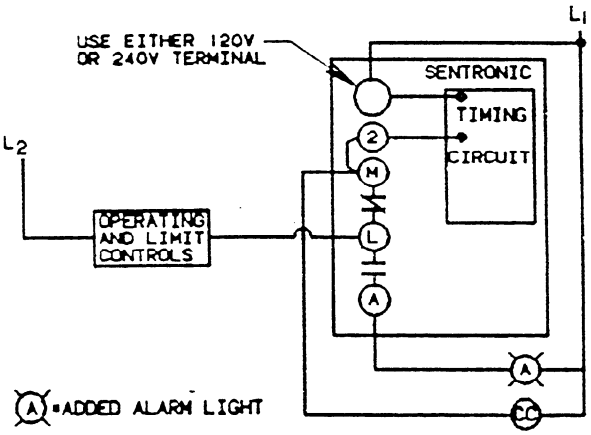


Diagram No. 2

Control with Current Sensing Relay

When a compressor with inherent motor protection is used, a current sensor (C.S.) is often placed in the control circuit. The (C.S.) contact which is normally open (N.O.), with no current flowing, prevents a false oil pressure trip if the compressor motor protector opens. When the protector recloses, and the compressor starts, the current relay recloses to provide voltage to Sentronic.

The addition of a control relay to ths circuit, which was necessary to the operation of the four and five terminal Sentronics, is not required when using the new Sentronic.

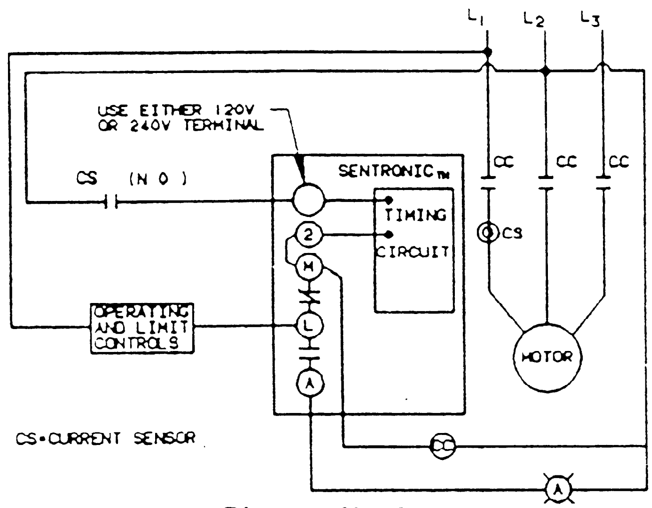


Diagram No. 3

Using the Sentronic Contact for Separate Control

Diagram #4 shows how Sentronic might be used with a voltage on its SPDT contact that is different from the voltage that supplies its power. Any AC. voltage up to and including 240V might be used.

To use the Sentronic contact for a separate voltage, remove the jumper between terminals "2" and "M". In this diagram, the separate control voltage is supplied by "LL1" and "LL2". The separate voltage powers the compressor contactor (CC), by means of a Remote Relay. When the Remote Relay is energized, requesting the compressor to run, its contact, (RR), closes to deliver "LL1" voltage to the operating and limit contacts. If the contacts in the operating and limit circuit are closed, "LL1" voltage energizes the compressor contactor coil (CC). When the compressor contactor closes, it provides the power, through a control circuit transformer (XFMR), to energize the Sentronic . If the Sentronic trips, its contact ("L" to "M") in the "LL1-LL2" control circuit opens to deenergize the compressor contactor and stop the compressor. The Sentronic contact ("L" to "M") closes to energize an Alarm Relay (AR).

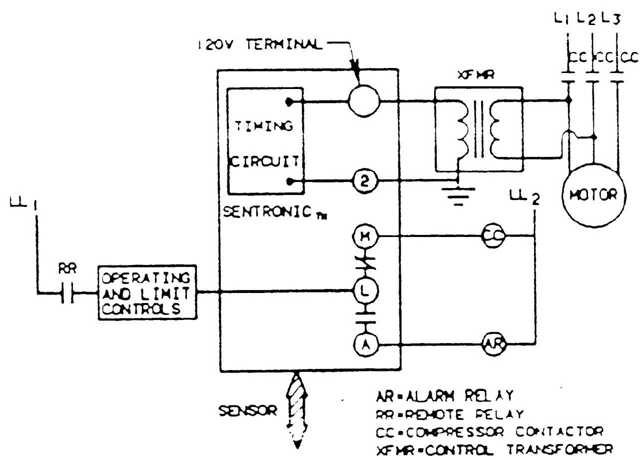


Diagram No. 4

Application Engineering Bulletin
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COPELAND DISCUS DEMAND COOLING

Introduction

HCFC-22, when used in a properly designed and controlled refrigeration system, is a realistic low temperature refrigerant alternative to CFC-502, which must be phased out due to its high ozone depletion potential. However, experience has shown that HCFC-22 can present problems as a low temperature refrigerant because under some conditions the internal compressor discharge temperature exceeds the safe temperature limit for long term stability of refrigeration oil.

The Copeland Demand Cooling System (see Figure 1) uses modern electronics to provide a reliable cost effective solution to this problem. It is required for all single stage HCFC-22 applications with saturated suction temperatures below -10°F.

Demand Cooling is compatible with single (conventional) units as well as parallel racks.

The Demand Cooling module uses the signal of a discharge head temperature sensor to monitor discharge gas temperature. If a critical temperature is

