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7/26/90, 9/24/90

KYSOR//WARREN

The Leading Edge of Technology

INSTALLATION & OPERATION MANUAL

MODEL: **PARALLEL REFRIGERATION CONDENSING UNITS**

KYSOR//WARREN

DIVISION OF KYSOR INDUSTRIAL CORPORATION

1600 INDUSTRIAL BLVD., CONYERS, GEORGIA 30207/(404) 483-5600
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THE KYSOR//WARREN 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 Kysor//Warren Parallel System is the proper selection of the optimum systems 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.

07/26/90

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.

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.

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 plant in Conyers, Ga.

LOCATION OF EQUIPMENT

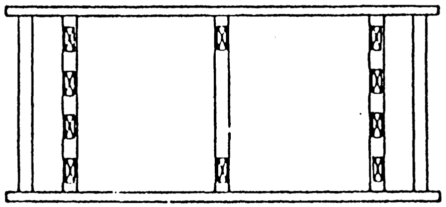
The Parallel Systems must be located so they are level and easily serviced. A minimum of 30" service clearance between units and any other walls or stationary equipment is recommended. For Parallel System units placed end to end 18 inches between units is adequate. The Parallel System is designed so 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 so that air flow passes over the units.

Vibration Mounts

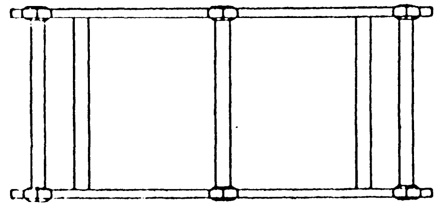
Vibration pads are supplied with each unit, if optional isolator springs are not ordered. Quantities of vibration pads or isolator springs and the recommended placing is shown on pages 3 and 4.

PAD AND SPRING LOCATIONS

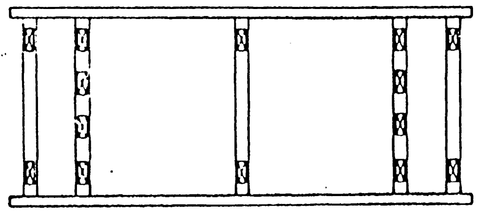
NARROW RACK



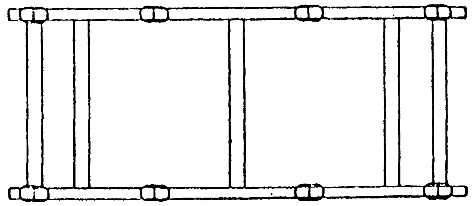
2 AND 3 COMPRESSORS
10 PADS REQUIRED



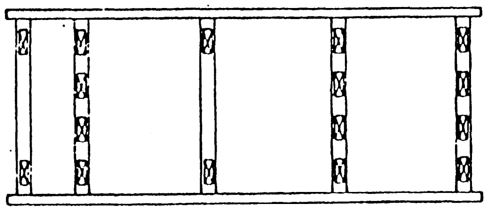
2 AND 3 COMPRESSORS
6 SPRINGS REQUIRED



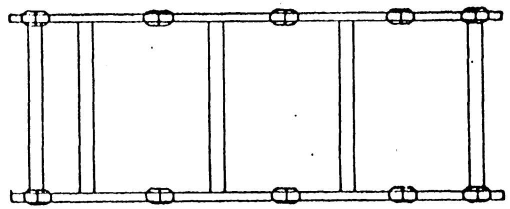
3 AND 4 COMPRESSORS
14 PADS REQUIRED



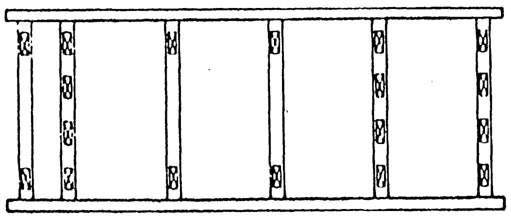
3 AND 4 COMPRESSORS
8 SPRINGS REQUIRED



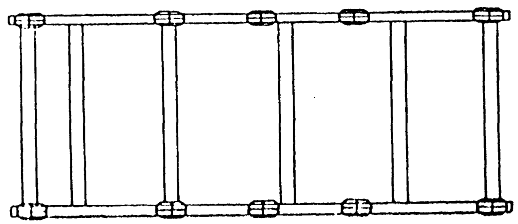
4 AND 5 COMPRESSORS
16 PADS REQUIRED



4 AND 5 COMPRESSORS
10 SPRINGS REQUIRED

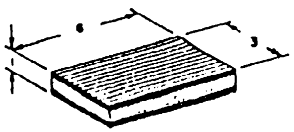


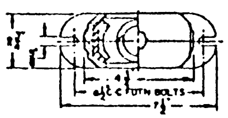
5 AND 6 COMPRESSORS
18 PADS REQUIRED



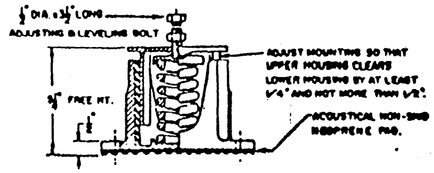
5 AND 6 COMPRESSORS
10 SPRINGS REQUIRED

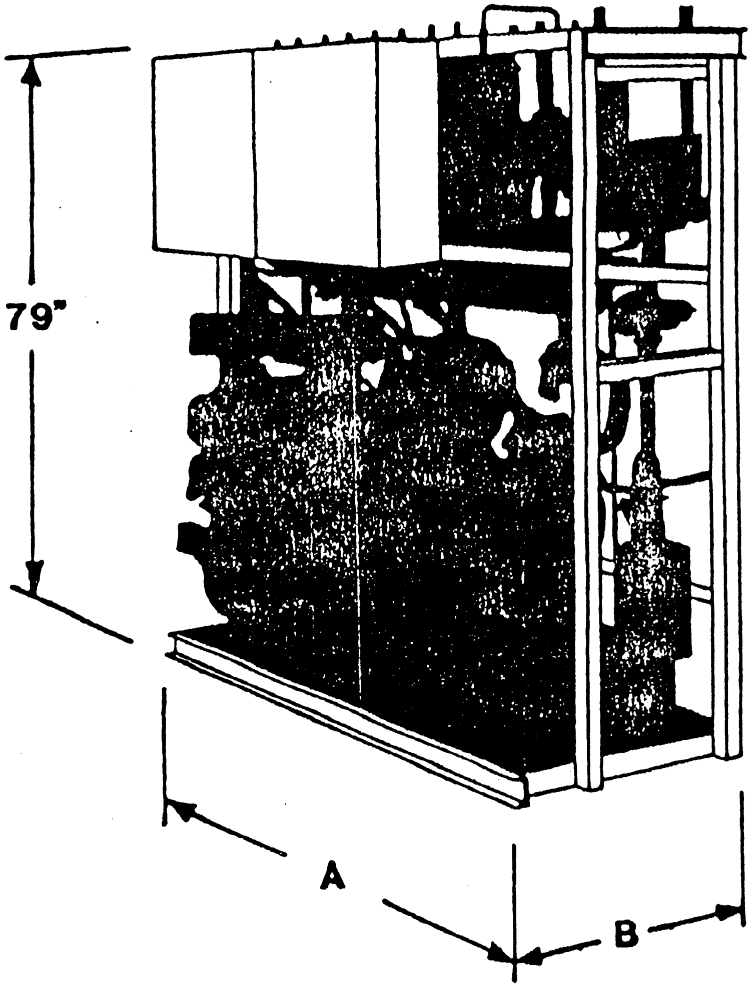
VIBRATION PAD





SPRING





Unit Length Dim. "A"	Compressors & Length
79"	2 Compressors, 1-8 Circuits 3 Compressors, 1-8 Circuits
107"	2 Compressors, 9-12 Circuits 3 Compressors, 9-12 Circuits 4 Compressors, 1-12 Circuits
129"	3 Compressors, 13-16 Circuits 4 Compressors, 13-16 Circuits 5 Compressors, 1-16 Circuits

Unit Width Dim. "B"	Compressors
36"	Copeland
36"	Carlyle-D
40"	Carlyle-E

LETTER	REVISED	DATE	BY

DATE 12/30/85

SCALE NONE

DRAWN

APPD PM

TITLE

PARALLEL UNIT DIMENSIONS - SLIMLINE

KYSOR | WARREN / SHERER — DIVISION OF KYSOR INDUSTRIAL CORPORATION

DRAWING NUMBER PA-22287

UNIT DESIGNATION

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

Unit Model	No. Compressors	Compressor Manufacturer
EM 2	2	Copeland - Even
ED 2	2	Copeland (Discus)-Even
EC 2	2	Carlyle - Even
TM 3	3	Copeland - Uneven
TD 3	3	Copeland (Discus)-Uneven
TC 3	3	Carlyle - Uneven
EM 3	3	Copeland - Even
ED 3	3	Copeland (Discus)-Even
EC 3	3	Carlyle - Even
EM 4	4	Copeland - Even
ED 4	4	Copeland (Discus)-Even
EC 4	4	Carlyle - Even
TM 4	4	Copeland - Uneven
TD 4	4	Copeland (Discus)-Uneven
TC 4	4	Carlyle - Uneven

Application Temperature & Refrigerant Type

R-12	Medium Temp	FC
R-502	Medium Temp	RC
R-502	Low Temp	RL
R-22	High Temp	DH
R-22	Medium Temp	DC
R-22	Low Temp	DL

Example Designation

TM3 - 2005DC

R-22, Med. Temp
Total Nominal Horsepower (20)
3 Copeland Compressor - Uneven Sizes

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 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 208/230/3/60 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 in compliance with the National Electrical Code 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 28, 29, & 30. 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 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 page 13 for general system piping arrangement.

COMPRESSORS

The compressors, Copeland or Carlyle are solid mounted to the base frame assembly. All systems will incorporate the AC & R oil floats and pressurized reservoir. 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 on 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 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. The hot gas line is piped into the suction line up stream of the EPR or solenoid valve. All controls, valves, and piping are factory installed. Cases are equipped accordingly when ordered.

When defrost is initiated by the time clock the master liquid line solenoid* 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 pressures occurs, a twenty (20) pound differential check valve piped in parallel with the main liquid line solenoid will open and supply the required liquid.

A typical piping schematic for gas defrost can be found on page 14.

*Master liquid line solenoid is NORMALLY OPEN - Close when energized.

See page 16a for discussion of other type controls.

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 is 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. 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 than 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.

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 at least 6ft. is required. The dual drop legs should be dropped the 6ft. 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. See page 45.4, Table 9 in Condenser Bulletin for recommended settings.

THE OIL SYSTEM

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.

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 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.

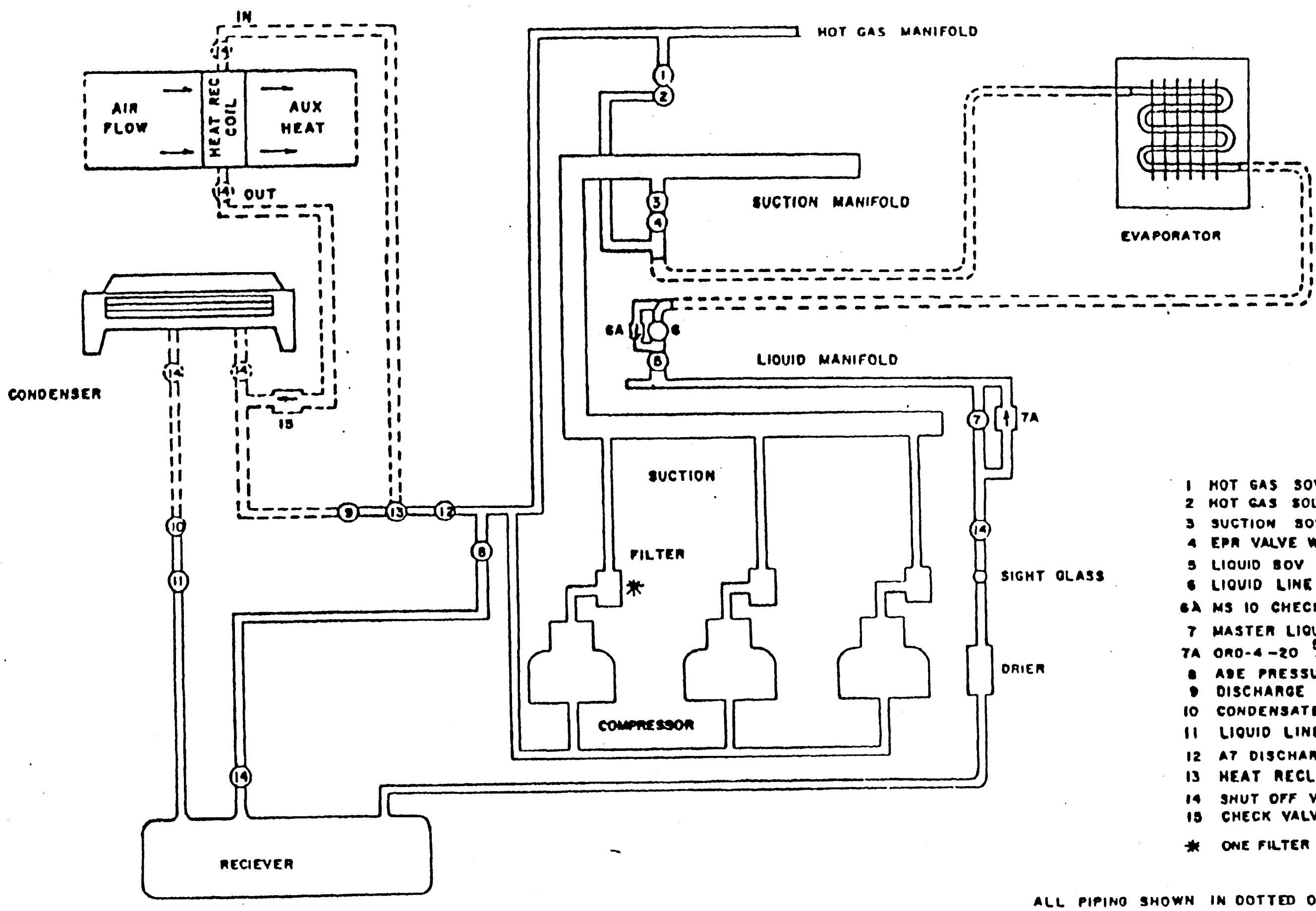
On system start-up of a new parallel system, oil should be added to the reservoir until oil is visible in the upper sight glass port, NOT ABOVE IT. It is commonly accepted that in a new refrigeration system, some oil will be absorbed by the refrigerant as the system operates. After two hours of operation, 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.

SATELLITE COMPRESSOR

A compressor may be added to the Parallel System for ice cream or fresh meat 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 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.

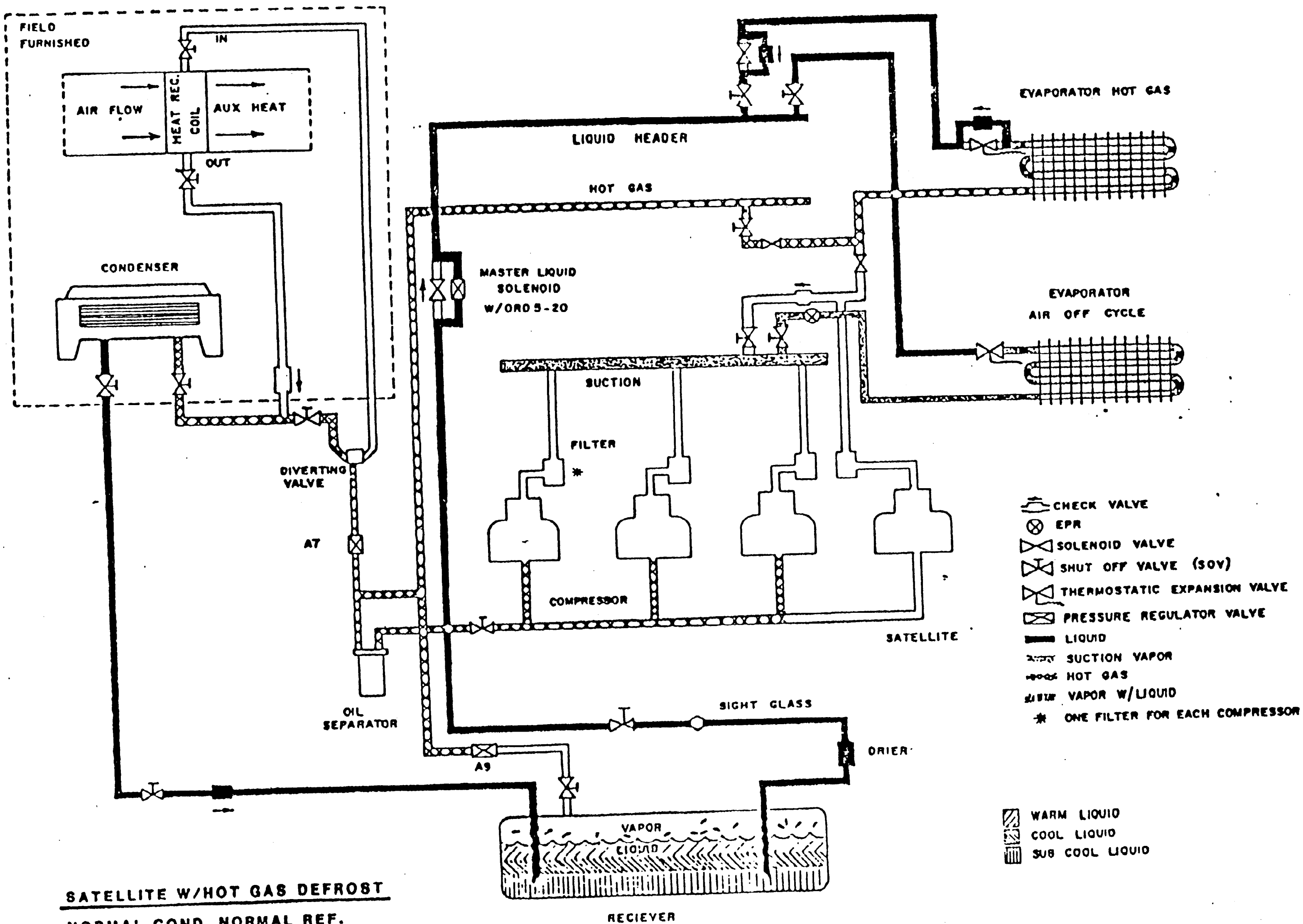
See page 14 and 16 for satellite piping schematic.



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 ORO-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

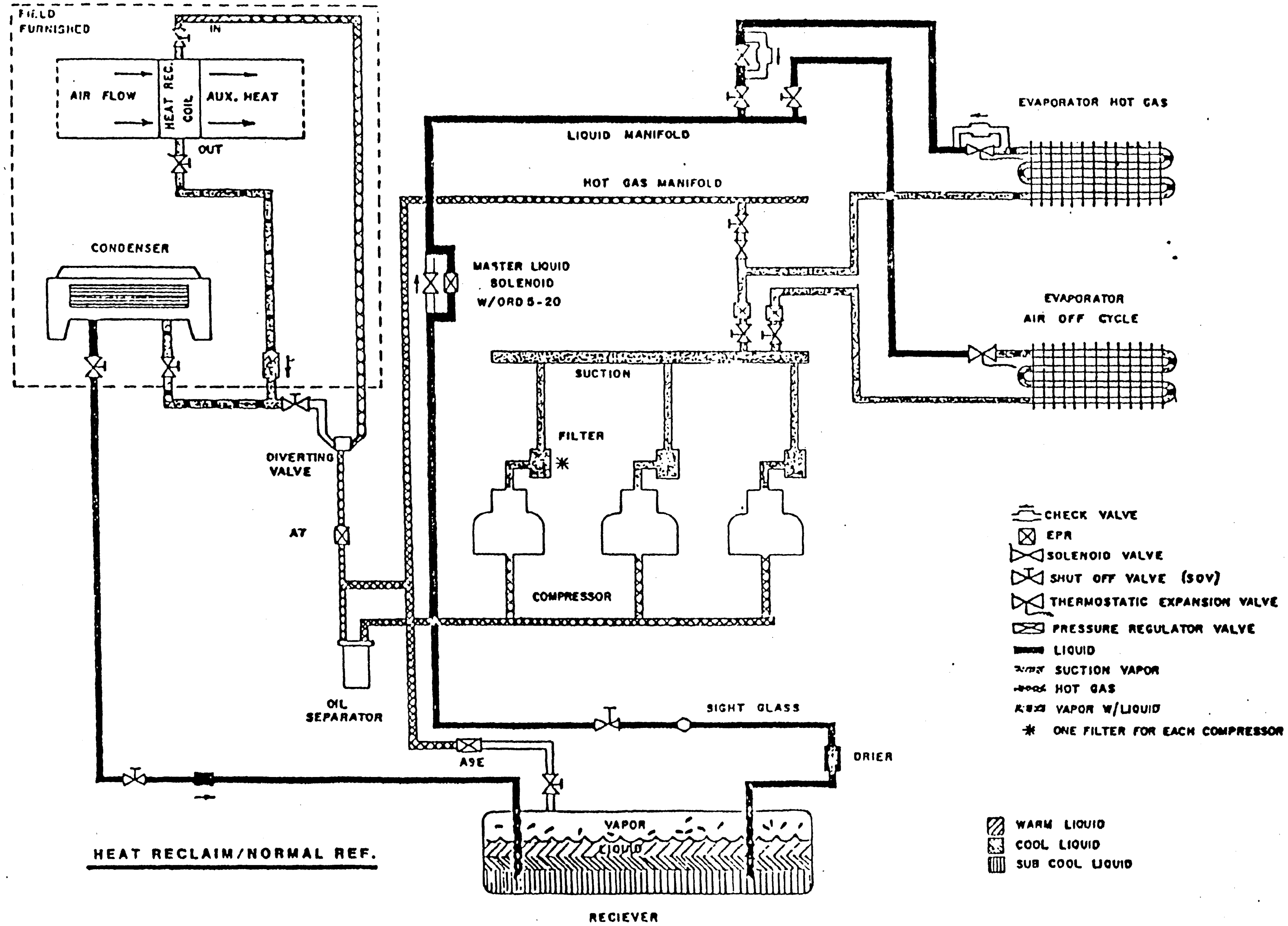
ALL PIPING SHOWN IN DOTTED OUTLINE ARE FIELD INSTALLED AS PER CUSTOMER SPECIFICATIONS.

