FORM NUMBER: 81-196-7
DATE: 7/81
REVISED:

Rec'd 8/24/83

WARREN//SHERER

INSTALLATION & OPERATION MANUAL

MODEL:

DUAL METIC AND TRI METIC

THIS REFRIGERATOR CONFORMS TO THE COMMERCIAL REFRIGERATOR MANUFACTURERS ASSOCIATION HEALTH AND SANITATION STANDARD.
CRS-SI-78

WARREN//SHERER
DIVISION OF KYSOR INDUSTRIAL CORPORATION
1600 ROCKDALE INDUSTRIAL BLVD., CONYERS, GEORGIA 30207/404•483•5600

THE WARREN/SHERER PARALLEL COMPRESSOR SYSTEMS

The advantages of parallel refrigeration systems are well known and accepted in the industry for their past performances. The simplicity and compactness of 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 Warren/Sherer Parallel System is the total load required by the system.

The selection and design of the system is based on the needs of the individual customer. This information must be passed on to the design 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 sales engineer, and he in turn must be sure that this information is passed on to the design 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 Warren/Sherer 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. A claim must be filed with the carrier by the consignee for all damage.

NOTE: Your equipment, when delivered, will have a sticker attached advising what must be done to report any damage.

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 Sales Engineer in your area or contacting the Warren/Sherer plant in Conyers, Georgia.

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 components available.

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

Parallel System units are available with compressors rated at 208/230/3/60 or 440/480/3/60 and a single power feed is required for the unit. If the compressors are 440/480/3/60 a separate 208/230/1/60 control circuit supply is required. If electric defrost is used a 208/230/3/60 supply is required, which may be combined with the control circuit supply. An optional transformer may be added to step down the 440V for the control circuit on each unit.

All field wiring must be in compliance with the NEC and local codes. Minimum unit wiring ampacity and maximum fuse sizes as calculated per the National Electric Code are shown on the Parallel System nameplate.

Typical 208/230/ and 440/480 volt wiring diagrams are shown with typical circuit wiring for different types of circuits on pages 27-29. 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 for the circuits 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.

COMPRESSORS
The compressors are solid mounted using the Warren/Sherer oil system or the optional AC & R pressurized system. Crankcase heaters and compressor cooling fans are installed and wired. High/Lo and oil failure controls are installed and wired. Suction filter cores are also factory installed while the liquid line filter/drier cores are supplied for field installation.

PIPING
All piping leaving the unit is equipped with a shut-off valve with the exception of the heat reclaim line. This 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.

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 is installed between the liquid and suction headers at the rear of the unit and each circuit is piped into the suction line. Manual shut-off and solenoid valves are installed and wired (refer to Page 7 diagram). The hot gas line is piped into the suction line up-stream of the EPR valve. All controls, valves, and piping come factory installed. Cases are equipped when ordered.

When defrost is initiated by the time clock the main liquid line solenoid is energized on defrost. 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 built-in check valve and back through the liquid line to 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 pressures occur, a twenty (20) pound differential check valve piped in parallel with the main liquid line solenoid will open and supply the required liquid.

UNIT DESIGNATION

Units come numbered, and circuits are designated including condenser and heat reclaim coils. All refrigeration circuits are numbered from one to eight and from left to right facing the electrical panel.

EXAMPLE UNIT DESIGNATION

DM2 2000 FC

TOTAL NOMINAL H.P.

		APPLICATION TEMP & TYPE FREON	
Dual Metic	DM2	R-12 Med. Temp.	FC
Tri Metic	DM3	R-502 Med. Temp.	RC
		R-502 Low Temp.	RL

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 properly.

HEAT RECLAIM

The valving comes factory installed. Piping and wiring from the controls and the heat reclaim coil are field installed. Warren/Sherer requirements for piping are shown on Page 7 and are at the customer's choosing. The check valve required for series piping is field furnished.

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 7 . 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 than the reclaim, should it call for both at the same time. Warren/Sherer 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 the pressure on the liquid receiver.

CONDENSERS

All condensers should be located at an elevation higher than the Parallel System unit to assure liquid drainage from the condensers to the receiver. If the condenser has dual drop legs to a single dual metic unit, an elevation difference of at least 6 ft. is required. The dual drop legs should be dropped the 6 ft. 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 to interfere with condenser operations. Vertical air flow condensers must be cross-leveled.

THE OIL SYSTEMS

Standard - Balance Line Between Compressors (Dual Metic Systems only)

The Warren/Sherer oil system consists of an oil separator, a vent line between compressors, an oil supply line from the oil separator to the common suction, and an oil equalizing line between compressors. This system is used only with like compressors. Care must be taken to keep the oil level in the bottom half of the compressor sight glass. To check the oil level it is necessary to shut down both compressors and allow the oil level to stabilize. If this is not done an erroneous determination of oil supply may be made and unneeded oil added to the system. A new system should require approximately 3 to 4 gallons of oil on start-up.

AC & R Oil Control System - Tri Metic and Dual Metic with Satellites, Optional on all Dual Metic Systems

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.

The oil level observed in the sight glass should be within 1/8" of the center of the sight glass on S-9110 series regulators and within the lower quarter of the sight glass on S-9120 series regulators. Maximum differential working pressure is 50 PSIG on the float mechanism. The regulator is U.L. approved at 450 PSIG working pressure design with 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 stand by oil. It has two sight glass ports on the shell to observe the oil level inside the vessell. Oil is fed into the oil reservoir by the oil separator.

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 oil reservoir to the upper sight glass port, NOT ABOVE IT. It is commonly accepted that in a new refrigeration system, some oil will be absorbed by the refrigerant as the system becomes balanced out. After two hours of operation, the oil reservoir, if necessary, should again be filled to the upper sight glass and also after two days, by which time the entire refrigeration system should be balanced out. Then the oil reservoir must be observed on each service call. No oil should be added again until the oil level falls below the lower sight glass port.

SATELLITE

A compressor may be added to the Parallel System unit for ice cream cases. This compressor would maintain lower suction pressure than the main suction header and provide several advantages over a remote unit.

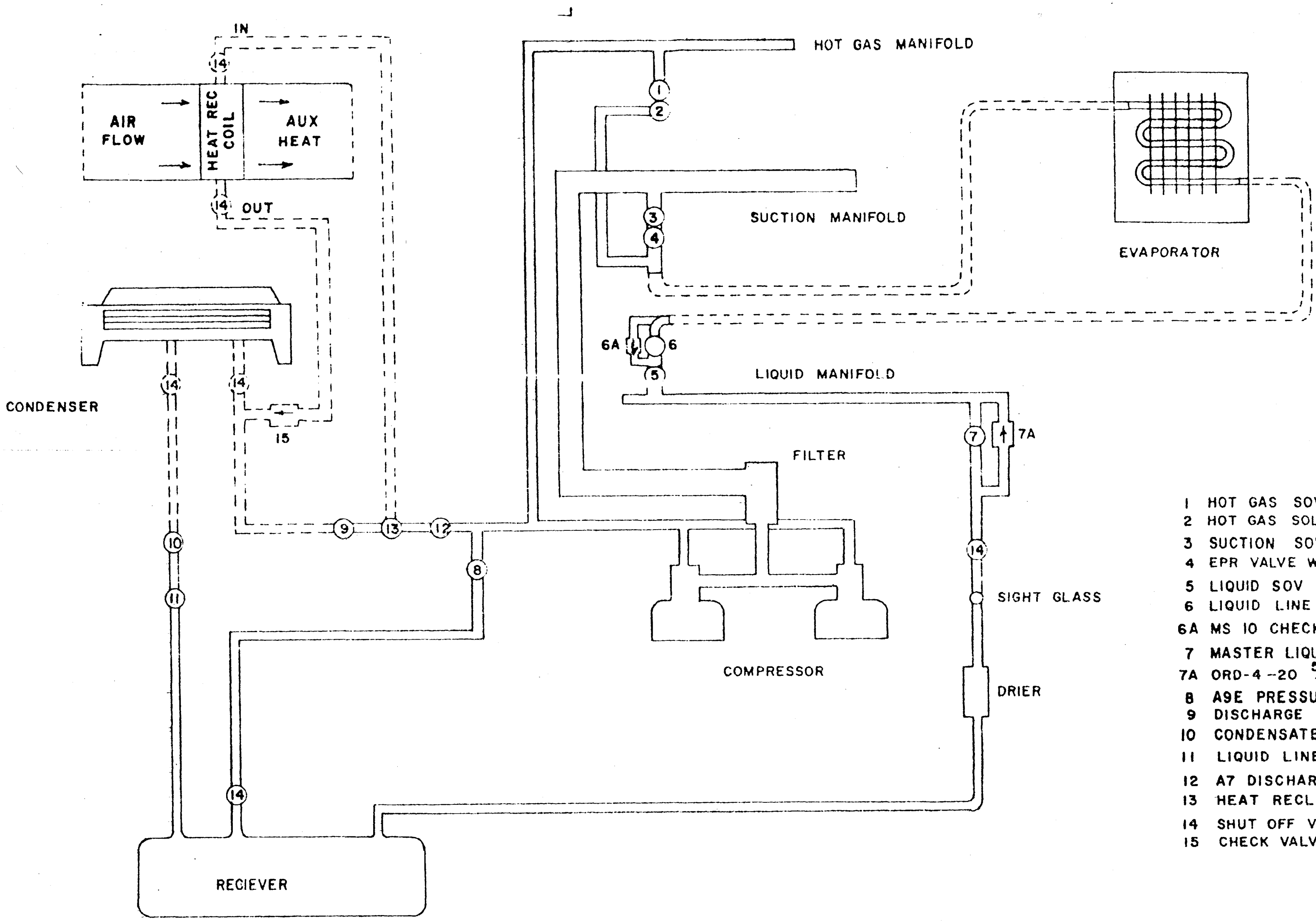
Hot gas defrost would be available to the ice cream circuit if desired, and the suction would be connected to the main header providing assistance on pull down and standby protection should the satellite compressor fail.

LOCATION OF EQUIPMENT

The Parallel System must be located so they are level and easily serviced. A minimum of 30" 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 front of the unit should installation in an outdoor machine house be desired or if machine room size necessitates sacrificing service. The machine room ventilation system should provide for approximately 100CFM of air flow for each compressor horsepower. The air intake should be positioned for the air flow to pass over the units.