DEMAND COOLING SYSTEM

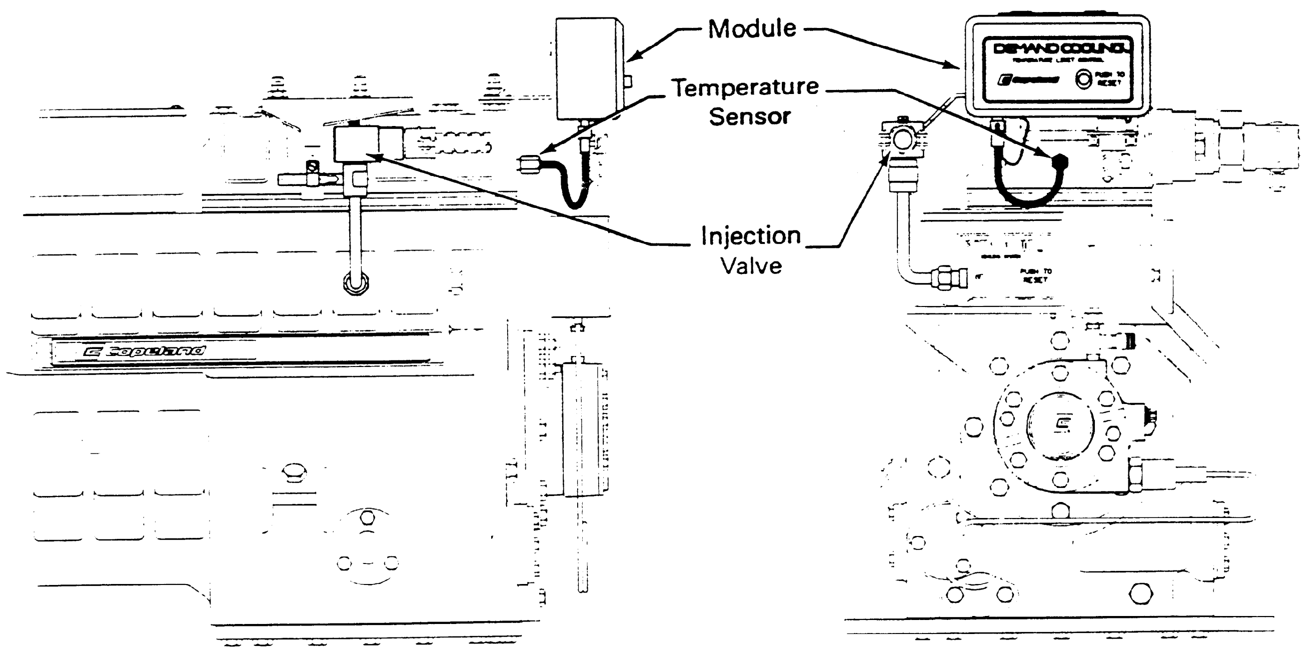


Figure 1

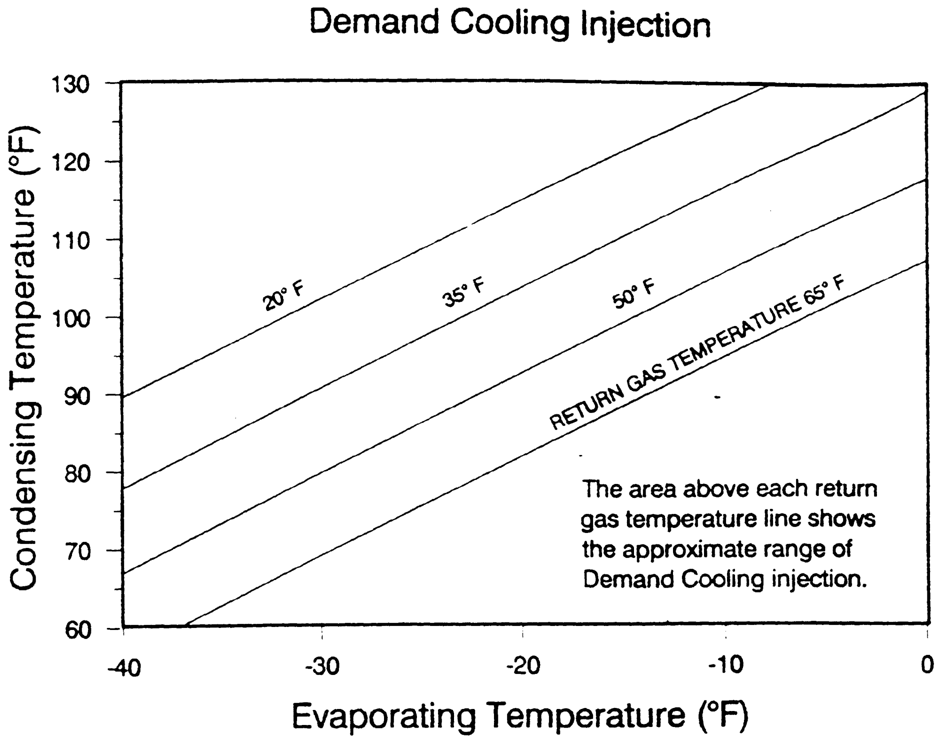


Figure 2

reached, the module energizes a long life injection valve which meters a controlled amount of saturated refrigerant into the compressor suction cavity to cool the suction gas. This process controls the discharge temperature to a safe level. If, for some reason, the discharge temperature rises above a preset maximum level, the Demand Cooling module will turn the compressor off (requiring a manual reset) and actuate its alarm contact. To minimize the amount of refrigerant which must be injected, the suction gas cooling process is performed after the gas has passed around and through the motor.

Injection valve orifices have been carefully chosen for each body style to be large enough to provide the necessary cooling when required but not so large that dangerous amounts of liquid are injected, or that excessive system pressure fluctuation occurs during injection valve cycling. Normally, pressure fluctuations are no greater than 1 to 2 psi. It is important to use the correct valve for each compressor body style.

Performance data for Demand Cooling compressors includes the effects of injection when it is required. The approximate conditions where injection occurs are shown in Figure 2. At the conditions where Demand Cooling is operating, the performance values are time averages of the instantaneous values, since small fluctuations in suction and discharge conditions occur as the Demand Cooling injection valve cycles.

While the refrigerant injection concept has been widely recognized for some time, its application has not been widely used since the early 1960's because of the widespread availability of CFC-502, reduction of capacity and efficiency, and poor reliability of injection systems.

The Copeland Demand Cooling system addresses the capacity and efficiency issues by limiting injection to those times when it is required to control discharge temperatures to safe levels. For most applications this will only be during periods of high condensing temperatures, high return gas temperatures, or abnormally low suction pressure. The Demand Cooling system has been designed to meet the same high reliability standards as Discus compressors.

In most cases, with floating head systems where condensing temperatures are low during most of the year, Demand Cooling will operate primarily as a compressor protection control much as the oil failure control protects the compressor during periods of low oil pressure. Demand Cooling will be called to operate only during those periods when condensing temperatures and return gas temperatures are high or in periods where a system failure (such as an iced evaporator, an expansion valve which does not control superheat, blocked condenser, or a failed condenser fan) raises condensing temperatures or return gas temperatures to abnormally high levels or lowers suction pressure to abnormally low levels.

Operating Range

Demand Cooling is designed to protect the compressor from high discharge temperatures over the evaporating and condensing temperature ranges shown in Figure 2 at a maximum return gas temperature of 65°F.