GENERAL PARALLEL SYSTEM LAYOUT OF PIPING

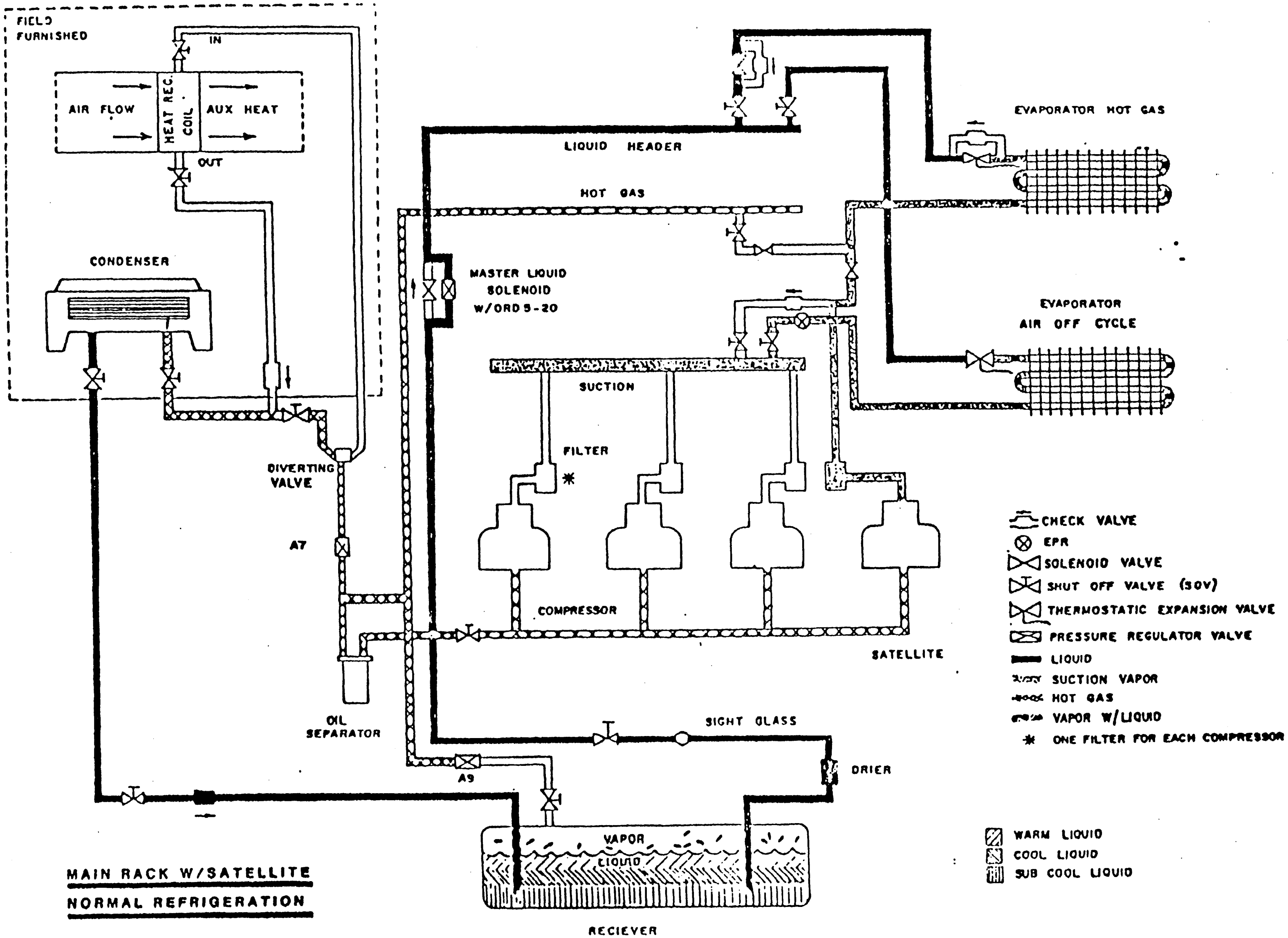


SATELLITE W/HOT GAS DEFROST

NORMAL COND. NORMAL REF.



HEAT RECLAIM/NORMAL REF.



MAIN RACK W/SATELLITE
NORMAL REFRIGERATION

SYSTEM OPERATION

Floating Head/Gas Defrost

The attached drawing is a typical piping arrangement for a refrigeration system incorporating heat reclaim, remote condenser, gas defrost and ambient liquid sub-cooling.

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

Components/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 A7BL is adjusted during the defrost mode to maintain a 20 to 25 psig differential between the discharge and liquid header pressures.

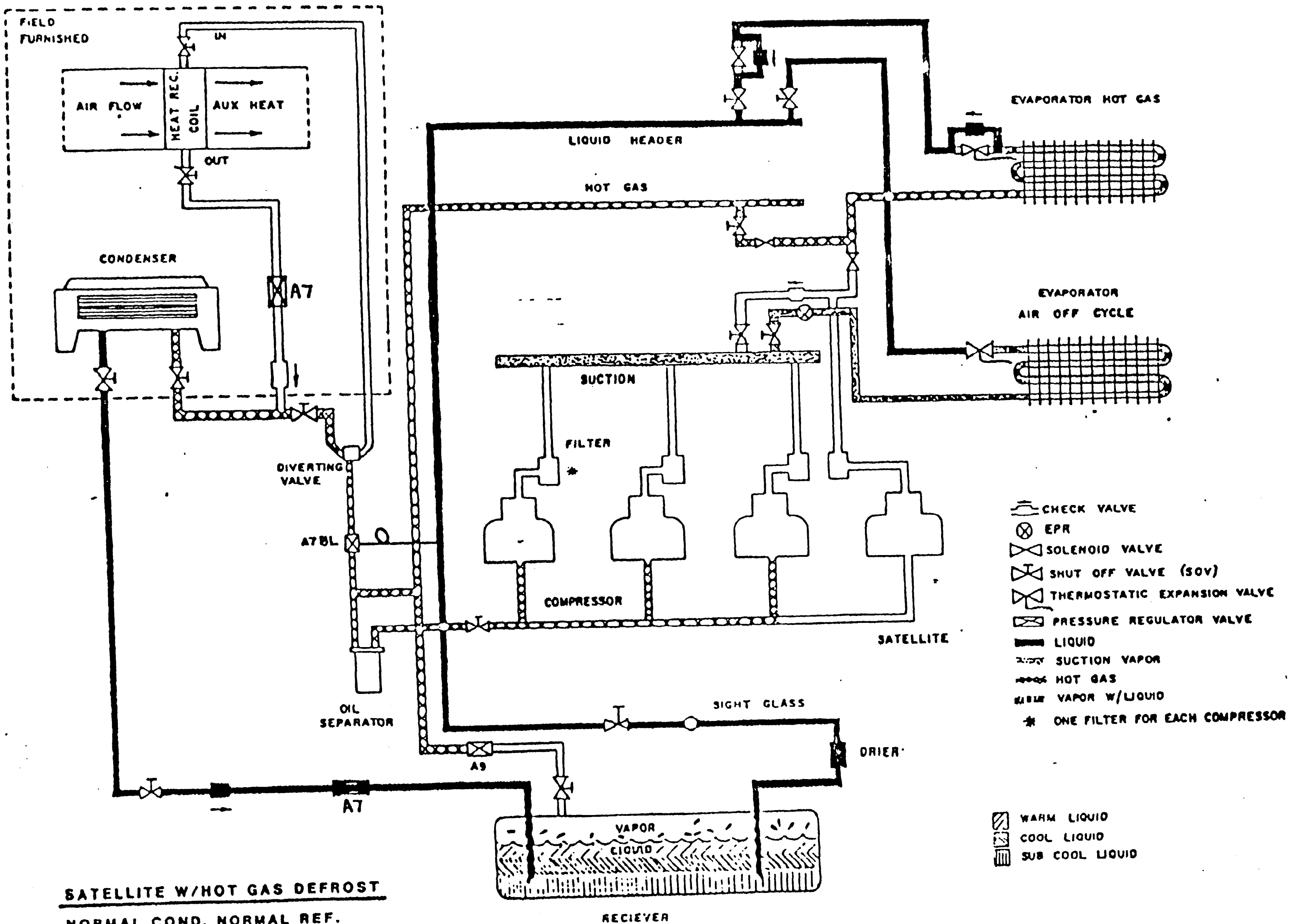
2.) A7 Pressure Regulator - Heat Reclaim Return - The A7 at this location is optional and is used to maintain a minimum head pressure when the system is in the heat reclaim mode. This valve is normally set to maintain 105 to 110 degree F condensing temperature in the heat coil.

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 R-502 this valve would be set at 140 to 150 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 same pressure as A7 in condenser return line.

    An alternate 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 to maintain receiver pressure 3 psig over 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 40 to 50 degree F.



SATELLITE W/HOT GAS DEFROST

NORMAL COND. NORMAL REF.

Recommended Control Settings

A. Set (A7) Discharge Pressure Regulator at 170 PSIG with R-502; 150 PSIG with R-22; 100 PSIG with R-12. Gauge should be on compressor discharge service valve.

B. Set (A9) Receiver Pressure Regulator at 160 PSIG with R-502; 140 PSIG with R-22; 90 PSIG with R-12. Gauge should be on receiver outlet valve.

C. High Pressure Controls:

R-502	350	Cut-Out
R-12	250	Cut-Out
R-22	350	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(+10dg F)	Comp 2	29	38
R-502	Comp 1	30	41
MT(+20dg F)	Comp 2	41	48
R-12	Comp 1	3	10
MT(+10dg F)	Comp 2	8	13
R-12	Comp 1	8	15
MT(+20dg F)	Comp 2	15	19

Tri Metic and Dual Metic with SSPC 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 #85-130-3 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 compressor 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 #85-130-3

G. Adjustable Time Delay Controls - Satellite Compressors

Minimum Setting 3 minutes

KYSOR//WARREN

Recommended Suction Pressure Control Settings

	Cut In	Cut Out
R-12 "FC" Units		
+10 Systems	15	11
+15 Systems	18	14
+20 Systems	21	17
R-22 "DH" Units		
+10 Systems	34	30
+15 Systems	38	34
+20 Systems	43	38
+40 Systems	67	60
R-502 "RC" Units		
+10 Systems	42	38
+15 Systems	47	43
+20 Systems	52	47
R-502 "RL" Units		
-25 Systems	16	11

Note: These are approximate settings and could vary with actual operating conditions.

July 26, 1990

KYSOR//WARREN

ALTECH OVERRIDE SETTINGS

Approximate settings for compressor dual pressure controls when Altech SSPC is placed in override positions.

Two Compressor System	Compressor	Cut-Out	Cut-In
R-502 LT	1	1	11
(-25Dg.F)	2	7	15
R-502 MT	1	20	33
(+10Dg.F)	2	29	40
R-502 MT	1	30	43
(+20Dg.F)	2	40	50
R-12 MT	1	2	11
(+10Dg.F)	2	7	14
R-12 MT	1	7	17
(+20Dg.F)	2	14	21

Three Compressor System

R-502 LT	1	8	16
(-25Dg.)	2	4	12
R-502 MT	1	29	39
(+10Dg.F)	2	25	36
R-502 MT	1	41	50
(+20Dg.F)	2	35	45
	3	30	41
R-12 MT	1	7	14
(+10Dg.F)	2	5	12
R-12 MT	1	14	21
(+20Dg.)	2	10	18
	3	7	15

Four Compressor System

Use same settings as THREE COMPRESSOR SYSTEM.
Set compressor #4 same as Compressor #3.

Note: When compressor control is switched back to the Altech, reset the dual pressure controls to approximately 1psig.

July 26, 1990

KYSOR // WARREN
DIVISION OF KYSOR INDUSTRIAL CORPORATION

Subject: INITIAL CONTROL SETTINGS Date: 7/26/90

Engineering Bulletin: #90-130-7
Supersedes: #86-130-2

NOTE: The attached recommended settings are based upon 75 deg.F - 55% RH store conditions and properly loaded cases. Some adjustments may be required in case temperature of 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 Dualmetics and Trimetics on cases requiring higher temperature evaporators than 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 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, Georgia 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/24HR
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		36	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 R-12

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)	0--5	N/A	N/A	N/A
	LM1A(G)	-10-0	N/A	N/A	N/A
	LV5H1	0--5	N/A	N/A	N/A
	WALK-IN	-5--10	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	-24--28	N/A	N/A	N/A
	I5F	-22--12	N/A	N/A	N/A
	ILA	-24--28	N/A	N/A	N/A
	IV5H1	-12--15	N/A	N/A	N/A
	WALK-IN	-10--15	N/A	N/A	N/A
	WTLA/EWTLA	-24--28	N/A	N/A	N/A
	XLA	-24--28	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 R-502

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)	0 - -5	14#	10#	4#
	LM1A(G)	-10 - 0	12#	16#	9#
	LV5H1	0 - -5	18#	15#	5#
	WALK-IN	-5 - -10	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	-24 - -28	N/A	8#	2#
	I5F	-22 - -12	N/A	12#	5#
	ILA	-24 - -28	N/A	8#	2#
	IV5H1	-12 - -15	N/A	8#	1#
	WALK-IN	-10 - -15	12#	N/A	N/A
	WTLA/EWTLA	-24 - -28	N/A	8#	2#
	XLA	-24 - -28	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#

Subject: INITIAL CONTROL SETTINGS Date: 7/26/90

Engineering Bulletin: #90-130-7

CONTROL SETTINGS R-22

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)	0 - -5	8#	8#	1#
	LM1A(G)	-10 - 0	8#	8#	1#
	LV5H1	0 - -5	13#	8#	1#
	WALK-IN	-5 - -10	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	-24 - -28	N/A	4#	1#
	I5F	-22 - -12	N/A	4#	1#
	ILA	-24 - -28	N/A	4#	1#
	IV5H1	-12 - -01	8#	4#	1#
	WALK-IN	-10 - -15	7#	4#	1#
	WTLA/EWTLA	-24 - -28	N/A	4#	1#
	XLA	-24 - -28	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			

KYSOR//WARREN CONDENSING UNIT CONTROL/ALARM PANEL

The Kysor//Warren condensing unit control/alarm panel provides a means of controlling multiple compressors on a condensing unit rack and also provides indication of 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 L.E.D. 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 and 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 the auto mode. In the manual mode the alarm reset switch must be depressed to remove the transmission of an alarm condition from the alarm relay whenever it has been triggered by an alarm condition. In the off mode no alarm signal will be transmitted in the event of an alarm condition; however, the L.E.D. circuitry for each alarm condition will remain active.

Specifications

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)

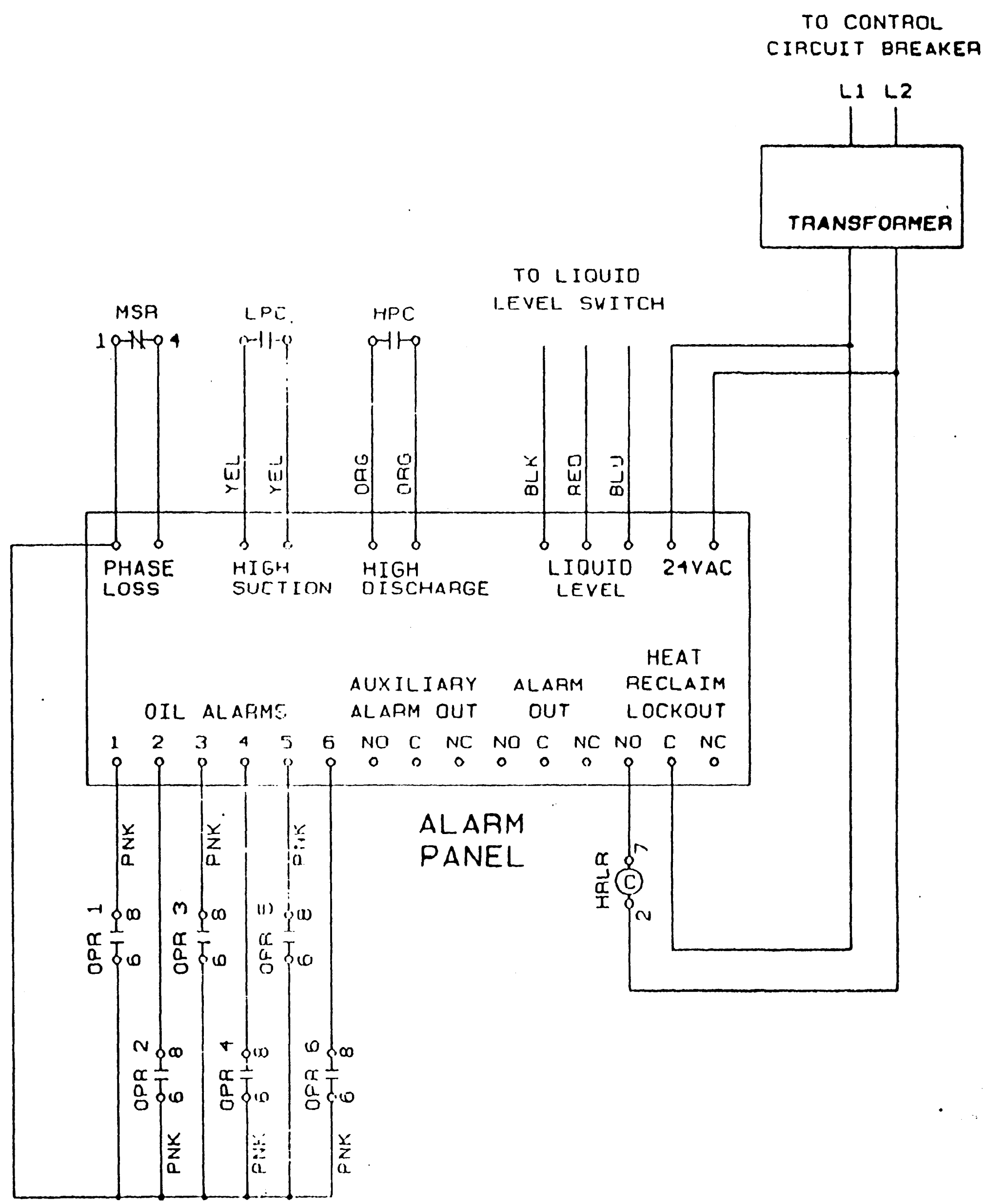
Output

Alarm Relay	DPDT (10amp @ 240VAC)
Heat Reclaim	SPDT (10amp @ 240VAC)

Initial Recommended Pressure Settings (PSIG) Adjust as Necessary

Refrigerant	High Suction		High Discharge
R-12	Med Temp (+10dg F)	20	200
R-12	Med Temp (+20dg F)	26	200
R-502	Low Temp (-25dg F)	21	325
R-502	Med Temp (+10dg F)	47	325
R-502	Med Temp (+20dg F)	57	325

ALARM HOOKUP



CR	COMPRESSOR RELAY
DR	DEFROST RELAY
HPS	HIGH PRESSURE SWITCH
HRLR	HEAT REC. LOCK OUT RELAY (OPT)
LLS	LIQUID LEVEL SWITCH
LPS	LOW PRESSURE SWITCH
PLR	PHASE LOSS RELAY (OPT)
OPR	OIL PRESSURE RELAY
LP	LOW PRESSURE CONTROL
UR	UNLOADER RELAY
SR	SATELLITE COMPRESSOR RELAY
GR	GROUND
MSR	MOTOR SAVER RELAY

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 VOLTAGES BETWEEN L1-L2, L1-L3, & L2-L4. THESE VOLTAGES SHOULD BE APPROXIMATELY EQUAL AND WITHIN 10% OF THE RATED 3 PH. LINE TO LINE VOLTAGE.

B. IF THESE VOLTAGES ARE EXTREMELY LOW 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, L3. THIS MAY BE NECESSARY AS MOTORSAVER IS SENSITIVE TO PHASE REVERSAL.