LIFTING INSTRUCTIONS

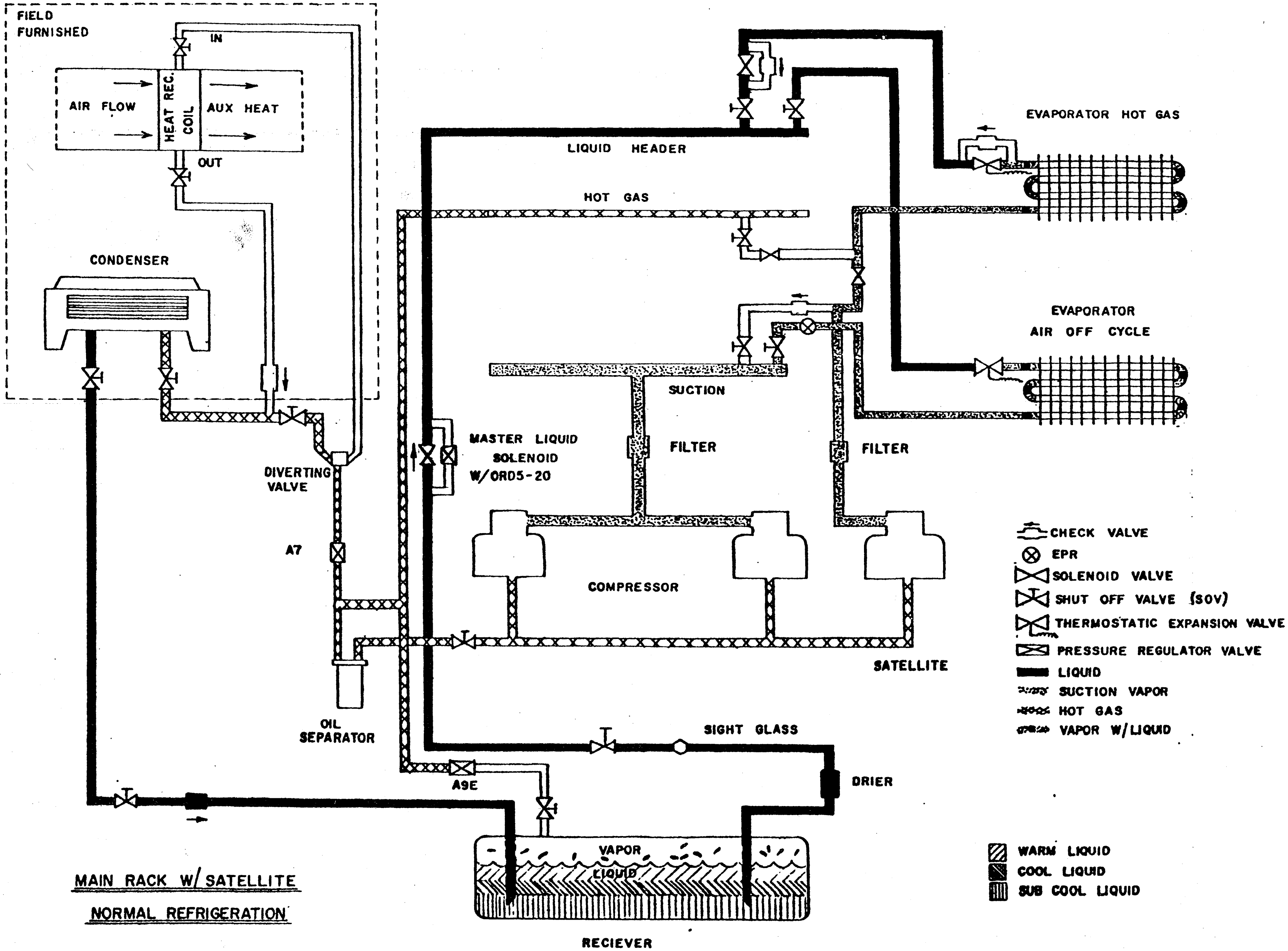
The Parallel System is a heavy piece of machinery and careful considerations of lifting procedures should be made before the unit is lifted by any means. The only part of the unit designed to carry any of the lifting load is the base. The unit may be lifted at the base with a forklift or by means of cables at the four corners of the base. If cables are used the lifting cables should be prevented from contacting any of the unit piping or electrical components.



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

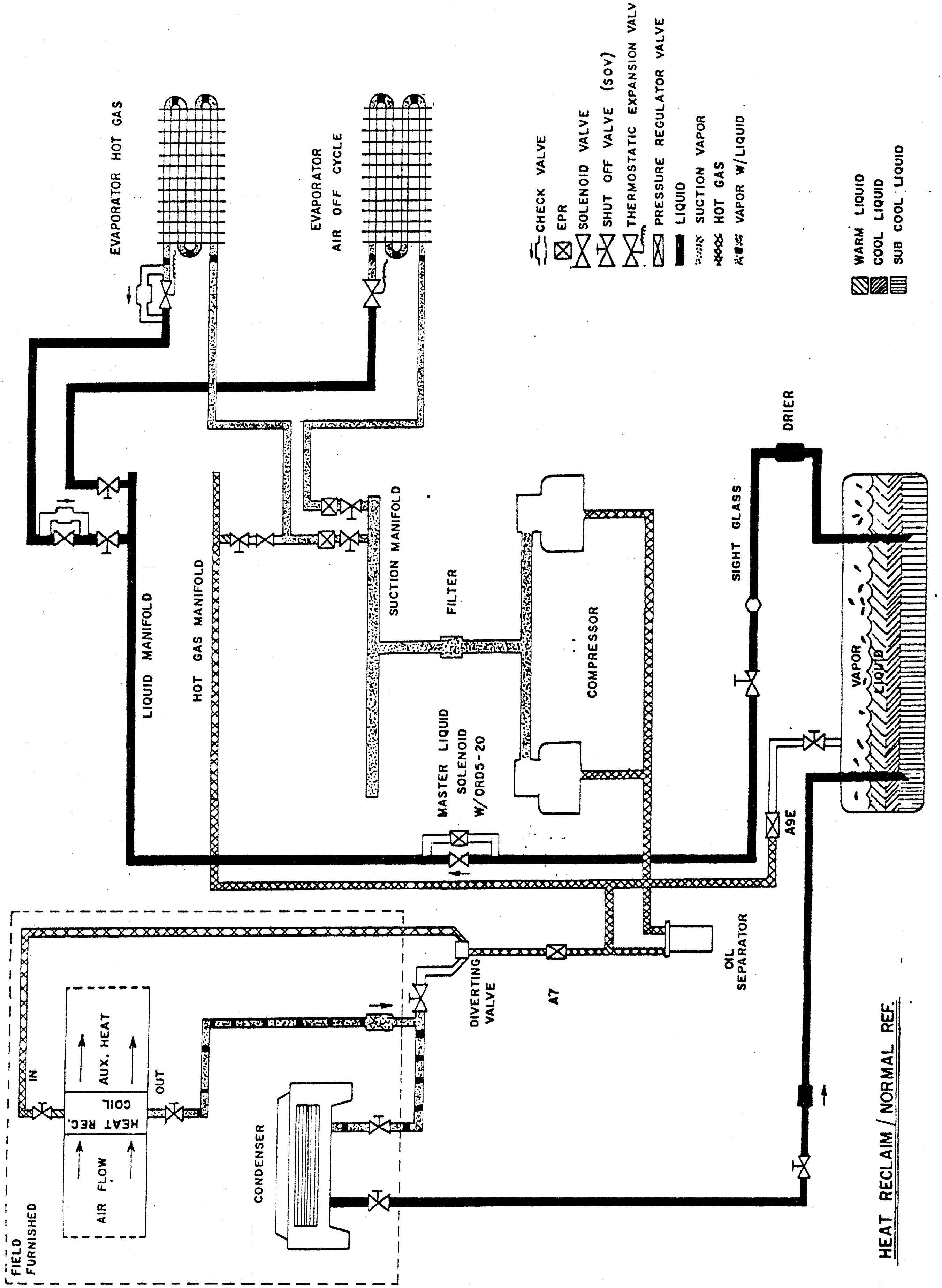
ALL PIPING SHOWN IN DOTTED OUTLINE ARE FIELD INSTALLED AS PER CUSTOMER SPECIFICATIONS.

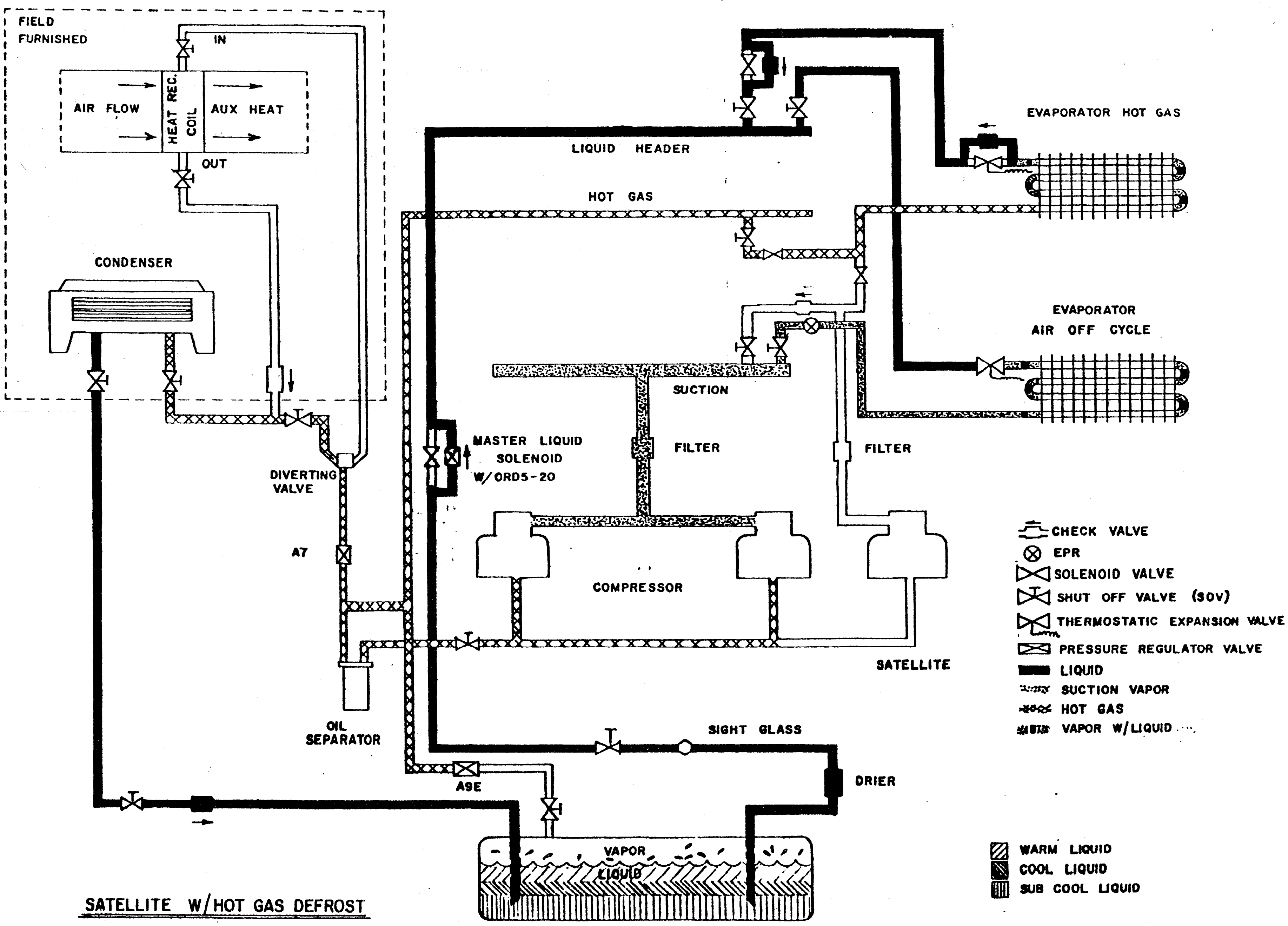
GENERAL PARALLEL SYSTEM LAYOUT OF PIPING