Demand Cooling System Design

When Demand Cooling operates, it "diverts" refrigeration capacity in the form of injected saturated refrigerant from the evaporator to the compressor (See Figure 3 for a typical single system schematic). The effect of this diversion on evaporator capacity is minimal because the diverted capacity is used to cool the gas entering the compressor. As the gas is cooled, it naturally becomes more dense, increasing the mass flow through the compressor, which partly compensates for the capacity diverted from the evaporator.

If there is substantial heat gain along the suction line, injection may result in a substantial loss in evaporator capacity during Demand Cooling operation. In order to minimize this loss, good practice indicates Demand Cooling operation be kept to a minimum through proper system design and installation practices. There are three areas which can be addressed to minimize the impact of Demand Cooling operation on performance.

1) Compressor Return Gas Temperature: Suction lines should be well insulated to reduce suction line heat gain. Return gas superheat should be as low as possible consistent with safe compressor operation.

2) Condensing Temperatures: It is important when using HCFC-22 as a low temperature refrigerant that condensing temperatures be minimized to reduce compression ratios and compressor discharge temperature.

3) Suction pressure: Evaporator design and system control settings should provide the maximum suction pressure consistent with the application in order to have as low a compression ratio as possible.

DEMAND COOLING™ SYSTEM DIAGRAM

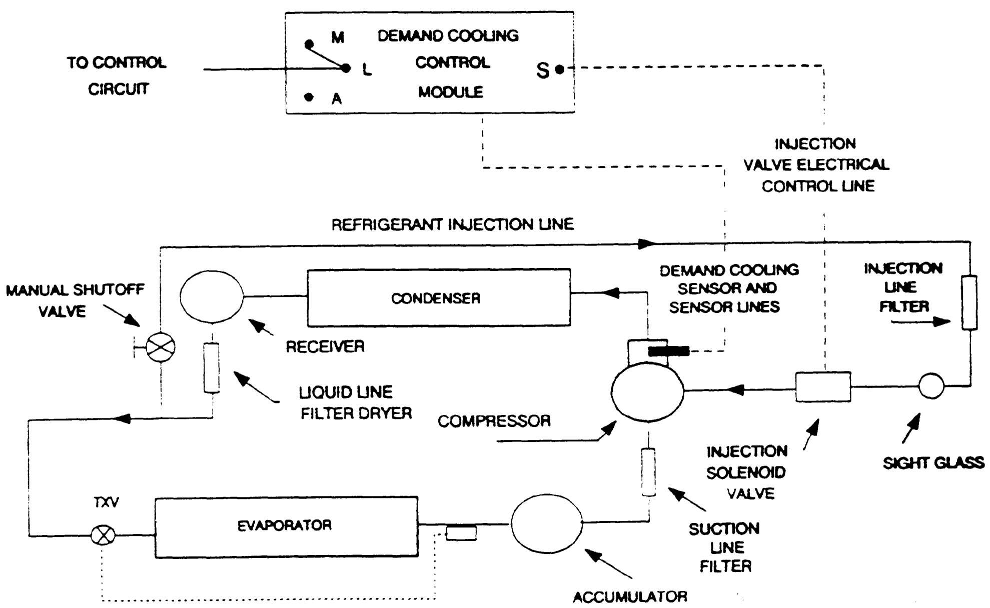


Figure 3

Demand Cooling Compressors

No new compressor models have been introduced for Demand Cooling. Instead, existing low temperature Discus CFC-502 compressors have been modified and rerated for use with HCFC-22 and Demand Cooling. The modifications are the addition of an injection port on the compressor body and a temperature sensor port in the head of the compressor. The locations of these ports are critical and were determined through an extensive development program.

The HCFC-22 rating data includes the effects of Demand Cooling injection when operating conditions require it.

Condenser Sizing

Condensers should be sized using conventional methods. Demand Cooling has virtually no effect on system heat of rejection.

Demand Cooling System Components

The Demand Cooling System (see Figure 1) consists of: The Demand Cooling Temperature Sensor (TS), The Demand Cooling Module (CM), and the Injection Valve (IV).

The TS uses a precision **N**egative **T**emperature **C**oefficient (NTC) Thermistor (thermistor resistance drops on temperature rise) to provide temperature signals to the CM.

The IV meters refrigerant flow from the liquid line to the compressor. The IV solenoid receives on-off signals from the CM. When compressor cooling is required the solenoid is energized and opens the IV orifice to deliver saturated refrigerant to the compressor for cooling. The valve orifice is carefully sized to meet the requirements of each body style of Discus compressors.

The CM has three functional groups:

A) The **Input signal and calculator circuits** compare the temperature sensor input signal to an internal set-point and decide whether to energize the IV solenoid or, in the case of a problem, the CM alarm relay.

B) The **output signal to the IV** is controlled by an electronic switch connected to the IV solenoid so that, when required, refrigerant vapor can be metered to the compressor to prevent compressor overheating. One side of the electronic switch is connected internally to "L1" and the other side to output terminal "S" (see Figure 4).

C) The **alarm signal for local or remote control.** The alarm relay is energized, after a one minute delay, by a continuous, low or high TS temperature signal. An alarm signal can indicate the following:

1) Compressor discharge temperature has risen above the level designed to be controlled by Demand Cooling.
2) A shorted sensor.
3) An open sensor.

In order to avoid nuisance trips, a one minute time delay is provided before alarm after a continuous high or low resistance reading or overtemperature condition.

The alarm relay uses a single-pole-double-throw contact. The contact terminals are "L", "M", and "A":

"L" - Common (to "A" and "M")
"L-M" - Normally closed (compressor run, open on alarm)
"L-A" - Normally Open (alarm signal, close on alarm)

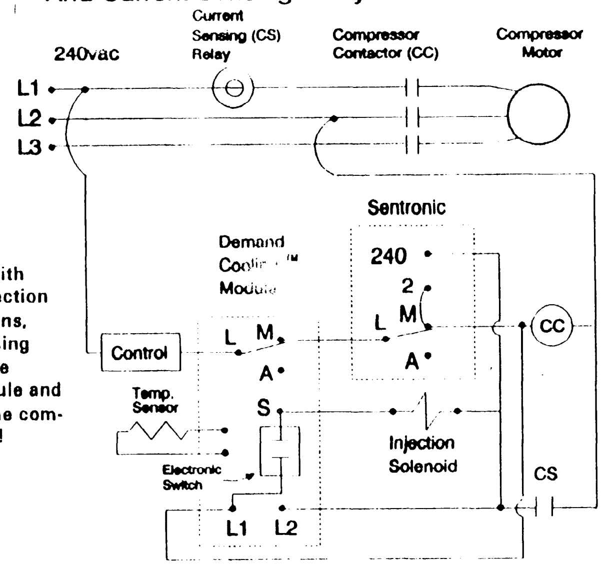
The Normally Closed (NC) contact of the alarm relay ("L" to "M") should be wired in the compressor contactor control circuit so that opening this contact removes the compressor from the line and removes power to the CM. See Figures 4A, B, C, & D.