Rev. 7/26/90

KYSOR//WARREN

CASE WIRING IDENTIFICATION 115/VOLT 1 PHASE

WIRE NO:	
#1:	Anti-Sweat Heater
#2:	Anti-Sweat Heater
#3:	Drain Heater & Fan Motor
#4:	Drain Heater & Fan Motor
#5:	Light Circuit
#6:	Light Circuit
#11:	Air Def. Blower (LM1AG only) 115 V
#12:	Air Def. Blower (LM1AG only) 115 V
#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.

KYSOR//WARREN

CASE WIRING CONNECTION TO UNITS

WIRE NO:		(WARREN/SHERER) DM/TM	OCD/MAD/RAD
#7:	Def. Heaters (Elec Def)	*	*
#8:	Def. Heaters (Elec Def)	*	*
#7:	Def. Relay Coil (Air Def)	L	N
#8:	Def. Relay Coil (Air Def)	2	3
#9:	Temperature Control	T	4
#10:	Temperature Control	L	**
#17:	Def. Termination	L	N
#18:	Def. Termination	8	X
#19:	Def. Relay Cir. (I4H/IV5H)	1	4

* Defrost Contactor
** Wires in series w/press. control

Note:
1) Dual & Tri-metic: Connections at unit electrical panel.
2) OCD/MAD/RAD Connections at 8145-20 time clock at unit.

KYSOR/WARREN

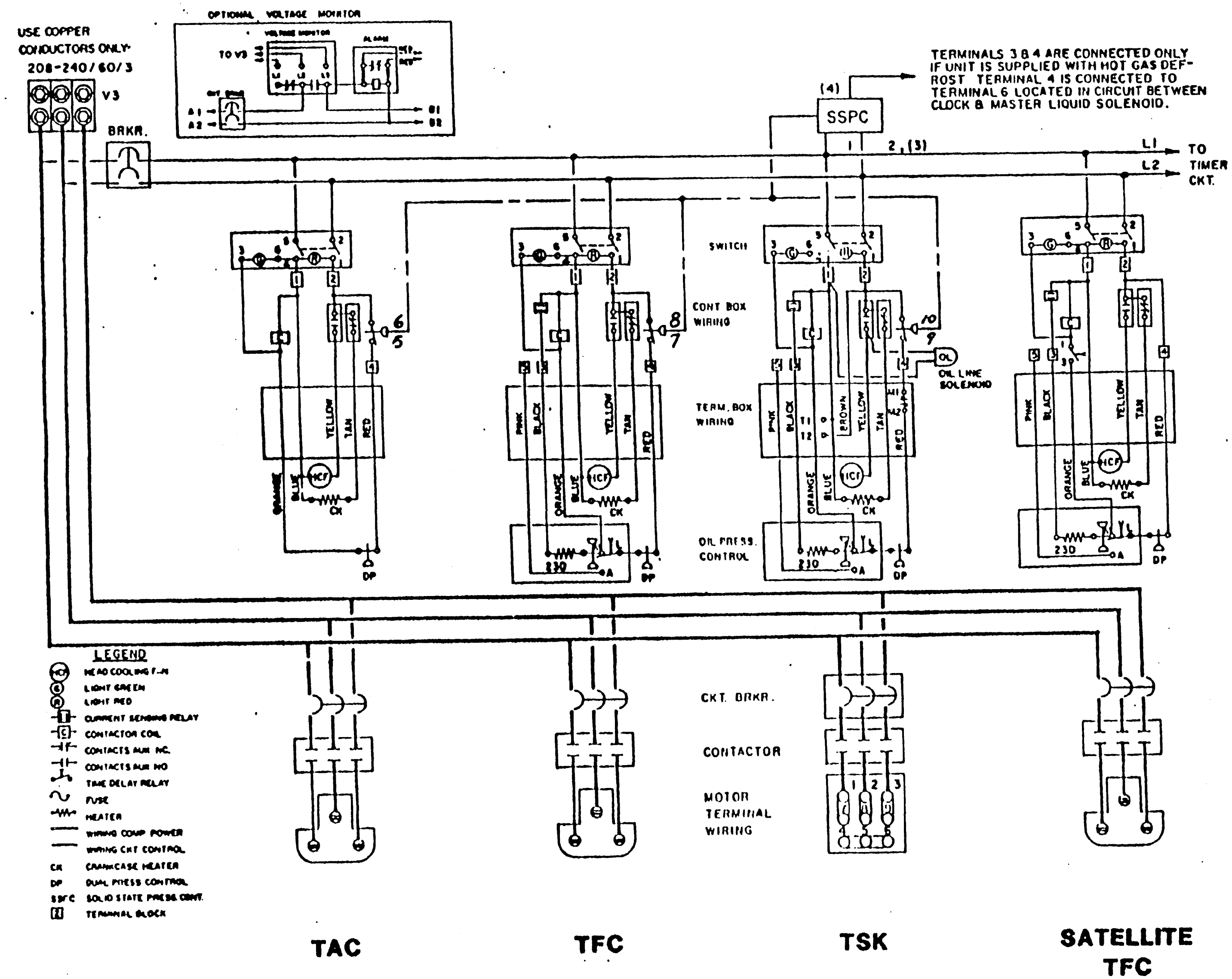
WALK-IN COOLER COIL WIRING IDENTIFICATION & CONNECTIONS
(HOT GAS & ELECTRIC DEFROST)

WIRE LETTERS & NO:	DM/TM:	OCD/MAD/RAD
L1-4 Evap Fan Motor (230 V)	*	4
L2 Evap Fan Motor (230 V)	*	**
F Def Termination Control	F	**
N-L Def Termination Control	L	N
X-8 Def Termination Control	8	X

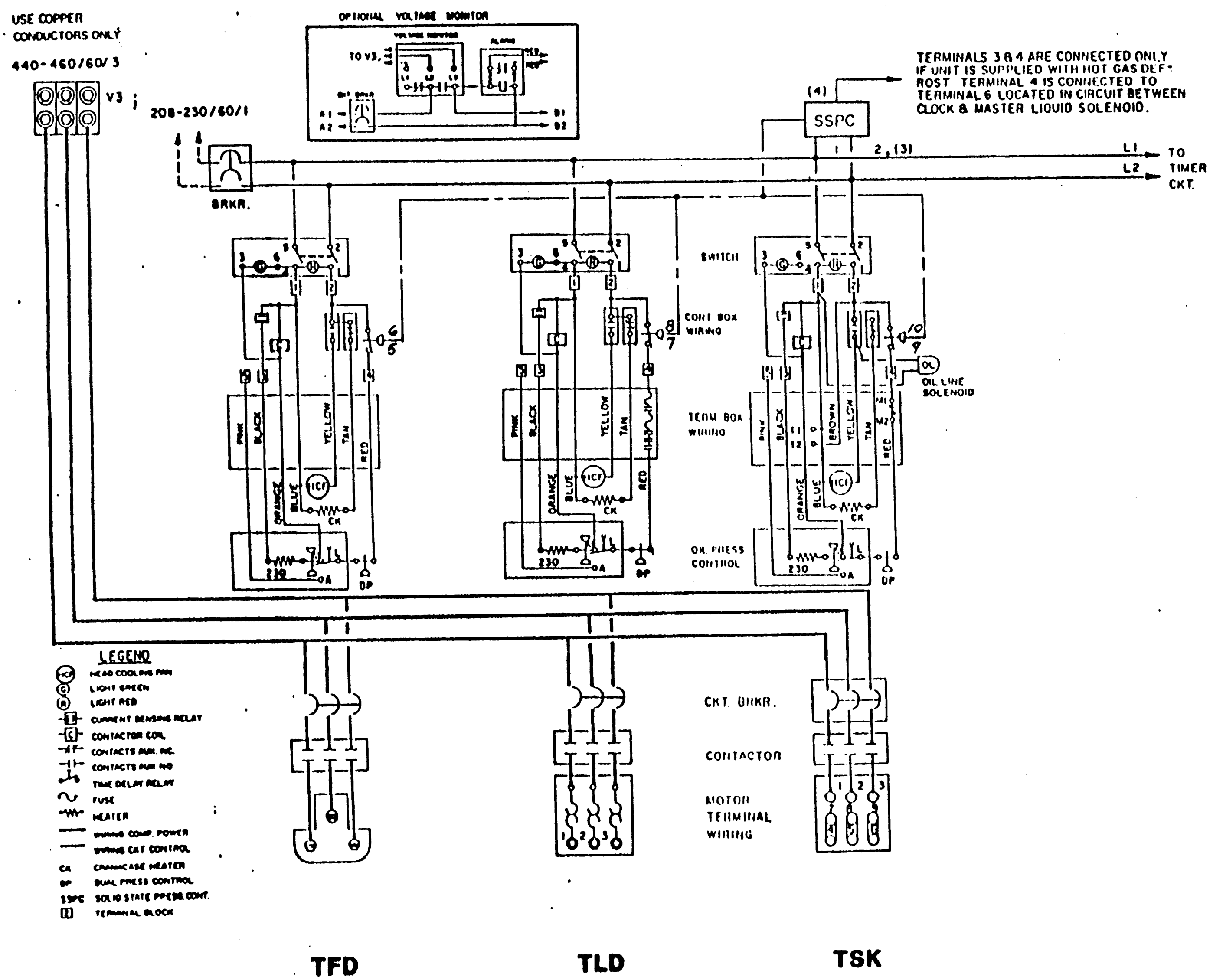
*Connect to fan relay at unit electrical panel
**Connect L2 & F together when using Paragon 8145-20 Time Clock

Note:
1) Dual & Tri-metic: Connections at unit electrical panel
2) OCD/MAD/RAD: Connections at 8145-20 Time Clock at unit

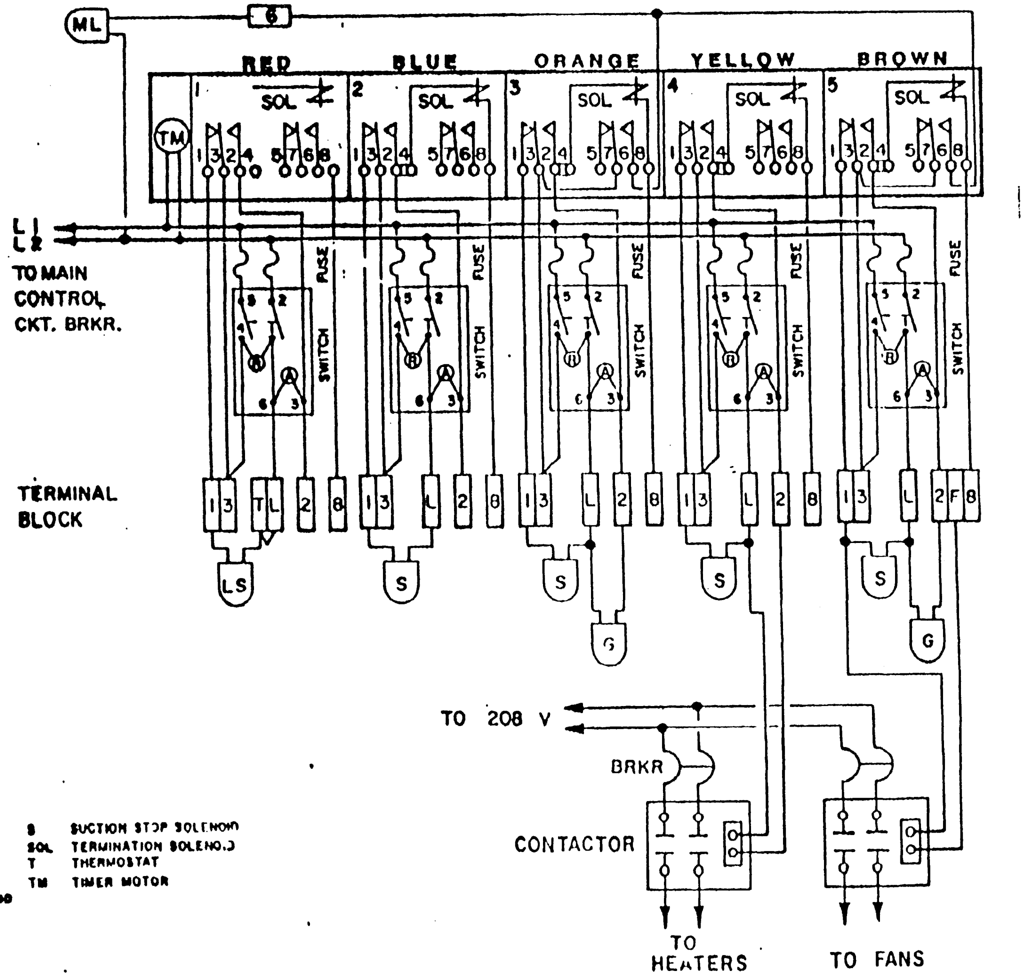
TYPICAL COMPRESSOR WIRING FOR THREE COMPRESSOR W/SATELLITE AND SHIFT LOGIC WIRED 208/60/3



TYPICAL COMPRESSOR WIRING FOR THREE COMPRESSOR AND SHIFT LOGIC WIRED 460/60/3



TYPICAL TIMING CIRCUIT WIRING



BRKR	BREAKER	S	SUCTION STOP SOLENOID
CKT	CIRCUIT	SOL	TERMINATION SOLENOID
G	HOT GAS SOLENOID	T	THERMOSTAT
LS	LIQUID LINE SOLENOID	TM	TIMER MOTOR
ML	MASTER LIQUID SOLENOID		

1. OFF-CYCLE

2. TEMPERATURE TERMINATE

3. HOT GAS

4. ELECTRIC

5. HOT GAS WALK-IN FREEZERS

DUAL-METIC AND TRI-METIC LEAK CHECKING, EVACUATION, AND START-UP

1) To check the systems for leaks, leave all valves closed on suction and liquid manifolds. Add refrigerant to each circuit through the access port in the suction line at EPR valves or suction stop. Build up the pressure to a maximum of 150 lbs. 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. (System is shipped with a holding charge).

3) After the system is leak checked, evacuate the system to 1500 microns for the first evacuation, install drier cores between first and second evacuation then evacuate system to 500 microns. After each evacuation, the system should be pressurized to 2# pressure with refrigerant before starting the next evacuation.

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 (approximately 250 lbs.). Now you are ready to start the system.

5) Set all low pressure controls at approximately 2 PSIG cut-out and 12 PSIG cut-in. Recheck <u>all</u> 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 refrigeration oil to oil reservoir until oil is shown in upper glass.

7) Remove all time clock trippers or remove program from all defrost modules.

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 the "red" running light must come on before going any further. 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 Altech SSPC Controller, you can adjust the cut-in and cut-out at this time. Refer to pages 10 and 11 in the SSPC Manual for these adjustments based on the lowest evaporator temperature.

11) Check the actual suction header pressure with an accurate gauge and see if the Altech is displaying the same pressure. (Pressure must be below 65 PSIG before this can be done). Calibrate as necessary. Refer to pages 13, 14, and 15 in SSPC Manual. Set Altech Controller on override.

12) Turn on circuit breakers to all compressors. All rocker switches on center control panel must be off.

13) Close control panel doors before actually starting compressors.

14) Now, with a low side gauge and high side gauge installed, turn on the rocker switch to the smallest compressor. Allow the compressor to pull the suction down to your approximate operating pressure of the system. As the pressure lowers, turn on one circuit rocker switch at a time. Try to maintain no more than 20 PSIG above Altech 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.

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

16) Now that the system is operating, it is time to set the A7 and A9 valves. See page 16 for settings. Once they are set, recheck again as these settings are important.

17) Set and check expansion valve superheat on each cabinet. (EPR stems (manual) must be open).

18) Set each EPR valve (manual stems closed) as needed (approximately 2 lbs. less than desired evaporator temperature). Suction header pressure must be lower than setting on EPR before valve can be set correctly.

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

20) Readjust Altech as needed to maintain necessary suction header pressure.

21) Set condenser fan controls as recommended to maintain head pressure and liquid receiver level. Recommended settings for Warren/Sherer condensers are the Condenser Technical Bulletin.

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 and set defrost failsafe. Check defrost timer and temperature at which cases terminate.

24) Set the time delay on satellite compressor(s) at 3 minutes. This delay allows the satellite compressor to wait after defrost of the circuit for the Dual-Metic or Tri-Metic to lower the circuit pressure so not to overload the satellite.

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 for operation detail.

26) Check oil reservoir after two (2) days operation and add oil as necessary to maintain a level between the two sight glasses. Do not add more than a total of 2 or 3 gallons of oil to each system. If more than this is needed, recheck piping and etc., as oil is not returning to unit as designed.

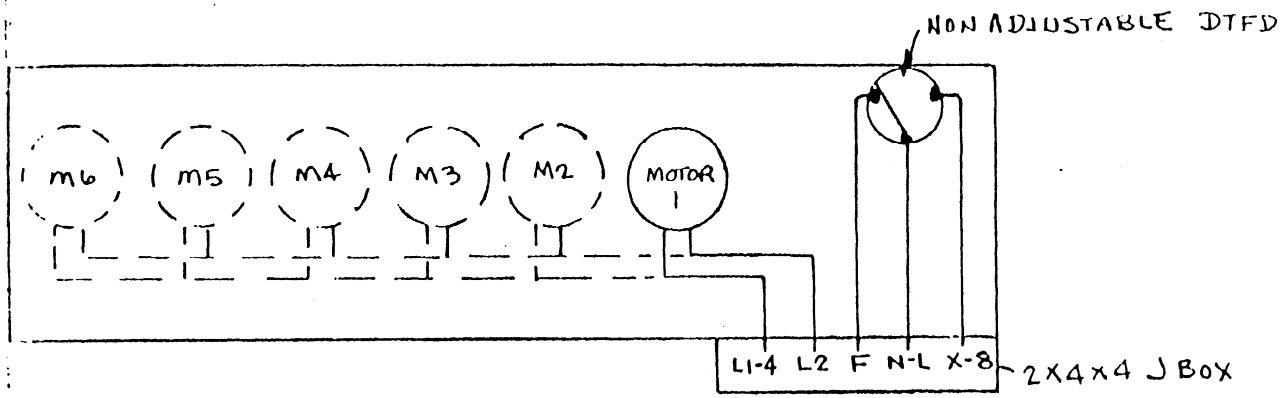
27) After all adjustments have been made, check all valves for proper stem position and replace all valve caps.