MAIN RACK W/ SATELLITE

NORMAL REFRIGERATION


EVAPORATOR HOT GAS
EVAPORATOR
AIR OFF CYCLE
CHECK VALVE
EPR
SOLENOID VALVE
SHUT OFF VALVE (SOV)
THERMOSTATIC EXPANSION VALV
PRESSURE REGULATOR VALVE
LIQUID
SUCTION VAPOR
HOT GAS
VAPOR W/LIQUID
WARM LIQUID
COOL LIQUID
SUB COOL LIQUID
DRIER
SIGHT GLASS
SUCTION MANIFOLD
FILTER
COMPRESSOR
LIQUID MANIFOLD
HOT GAS MANIFOLD
MASTER LIQUID SOLENOID W/ORD5-20
VAPOR
LIQUID
RECIEVER
A9E
OIL SEPARATOR
A7
DIVERTING VALVE
IN
AUX. HEAT
OUT
HEAT REC. COIL
AIR FLOW
CONDENSER
FIELD FURNISHED
HEAT RECLAIM / NORMAL REF.



SATELLITE W/HOT GAS DEFROST

NORMAL COND. NORMAL REF.

PARALLEL SYSTEMS

Recommended Control Settings

A. Set (A7) Discharge Pressure Regulator at 180 PSIG with R-502; 110 PSIG with R-12 and gauge on compressor discharge service valve.

B. Set (A9) Receiver Pressure Regulator at 160 PSIG with R-502; 90 PSIG with R-12 and gauge on receiver outlet valve.

C. High Pressure Controls:

R-502	350	Cut-Out
R-12	275	Cut-Out

D. Low Pressure Controls:

Dual Metic - Without SSPC-2 option, set low pressure control as shown

System	Compressor	Cut-Out	Cut-In
R-502	Comp 1	1	9
LT	Comp 2	9	15
	Satellite (Ice Cream)	1	6
R-502	Comp 1	20	30
MT(+10°F)	Comp 2	29	38
R-502	Comp 1	30	41
MT(+20°F)	Comp 2	41	48
R-12	Comp 1	3	10
MT(+10°F)	Comp 2	8	13
R-12	Comp 1	8	15
MT(+20°F)	Comp 2	15	19

Tri Metic and Dual Metic with SSPC-2 Option
If the SSPC control is being used to control temperatures in one or more systems, set the SSPC pressure control to average approximate EPR valve settings shown on Engineering Bulletin #79-130-3 for the particular systems involved. A pressure differential setting of 6 PSIG is recommended. If EPR valves are being used to control all systems, set the SSPC slightly lower than the lowest EPR valve setting. Again a 6 PSIG pressure differential setting is recommended. The compressor dual pressure controls should be set low enough that control is always by the SSPC. Any Satellite compressor will be controlled separately, by means of the dual pressure control.

E. Adjustable Time Delay Controls - Dual Metic without SSPC Control

1. First compressor - Approximately 90 sec. (optional)
2. Second compressor - Approximately 180 sec.

F. Defrost and EPR Settings

See Engineering Bulletin #79-130-3

	FIXTURE	APPROXIMATE DEFROST TIME MINUTES AIR DEF.	OFF CYCLE	ELEC.	HOT GAS	APPROXIMATE DEFROST FAILSAFE SETTINGS (MINUTES) AIR DEF.	OFF CYCLE	ELEC.	HOT GAS	DEFROST CYCLES PER DAY	REFRIG-ERANT	(3)EPR VALVE SETTINGS	(1) DISCHARGE AIR TEMP.	(2)APPROX. PRESS. CONTROL SETTINGS CUT-OUT	CUT-IN
MEAT AND DELI	M1A(G)	15	45	--	14	45	50	--	18	3	12 502	12# 38#	24° - 30°	11# 37#	27# 63#
	M4A(G)	20	45	--	14	45	50	--	18	3 - 6	12 502	12# 38#	26° - 30°	11# 37#	27# 63#
	JM, SJM	--	--	16	10	--	--	20	14	6	12 502	9# 32#	23° - 25°	5# 32#	27# 63#
	ZT ZTS 7900(Deli)	--	72	--	--	--	72	--	--	1	12 502	(4)18# 48#	34° - 38°	15# 42#	28# 65#
	D6(Deli)	--	36	20	10	--	40	20	14	4	12 502	14# 40#	24° - 30°	12# 40#	28# 60#
	D5(Deli)	--	30	--	10	--	30	--	14	4	12 502	14# 40#	24° - 30°	12# 40#	28# 60#
DAIRY	D6	--	36	20	10	--	40	22	14		12 502	17# 47#	28° - 32°	15# 45#	28# 60#
	D5	--	30	20	10	--	30	22	14	4	12 502	15# 35#	28° - 32°	5# 25#	25# 60#
	BQD BRQD JSQD	--	35	20	10	--	40	24	14	4	12 502	17# 47#	24° - 28°	15# 45#	28# 60#
PRO-DUCE	HZV, ZV, TZP	--	30	--	--	--	32	--	--	4	12 502	18# 50#	38° - 42°	22# 52#	35# 68#
REACH-INS	L4H(A) (FF)	24	--	32	16	54	--	36	18	1	502	10#	-5° - -12°	5#	17#
	I4H(A) (IC)	28	--	36	16	54	--	40	18	1 - 2	502	4#	-15° - -22°	2#	8#
	D4H (Bev)	--	34	--	--	--	36	--	--	2	12 502	16# 42#	34° - 38°	15# 43#	28# 63#
FROZEN FOOD	XLA, ILA, BILA& EBILA	30	--	30	20	60	--	60	46	1	502	12#	-10° - 0°	9#	16#
	LM1A(G)	40	--	--	20	54	--	--	46	4	502	12#	-10° - 0°	9#	16#
	WTLA & EWTLA	35	--	30	20	40	--	40	36	1	502	12#	-10° - 0°	3#	16#
	L4(A), L5(A)	26	--	24	14	54	--	30	18	4	502	12#	-10° - 0°	3#	16#
ICE CREAM	XLA, ILA, BILA& EBILA	35	--	35	25	60	--	60	46	1-2	502	5#	-28° - -16°	2#	8#
	WTLA & EWTLA	40	--	35	25	60	--	60	36	1-2	502	5#	-28° - -16°	2#	8#
	I5F(A)		--	30	16		--	34	18	6	502		-22° - -12°	5#	12#

	FIXTURE	APPROXIMATE DEFROST TIME MINUTES AIR DEF.	OFF CYCLE	ELEC.	HOT GAS	APPROXIMATE DEFROST FAILSAFE SETTINGS (MINUTES) AIR DEF.	OFF CYCLE	ELEC.	HOT GAS	DEFROST CYCLES PER DAY	REFRIG-ERANT	(3) EPR VALVE SETTINGS	(1) DISCHARGE AIR TEMP.	(2) APPROX. PRESS CONTROL SETTINGS CUT-OUT	CUT-IN
WALK -- INS	30° MEAT	--	--	30	15	--	--	34	18	2 - 4	12 502	19-23 48-56	28° - 32°	20# 51#	26# 65#
	35° Dairy and Produce	--	60	--	--	--	60	--	--	2	12 502	22-26 54-61	35° - 39°	20# 51#	26# 65#
	Poultry and Deli	--	60	--	--	--	60	--	--	2	12	21-25	33° - 38°	18#	26#
	Meat Prep Cutting Room	--	60	--	--	--	60	--	--	1	12	24-29	45° - 50°	--	--
	Frozen Food Storage	--	--	30	15	--	--	34	18	2 - 4	502	15-18	-5° - -10°	--	--
	Ice Cream Storage	--	--	30	15	--	--	34	18	2 - 4	502	10-12	-10° - -15°	--	--

Note: The above recommended settings are based upon 75°F - 55% RH store conditions and properly loaded cases. Some adjustments may be required in case temperature or 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 (ZT & 7900) as noted in note 4.
(2) Low pressure controls may require different settings if cases are controlled by thermostats
(3) EPR valves should only be used on Dualmetics and Trimetics on cases requiring higher temperature evaporators than system design level.
(4) Service meat cases (ZT & 7900) should always have EPR as primary control and temperature thermostat and secondary control for peak performance.