Figures 4A & B also shows a current sensing relay **(which must be used with compressors employing internal overcurrent protection)** and Sentronic oil pressure switch. The control circuit is purposely arranged so that an internal overload protector trip removes power to both the Sentronic and the Demand Cooling module. This precaution prevents the oil pressure swtich from timing out and the Demand Cooling solenoid from injecting when the compressor is not operating.

The alarm relay requires a manual reset in order to call attention to a system problem.

Demand Cooling™ Wiring Schematic

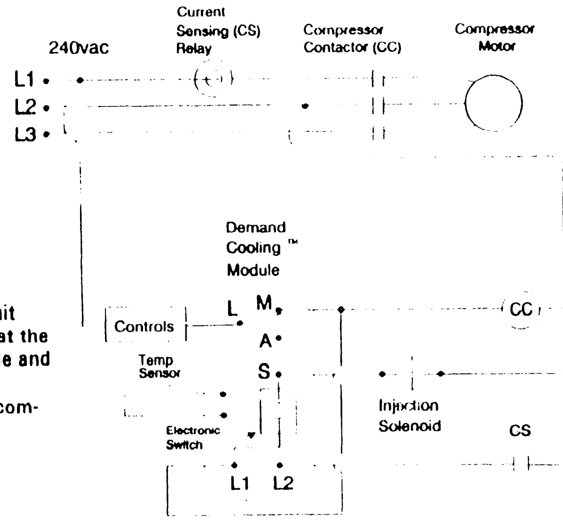
With Sentronic Oil Pressure Control And Current Sensing Relay



NOTE: Compressors with internal overload protection MUST have some means, such as a current sensing relay, to deenergize the Demand Cooling Module and the Sentronic when the compressor is not running!

Figure 4A

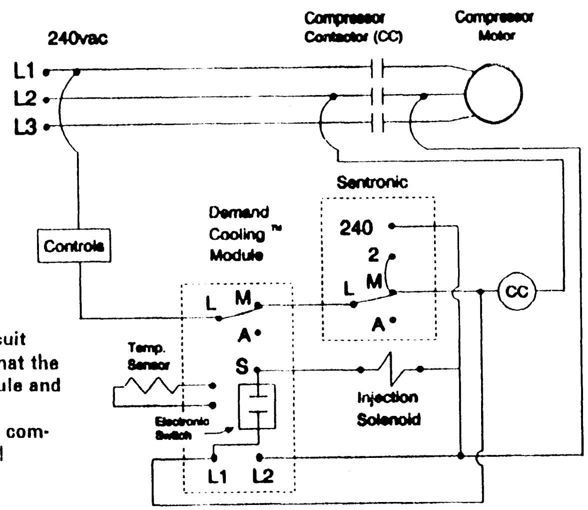
Less Sentronic Oil Pressure Control



NOTE: The control circuit must be arranged so that the Demand Cooling Module and the Sentronic are deenergized when the compressor is not running!

Figure 4B

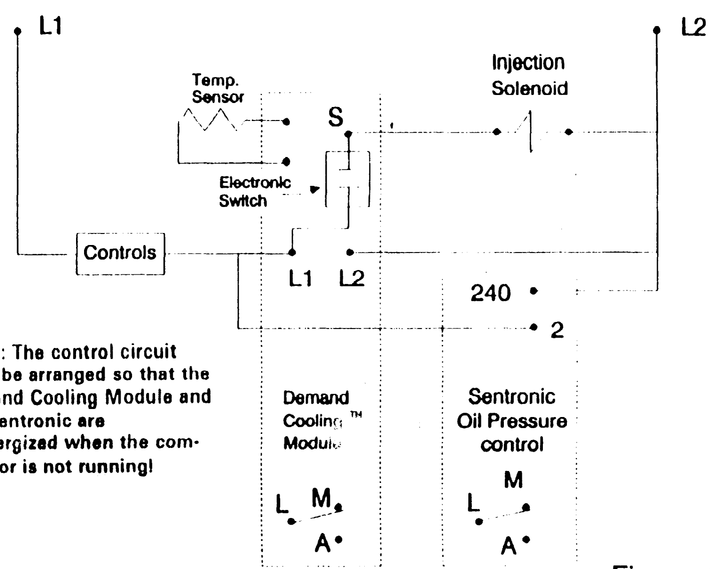
With Sentronic Oil Pressure Control, Less Current Sensing Relay



NOTE: The control circuit must be arranged so that the Demand Cooling Module and the Sentronic are deenergized when the compressor is not running!

Figure 4C

With Isolated Control Contacts



NOTE: The control circuit must be arranged so that the Demand Cooling Module and the Sentronic are deenergized when the compressor is not running!

Figure 4D

Figure 4

System Information

1) Demand Cooling is designed to work on all Copeland Discus compressors equipped with injection ports. A different kit is required for each compressor body style and control voltage. See Table 2 for a listing of Demand Cooling Kit part numbers.

2) The system must be **clean**. A dirty system may have foreign material that can lodge in the solenoid orifice. Always install a liquid line filter dryer in the injection valve inlet line capable of removing particles as small as 25 microns.

3) Do not use any filters containing materials that can leave the filter and possibly clog the IV orifice.

4) The liquid refrigerant supply line must be a minimum of 3/8" and routed so it will not interfere with compressor maintenance. Liquid refrigerant must have sufficient subcooling at the injection valve to prevent flashing upstream of the valve.

5) The liquid refrigerant supply line to the IV must be supported so that it does not place stress on the IV and IV tubing or permit excess vibration. Failure to make this provision may result in damage to the IV and its tubing and/or refrigerant loss.

6) A head fan must be used to help lower compressor discharge temperatures.

7) Return gas temperatures must **NOT** exceed 65°F.

8) System designers are advised to review their defrost schemes to avoid floodback to the compressor which may occur at defrost termination with HCFC-22. HCFC-22 has a significantly higher heat of vaporization than does CFC-502, and, if the same design parameters used with CFC-502 are used with HCFC-22, floodback could occur.

Capacity Modulation

Demand Cooling is not approved as yet for compressors with capacity modulation.