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

7/26/90

107258

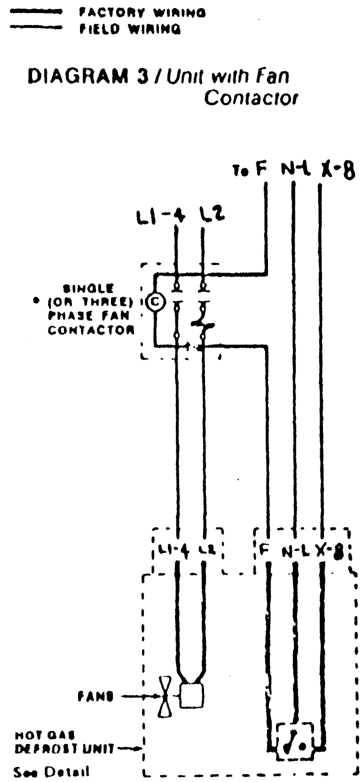
DESCRIPTION	EN NO.	BY DATE
INITIAL RELEASE	108 -0270	BJ 1-19-84



LEAVE LEADS 6" LONG-MIN.-IN J BOX
LABEL LEAD WIRES AS SHOWN

MOTORS MAY BE EITHER 115 OR 230V PER ORDER SPECIFICATIONS

DTFD MAY BE 115 OR 230V PER ORDER SPECIFICATIONS



KYSOR | WARREN/SHERER
DIVISION OF KYSOR INDUSTRIAL CORPORATION

HOT GAS WIRING - WPG, SPG, SVG UNITS

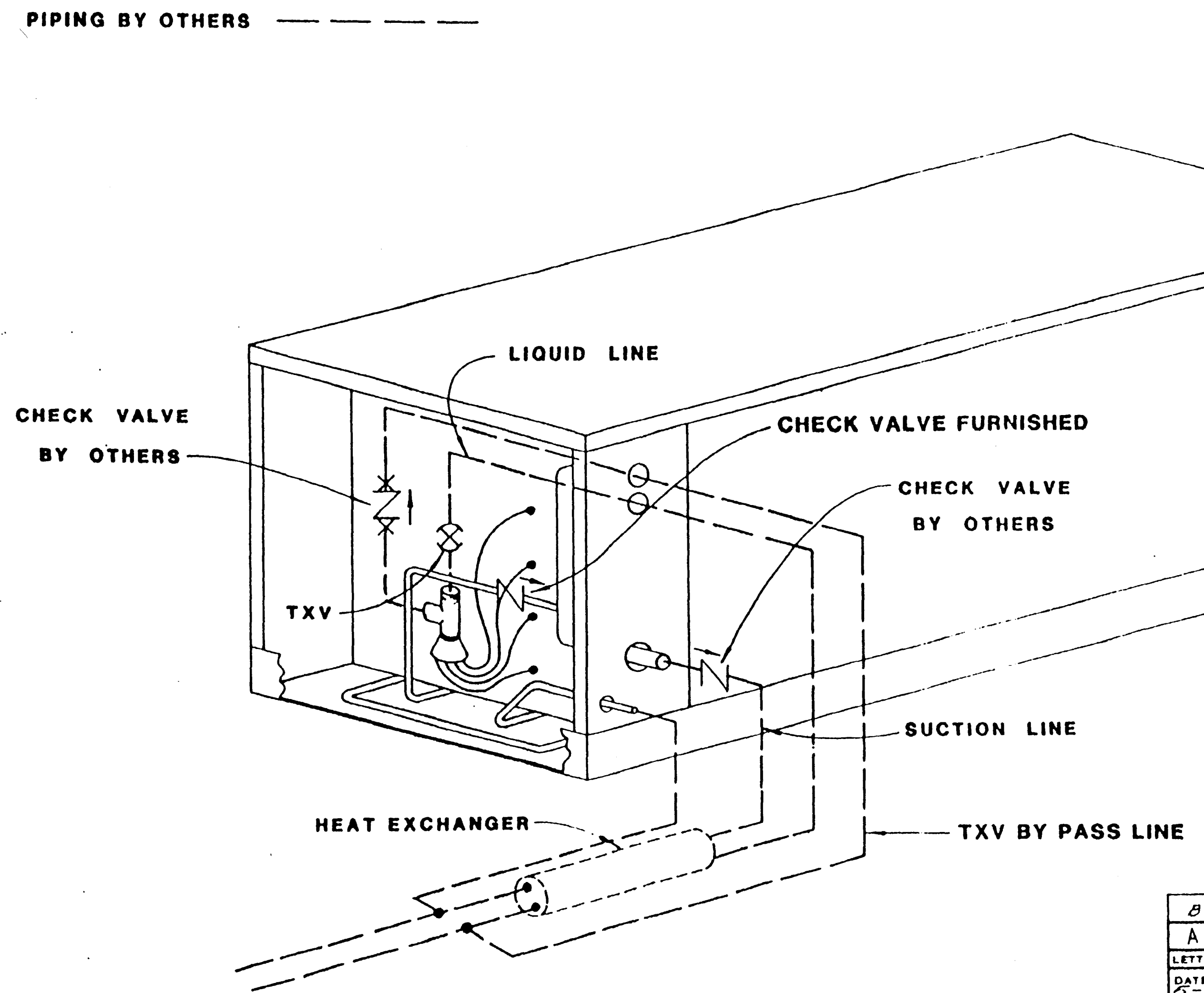
[redacted]

DATE: 1-17-84

DRAWN BY [redacted]

DRAWING NUMBER 107258

TOLERANCES UNLESS OTHERWISE NOTED FRACT. ± DEC. ±



LETTER	REVISED	DATE	BY
B	REVISED PIPING PER LATEST RUSSELL DRAWING	6-4-84	DK
A	Removed Hot Gas + Arrow	5/13/83	PML

DATE 5-4-83	TITLE **Hot Gas System** REVERSE CYCLE
SCALE NONE	
DRAWN D.S. KWAK	KYSOR WARREN/SHERER Division of Kysor Industrial Corporation
APPD	DRAWING NUMBER PB-21853

W A R R E N / S H E R E R

Dual Metic System

DEFROST SCHEDULE

CIRCUIT NO.	FIXTURE	FAILSAFE SETTING	TIME OF DEFROST																																														
			A.M.																								P.M.																							
			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	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

RECOMMENDED PIPING PRACTICES FOR KYSOR//WARREN CASES

7/25/80
Rev. 7/26/90

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.

KYSOR // WARREN
DIVISION OF KYSOR INDUSTRIAL CORPORATION

Technical Bulletin #85-204-3

Subject: Expansion Loops - Gas Defrost

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 refrigerant lines, kinking and breaking of the lines could occur.

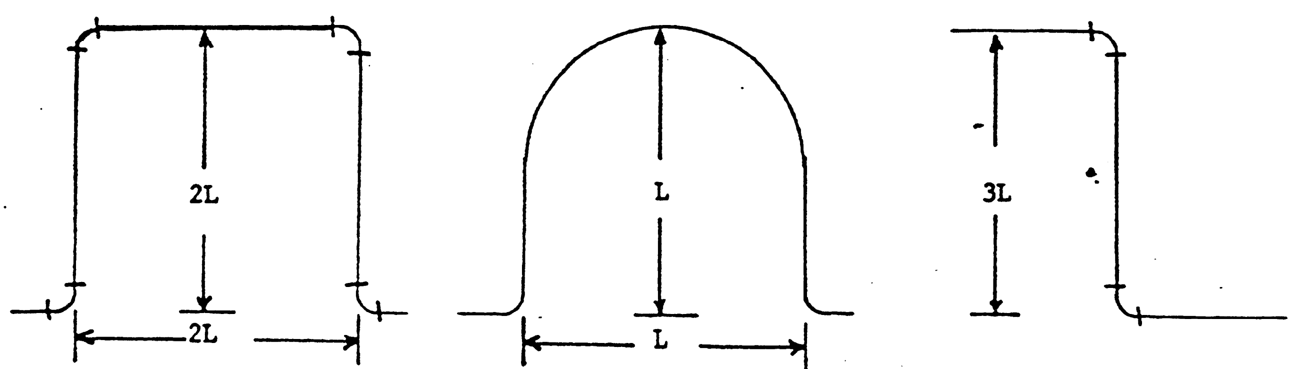
In order to compensate for the expansion of the tubing, it is necessary to estimate the amount of expansion and then provide offsets or loops in the refrigerant piping. As a general rule, medium temperature lines will expand approximately 1-1/2" for each 100 feet and low temperature lines approximately 2" 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 cannot 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, Georgia 30207-0019 Phone: (404) 483-5600 FAX: 404-929-4379

EXPANSION CHART

Ref. Line	Length - L (inches) Amount of Expansion								
O.D.	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'
Line Size 1-5/8"

Amount of expansion = $\frac{200}{100}$ x 1.5"/100 ft = 3"

Based on 3" expansion and 1-5/8" tubing, the legs of the loop would be 2 times L Valve 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

PFR:tg

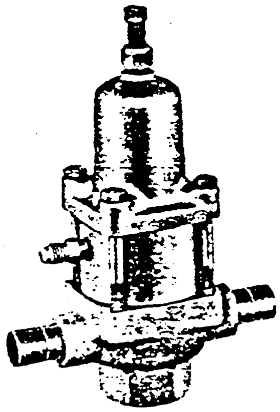
3/13/85

rev. 9/11/90

Hot Gas Bypass Regulator

BULLETIN 25-95C
TYPE A9

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



A9E

December, 1980
Installation Service
and Parts Information

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.† lbs.	Shipping Wt.† kg.	Nominal Capacity* Tons R-12	Tons R-22	Tons R-502	1000 kcal/hr R-12	1000 kcal/hr R-22	1000 kcal/hr 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	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	24-1018-02K	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	24-1013-02K	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	24-1086-11K	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	24-1034-00K	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 and size		
7/8"	24-1017-01K	1	23. Label	24-1041-01	1			
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.

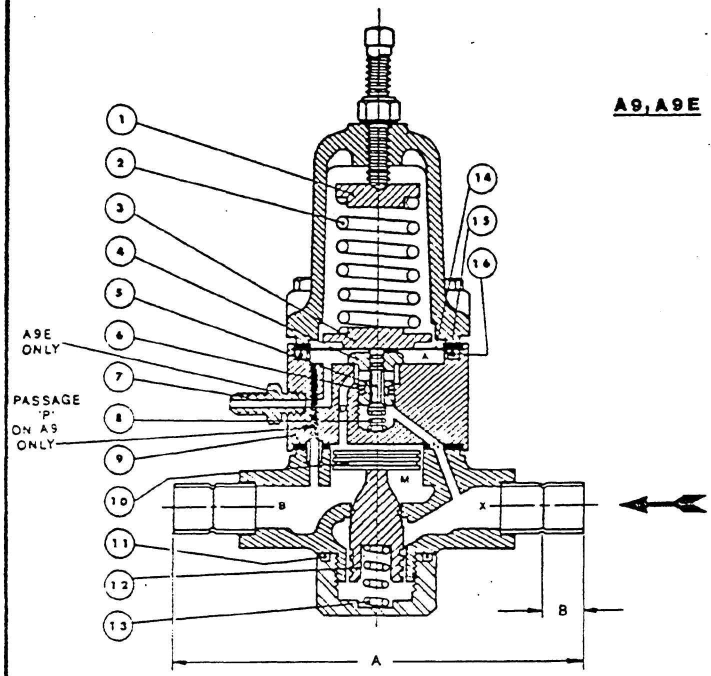
2. Failure to open: (a) #10 Piston or #12 Piston Plug may be jammed due to excessive dirt. This is the most likely cause of not opening; to correct, see 1 (a) above. (b) #17 adjusting stem may be turned out so far that a lower downstream pressure may be required to open the regulator than can be created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

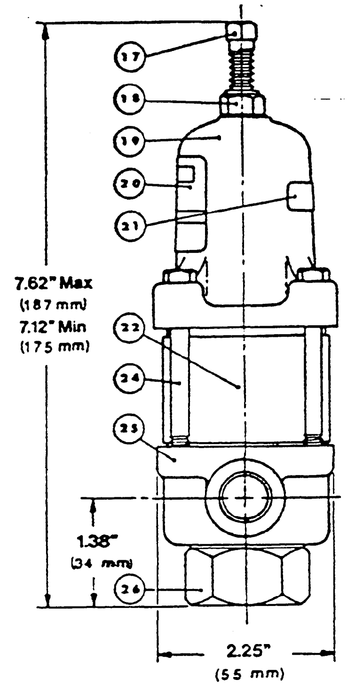
3. Failure to close: (a) #10 Piston or #12 Piston Plug may be jammed due to excessive dirt. This is the most likely cause of not closing; to correct, see 1 (a) above. (b) #17 adjusting stem may be turned in so far that a higher pressure is opening the regulator than is desired in the system. (Turn out #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.

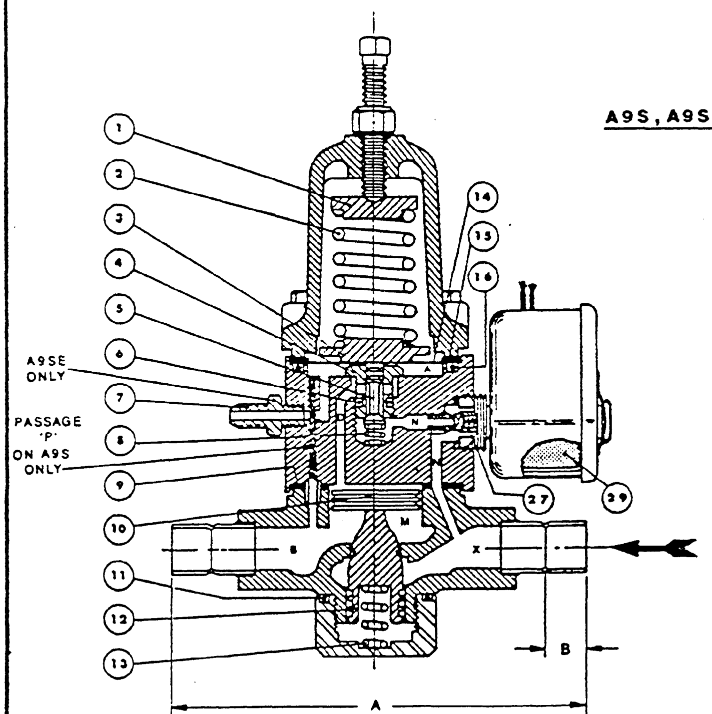
4. Hunting: Under light load conditions, a system may hunt. Unless the hunting is adversely affecting temperatures or bothering the performance of the equipment, the hunting itself should be ignored. If very serious, the matter should be looked into further.

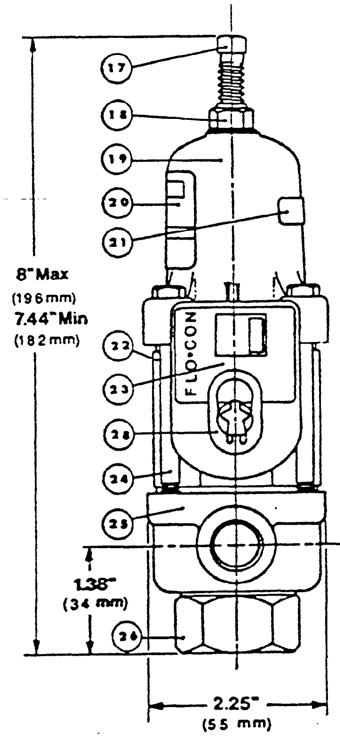
The Hot Gas Bypass Regulator is sometimes blamed if the system seems to hunt. The A9E regulator was especially designed with a characterized plug to give controlled flow over its entire hot gas flow range. For this reason, we suggest that the other elements and control valves in the system be critically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









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.

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

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

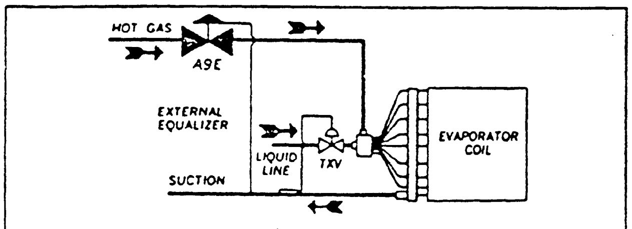
HOT GAS BY-PASS REGULATOR

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

REV B 7/74

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.

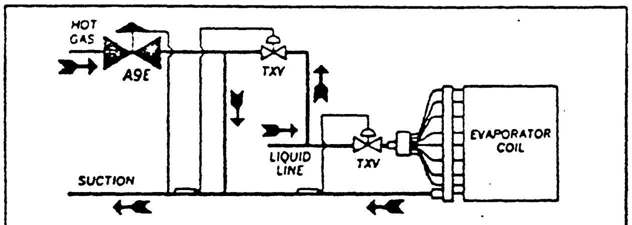
APPLICATION — (See Bulletin BYG)



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 —

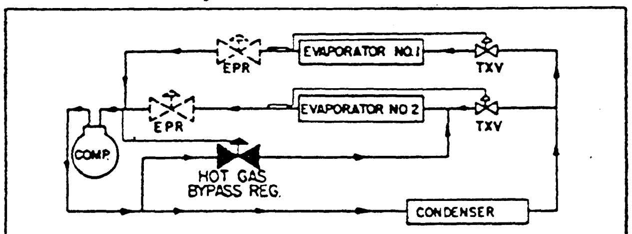


Figure 3

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.

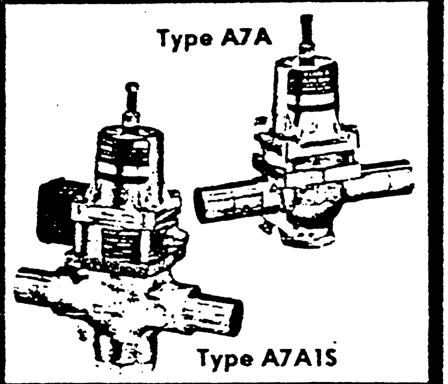
THE EXPRESS WARRANTY SET FORTH ABOVE CONSTITUTES THE ONLY WARRANTY APPLICABLE TO REFRIGERATING SPECIALTIES PRODUCTS, AND IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, WRITTEN OR ORAL, INCLUDING ANY WARRANTY OF MERCHANTABILITY, OR FITNESS FOR A PARTICULAR PURPOSE. No employee, agent, dealer 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 (counterclockwise).

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

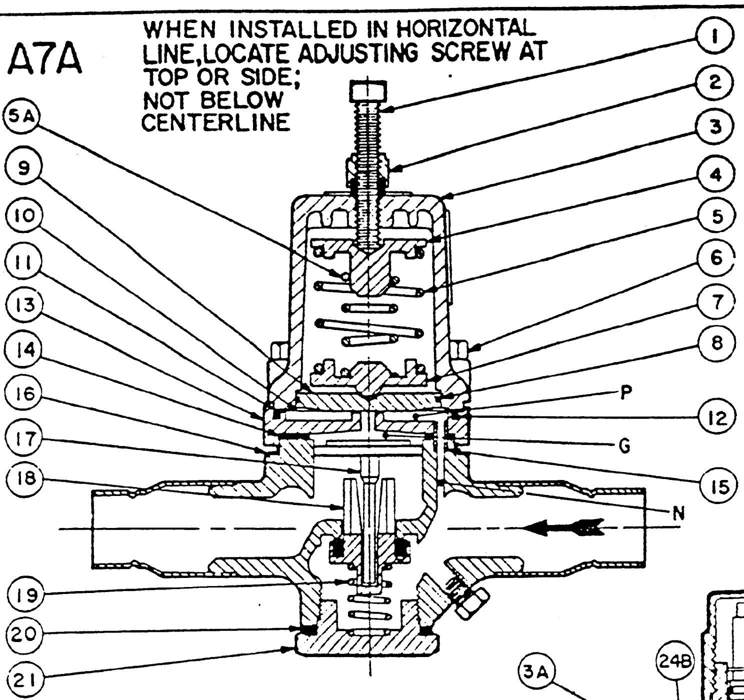
Note: A7AL available in Range A only

Item	Description	Qty	Used On: A7A	S	B	L	Part Numbers: 15 mm (⅝")	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 ① ②	1	X	X	X	X	81-1001-33	81-1001-33	81-1001-33
12	"O" Ring, Bonnet ① ②	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 ①	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

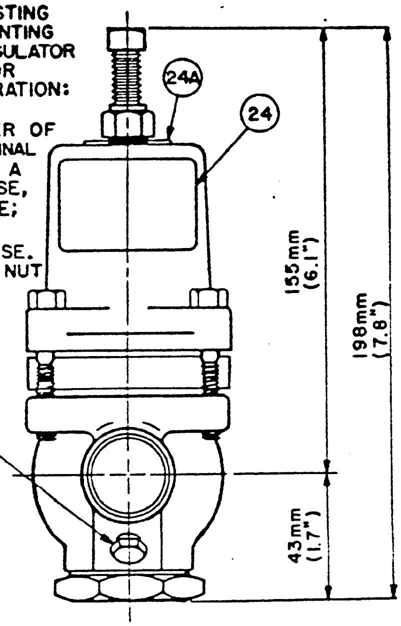
① Included in "O" Ring and Gasket Replacement Kit Part No. 24-0169-01K for Range A/D
② Included in Diaphragm-Gasket Replacement Kit Part No. 24-0166-00K for Range A/D
③ 49% reduced capacity Main Valve Assembly available as standard on A7A and A7AS. Replacement kit number is 24-0122-04K.