TYPICAL DEFROST SCHEDULE

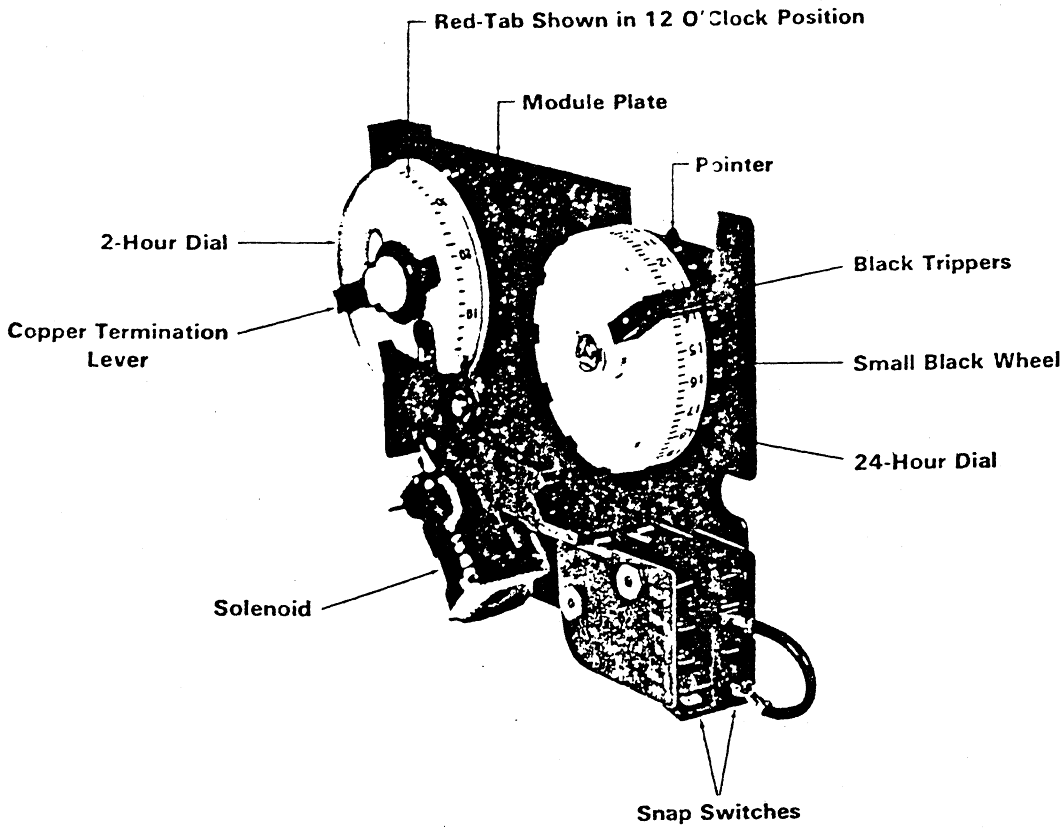
TIME OF DEFROST — A.M.

UNIT NO.	CIRCUIT NO.	FIXTURE	FAILSAFE SETTING	0:30	1:00	1:30	2:00	2:30	3:00	3:30	4:00	4:30	5:00	5:30	6:00	6:30	7:00	7:30	8:00	8:30	9:00	9:30	10:00	10:30	11:00	11:30	12:00
A	1	24'-MAA	44												X												X
	2	44'-MIA	44	X																X							
	3	24'-D6(DG4)	40		X												X										
	4	32'-D6(DG61)	40			X												X									
	5	24'-D6R	40				X												X								
	6	24'-D6R	40					X												X							

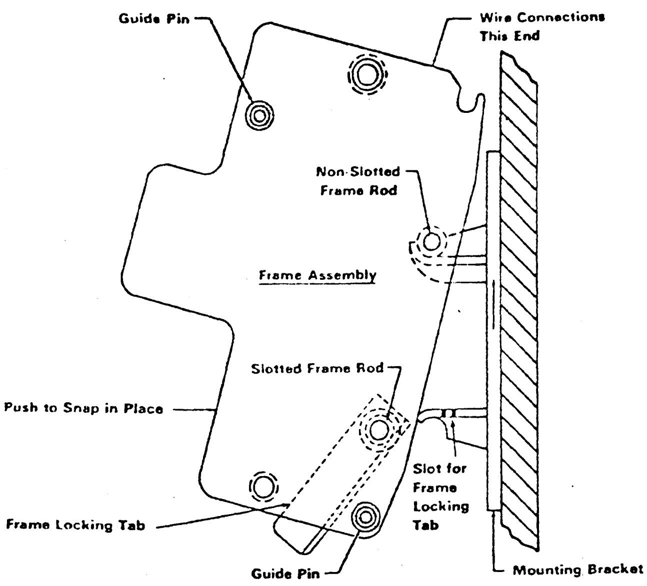
TIME OF DEFROST — P.M.

UNIT NO.	CIRCUIT NO.	FIXTURE	FAILSAFE SETTING	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
A	1	24'-MAA	44												X												X
	2	44'-MIA	44																								
	3	24'-D6(DG4)	40		X												X										
	4	32'-D6(DG61)	40			X												X									
	5	24'-D6R	40				X												X								
	6	24'-D6R	40					X												X							

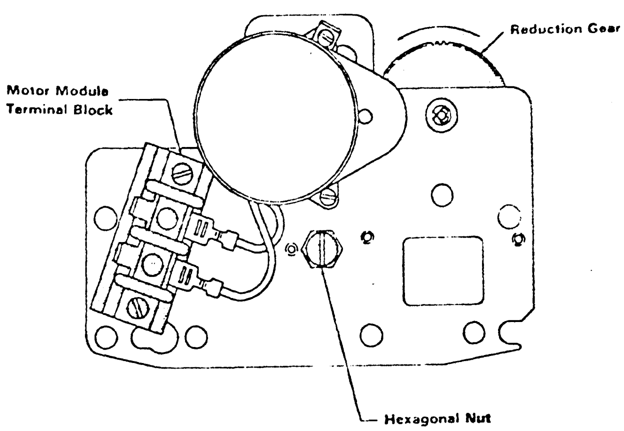
RM MODULE



FRAME AND BRACKET



MOTOR MODULE



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 Mötor terminal block.

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.

Installation/Removal of Drive Module

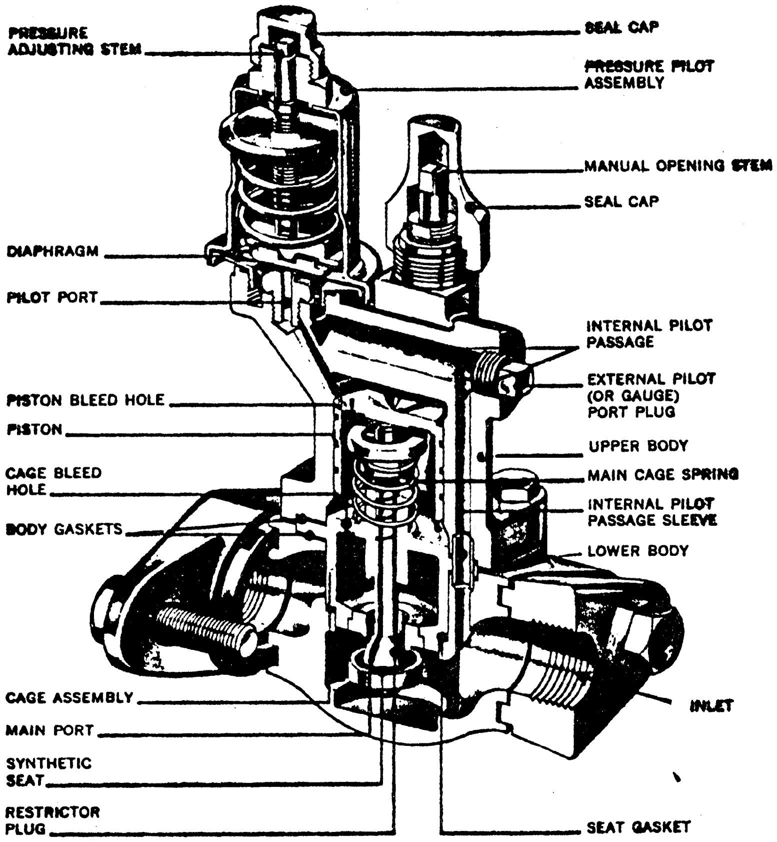
1. To remove Drive Module, rotate black reduction gear until tongue/groove with Program Module #1 is parallel to mounting surface.

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.

EPR



The illustration above shows the basic internal components common to the EPR series and its many pilot combinations. While other models may vary somewhat in construction and pilot configuration, they all operate on a similar principle.

The upstream or inlet pressure signal is transmitted through the internal pilot passage to the area below the pressure pilot diaphragm. Above the diaphragm is an adjustable springload. When the inlet pressure signal increases to exceed the spring setting, the diaphragm deflects to open the pilot port. This permits the pilot pressure signal to exert a pressure on top of the piston. The pressure exerted on the top of the piston drives the cage stem down and opens the main port, thus permitting flow through the valves. The cage bleed hole is sized to provide dash pot action.

Should the inlet pressure signal decrease to the spring set point, the pilot port closes, and the pressure on top of the piston bleeds off through the piston bleed hole.

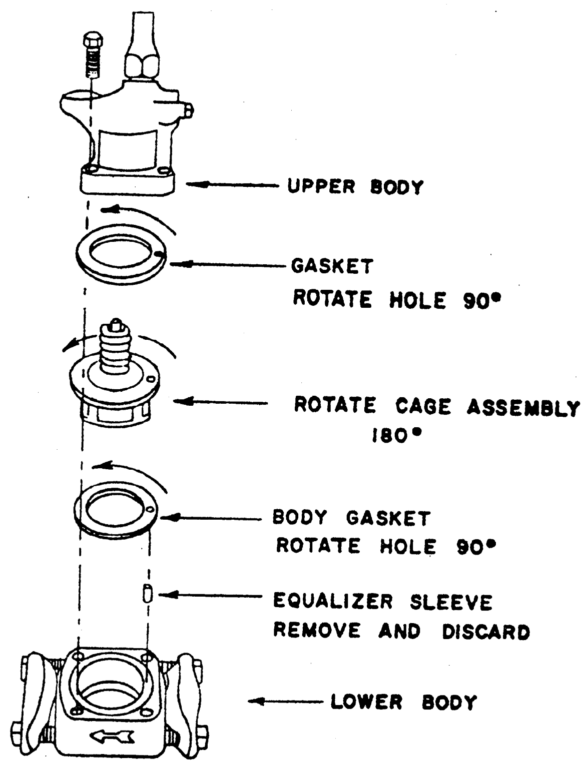
The main cage spring closes the main port.

In operation, the pilot diaphragm, piston and cage port may assume intermediate or throttling positions depending on load. Characterized parabolic restrictor plugs or vee ports are standard features which provide smooth modulation without hunting or chatter.