Performance Adjustment Factors

Since compressor discharge temperature depends strongly on the return gas temperature, the amount of injection and its effect on evaporator capacity and mass flow will vary somewhat with return gas temperature. The approximate effects of return gas temperture on evaporator capacity and mass flow are tabulated in Table 3A and B. These factors should be applied to the 65°F. return gas capacity and mass flow values in the published performance data sheets.

Demand Cooling Specifications

Demand Cooling is designed to operate and protect the compressor within the evaporating and condensing envelope identified in Figure 2. Operating setpoints and control actions are listed in Table 1.

Table 1

DEMAND COOLING OPERATING SETPOINTS AND CONTROL ACTIONS

Internal Head Temperature	CM Operation	Approximate Sensor Resistance
Rising through 292°F	Demand Cooling Solenoid On	2100 Ohms
Falling through 282°F	Demand Cooling Solenoid Off	2400 Ohms
Rising through 310°F	Alarm Contact Energized	1700 Ohms
At Room Temp. (77°F)	Demand Cooling Solenoid Off	90,000 Ohms

Maximum Contact Ratings: 720VA, 120/240VAC, 60HZ Maximum Solenoid Output ("S" Terminal) Rating: 16W (The IV solenoid must be the only load on this output.)

Time Delay For Demand Cooling Alarm Actuation (after a continuous low or high resistance TS signal input): 1 minute

Table 2

DEMAND COOLING KIT PART NUMBERS

		2D	3D	4D	6D
50 Hz	120 V	998-1000-12	998-1001-13	998-1001-14	998-1001-16
	240 V	998-1000-22	998-1001-23	998-1001-24	998-1001-26
60 Hz	120 V	998-1000-12	998-1000-13	998-1000-14	998-1000-16
	240 V	998-1000-22	998-1000-23	998-1000-24	998-1000-26

Demand Cooling Kits Include:
- Demand Cooling Module with 2 mounting screws
- Temperature Sensor with 3 ft. shielded cable
- Injection Valve and Solenoid (with mounting hardware)
- Installation/Troubleshooting Guide

Optional Demand Cooling Module Mounting Brackets

2D and 3D Models	998-0700-09
4D and 6D Models	998-0700-10

Temperature Sensors

3 ft. Shielded Cable (standard)	085-0109-00
10 ft. Shielded Cable (optionl)	085-0109-01

See also: Demand Cooling Installation Instruction Guides
Copeland Publication Nos. 90-130 for 2D/3D Compressors
90-131 for 4D Compressors
90-133 for 6D Compressors

Table 3A

DEMAND COOLING EVAPORATOR CAPACITY ADJUSTMENT FACTORS

Return Gas Temperature (°F)	Condensing Temperature (°F)	Saturated Suction Temperature (°F) -40	-35	-30	-25	-20	-15	-10	-5	0
50	70	1.003	1.003	1.004	1.004	1.004	1.005	1.005	1.005	1.005
	80	.976	.994	1.002	1.003	1.003	1.003	1.004	1.004	1.004
	90	1.000	.997	.995	.992	1.002	1.002	1.003	1.003	1.003
	100	1.004	1.001	.998	.995	.993	.990	1.001	1.002	1.002
	110	1.007	1.004	1.002	.999	.996	.993	.990	.998	1.000
	120	1.010	1.008	1.005	1.002	.999	.997	.994	.991	.988
	130	1.013	1.011	1.008	1.005	1.002	1.000	.997	.994	.991
35	70	1.007	1.007	1.008	1.008	1.009	1.009	1.010	1.010	1.011
	80	1.005	1.005	1.006	1.006	1.007	1.007	1.008	1.008	1.009
	90	1.000	.996	1.004	1.004	1.004	1.005	1.006	1.006	1.007
	100	1.006	1.001	.997	.993	1.002	1.002	1.003	1.003	1.004
	110	1.010	1.006	1.002	.998	.994	.989	1.000	1.000	1.001
	120	1.016	1.011	1.007	1.003	.990	.995	.991	.986	1.000
	130	1.020	1.016	1.012	1.007	1.003	.999	.994	.990	.985
20	70	1.012	1.012	1.013	1.014	1.015	1.016	1.017	1.018	1.019
	80	1.009	1.009	1.009	1.010	1.011	1.013	1.014	1.014	1.015
	90	1.006	1.006	1.006	1.070	1.008	1.009	1.010	1.010	1.011
	100	.990	.985	1.003	1.003	1.003	1.004	1.005	1.006	1.007
	110	1.003	.998	.993	.988	.999	1.000	1.001	1.002	1.003
	120	1.016	1.011	1.005	1.000	.995	.990	1.000	.998	.995
	130	1.027	1.022	1.017	1.012	1.006	1.001	.996	.990	.991

Table 3B

DEMAND COOLING EVAPORATOR MASS FLOW ADJUSTMENT FACTORS

Return Gas Temperature (°F)	Condensing Temperature (°F)	Saturated Suction Temperature (°F) -40	-35	-30	-25	-20	-15	-10	-5	0
50	70	1.020	1.017	1.015	1.012	1.009	1.006	1.004	1.001	1.000
	80	1.025	1.022	1.020	1.017	1.014	1.012	1.009	1.006	1.004
	90	1.030	1.027	1.025	1.022	1.019	1.017	1.014	1.011	1.009
	100	1.035	1.032	1.030	1.027	1.024	1.022	1.019	1.016	1.014
	110	1.040	1.037	1.035	1.032	1.029	1.027	1.024	1.021	1.019
	120	1.045	1.042	1.040	1.037	1.034	1.032	1.029	1.026	1.024
	130	1.050	1.047	1.045	1.042	1.039	1.037	1.034	1.031	1.029
35	70	1.025	1.023	1.019	1.015	1.010	1.006	1.002	1.000	1.000
	80	1.042	1.038	1.034	1.030	1.025	1.021	1.016	1.011	1.006
	90	1.061	1.057	1.053	1.049	1.045	1.041	1.037	1.033	1.029
	100	1.070	1.066	1.062	1.058	1.054	1.050	1.046	1.042	1.038
	110	1.078	1.074	1.070	1.066	1.062	1.058	1.054	1.050	1.046
	120	1.087	1.083	1.079	1.075	1.071	1.067	1.063	1.059	1.055
	130	1.096	1.092	1.088	1.084	1.079	1.075	1.071	1.069	1.062
20	70	1.031	1.026	1.021	1.016	1.011	1.006	1.001	1.000	1.000
	80	1.050	1.045	1.040	1.035	1.030	1.025	1.020	1.015	1.010
	90	1.069	1.064	1.059	1.054	1.049	1.044	1.039	1.034	1.029
	100	1.088	1.083	1.078	1.073	1.068	1.063	1.058	1.053	1.048
	110	1.107	1.102	1.097	1.092	1.087	1.082	1.077	1.072	1.067
	120	1.126	1.121	1.116	1.111	1.106	1.101	1.096	1.091	1.086
	130	1.145	1.140	1.135	1.130	1.125	1.120	1.115	1.110	1.105