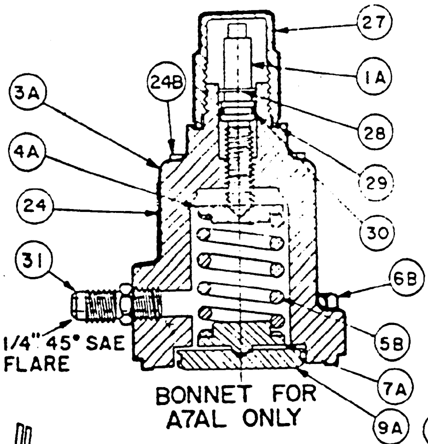
A7A

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



TO MANUALLY OPEN-LOOSEN LOCK NUT AND TURN ADJUSTING STEM OUT, COUNTING TURNS UNTIL REGULATOR STAYS OPEN. FOR AUTOMATIC OPERATION: TURN STEM IN COUNTED NUMBER OF TURNS, ADJUST FINAL PRESSURE USING A GAUGE: TO RAISE, TURN CLOCKWISE; TO LOWER, TURN COUNTERCLOCKWISE. RETIGHTEN LOCK NUT

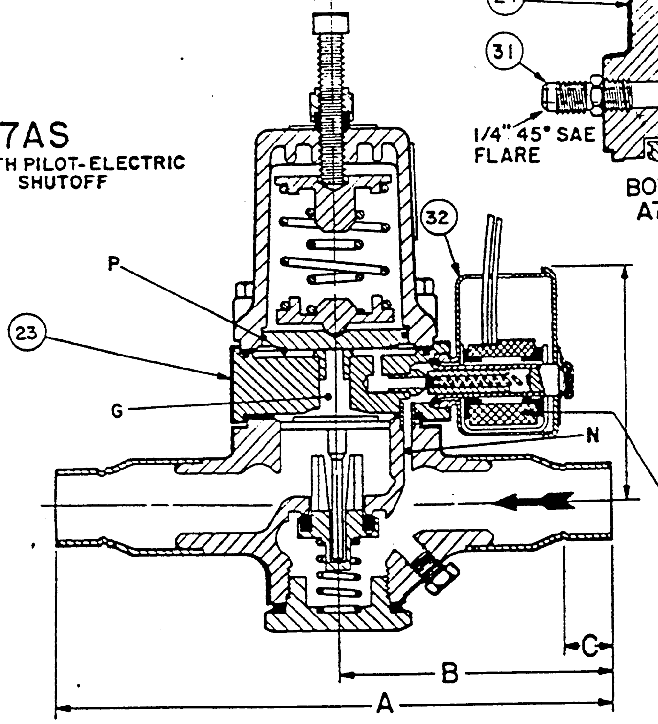


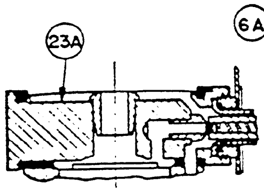


BONNET FOR A7AL ONLY

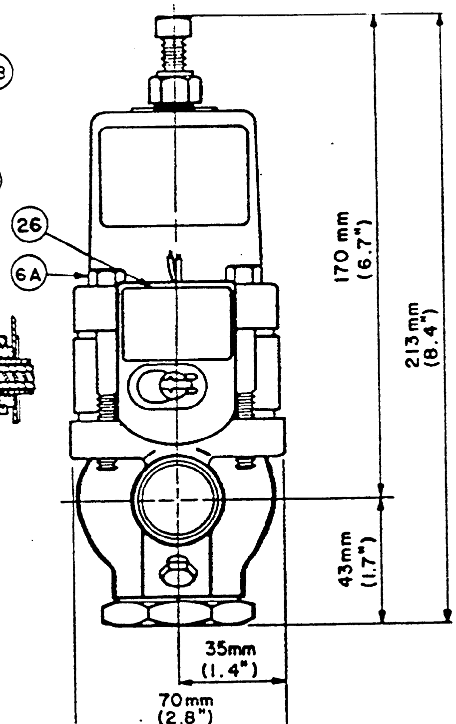
A7AS

WITH PILOT-ELECTRIC SHUTOFF





ADAPTER FOR A7AB ONLY



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

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

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

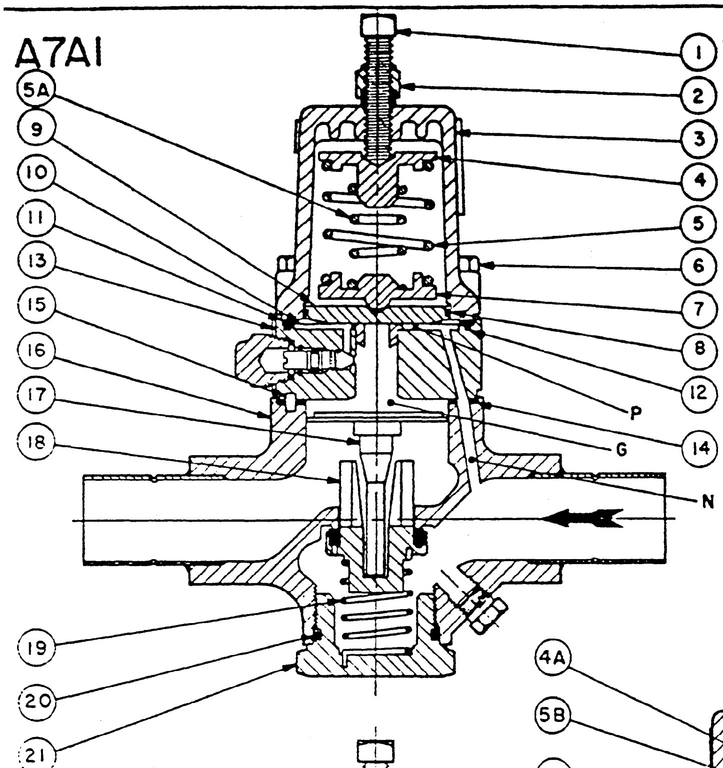
A7A1, A7A1S, A7A1B, A7A1L and A7A1BL Parts List—Range A/D

Note: A7A1L & A7A1BL available in Range A only

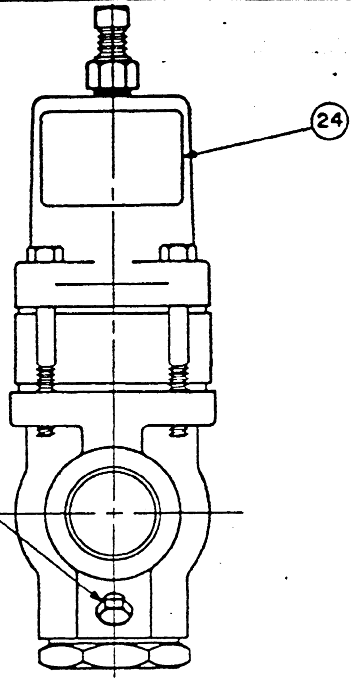
Item	Description	Qty	Used On: A7A1	S	B	L	BL	Part Numbers: 28 mm (1⅛")	35 mm (1⅜")	42 mm (1⅝")
1	Adjusting Stem, Range A/D	1	X	X	X			90-1002-14	90-1002-14	90-1002-14
1A	Adjusting Stem, Range A	1				X	X	24-1111-00K	24-1111-00K	24-1111-00K
2	Seal Nut	1	X	X	X			90-1000-15	90-1000-15	90-1000-15
3	Valve Bonnet	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 ②	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

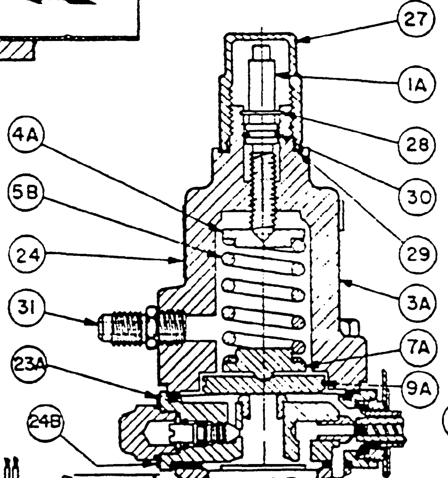
① Included in "O" Ring and Gasket Replacement Kit Part No. 24-0168-01K for Range A/D
② Included Diaphragm-Gasket Replacement Kit Part No. 24-0166-00K
③ 35% reduced capacity Main Valve Assembly available as standard on A7A1 and A7A1S. Replacement kit number is 24-0113-01K.

A7A1



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

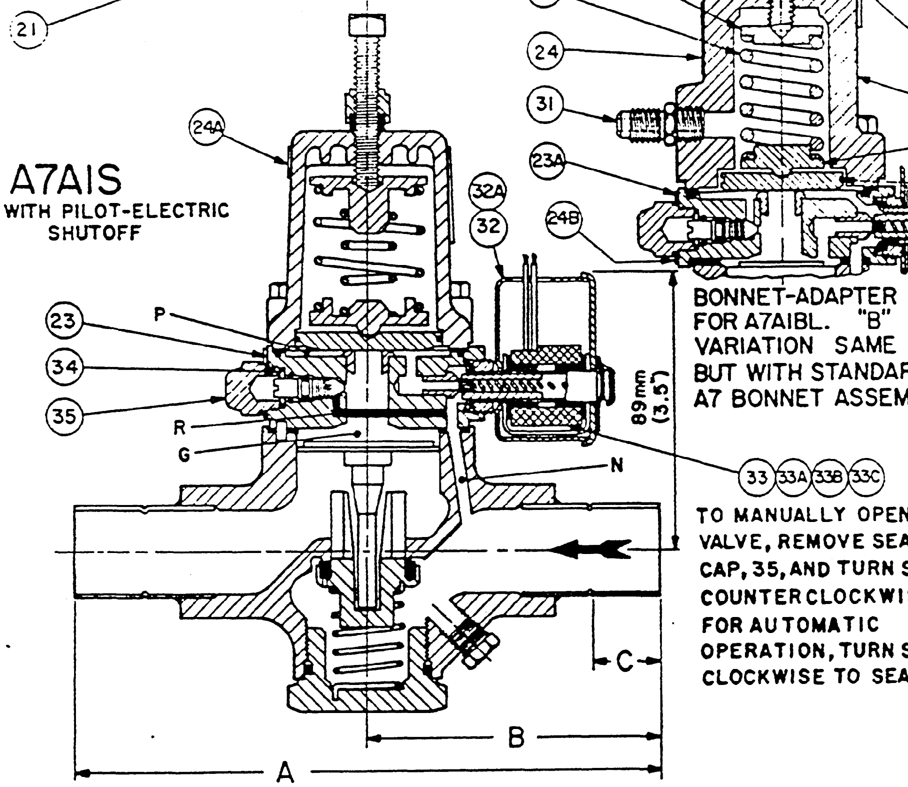




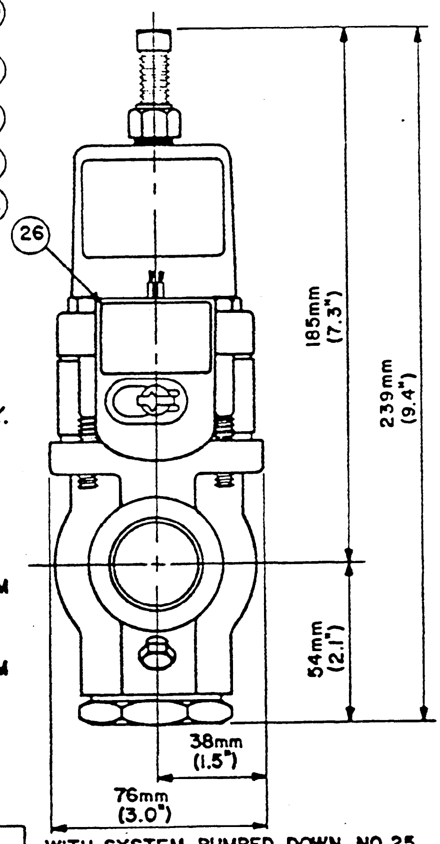
BONNET-ADAPTER FOR A7A1BL. "B" VARIATION SAME BUT WITH STANDARD A7 BONNET ASSEMBLY.

A7A1S

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		
J KLERMAN	A7A1, A7A1S, A7A1B, A7A1L, A7A1BL	
J. YENCHO	1-29-80	4095

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

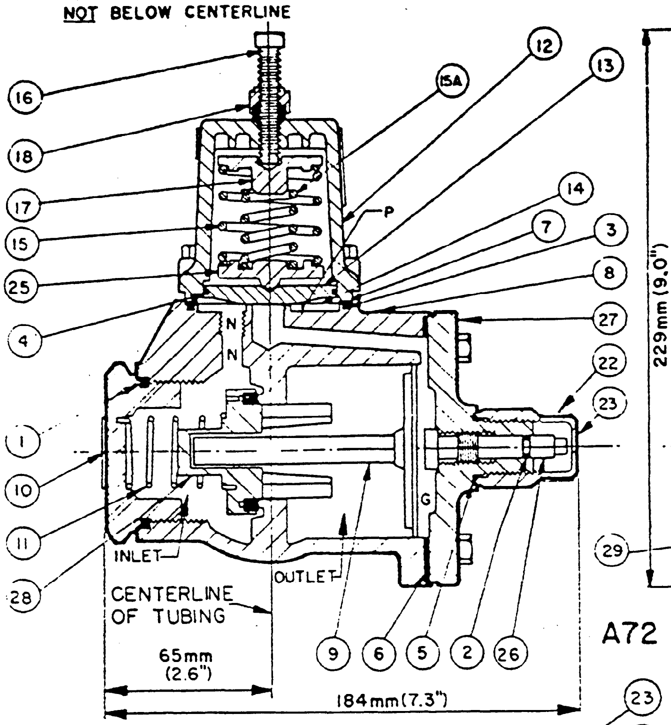
Note: A72L & A72BL available in Range A only

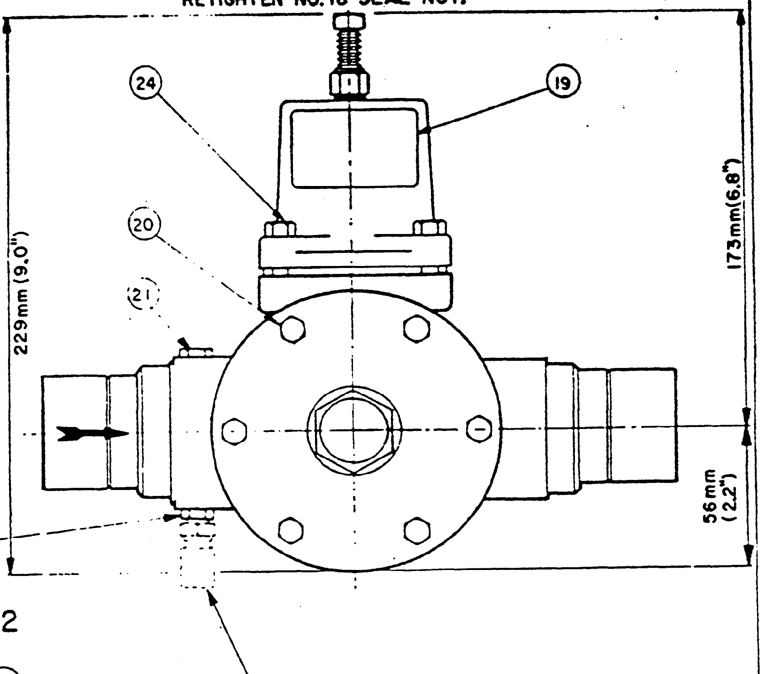
Item	Description	Qty	Used On: A72	S	B	L	BL	Part Numbers: 42 mm (1⅝")	54 mm (2⅛")	66 mm (2⅝")
1	"O" Ring, Bottom Cap ①	1	X	X	X	X	X	93-1000-69	93-1000-69	93-1000-69
2	"O" Ring, Mnl. Operating stem ①	1	X	X	X	X	X	93-1000-70	93-1000-70	93-1000-70
3	"O" Ring, Bonnet ①②	1	X	X	X	X	X	93-1000-57	93-1000-57	93-1000-57
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 ① ③	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
33A	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

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

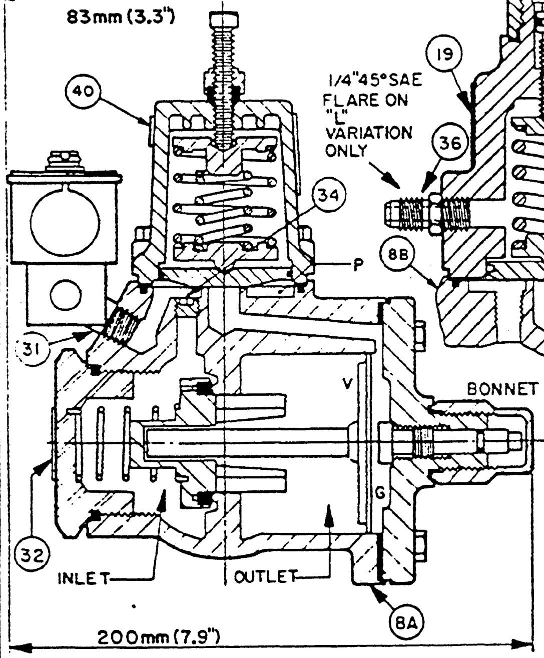
TO RAISE PRESSURE SETTING OF VALVE, LOOSEN SEAL NUT NO.18 AND TURN NO.16 ADJUSTING STEM CLOCKWISE, RETIGHTEN NO.18 SEAL NUT.



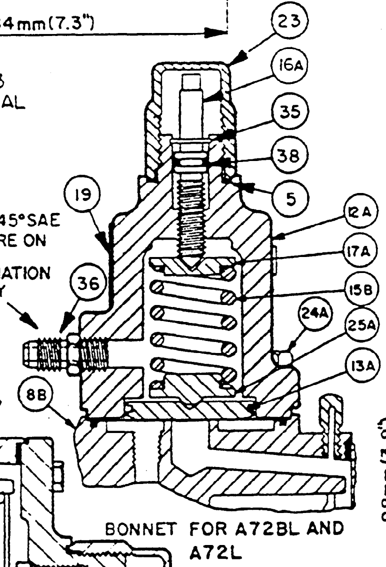


WITH SYSTEM PUMPED DOWN, NO. 29 1/8"NPT PIPE PLUG CAN BE REMOVED AND OPTIONAL GAUGE OR SCHRADER TYPE GAUGE VALVE INSTALLED AS SHOWN FOR INLET (EVAPORATOR) PRESSURE READING.

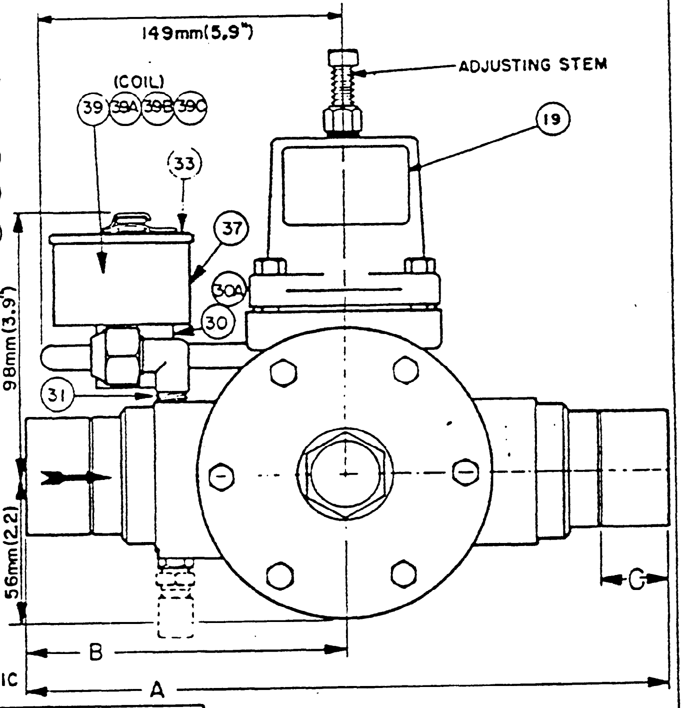
TO MANUALLY OPEN MAIN VALVE, AS FOR PUMP OUT, REMOVE NO 23 SEAL CAP, AND TURN NO. 26 MANUAL OPENING STEM CLOCKWISE



A72S WITH PILOT ELECTRIC SHUTOFF



BONNET FOR A72BL AND A72L



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		
RDH	A72, A72S, A72B, A72L, A72BL	
G.K.	3-10-67	4051

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.

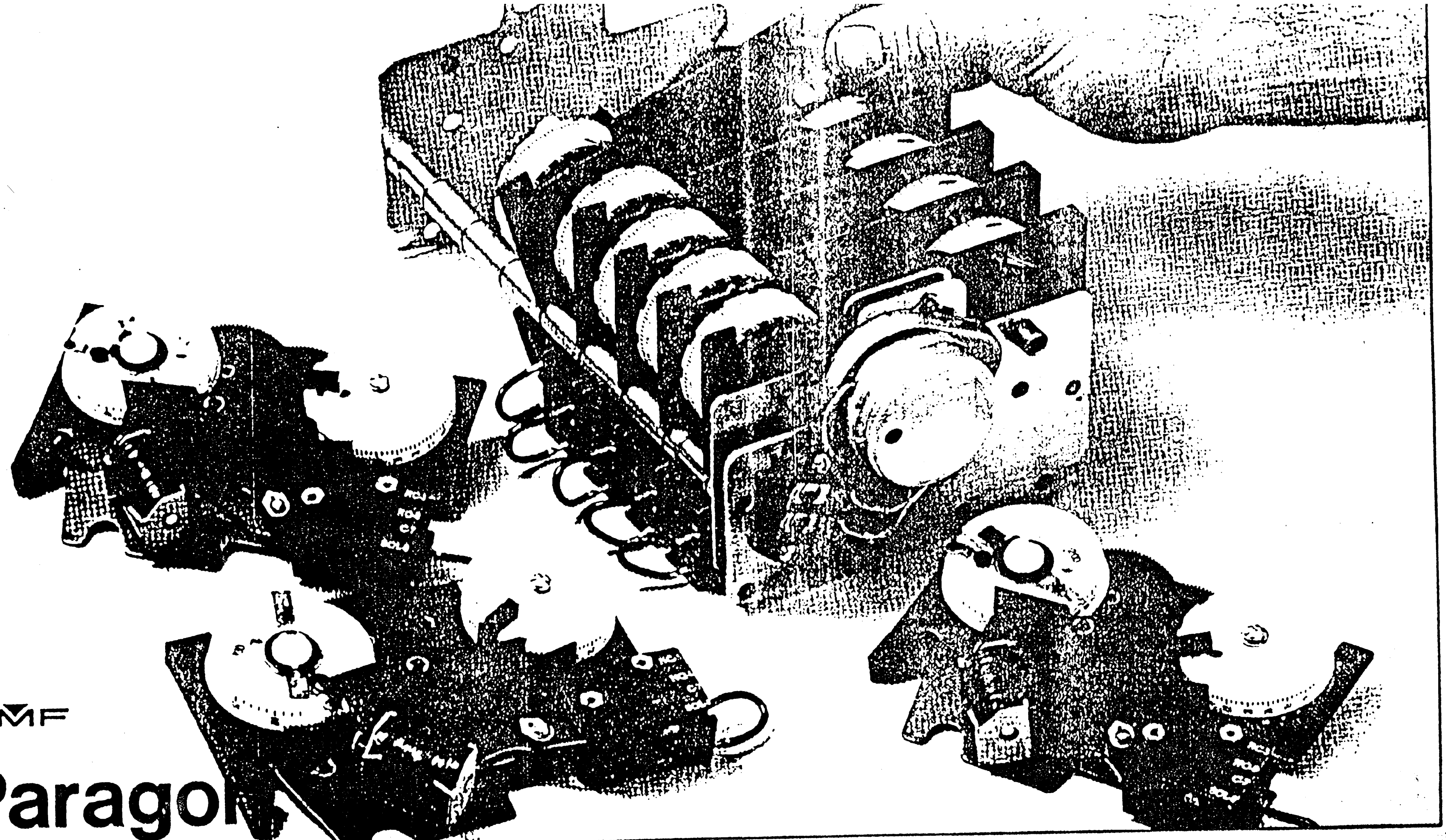
SAFE OPERATION (See Bulletin RSB)

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.