Increasing the pressure pilot spring tension raises the set point; decreasing the tension lowers the set point. The installation of an access fitting or gauge valve in the external pilot port connection permits pressure readings for easy adjustment.

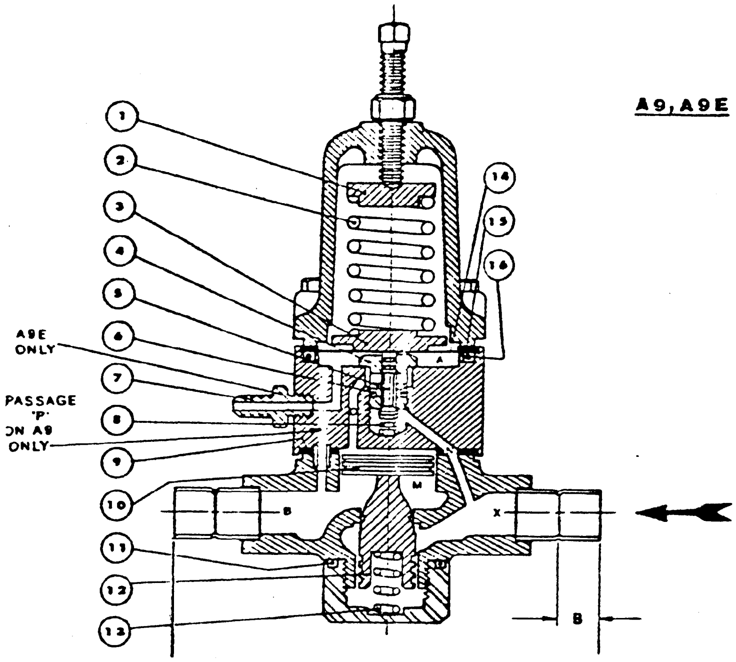
All EPR models are easily converted to external pilot connection by rotating parts to block the internal pilot passage and connecting the external pilot port to the remote pressure signal source.

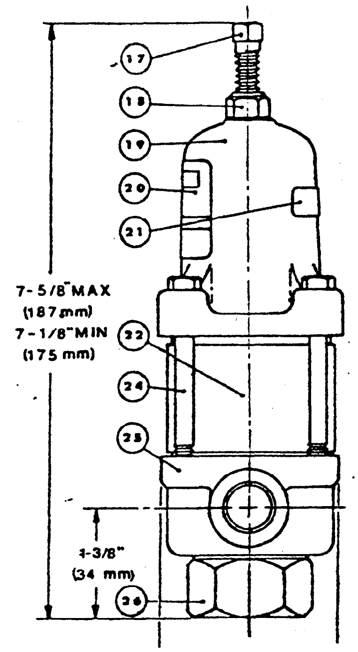
All models are equipped with a manual opening stem to permit full port manual operation.



IF AN EPR VALVE IS PURCHASED FROM A REFRIGERATION WHOLESALER THE ILLUSTRATED MODIFICATION MUST BE MADE FOR PROPER VALVE OPERATION.

A9, A9E





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	80-1000-05	1	24. Bonnet Bolts A9, A9E	90-1000-56	4
2. Bonnet Spring Range A	80-1001-08	1	14. Diaphragm Range A	24-1088-00	2	A9S, A9SE	90-1001-63	4
Range B	80-1001-09	1	Range B	24-1088-00	3	25. Valve Body Assem. 5/8"	24-0108-00	1
3. Diaphragm Follower	24-1018-02	1	15. Gasket, Bonnet	81-1001-38	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	24-1013-02	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	24-1086-11	1	28. Cover Retaining Clip	83-1000-76	1
8. Pilot Spring	80-1000-54	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	24-1034-00	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"	24-1017-03	1	A9S	24-0157-02	1			
7/8"	24-1017-01	1	A9SE	24-0157-00	1	NOTE: When ordering parts specify valve type and size		
1-1/8"	24-1017-02	1	23. Label	24-1041-01	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.

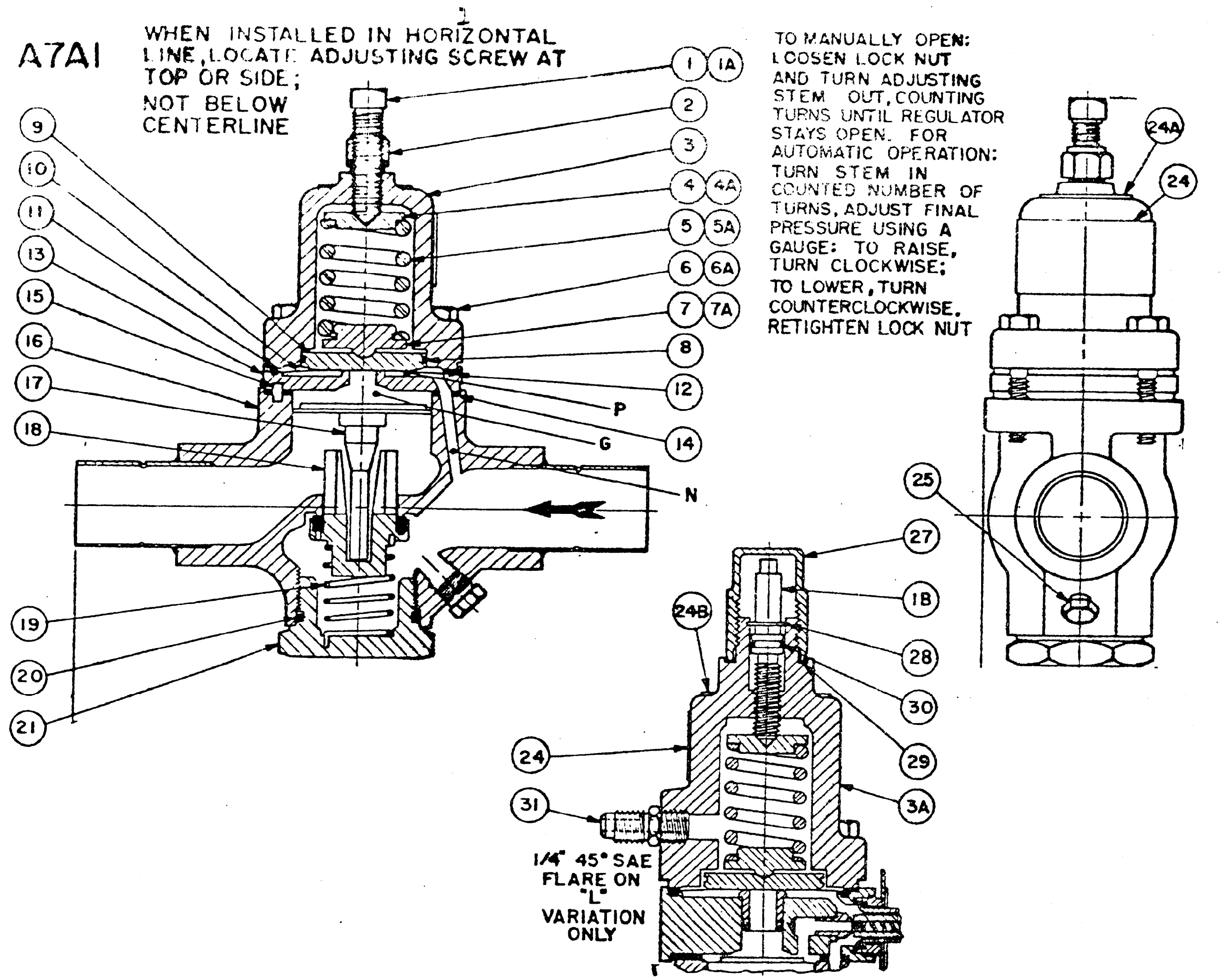
2. Failure to open: (a) #10 Piston or #12 Piston Plug may be jammed due to excessive dirt. This is the most likely cause of not opening; to correct, see 1 (a) above. (b) #17 adjusting stem may be turned out so far that a lower downstream pressure may be required to open the regulator than can be created 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



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 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 evaporator pressure, loosen the Seal Nut #2 or #18 then turn the #1 or #16 Adjusting Stem out (counter-clockwise).

To raise the evaporator pressure, turn Adjusting Stem in (clockwise). Always retighten Seal Nut after pressure adjustment is made. One complete turn of the Adjusting Stem will change the inlet pressure by approximately 1.35 kg/cm² (19 psi) for Range A, or 5.27 kg/cm² (75 psi) for Range D.

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

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

Any of the A7 Series of Regulators can be manually opened during system operation as follows: Loosen Lock Nut (#2 or #18)—except on "L" Variations which have no Lock Nut—and turn Adjusting Stem (#1 or #16) 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 gauge. Tighten Lock Nut after adjustment.

PRINCIPLES OF OPERATION

Operation is as follows, starting with a closed regulator whose inlet (evaporator) pressure is initially below the set-for pressure.

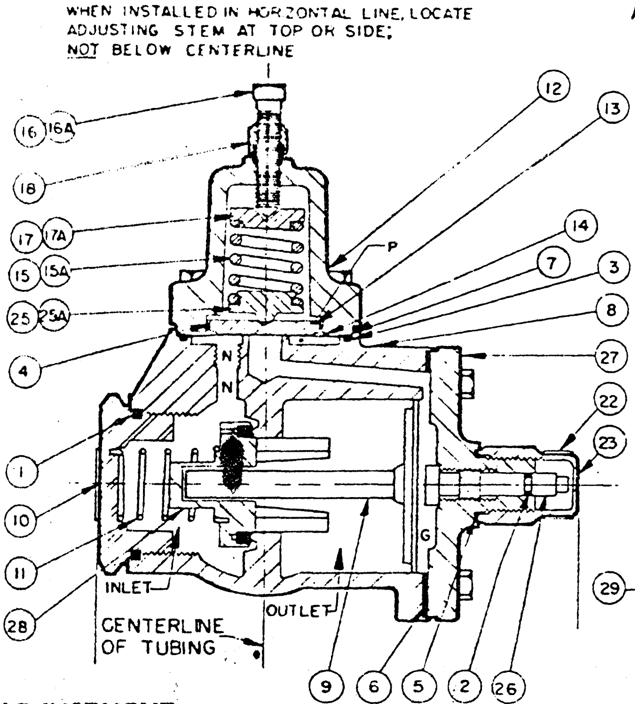
The inlet pressure flows through passage N to the lower side of #10 or #14 Diaphragm in Chamber P. As the inlet pressure rises, the Diaphragm exerts a force upward against #5 or #15 Diaphragm Spring. As the inlet pressure rises above the set-for pressure (determined by the position of Adjusting Stem), 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.