SUBJECT: LIQUID LINE DIFFERENTIAL REGULATING VALVE
OLDR --- LDR --- XTM --- XTO

LIMITED M/W

In many supermarket applications refrigerant gas from the discharge line or from the top of the receiver is used for defrost by diverting a portion of the flow to the suction line and back through the evaporator being defrosted. The gas condenses in the evaporator and flows in reverse around the TEV and liquid line solenoid valve through check valves. This liquid refrigerant then flows to the liquid header where it is distributed to evaporators not in defrost. In order for this reverse flow to occur, the pressure of the defrost header must be greater than the pressure of the liquid header.

Several methods are used to obtain this differential. A common liquid line method is to install a differential valve in parallel with a solenoid valve between the receiver and liquid header. The solenoid valve is closed during defrost allowing the differential valve to control. The liquid line differential pressure regulating valve combines the features of a separate differential valve and solenoid valve. The advantages of this type of valve are a reduction in piping costs and the added ability to adjust the differential.

DIFFERENTIAL VALVE DESIGN

This valve has a solenoid bypass feature so that the valve can either remain full open or operate to maintain a differential. We supply two versions of this valve:

The OLDR uses an MKC-2 coil and fails in the open position. (Figure 3)
The LDR uses an OMKC-2 coil and fails in the differential mode. (Figure 2)

A pilot differential valve controls the valve by varying the pressure on top of the main piston. These valves are available in two port sizes. Inlet pressure enters the pilot assembly through a passageway in the valve body on the smaller size and through an external tube connected to the inlet fitting on the larger size. The outlet of the pilot differential valve is connected to the outlet fitting with an external tube on both valves.

DIFFERENTIAL OPERATION (OLDR-Coil Energized, LDR-Coil De-Energized)

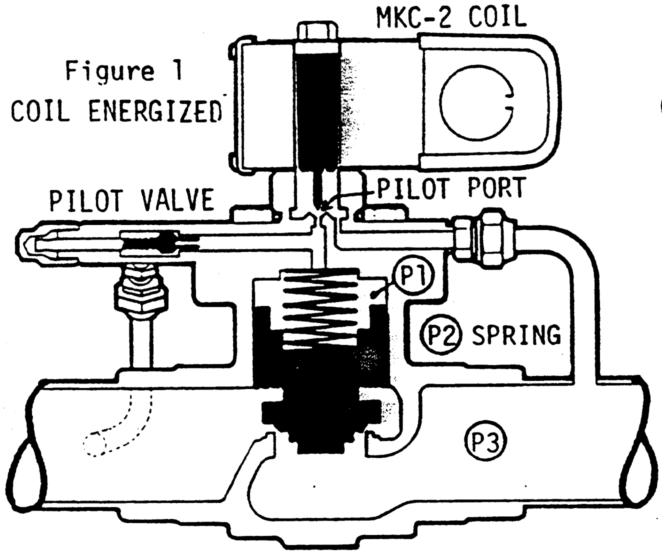
The valve is in the differential mode when the solenoid coil is energized on the OLDR valve and de-energized on the LDR valve. The plunger lifts off of the pilot port, allowing inlet pressure to enter the chamber on top of the main piston and bleed out through the pilot differential valve. (see figures 1 and 2).

When the differential pressure across the valve is below the setting of the pilot valve, the pilot valve modulates closed. This allows pressure to build on top of the main piston. As this pressure (P1) approaches the inlet pressure (P3), the force combined with the force from the spring (P2) pushes the piston down, modulating the valve closed.

As the differential pressure rises above the pilot valve setting, the pilot valve modulates open. This bleeds refrigerant from the chamber on top of the piston at a faster rate than it is entering, so the pressure decreases. As this pressure (P1) plus the pressure from the spring (P2) falls below the inlet pressure (P3), the inlet pressure pushes the piston up, modulating the valve open. The valve will open only as far as necessary to maintain the pilot valve setting. The pilot valve will then modulate the piston from partially open to partially closed to maintain its setting.

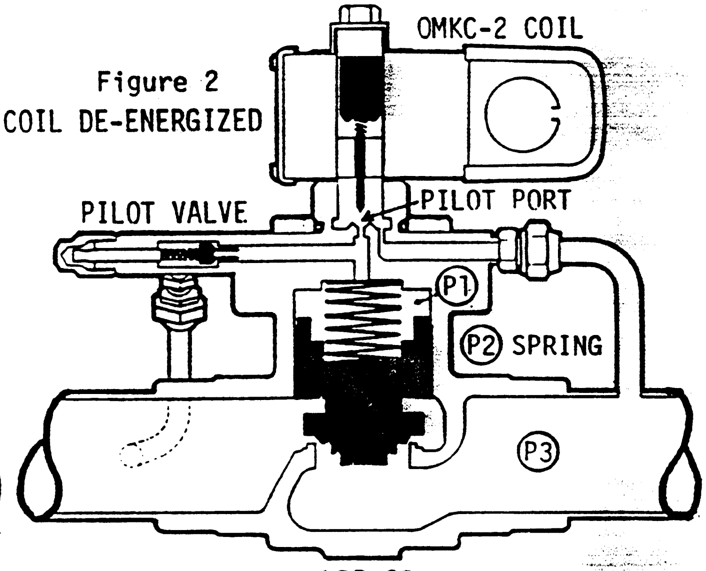
FULL OPEN OPERATION (OLDR-Coil De-Energized, LDR-Coil Energized)
The valve is in the full open position when the coil is de-energized on the OLDR valve and energized on the LDR valve. The plunger moves down to close the pilot port which stops all flow to the chamber above the piston. The refrigerant remaining above the piston then bleeds to the valve outlet through an orifice (bleed hole) in the pilot differential valve piston. The pressure in the chamber (P1) decreases so the inlet pressure (P3) moves the piston up and the valve opens. (see figures 3 and 4).