AMF

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.

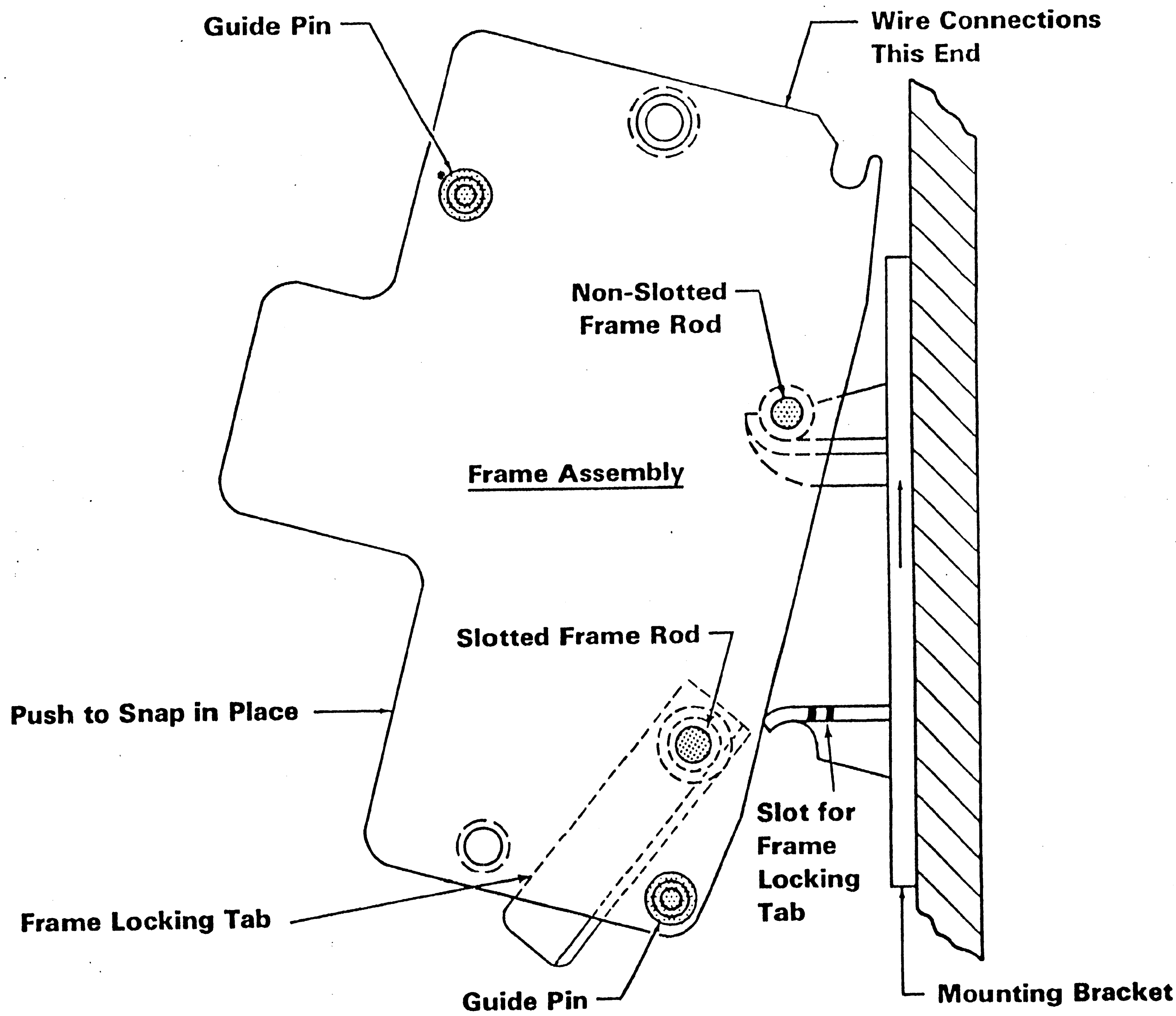
5. Position non-slotted frame rod of Slave Unit on upper hooks of brackets. Be certain that the Frame Locking Tab is in the up position and does not interfere with the mounting feet. Be sure Slave Unit guide pins engage on the Master Unit. Be sure the tongue on Slave Circuit #1 engages the groove on 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

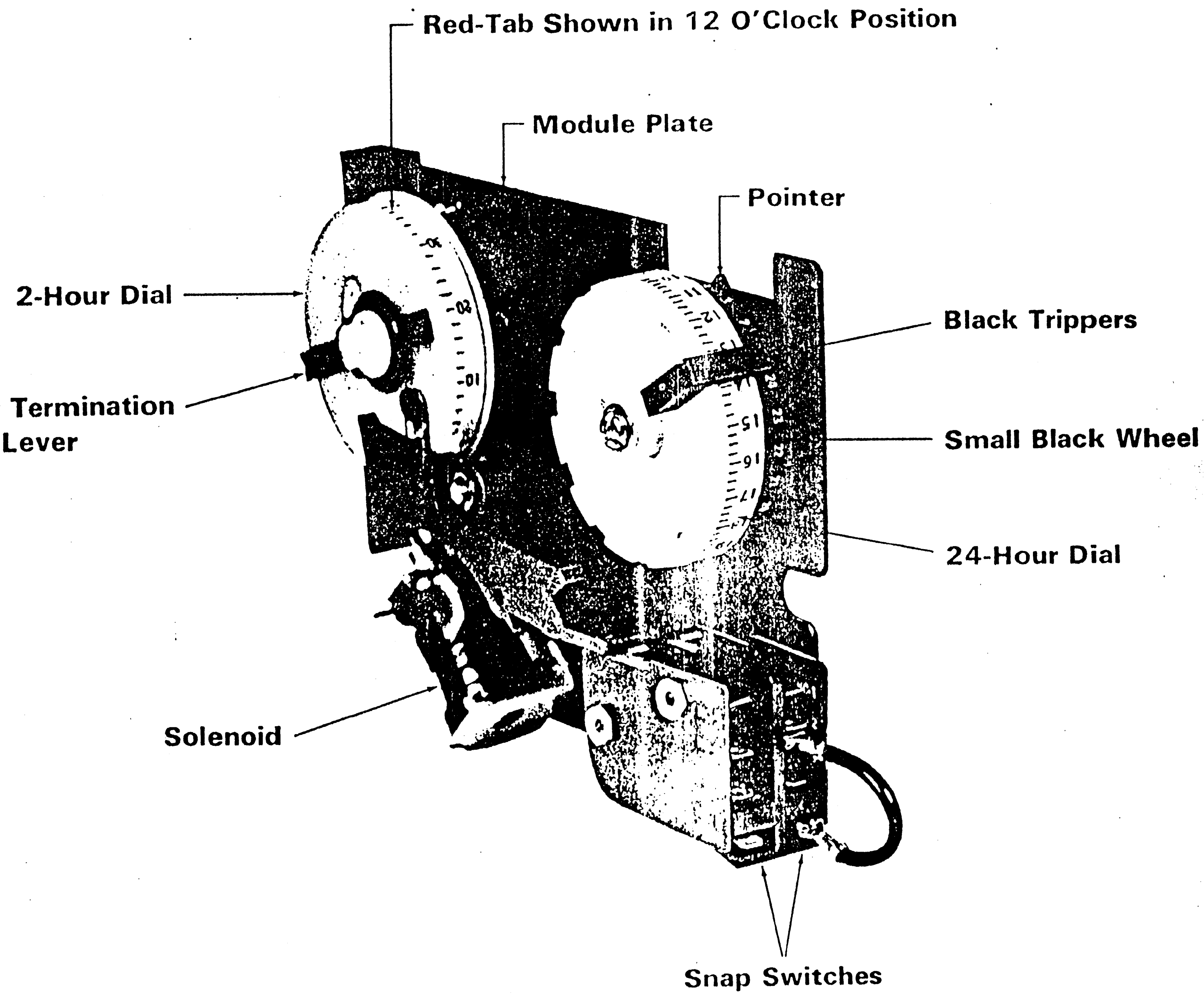
1. For each circuit (Program Module) insert black trippers into the slots in the 24-hour dial at the times of day (indicated by the black numbers) when a defrost cycle is to occur.

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 <u>all</u> 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 <u>all</u> Red Tabs line up and <u>all</u> 24 hour dial numbers line up.

V. Installation/Removal of Drive Module

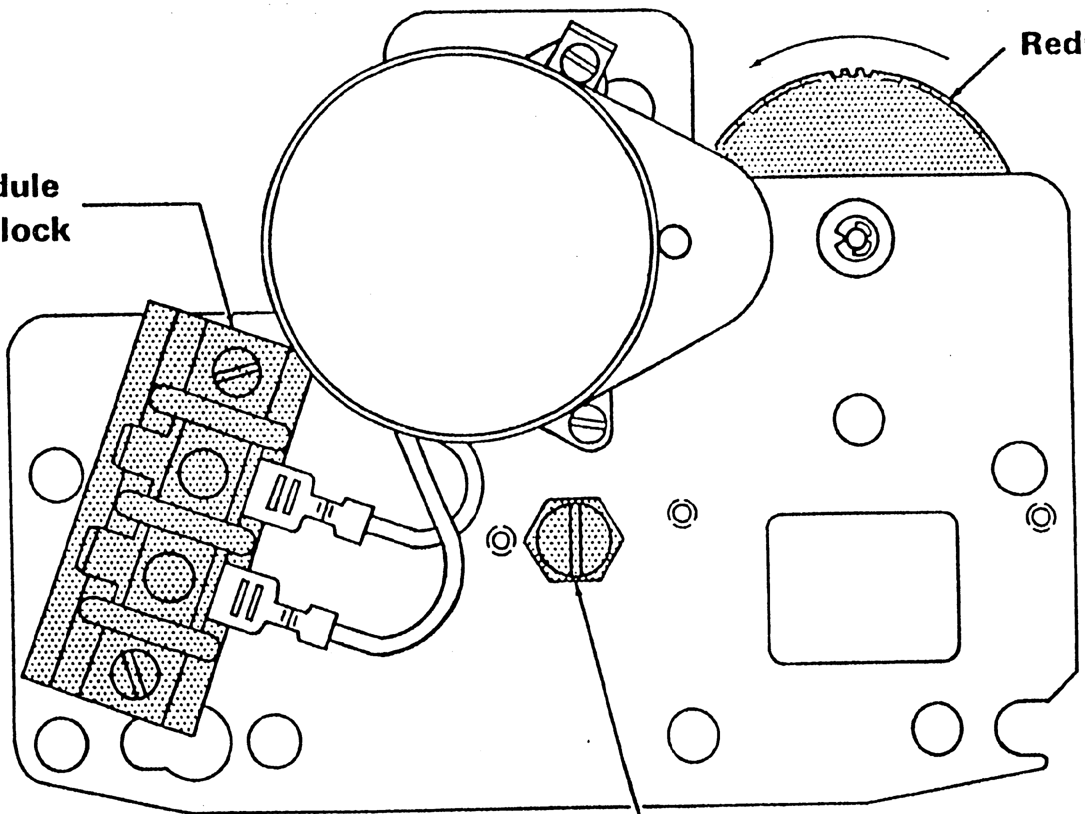
1. To remove Drive Module, rotate black reduction gear until tongue/groove with Program Module #1 is parallel to mounting surface.

2. Loosen hex nut fully.

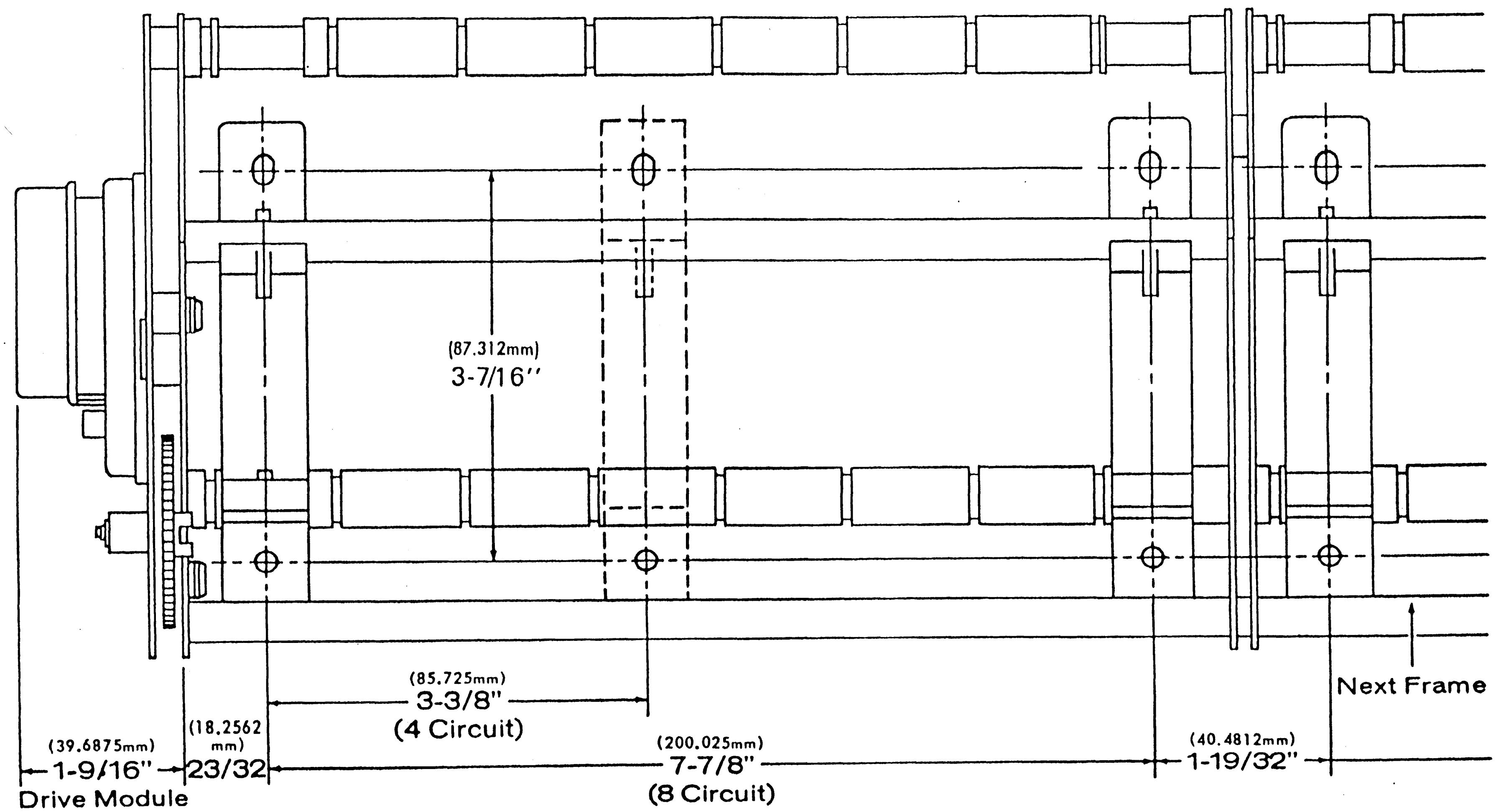
3. Slide complete Motor Module parallel to mounting surface and toward the 24-Hour Dials until the three locator studs clear their keyslots, then remove the Module.

4. To reinstall, reverse steps above.

MOTOR MODULE



DIMENSIONAL DIAGRAM



AMF
Paragon

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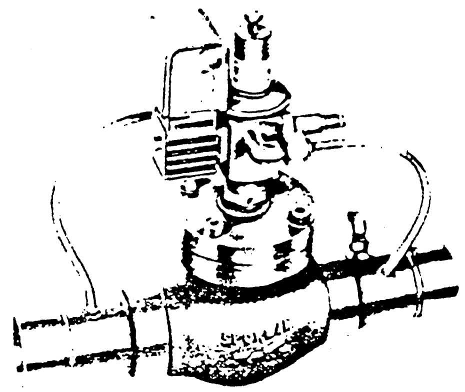
SPORLAN

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.

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.

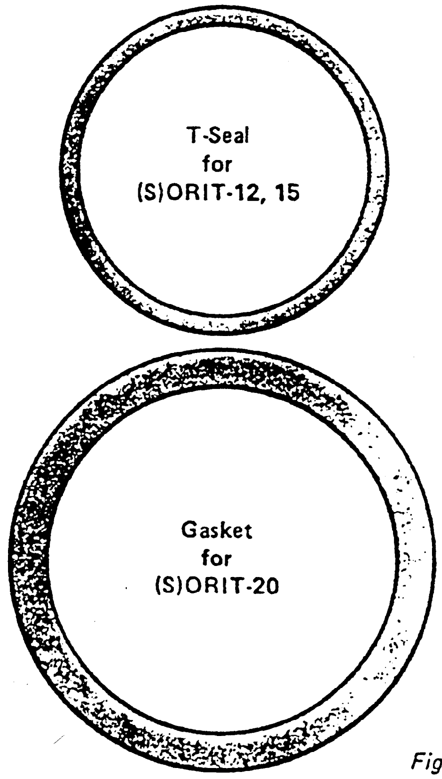


Figure 1

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 PARTS KIT NO. K-Y896	(S) ORIT-12 PARTS KIT NO. K-Y819	(S) ORIT-12 PARTS KIT NO. KS-ORI-12	(S) ORIT-15 PART NO.	(S) ORIT-15 PARTS KIT NO. K-Y896	(S) ORIT-15 PARTS KIT NO. K-Y819	(S) ORIT-15 PARTS KIT NO. KS-ORI-15	(S) ORIT-20 PART NO.	(S) ORIT-20 PARTS KIT NO. K-Y896	(S) ORIT-20 PARTS KIT NO. K-Y819	(S) ORIT-20 PARTS KIT NO. KS-ORI-20
1	Pilot Valve Asbly ① — With Solenoid	Y896	★			Y896	★			Y896	★		
	Pilot Valve Asbly ① — 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				—				—			

① 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.

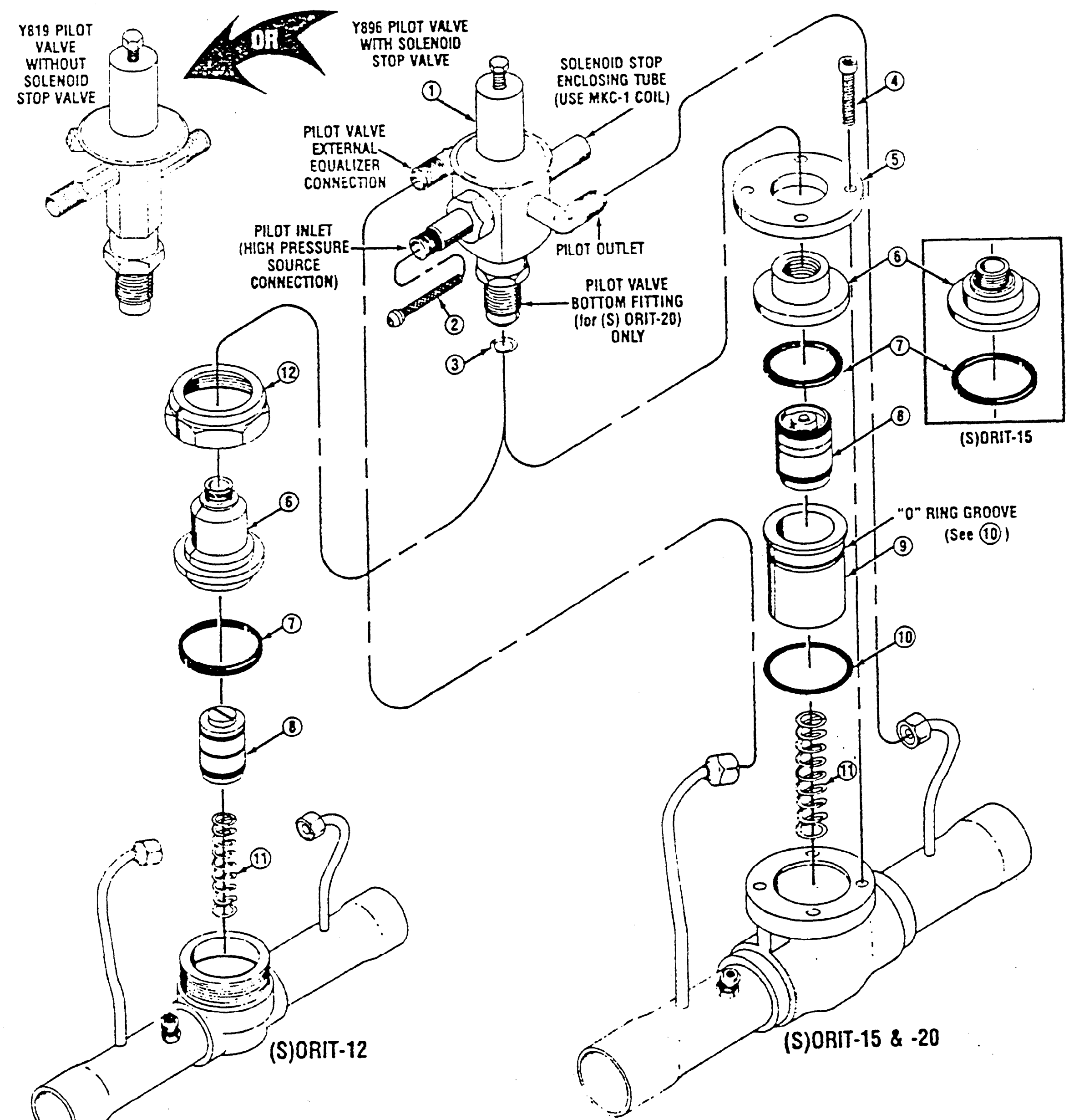


Figure 2

5. With the old tetraseal still in place, mount the complete pilot assembly to the main valve body. Tighten the locknut to 30 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 pilot 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.