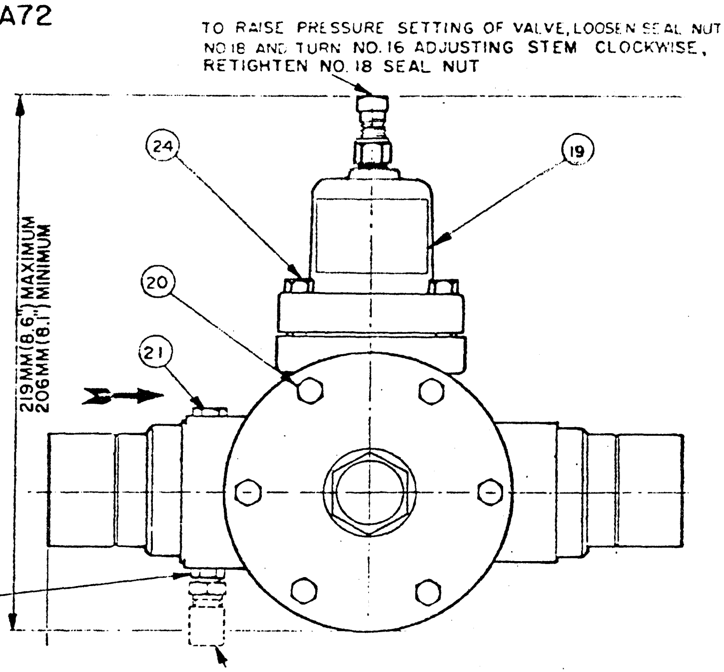
Whenever the upstream pressure drops below the set-for pressure, the Diaphragm moves downward to close the Pilot Seat passage. As the pressure in Chamber G escapes around the Power Disc to the downstream side of the regulator, the Valve Closing Spring gradually returns the Main Valve Assembly toward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

A7A1

Item	Description	Qty	Part Numbers A7AI	35 mm (1⅜")
1	Adjusting Stem, Range A	1	X	90-1000-77
1A	Adjusting Stem, Range D	1	X	90-1000-78
1B	Adjusting Stem, Range A	1		24-1111-00
2	Seal Nut	1	X	90-1000-15
3	Valve Bonnet	1	X	24-1050-03
3A	Valve Bonnet	1		24-1110-11
4	Spring Rest, Upper, Range A	1	X	24-1048-01
4A	Spring Rest, Upper, Range D	1	X	24-1048-02
5	Diaphragm Spring Range A	1	X	80-1000-25
5A	Diaphragm Spring Range D	1	X	80-1000-24
6	Bonnet Screw	4	X	90-1001-67
6A	Bonnet Screw	4		90-1001-78
7	Spring Rest, Lower, Range A	1	X	40-1026-00
7A	Spring Rest, Lower, Range D	1	X	20-1086-00
8	"O" Ring, Follower ①	1	X	93-1000-79
9	Diaphragm Follower	1	X	22-1032-00
10	Diaphragm ②	1②	X	21-1007-04
11	Gasket, Bonnet ①②	1	X	81-1001-33
12	"O" Ring Bonnet ①②	1	X	93-1000-57
13	Adapter	1	X	24-1074-03
14	Gasket, Body ①	1	X	81-1001-60
15	Locating Pin	1	X	91-1000-52
16	Valve Body Assembly	1	X	24-0103-03
17	Valve Stem & Disc Assembly	1	X	24-0147-01
18	Main Valve Assembly	1	X	24-0117-00
19	Closing Spring	1	X	80-1001-38
20	"O" Ring, Bottom Cap ①	1	X	93-1000-63
21	Bottom Cap	1	X	24-1003-02
23	Adapter Assembly	1		24-0165-00
23A	Adapter Assembly	1		24-0165-01
24	Nameplate	1	X	24-1127-00
24A	Nameplate, Adjustment	1	X	24-1128-00
24B	Nameplate, Adjustment	1		24-1129-00
25	Pipe Plug ⅛" NPT Hex Head	1	X	92-1001-21
26	Solenoid Nameplate	1		24-1041-01
27	Seal Cap	1		30-1173-00
28	Retaining Ring	1		91-1000-34
29	Gasket, Seal Cap	1		81-1000-65
30	"O" Ring, Adjusting Stem	1		93-1000-58
31	¼"SAE Connector	1		92-1000-64
32	Solenoid Operator, Coil & Housing Assy. 120 V, 60 Hz (110 V, 50 Hz)	1		83-1000-74
32A	Solenoid Operator, Coil & Housing Assy. 240 V, 60 Hz (220 V, 50 Hz)	1		83-1000-75

A72





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 or a Schrader type valve in some of the ⅛" regulator gauge ports before the system is charged with refrigerant.

Fully charge the system and operate near the normal design conditions. To lower the evaporator pressure, loosen the Seal Nut #2 or #18 then turn the #1 or #16 Adjusting Stem out (counter-clockwise). To raise the evaporator pressure, turn Adjusting Stem in (clockwise). Always retighten Seal Nut after pressure adjustment is made. One complete turn of the Adjusting Stem will change the inlet pressure by approximately 1.35 kg/cm² (19 psi)

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

Any of the A7 Series of Regulators can be manually opened during system operation as follows: Loosen Lock Nut (#2 or #18)—except on "L" Variations which have no Lock Nut—and turn Adjusting Stem (#1 or #16) 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 gauge. Tighten Lock Nut after adjustment.

PRINCIPLES OF OPERATION

Operation is as follows, starting with a closed regulator whose inlet (evaporator) pressure is initially below the set-for pressure.

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 upstream 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 from the evaporator is thereby reduced and the evaporator pressure is brought back up to the set-for pressure.

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.
	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.
	Diaphragm spring not suitable for range.	Replace spring with one suitable for range.
	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)

A72

Item	Description	Qty	A72	Part Numbers 42 mm (1⅝")	Part Numbers 54 mm (2⅛")
1	"O" Ring, Bottom Cap ①	1	X	93-1000-69	93-1000-69
2	"O" Ring, Mnl. Opening stem ①	1	X	93-1000-70	93-1000-70
3	"O" Ring, Bonnet ①④	1	X	93-1000-57	93-1000-57
4	"O" Ring, Diaphragm Follower ①	1	X	93-1000-79	93-1000-79
5	Gasket, Seal Cap ①	1	X	81-1000-65	81-1000-65
6	Gasket, Valve Cover ①	1	X	81-1001-29	81-1001-29
7	Gasket, Diaphragm ①④	1	X	81-1001-33	81-1001-33
8	Valve Body Assembly	1	X	24-0127-00	24-0128-00
8A	Valve Body Assembly	1		24-0127-02	24-0128-02
8B	Valve Body Assembly	1		24-0127-04	24-0128-04
9	Power Disc & Stem Assembly	1	X	24-0126-00	24-0126-00
10	Valve Bottom Cap	1	X	24-1060-00	24-1060-00
11	Valve Closing Spring	1	X	80-1001-39	80-1001-39
12	Valve Bonnet	1	X	24-1050-03	24-1050-03
12A	Valve Bonnet	1		24-1110-11	24-1110-11
13	Diaphragm Follower	1	X	22-1032-00	22-1032-00
14	Diaphragm ①	1①	X	21-1007-04	21-1007-04
15	Diaphragm Spring, Range A	1	X	80-1000-25	80-1000-25
15A	Diaphragm Spring, Range D	1	X	80-1000-24	80-1000-24
16	Adjusting Stem, Range A	1	X	90-1000-77	90-1000-77
16A	Adjusting Stem, Range D	1	X	90-1000-78	90-1000-78
16B	Adjusting Stem, Range A	1		24-1111-00	24-1111-00
17	Spring Rest, Upper, Range A	1	X	24-1048-01	24-1048-01
17A	Spring Rest, Upper, Range D	1	X	24-1048-02	24-1048-02
18	Seal Nut	1	X	90-1000-15	90-1000-15
19	Nameplate	1	X	24-1114-01	24-1114-01
20	Valve Cover Screw	6	X	90-1000-76	90-1000-76
21	Pipe Plug, ¼" NPT, Hex Head	1	X	92-1000-13	92-1000-13
22	Nametag, Mnl. Opening Stem	1	X	24-1040-00	24-1040-00
23	Seal Cap	1	X	30-1173-00	30-1173-00
24	Bonnet Screw	4	X	90-1000-55	90-1000-55
25	Spring Rest, Lower, Range A	1	X	40-1026-00	40-1026-00
25A	Spring Rest, Lower, Range D	1	X	20-1086-00	20-1086-00
26	Manual Opening Stem	1	X	24-1006-00	24-1006-00
27	Valve Cover	1	X	24-1058-11	24-1058-11
28	Main Valve Assembly	1	X	24-0124-01	24-0124-00
29	Pipe Plug, ⅛" NPT, Hex Head	1	X	92-1001-21	92-1001-21
30	Solenoid Body & Tubing Assy.	1		24-0152-00	24-0152-00
30A	Solenoid Body & Tubing Assy.	1		24-0152-03	24-0152-03
31	¼" NPT x ⅜" SAE Elbow	2		92-1000-42	92-1000-42