Figure 1
COIL ENERGIZED



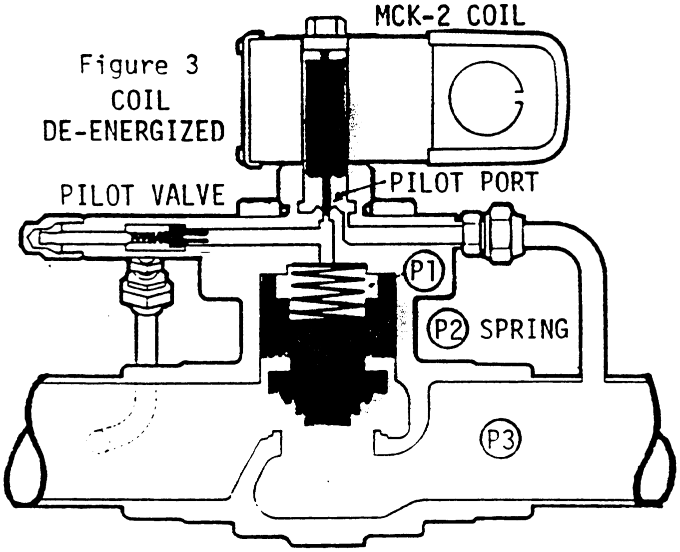
OLDR-20
DIFFERENTIAL OPERATION

Figure 2
COIL DE-ENERGIZED



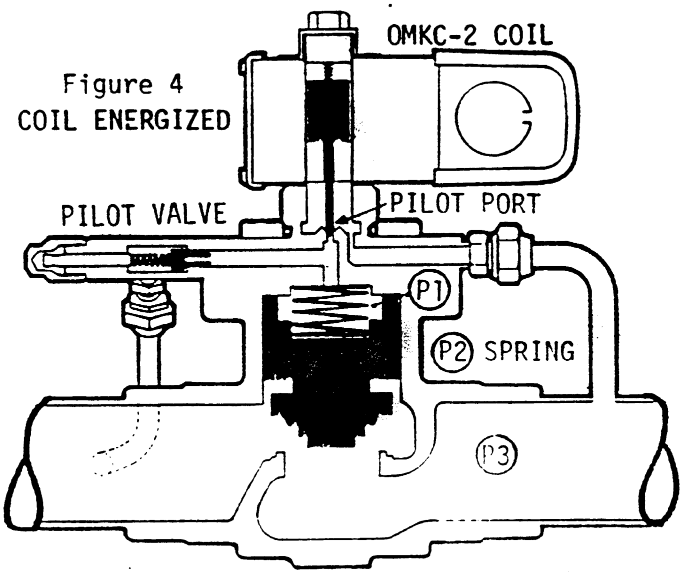
LDR-20
DIFFERENTIAL OPERATION

Figure 3
COIL
DE-ENERGIZED



OLDR-20
FULL OPEN OPERATION

Figure 4
COIL ENERGIZED



LDR-20
FULL OPEN OPERATION

NOTE:
(O)LDR-15 size valves do not have the tube from inlet fitting to pilot assembly. Inlet pressure enters the pilot assembly through a passageway in the valve body. (see figure 5).

VALVE TYPE	PORT SIZE INCHES	DIFFERENTIAL SETPOINT RANGE	CONNECTIONS - INCHES INLET x OUTLET	DIMENSIONS - INCHES A	B	C	D	COIL
OLDR-15	1	5/50 psi	1-1/8 ODF x 1-1/8 ODF or 1-3/8 ODF x 1-3/8 ODF	10.06	1.66	5.00	2.68	MKC-2
LDR-15								OMKC-2
OLDR-20	1-5/16		1-5/8 ODF x 1-5/8 ODF or 2-1/8 ODF x 2-1/8 ODF	11.06	1.66	5.54	3.35	MKC-2
LDR-20								OMKC-2