(S)ORIT-20 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 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.

PISTON REPLACEMENT

(S)ORIT-12:

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.

(S)ORIT-15 AND -20:

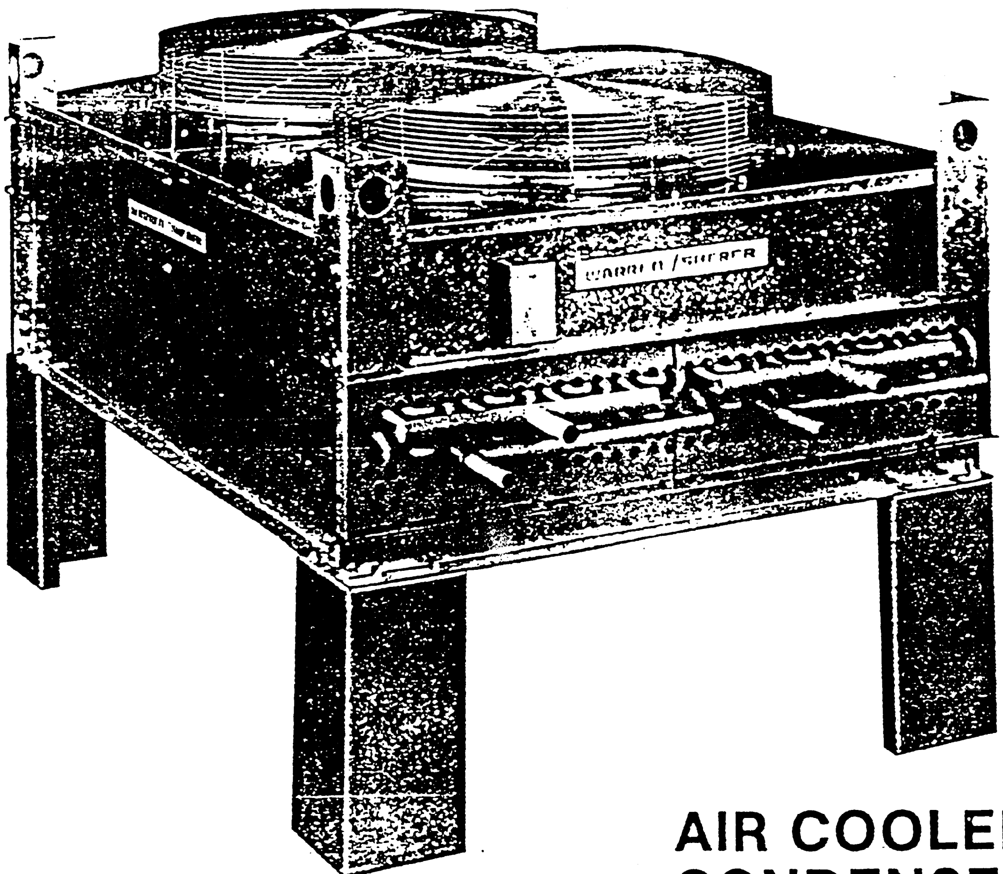
Remove the four cap screws with a 1/4" Allen wrench. The complete pilot assembly, adapter, and body flange can now be lifted off the main valve body. Inspect all internal parts for wear or dirt.

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. Re-locate 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 open 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.

TECHNICAL BULLETIN

WARREN/SHERER



AIR COOLED CONDENSER

WARREN/SHERER DIV. OF KYSOR INDUSTRIAL CORP., 1600 INDUSTRIAL BLVD., CONYERS, GA 30207-0019 TELEPHONE 404-483-5600

Warren/Sherer Air Cooled Condensers

General

Warren/Sherer Air cooled condensers, cover 27 different models from 3/4 thru 108 nominal tons.

Models KD-1-3/4 thru 3, ranging in capacity from 3/4 tons through 3 tons, are direct drive with legs for horizontal or vertical discharge. Fan motors on these units are shaded-pole internally protected, 1050 RPM, mounted on heavy motor supports inside the housing.

Models KD-1-5 thru 12-108 are direct-drive vertical discharge only (vertical & horizontal standard 5-8.5), in capacities from 5 tons through 108 tons. Fan motors are permanent split-capacitor type, ball bearing, permanently lubricated, thermally protected. Motors are 200-230 volt, 60 cycle, single phase (three phase motors are also available). KD-1-5 thru KD-4-37 wired for single phase connection as standard. KD-6-45 thru KD-12-108 wired for three phase connection. Standard KD Models UL-CSA listed.

Features

Coil Surface

Ripple fin staggered tube coil design results in maximum heat rejection capacity. Cores are circuited for optimum refrigerant side pressure drop.

Multiple Fans

Permit use of low-cost fan cycling for control of head pressure at low ambients. Full width divider between fan sections prevents air by-pass.

Mechanical Specifications

Condenser Coil

Manufactured from highest purity copper tube in a staggered tube pattern with fully collared, plate type rippled aluminum fins, mechanically bonded to the tubes.

Housings

The smaller capacity KD-1-3/4 thru 8.5 model casings are constructed from heavy gauge textured aluminum. Models KD-2-9.5 & larger are made from sturdy, heavy gauge, galvanized steel, designed to provide maximum housing rigidity as well as excellent resistance from corrosion.

Fans

All KD fan blades are constructed of heavy gauge aluminum. Fans on all models are operated at low tip speeds and are statically balanced and factory run before shipment.

Motors and Wiring

All motors for KD are equipped with inherent overload protectors rated for group installation. Direct drive motors on Models KD are drip proof, permanent split capacitor type, ball bearing. All units are factory wired. All leads are marked and terminated in a readily acessible junction box.

Optional Features

Fan Cycling Controls

Cycles condenser fan(s) in response to condenser air temperature on all fan units.

Condenser Flooding Control

Single control consisting of 2 pressure sensitive valves. See "Low Ambient Control" section for further details.

Selecting Your Warren/Sherer Air Cooled Condenser

Based on Total Heat Rejection at the Condenser

Simply stated, the total heat rejection at the condenser is the sum of the refrigerating effect and the heat equivalent of the power input to the compressor. In a hermetic compressor, this heat rejection-generally expressed in BTUH - includes the effect of suction gas cooling of the motor. Where heat rejection figures are available from the compressor manufacturer, these figures should be used when selecting your Warren/Sherer Condenser. Where not available, factors for estimating heat rejection for both open and suction-cooled compressors are provided below together with instructions in their use.

Heat Rejection Factors / Compressor Capacity X Factor = Condenser Load

Table 1 Open Compressors

Temp. Evap.	Condensing Temperature 90	100	105	110	115	120	125	130
-40	1.45	1.48	1.52	1.56	1.58	1.61		
-35	1.42	1.45	1.47	1.51	1.54	1.57		
-30	1.39	1.41	1.44	1.47	1.50	1.53		
-25	1.37	1.39	1.41	1.44	1.46	1.49	1.52	
-20	1.34	1.37	1.39	1.41	1.43	1.45	1.48	1.51
-15	1.31	1.34	1.37	1.38	1.40	1.42	1.45	1.47
-10	1.28	1.31	1.33	1.37	1.38	1.40	1.42	1.45
[illegible]	1.24	1.26	1.29	1.32	1.33	1.35	1.38	1.41
+10	1.21	1.24	1.26	1.28	1.30	1.31	1.34	1.36
+20	1.18	1.21	1.23	1.24	1.26	1.28	1.30	1.32
+30	1.15	1.18	1.20	1.21	1.23	1.24	1.26	1.28
+40	1.13	1.15	1.17	1.18	1.19	1.20	1.22	1.24
+50	1.11	1.13	1.14	1.15	1.16	1.17	1.18	1.20

Table 2 Suction Cooled Compressors

Temp. Evap.	Condensing Temperature 90	100	105	110	115	120	125	130
-40	1.67	1.71	1.75	1.79	1.84	1.90	•	•
-35	1.63	1.67	1.70	1.73	1.78	1.83	•	•
-30	1.58	1.62	1.65	1.68	1.72	1.77	•	•
-25	1.54	1.58	1.60	1.64	1.67	1.71	1.76	•
-20	1.49	1.53	1.56	1.58	1.63	1.66	1.70	1.75
-15	1.46	1.50	1.52	1.54	1.58	1.62	1.65	1.69
+10	1.31	1.34	1.36	1.38	1.40	1.43	1.47	1.49
+15	1.29	1.32	1.33	1.35	1.37	1.40	1.43	1.46
+20	1.26	1.29	1.31	1.33	1.35	1.37	1.40	1.43
+25	1.25	1.27	1.29	1.31	1.33	1.35	1.38	1.40
+30	1.22	1.25	1.26	1.28	1.30	1.32	1.35	1.37
+35	1.20	1.23	1.25	1.26	1.27	1.29	1.32	1.34
+40	1.18	1.21	1.22	1.24	1.26	1.27	1.30	1.32

Total Heat Rejection, MBH — R-12**

Table 3 Models KD Vertical Discharge

TD*	1-¾	1	1-1½	1-2	1-3
10	4.2	5.4	7.8	10.0	14.6
15	6.3	8.1	11.8	15.0	21.9
20	8.4	10.0	15.7	20.0	29.2
25	10.5	13.5	19.6	25.0	36.5
30	12.6	16.2	23.5	30.0	43.8

Table 4 Models KD Vertical Discharge

TD*	1-5	1-6.5	1-7.5	1-8.5	2-9.5	2-13	2-15.5	2-17	3-19	3-23
10	23.0	30.8	36.7	41.0	46.0	61.7	76.2	81.9	92.4	110.4
15	34.5	46.2	55.0	61.9	68.9	92.5	112.5	122.8	138.5	165.5
20	46.0	61.7	73.4	81.9	91.9	123.4	152.4	163.8	184.8	220.8
25	50.5	80.0	91.7	102.3	114.8	154.2	187.5	204.5	230.8	275.7
30	69.0	92.4	110.0	122.8	137.8	185.0	225.0	245.5	277.0	331.0

Table 5 Models KD Vertical Discharge

TD*	3-26	4-31	4-35	4-37	6-45	6-51	6-55	9-62	9-73	9-83	9-90	12-108
10	124.0	152.4	165.0	177.5	217.5	244.5	264.5	295.0	350.5	400.0	426.5	497.0
15	185.0	228.5	247.0	266.0	326.0	366.0	397.0	442.0	526.0	600.0	639.0	745.0
20	248.0	304.7	330.0	355.0	435.0	489.0	529.0	590.0	701.0	800.0	853.0	993.0
25	310.0	380.9	412.0	444.0	544.0	611.0	661.0	737.0	876.0	999.0	1065.0	1242.0
30	370.0	457.0	495.0	533.0	653.0	733.0	794.0	885.0	1052.0	1200.0	1279.0	1490.0

* TD Temperature difference between entering air & condensing temperature
** For R22 or R502 multiply load by .952 then select unit

Selection Example

Example

DESIGN

Condensing Unit Model	DM2-2000FC
Capacity	140,000
Suction Temperature	+20°F
Refrigerant	R-12
Design Condensing Temperature	115°F
Design Ambient Temperature	100°F
Temperature Difference (TD)	15°F

Solution

1. From Table 2 opposite +20°F Evaporator Temperature and under 115°F condensing, select the heat rejection factor of 1.35.
2. Multiply condensing unit capacity by this factor: 140.000 x 1.35 = 189000 BTUH
3. From Page 2 Table 5, opposite 15°TD select a Warren/Sherer Model KD-4-31.

As a guide to selection of the TD (temperature difference between condensing temperature and ambient temperature) the following are suggested:

Air Conditioning	25° TD
High and Medium Temperature Refrigeration	15° TD
…w Temperature Refrigeration	10° TD

How To Divide W/S Condensers into Multiple Systems

Considerable cost savings can be made in many applications by using one large condenser to satisfy the condensing requirements of several compressors. Warren/Sherer Condensers lend themselves readily and easily to such multi-system requirements, by following these simple steps:

Step 1.
Determine whether the compressors to be used are open or suction cooled; the capacity in BTUH of each at the operating back pressure; the refrigerant, whether R-12, R-22 or R-502; the design ambient air temperature and the condensing temperature desired.

Step 2.
Using a work-sheet form like or similar to that used in the hypothetical "Example" immediately below, detail the capacity of each compressor at the operating back-pressure; the applicable heat rejection factor (Table 1 or 2); and, by multiplying, its heat rejection. Then, by totaling the individual heat-rejection figures, arrive at the total heat rejection capacity required of the condenser.

If different TD's are required for different refrigeration systems, correct compressor heat rejection figures to one common TD.

Step 3.
In the "Example", where all compressors are suction cooled and the specifications call for a vertical discharge condenser, the total condenser heat rejection requirement was found to be 175.147 BTUH. Referring to Table 5 opposite 15° TD, it is readily seen that Model KD-3-26 meets the heat rejection requirements and is the indicated selection.

Step 4.
Determine the portion of the total condenser surface required for each system. This information is required by Warren/Sherer along with the net refrigeration effect and suction temperature to calculate individual circuiting for each system. This information is also useful in establishing refrigerant charge covered in Table 12.

Example / Based on 90° Design Ambient

Compr.	Refrig. Type	Suction Temp.	Cond. Temp.	TD	BTUH Evap. NRE		THR Factor Table 1 or 2		Base Mult. for TD Table7		Refrig. Type Mult. Table 6		Corrected Total Heat Rej.	% of Unit Surface for Each System
1	12	+20°	110°	15°	14000	X	1.33	X	1.0	X	1.0	=	18620	18620/175147 X 100 = 10.6
2	12	+20°	110°	14°	10000	X	1.33	X	1.0	X	1.0	=	13300	13300/175147 X 100 = 7.6
3	502	-20°	105°	10°	30000	X	1.56	X	1.5	X	.952	=	66830	66830/175147 X 100 = 38.2
4	12	+30°	110°	15°	14500	X	1.28	X	1.0	X	1.0	=	18560	18560/175147 X 100 = 10.6
5	12	+20°	110°	15°	12500	X	1.33	X	1.0	X	1.0	=	16625	16625/175147 X 100 = 9.5
6	502	-20°	105°	10°	18500	X	1.56	X	1.5	X	.952	=	41212	41212/175147 X 100 = 23.5
													THR = 175,147	Using this as divisor

Select Model KD-3-26 From Table 5

Table 6 Refrig. Type Multiplier

Base Refrig.	Mult.
R-12	1.0
R-502	.952
R-22	.952

Table 7 Base Multiplier on TD

Design TD	Base TD 10	15	20	25	30
10	1.00	1.5	2.00	2.50	3.00
15	.67	1.0	1.33	1.67	2.00
20	.50	.75	1.00	1.25	1.50
25	.40	.60	.80	1.00	1.20
30	.33	.50	.67	.83	1.00

$$\text{Base Mult.} = \frac{\text{Base TD}}{\text{Design TD}}$$

NRE Net Refrigerating Effect
THR Total Heat Rejection
TD Temperature Difference between Entering Air and Condensing Temperature

Low Ambient Head Pressure Controls

A decrease in ambient air temperature results in a capacity increase in the air cooled condenser. This capacity increase is directly proportional to the temperature difference (TD) between the condensing temperature and the temperature of the ambient air entering the condenser. Since most refrigerating and air conditioning systems are designed for summer operation, it follows that when the same system operates under lower ambients resulting from seasonal changes, there occurs an increase in the condenser capacity with a consequent reduction in the system head pressure. If the head pressure drops below the point where the expansion valve can properly feed the evaporator, inefficient system operation will result.

To maintain adequate head pressure in the condenser under low ambient conditons, Warren/Sherer offers two basic control methods: (1) fan cycling on multiple fan units; (2) flooding the condenser with liquid refrigerant.

Fan Cycling Head Pressure Control* (1)

The optional fan cycling head pressure control is available on all condenser models and offers satisfactory head pressure control for ambient air temperature as low as the minimum temperature listed in Tables 8 and 8A. The control package consists of condenser air temperature sensing thermostats for each fan or group of fans and the necessary contactors mounted in a weatherproof control box.

This arrangement allows all condenser fans to cycle off during low ambient and low load conditions. All components are factory wired for the operation described. Recommended cut-in and cut-out settings are listed in Table 9.

The fan section of each condenser is partitioned to prevent air by-pass through the venturi section where a fan has been cycled.

Table 8
Models KD-2-9.5 thru 2-17 and KD-4-31 thru 4-37

Design TD	Min. Outside Temp.°F	TD @ Min. Outside Temp. & 90° Cond.
30	35	55
25	45	45
20	54	36
15	63	27
10	72	18

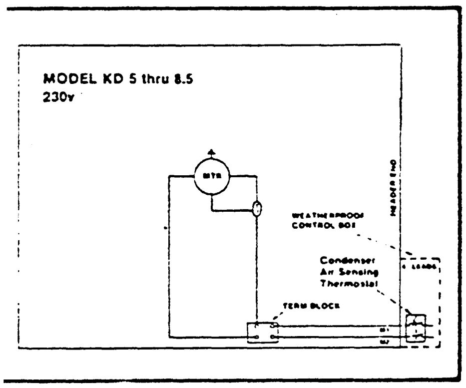
Table 8A
Models KD-3-19 thru 3-26 and KD-6-45 thru 12-108

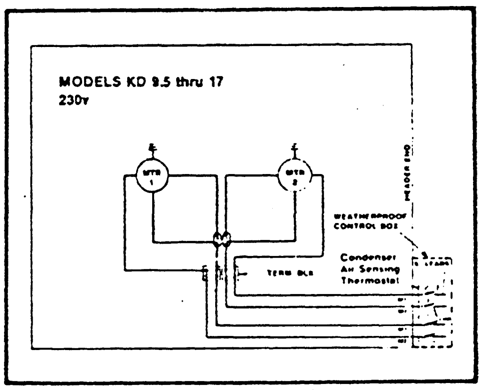
Design TD	Min. Outside Temp.°F	TD @ Min. Outside Temp. & 90° Cond.
30	15	75
25	27	63
20	40	50
15	52	38
10	65	25

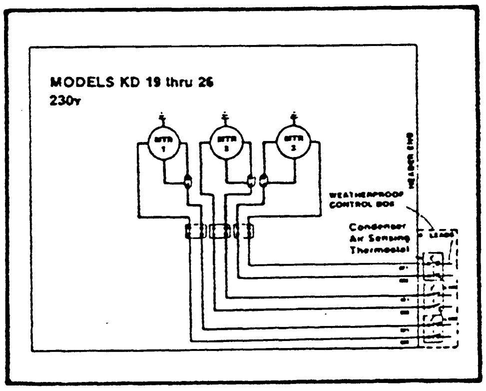
Table 9

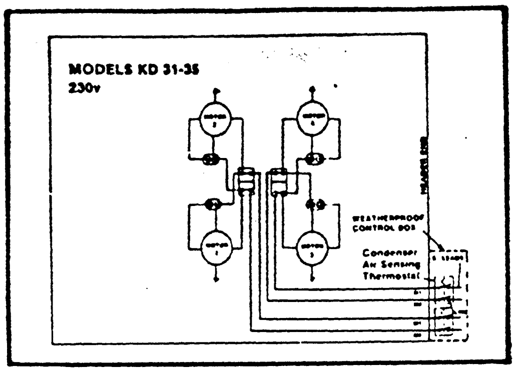
Condenser Model	TD	Thermostat 1		Thermostat 2		Thermostat 3	
All Models KD		CI	CO	CI	CO	CI	CO
1-5, 1-6.5, 1-7.5, 1-8.5	10	60	54				
	15	56	50				
2-9.5, 2-13, 2-15.5, 2-17	10	66	60	50	44		
4-31, 4-35	15	62	56	46	40		
3-19, 3-23, 3-26	10	74	68	66	60	50	44
4-37	15	70	64	62	56	46	40
6-45, 6-51, 6-55							
9-62, 9-73, 9-83, 9-90, 12-108							