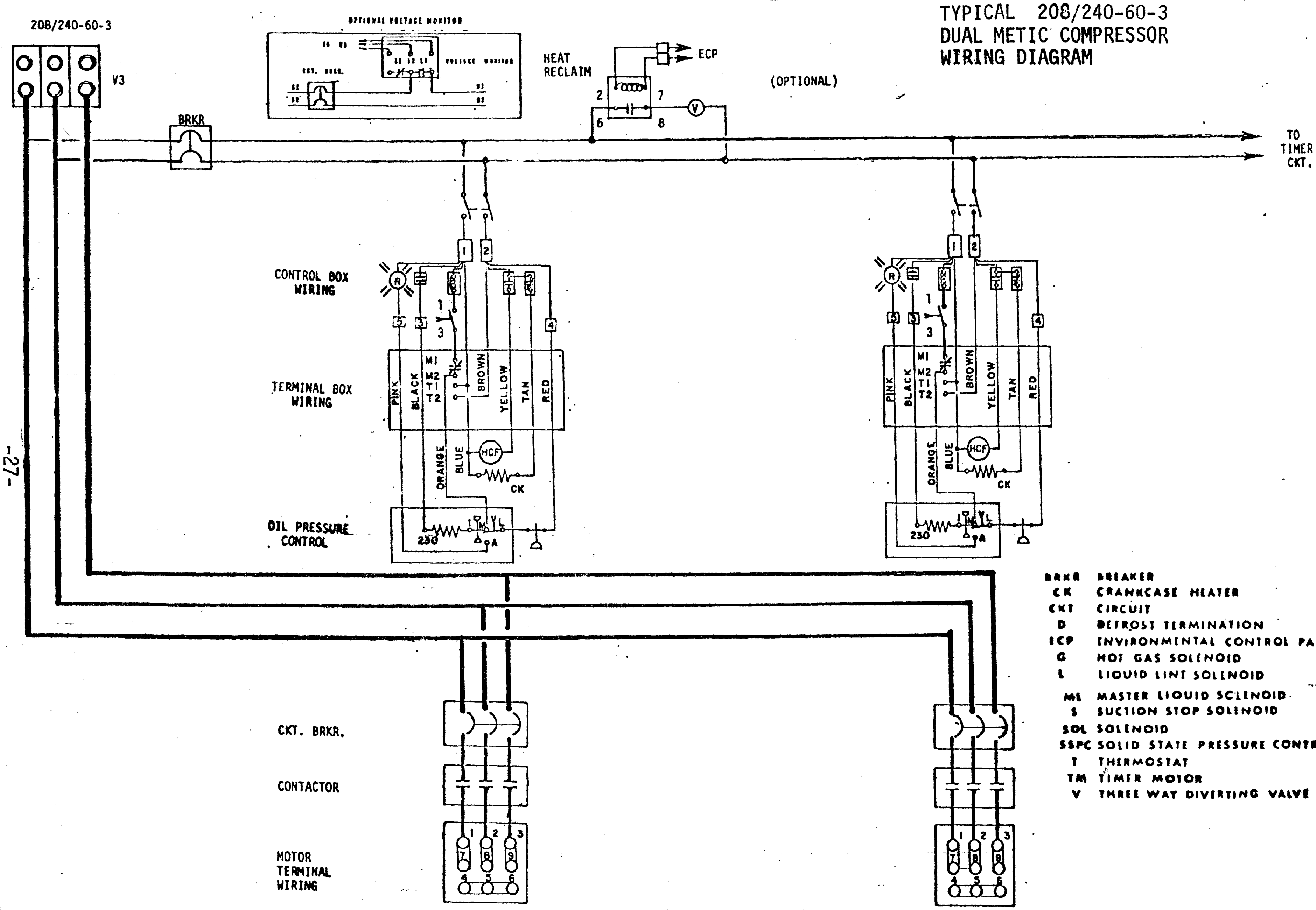
TROUBLE-SHOOTING CHART

SYMPTOM	CAUSE	REMEDY
A. COMPRESSOR DOES NOT RUN.	1. MOTOR LINE OPEN	1. CLOSE START OR DISCONNECT SWITCH
	2. FUSE BLOWN	2. REPLACE FUSE
	3. TRIPPED CIRCUIT BREAKER	3. RE-SET / CHECK OPERATION
	4. CONTROL CONTACTS DIRTY OR JAMMED IN OPEN POSITION.	4. REPAIR OR REPLACE
	5. PISTON SEIZED	5. REMOVE MOTOR - COMPRESSOR HEAD. LOOK FOR BROKEN VALVE AND JAMMED PARTS.
	6. FROZEN COMPRESSOR OR MOTOR BEARINGS.	6. REPAIR OR REPLACE
	7. TIME DELAY DEFECTIVE	7. REPLACE TIME DELAY ON COMP #2
B. UNIT SHORT CYCLES	1. CONTROL DIFFERENTIAL SET TOO CLOSE.	1. WIDEN DIFFERENTIAL
	2. DISCHARGE VALVE LEAKING	2. REPLACE VALVE PLATE
	3. MOTOR-COMPRESSOR OVER-LOAD	3. CHECK FOR HIGH HEAD PRESSURE, TIGHT BEARINGS, SEIZED PISTONS, FOULED WATER - COOLED CON-DENSER.
	4. REFRIGERANT SHORTAGE	4. REPAIR LEAK AND RECHARGE.
	5. REFRIGERANT OVERCHARGE	5. PURGE.
	6. CYCLING ON HIGH PRESSURE CUT-OUT.	6. CHECK CONDENSER AND TOWER PUMPS
C. COMPRESSOR WILL NOT START - HUMS INTER-MITTENTLY (CYCLING ON OVERLOAD).	1. IMPROPERLY WIRED	1. CHECK WIRING AGAINST DIAGRAM.
	2. LOW LINE VOLTAGE	2. CHECK MAIN LINE VOLTAGE - DETERMINE LOCATION OF VOLTAGE DROP.
	3. RELAY CONTACTS NOT CLOSING.	3. CHECK BY OPERATING MANUALLY. REPLACE RELAY IF DEFECTIVE.
	4. OPEN CIRCUIT IN STARTING WINDING	4. CHECK STATOR LEADS IF LEADS ARE ALL RIGHT, REPLACE COMPRESSOR.
	5. STATOR WINDING GROUNDED	5. CHECK ALL STATOR LEADS. IF LEADS ARE ALL RIGHT REPLACE COMPRESSOR.
	6. HIGH DISCHARGE PRESSURE	6. ELIMINATE CAUSE OF EXCESSIVE PRESSURE. MAKE SURE DISCHARGE SHUT-OFF VALVE IS OPEN.
	7. TIGHT COMPRESSOR	7. CHECK OIL LEVEL - CORRECT BINDING.

D. UNIT OPERATES LONG OR CONTINUOUSLY	1. REFRIGERANT SHORTAGE	1. REPAIR LEAK AND RECHARGE
	2. CONTROL CONTACTS STICKING IN CLOSED POSITION	2. CLEAN POINTS OR RE-PLACE CONTROL.
	3. DIRTY CONDENSER	3. CLEAN CONDENSER
	4. AIR IN SYSTEM	4. PURGE
	5. COMPRESSOR INEFFICIENT	5. CHECK VALVES AND PISTONS
	6. IMPROPER WIRING	6. CHECK WIRING AND CORRECT IF NECESSARY
E. FIXTURE TEMPERATURE TOO HIGH	1. REFRIGERANT SHORTAGE	1. REPAIR LEAK AND RECHARGE
	2. CONTROL SET TOO HIGH	2. RESET CONTROL
	3. CONTROL WIRING LOOSE	3. CHECK WIRING TO CONTROL
	4. EXPANSION VALVE OR STRAINER PLUGGED	4. CLEAN AND REPLACE
	5. COMPRESSOR INEFFICIENT	5. CHECK VALVES AND PISTONS
	6. EXPANSION VALVE SET TOO HIGH	6. LOWER SETTING
	7. ICED OR DIRTY COIL	7. DEFROST OR CLEAN
	8. CLOGGED OR SMALL GAS LINES.	8. CLEAR CLOGGING OR INCREASE LINE SIZE
	9. OIL LOGGED SYSTEM	9. REMOVE EXCESS OIL, CHECK REFRIGERANT CHARGE
F. HEAD PRESSURE TOO HIGH	1. REFRIGERANT OVERCHARGE	1. PURGE
	2. AIR IN SYSTEM	2. PURGE
	3. FOULED WATER COOLED CONDENSER	3. CLEAN CONDENSER - CHECK WATER TREATMENT METHODS
	4. HIGH SIDE RESTRICTION	4. REMOVE BLOCKAGE
	5. WATER REGULATING VALVE SET INCORRECTLY	5. READJUST
G. HEAD PRESSURE TOO LOW	1. REFRIGERANT SHORTAGE	1. REPAIR LEAK AND RECHARGE
	2. COMPRESSOR SUCTION OR DISCHARGE VALVES INEFFICIENT	2. CLEAN OR REPLACE LEAKY VALVE PLATES
	3. COLD AMBIENT	3. NO REMEDY AS EFF-ICIENCY IS GEN-ERALLY INCREASED. HOWEVER, IF CON-DENSING TEMP. IS BELOW 85^{o}F EXPANS VALVES WILL NOT BE ABLE TO FEED PROPERLY AND SOME FORM OF HEAD PRESSURE CONTROL MUST BE PROVIDED
	4. WATER REGULATING VALVE SET INCORRECTLY	4. READJUST