Table 1

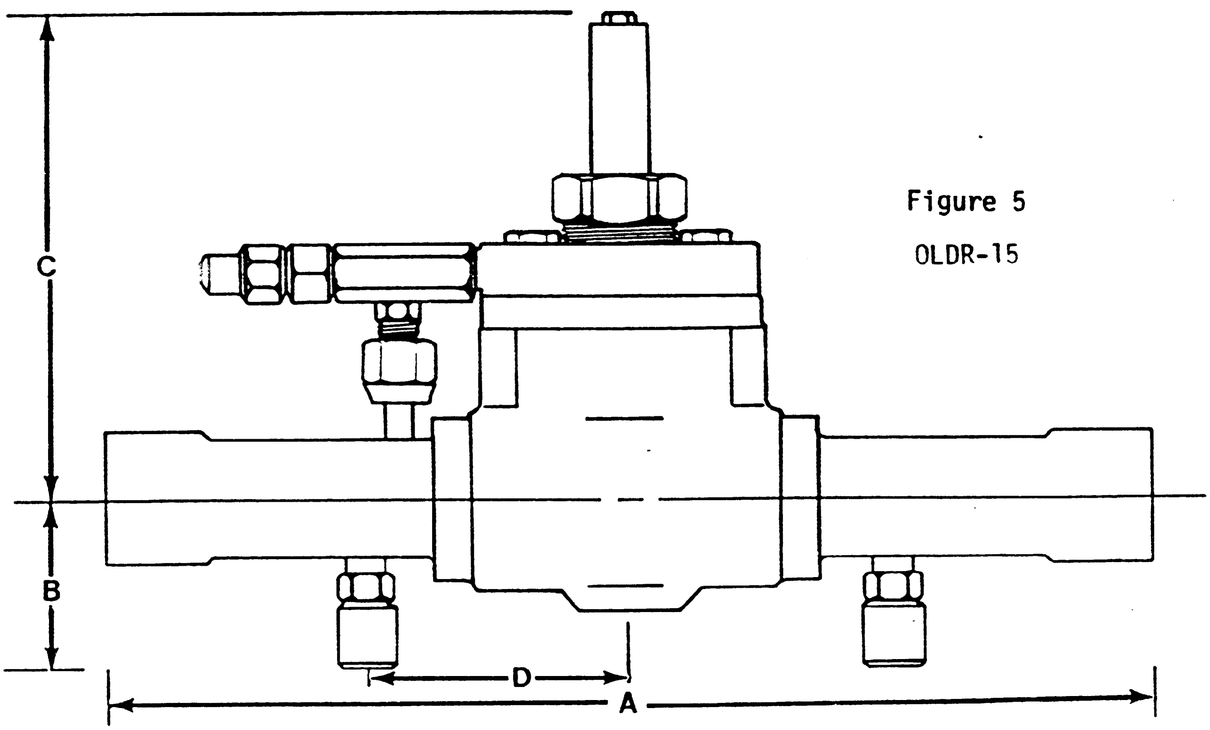


Figure 5

OLDR-15

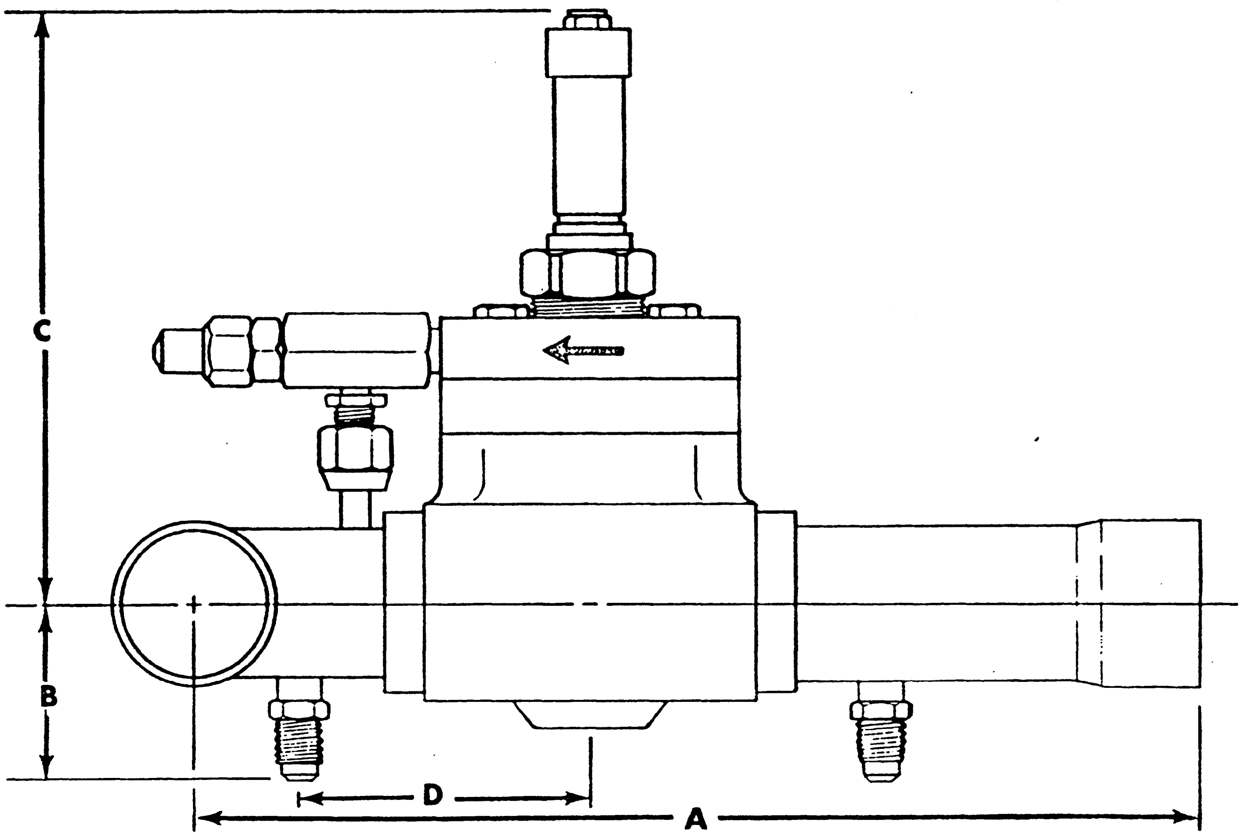
XTM and XTO Valves

We supply a version of these liquid line differential pressure regulators that operates the same as the LDR valve but has special outlet fittings. These valves are designated XTM-1, XTM-5, XTO-1, XTO-4.

SPECIFICATIONS

VALVE TYPE	PORT SIZE INCHES	DIFFERENTIAL SETPOINT RANGE	CONNECTIONS - INCHES INLET x OUTLET	DIMENSIONS - INCHES				COIL
				A	B	C	D	
XTM-1	1	5/50 psi	1-3/8 ODF x 1-5/8 ODM, 90° Elbow	8.72	1.66	5.44	2.68	OMKC-2
XTM-5			1-1/8 ODF x 1-5/8 ODM, 90° Elbow	8.72	1.66	5.44	2.68	
XTO-1	1-5/16		1-5/8 ODF x 1-5/8 ODM, 90° Elbow	10.19	1.77	5.98	3.35	
XTO-4			2-1/8 ODF x 2-1/8 ODF	11.06	1.77	5.98	3.35	

Table 2



XTM
Figure 6

CAPACITY TABLE

VALVE TYPE	PORT SIZE INCHES	TONS OF REFRIGERATION — Refrigerant 12 — Pressure Drop Across Valve -- psi: 1	2	3	4	5	22: 1	2	3	4	5	502: 1	2	3	4	5
(O)LDR-15 XTM	1	25.3	36.0	44.2	51.0	57.0	33.2	46.9	57.6	66.5	74.3	21.4	30.3	37.2	42.9	47.9
(O)LDR-20 XTO	1-5/16	56.3	79.7	97.6	113	126	73.4	104	127	147	164	47.6	67.0	82.1	95.1	106

SETTING PROCEDURE

The (O)LDR is set by turning the adjusting stem located under the cap on the pilot differential valve. Turning the stem clockwise increases the setting, counterclockwise decreases the setting. Adjustments must be made with the valve in its differential mode and no refrigerated cases in defrost, so that the head pressure is normal. Artificially low head pressure at the initiation of defrost can prevent a differential from occurring thereby making it impossible to set the valve. Therefore, always set the (O)LDR when no cases are in defrost.

Once the valve is set it will control to maintain this differential setting during defrost. However, there are several system conditions that can cause the differential to change beyond the valve's control:

1) When a defrost is initiated the head pressure may fall. It can take several minutes for the differential to be created while the head pressure returns to normal.

2) If there is a very low requirement for refrigeration, and therefore a low demand for liquid refrigerant, the differential may never build up enough to reach the valve setting.

3) As a gas defrost cycle progresses, condensing occurs in the evaporators in defrost at a slower rate. Therefore, there is more gas present in the evaporators, which results in a higher natural pressure drop. It is possible for this natural pressure drop to be higher than the differential valve's setting.

IMPORTANT:

To verify valve operation if no differential is occurring between the liquid header and the receiver during defrost, first take all cases out of defrost. Then put the valve in its differential mode and check its setting. If the valve is maintaining its set-point with normal head pressures and no cases in defrost, then the valve is operating correctly and some other system condition such as outlined above may be causing the problem.