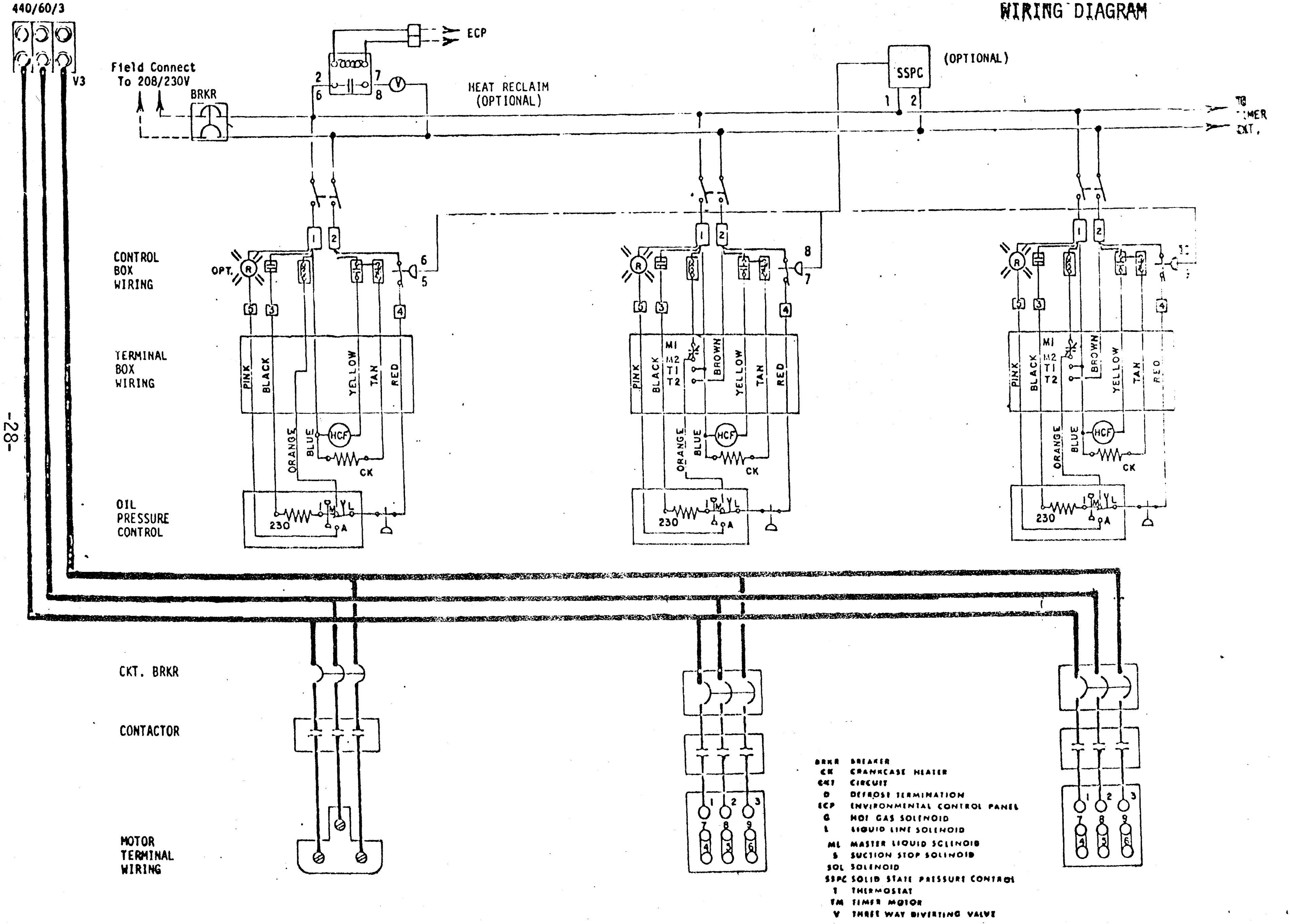
H. NOISY UNIT	1. INSUFFICIENT COMPRESSOR OIL	1. ADD OIL TO PROPER LEVEL
	2. TUBING RATTLE	2. BEND TUBES AWAY FROM CONTACT
	3. MOUNTINGS LOOSE	3. TIGHTEN
	4. OIL SLUGGING OR REFRIGERANT FLOODING BACK.	4. ADJUST OIL LEVEL OR REFRIGERANT CHARGE. CHECK EXPANSION VALVE FOR LEAK OR OVERSIZE ORIFICE
	5. UNBALANCED FAN OR DEFECTIVE FAN MOTOR	5. REPLACE BENT OR BROKEN FAN BLADES CHECK MOTOR BEARINGS
I. COMPRESSOR LOSES OIL	1. SHORTAGE OF REFRIGERANT	1. REPAIR LEAK AND RECHARGE
	2. GAS-OIL RATIO LOW	2. ADD 1 PT. OIL FOR EACH 10 LBS. OF REFRIGERANT ADDED TO FACTORY CHARGE.
	3. PLUGGED EXPANSION VALVE OR STRAINER.	3. CLEAN OR REPLACE
	4. OIL TRAPPING IN LINES	4. DRAIN TUBING TOWARD COMPRESSOR
	5. SHORT CYCLING	5. REFER TO PART B.
	6. SUPERHEAT TOO HIGH AT COMPRESSOR SUCTION.	6. CHANGE LOCATION OF EXPANSION VALVE BULB OR ADJUST VALVE TO RETURN WET GAS TO COMPRESSOR.
J. FROSTED OR SWEATING SUCTION LINE	1. EXPANSION VALVE ADMITTING EXCESS REFRIGERANT	1. ADJUST EXPANSION VALVE.
K. HOT LIQUID LINE.	1. SHORTAGE OF REFRIGERANT	1. REPAIR LEAK AND RECHARGE
	2. EXPANSION VALVE OPEN TOO WIDE	2. ADJUST EXPANSION VALVE
	3. IMPROPER WATER FLOW	3. CHECK WATER PUMPS-TOWER FANS AND SYSTEM CLEANLINESS
L. FROSTED LIQUID LINE	1. RECEIVER SHUT-OFF VALVE PARTIALLY CLOSED OR RESTRICTED.	1. OPEN VALVE OR REMOVE OBSTRUCTION
	2. CLOGGED DEHYDRATOR OR STRAINER	2. REPLACE CLOGGED PART
M. UNIT IN VACUUM FROST ON EXPANSION VALVE ONLY	1. ICE PLUGGINGS EXPANSION VALVE ORIFICE.	1. APPLY HOT WET CLOTH TO EXPANSION VALVE. IF SUCTION PRESSURE NOW INCREASES, THERE IS MOISTURE IN THE SYSTEM AND A DRIER SHOULD BE INSTALLED IN THE LINE.
	2. PLUGGED EXPANSION VALVE	2. CLEAN STRAINER OR REPLACE EXPANSION VALVE.
N. COMPRESSOR FAILURE	TO MAINTAIN PARTIAL REFRIGERATION, CLOSE LIQUID HAND VALVES UNTIL AMP DRAW ON RUNNING COMPRESSOR IS WITH IN NAME PLATE LIMITS. REPLACE DEFECTIVE COMPRESSOR.	

TYPICAL 208/240-60-3 DUAL METIC COMPRESSOR WIRING DIAGRAM

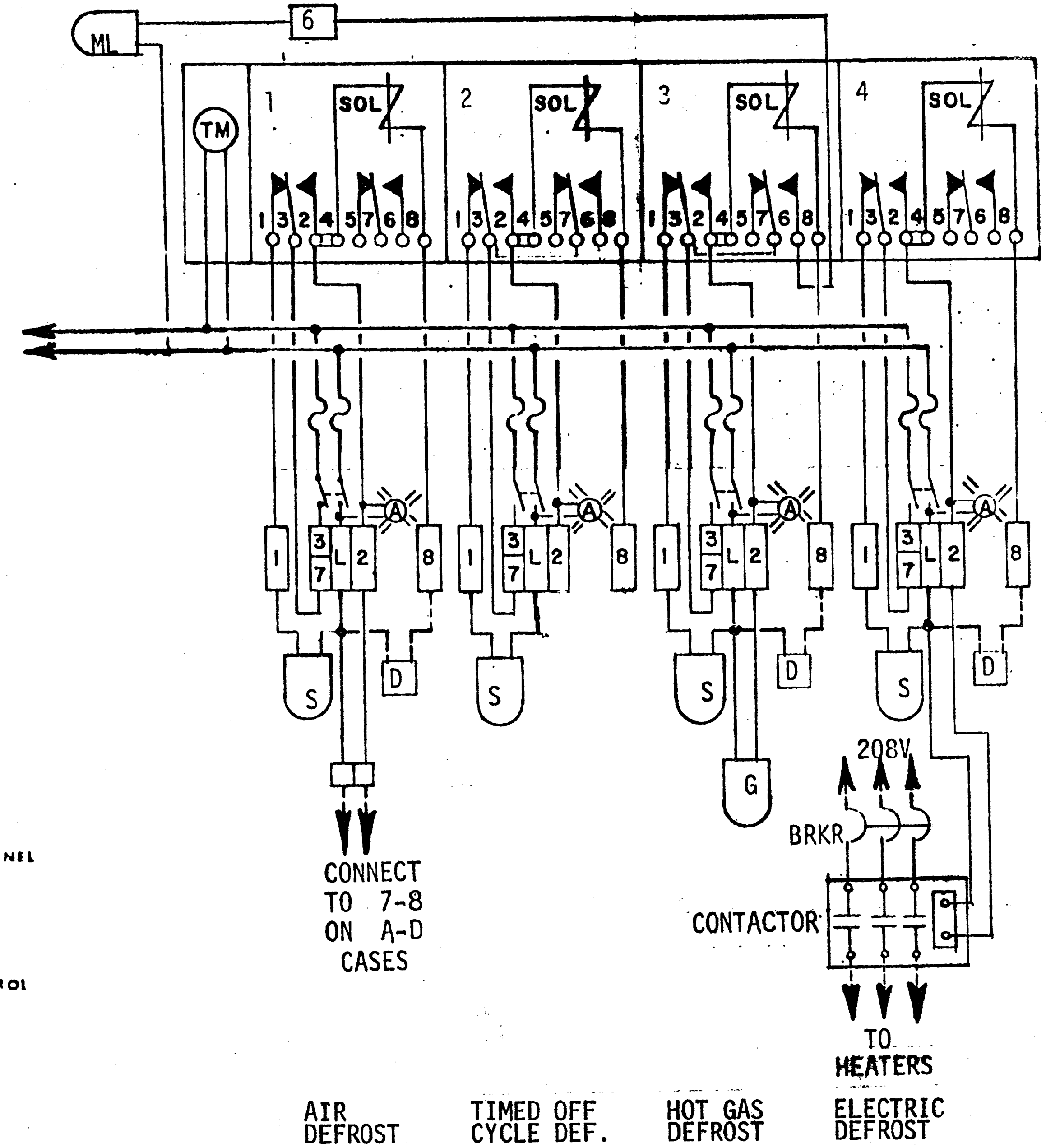


BRKR	BREAKER
CK	CRANKCASE HEATER
CKT	CIRCUIT
D	DEFROST TERMINATION
ECP	ENVIRONMENTAL CONTROL PANEL
G	HOT GAS SOLENOID
L	LIQUID LINE SOLENOID
ML	MASTER LIQUID SOLENOID
S	SUCTION STOP SOLENOID
SOL	SOLENOID
SSPC	SOLID STATE PRESSURE CONTROL
T	THERMOSTAT
TM	TIMER MOTOR
V	THREE WAY DIVERTING VALVE

TYPICAL 440/460-60-3 TRI METIC COMPRESSOR WIRING DIAGRAM



TYPICAL SYSTEM
CIRCUIT WIRING
DIAGRAM



BRKR	BREAKER
CK	CRANKCASE HEATER
CKT	CIRCUIT
D	DEFROST TERMINATION
ECP	ENVIRONMENTAL CONTROL PANEL
G	HOT GAS SOLENOID
L	LIQUID LINE SOLENOID
ML	MASTER LIQUID SOLENOID
S	SUCTION STOP SOLENOID
SOL	SOLENOID
SSPC	SOLID STATE PRESSURE CONTROL
T	THERMOSTAT
TM	TIMER MOTOR
V	THREE WAY DIVERTING VALVE