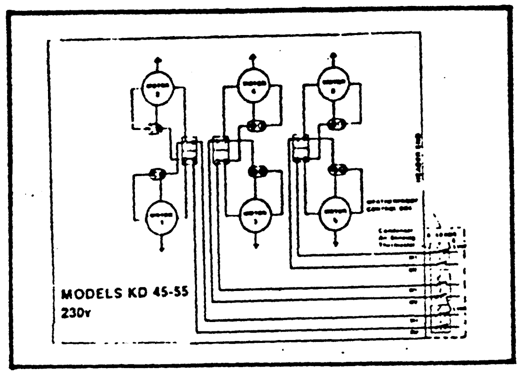
Typical Fan Cycle Wiring Diagrams — Head Pressure Controls

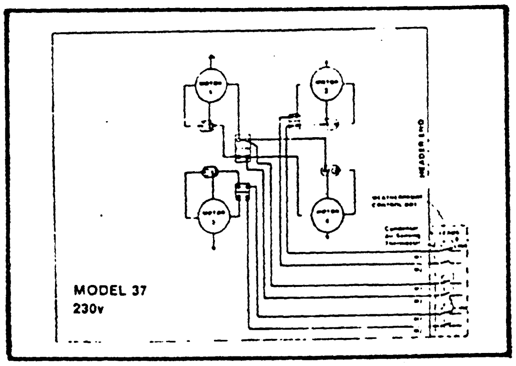


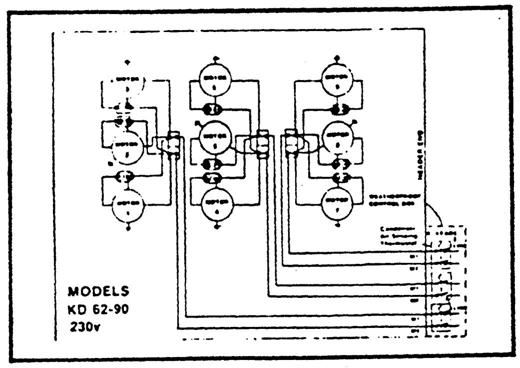


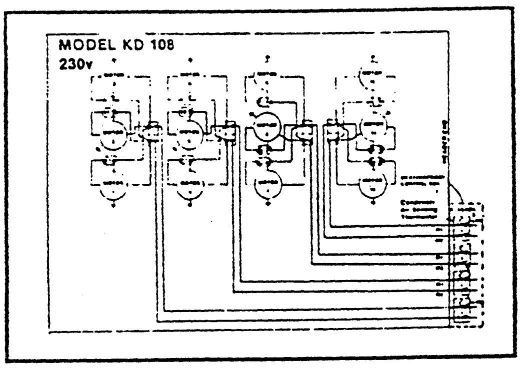


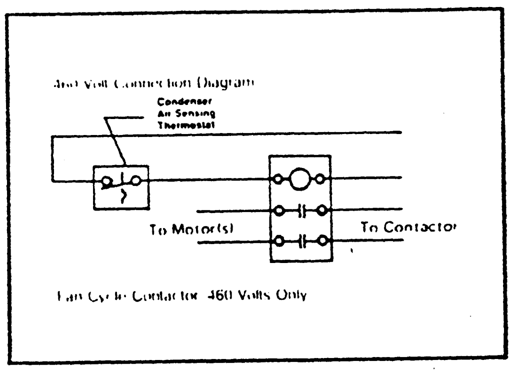






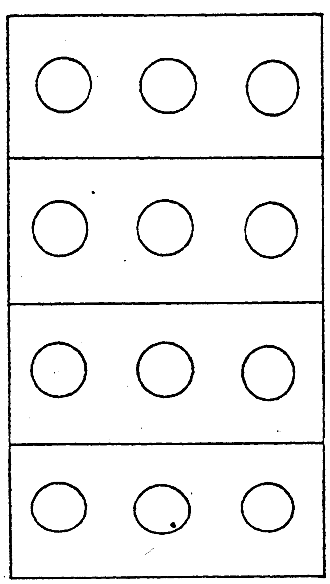




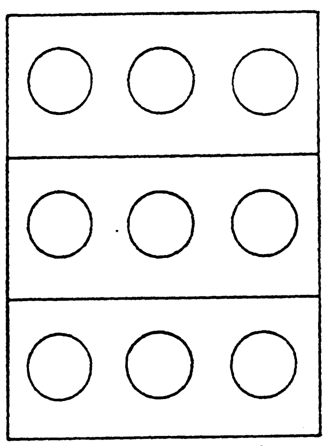


Fan Compartment Sections

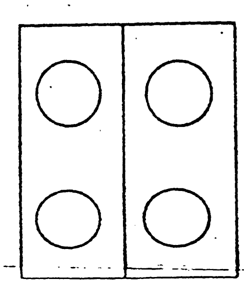
On KD 1-5 thru KD 3-26 (ie: all one, two and three fan units), there is one fan compartment and one fan cycle control per fan!



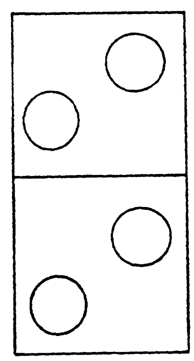
KD 12-108
(4 compartments, 4 fan cycle controls)



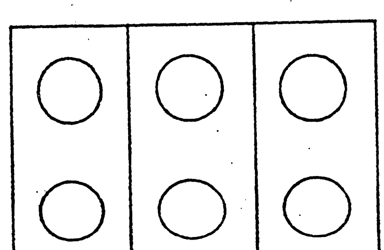
KD 9-62, -73, -83, -90
(3 compartments, 3 fan cycle controls)



KD 4-31, -35
(2 compartments, 2 fan cycle controls)



KD 4-37
(2 compartments, 2 fan cycle controls)



KD 6-45, -51, -55
(3 compartments, 3 fan cycle controls)

Flooded-Type Head Pressure Control (2)

The Warren/Sherer condenser-flooding type of low ambient head pressure control consists of a combination of modulating pressure sensitive valve(s) with three connections; one to the liquid line from the condenser; one to the compressor hot-gas discharge line; and one to the receiver. (See Fig. 1 & Fig. 2)

The controls described above are used primarily on MasterMetic units (MAH, SAH, RAH).
Parallel systems (DM2, DM3) are provided with head pressure controls as an integral part of the system.

How the Valves Work

Under normal summer ambient design conditions the liquid side of the valve remains fully open and the hot-gas side fully closed, thus offering no interference with the design operation of the system. Under conditions of reduced loads and/or cold ambient temperatures, the liquid side valve remains closed on start-up, causing the condenser to flood, thus reducing the effective condenser surface area. Flooding continues until the condenser pressure reaches the pressure of the valve setting. The gas side valve, meanwhile is open, allowing a portion of the hot discharge gas to flow directly into the receiver, maintaining in the receiver the high side pressure required for proper valve operation and prevention of compressor short-cycling. Once the desired pressure is reached in the condenser, the valve(s) modulate to maintain adequate high-side pressure regardless of outside ambient temperature conditions.

Valve Selection

Because different refrigerants have varying pressure-temperature characteristics and require different flow rates to produce given refrigeration tonnages, the valve ratings are based on net refrigerating tons at the evaporator. The Psig settings are based on the type of refrigerant to be used in the system.

Select valves from Table 10 Do not undersize.

Table 10 Condenser Flooding Valve Selection

Warren/Sherer Part Number	Unit Size	Refrigerant Type
8A12-31	3/4 - 7-1/2	FC / FH
8A12-30	10 - 25	FC / FH
8A12-32	3/4 - 7-1/2	RC / RL
8A12-29	10 - 25	RC / RL

Table 11 Valve Settings (PSIG)

Liquid Side		Hot Gas Side
R-12	100	20 PSIG difference between discharge line and receiver
R-22	180	
R-502	180	

Valve Installation

Figure 1 shows a typical installation of the condenser flooding low ambient control valve. Due to the tight seating arrangement of the valve, an auxiliary check valve in the liquid drain line to prevent refrigerant migration from the warm receiver to the cold condenser is not required under normal circumstances. Migration can occur only if the receiver pressure increases above the valve setting—where the receiver is located in an ambient of 90°F. or higher and the condenser in a lower ambient.

When condenser flooding valves are used, careful selection of the receiver is most important. Receiver pump-down capacity must equal or exceed the total refrigerant charge required in the system. Under all low ambient conditions, receivers should be located indoors in a warm area or, if outdoors, insulated and heated to a thermostatically controlled 60° to 65° temperature. Such heater(s) should be wired in parallel with the compressor crankcase heater, so it functions only during compressor off-cycle.

* Including Flooded Condenser see Page 7

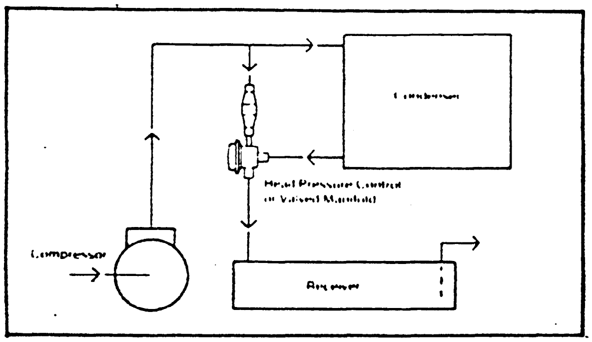


Figure 1

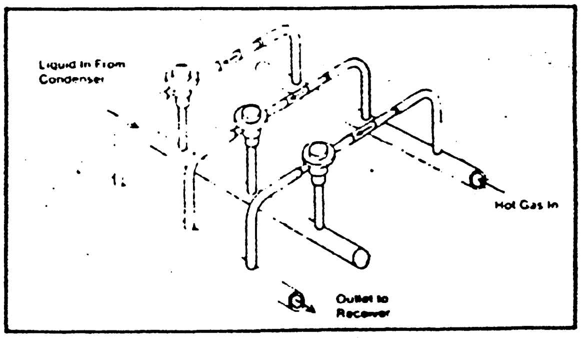


Figure 2

Refrigerant Charge

The summer design refrigerant charge necessary for effective system operation is the sum of operating charge for the evaporator, refrigerant piping (suction, liquid and discharge lines), condenser and receiver. The pump-down capacity of the receiver should be somewhat greater (10% to 15%) than the total refrigerant charge required. When using the Warren/Sherer low-ambient control system, additional refrigerant, over and above the summer design system charge, must be added to the system to allow for condenser flooding. The amount of this added charge is determined by the ambient in which the condenser will operate. Table 12 below lists the total unit charge for all Warren/Sherer single system air-cooled condensers.

The approximate refrigerant charge for each compressor system on multi-system condensers is as follows:

From example page 3

System	% Surface				Unit Chg.		#
1	10.6	÷	100	X	80	=	8.5
2	7.6	÷	100	X	80	=	6.1
3	38.2	÷	100	X	80	=	30.6
4	10.6	÷	100	X	80	=	9.3
5	9.5	÷	100	X	80	=	7.6
6	23.5	÷	100	X	80	=	18.8

Table 12 Operating Charges* /R-12 (Lbs.)**

Condenser Model Number	Ambient Above 60°F Unit Charge	Ambient Between 60°F & 20°F Unit Charge	Ambient Below 20°F Unit Charge
KD-1-¾	0.6	2.0	3.0
KD-1-1	0.8	2.7	4.0
KD-1-1½	1.0	3.5	5.0
KD-1-2	1.7	5.7	8.0
KD-1-3	2.3	8	11
KD-1-5	4.0	13	19
KD-1-6.5	5.0	17	24
KD-1-7.5	6.0	20	28
KD-1-8.5	8.0	27	38
KD-2-9.5	7.0	24	33
KD-2-13	10.0	34	47
KD-2-15.5	14.0	48	65
KD-2-17	17.0	58	80
KD-3-19	16.0	55	76
KD-3-23	20.0	68	95
KD-3-26	25.0	85	120
KD-4-31	28.0	96	130
KD-4-35	34.0	116	160
KD-4-37	43.0	140	240
KD-6-45	44.0	150	208
KD-6-51	54.0	180	256
KD-6-55	64.0	210	304
KD-9-62	51.0	170	242
KD-9-73	66.0	220	314
KD-9-83	80.0	270	380
KD-9-90	94.0	320	445
KD-12-108	110.0	384	534

*Based on 120° condensing for summer operation; 90° maximum condensing for below 60°/ **For R-22, multiply by .90; for R-502 by .93

Refrigerant Line Capacities [Tons]

Line Size-O.D. Type L Copper Tube	Discharge Line* R-12 Sat. Suct. Temp. -40	0	+40	R-22 Sat. Suct. Temp. -40	0	+40	R-502 Sat. Suct. Temp. -40	0	+40	Liquid Line Condenser to Receiver Velocity = 100 FPM R-12	R-22	R-502
½	.46	.56	.69	.88	1.04	1.25	.64	.80	.99	1.16	2.24	1.61
⅝	.85	1.04	1.28	1.66	1.97	2.38	1.21	1.52	1.88	3.12	3.57	2.58
⅞	2.25	2.73	3.36	4.41	5.24	6.32	3.31	4.15	5.12	6.61	7.41	5.35
1⅛	4.65	5.60	6.83	8.82	10.48	12.62	6.74	8.41	10.39	11.20	12.70	9.13
1⅜	7.82	9.50	11.74	15.38	18.28	22.10	11.90	15.92	18.59	17.10	19.20	13.90
1⅝	12.68	15.50	19.03	23.00	27.98	34.50	19.00	23.75	29.20	24.30	27.20	19.68
2⅛	25.84	31.52	38.80	50.87	60.45	72.90	40.42	50.50	62.30	42.30	47.30	34.23
2⅝	45.65	55.50	68.36	88.87	105.51	127.30	72.54	90.72	111.90	65.10	73.20	53.79
3⅛	73.50	89.50	110.23	138.70	164.82	199.00	120.26	150.51	185.90	93.00	104.10	75.35
3⅝	107.55	130.29	161.00	206.98	245.96	297.00	176.12	220.40	272.30	126.00	141.10	101.90
4⅛	151.75	184.94	228.38	297.04	352.00	426.00	258.79	323.68	399.60	163.00	183.00	132.50

*Line sizes based on pressure drop equivalent to 2 degrees per 100' length

Weight of Refrigerant in Type L Copper Lines (Lbs. per 100 Lineal Feet)

Line Size-O.D.	Liquid Line 110F R-12	R-22	R-502	Suction Line 40F R-12	R-22	-20F R-502	Discharge Line 115F R-12	R-22	R-502
½	7.8	7.0	7.3	.13	.15	.08	.40	.49	.72
⅝	12.6	11.3	11.7	.20	.24	.12	.65	.80	1.16
⅞	26.1	23.4	24.2	.43	.50	.25	1.34	1.68	2.42
1⅛	44.8	40.0	41.5	.74	.86	.43	2.30	2.86	4.15
1⅜	67.6	60.5	62.8	1.02	1.31	.65	3.47	4.34	6.28
1⅝	94.5	85.0	88.0	1.57	1.84	.92	4.90	6.10	8.80
2⅛	166.0	150.0	155.0	2.77	3.25	1.60	8.60	10.70	15.50
2⅝	258.0	232.0	240.0	4.30	5.03	2.46	13.30	16.60	24.50
3⅛	366.0	330.0	340.0	6.10	7.15	3.50	18.90	23.60	34.00
3⅝	495.0	446.0	461.0	8.30	9.65	4.75	25.60	31.90	46.10
4⅛	646.0	584.0	602.0	10.80	12.60	6.18	33.40	41.60	60.20

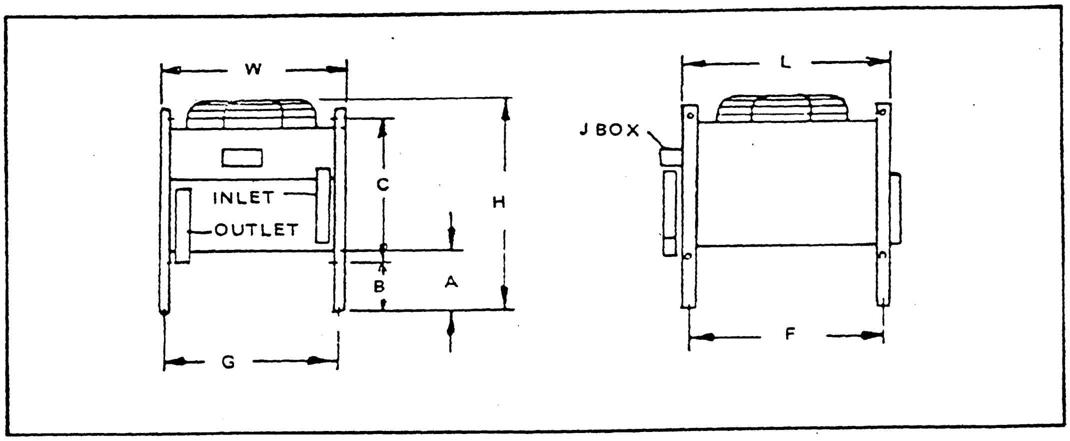
Altitude Correction Factors

Altitude	Sea Level	1000'	2000'	3000'	4000'	5000'	6000'	7000'	8000'	9000'	10000'
Factor	1.0	1.037	1.075	1.116	1.157	1.201	1.248	1.295	1.345	1.400	1.453

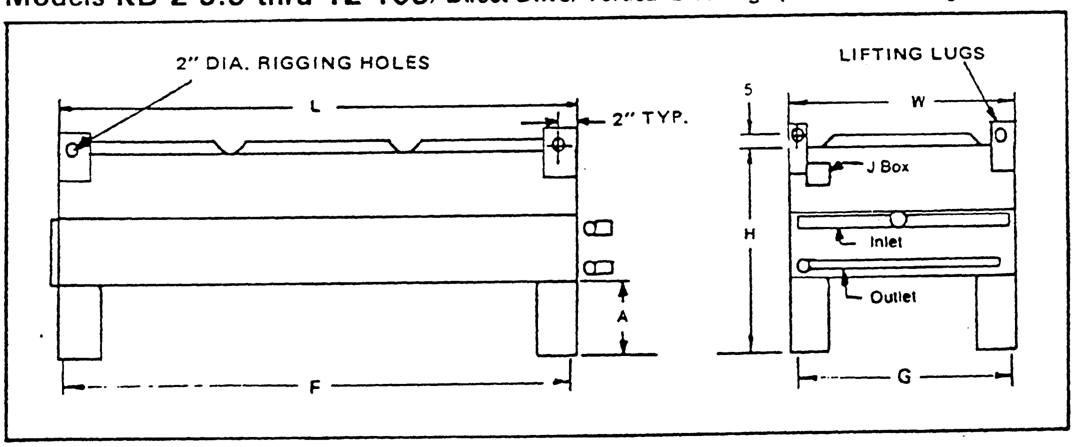
As altitude increases, the capacity of an air cooled condenser decreases because fewer pounds of air are circulated. To compensate for this, the basic calculated total heat rejection must be multiplied by the following factor (density ratio) associated with the altitude where the condenser is to be located. Use this increased total heat rejection figure in making condenser selection.

Dimensional Data

KD-1-¾ thru KD-1-8.5/Horizontal or Vertical Discharge



Models KD-2-9.5 thru 12-108/Direct Drive/Vertical Discharge (Horiz. Discharge Avail. 2-9.5 thru 3-26)



Physical Dimensions in Inches

Models KD/Direct Drive/Horizontal & Vertical Discharge

Model Number	A	B	C	F	G	H	L	W	Connections-O.D. Inlet	Connections-O.D. Outlet	Approx. Shipping Wt.
KD-1-¾	6	4¾	14¾	19⅛	19¼	21	21	20¼	½	⅝	58
KD-1-1	6	4¾	14¾	19⅛	19¼	21	21	20¼	⅝	⅝	65
KD-1-1½	6	4¾	14¾	23⅛	25¼	22	25	26¼	⅝	⅝	89
KD-1-2	6	4¾	14¾	23⅛	25¼	22	25	26¼	⅝	⅝	110
KD-1-3	6	4¾	14¾	23⅛	25¼	22	25	26¼	⅞	⅞	145

Models KD/Direct Drive

Model Number	A	B	C	F	G	H	L	W	Connections-O.D. Inlet	Connections-O.D. Outlet	Approx. Shipping Wt.
KD-1-5	10	8¾	19	41½	34⅜	31½	43½	35½	1⅛	1⅛	195
KD-1-6.5	10	8¾	19	41½	34⅜	31½	43½	35½	1⅛	1⅜	220
KD-1-7.5	10	8¾	19	41½	34⅜	31½	43½	35½	1⅜	1⅜	245
KD-1-8.5	10	8¾	19	41½	34⅜	31½	43½	35½	1⅜	1⅜	285
KD-2-9.5	15			58¾	38¾	34	63¼	43½	1⅝	1⅛	434
KD-2-13	15			58¾	38¾	34	63¼	43½	1⅝	1⅛	484
KD-2-15.5	15			58¾	38¾	34	63¼	43½	1⅝	1⅛	534
KD-2-17	15			58¾	38¾	34	63¼	43½	1⅝	1⅛	581
KD-3-19	15			88¾	38¾	34	93¼	43½	2⅛	1⅜	656
KD-3-23	15			88¾	38¾	34	93¼	43½	2⅛	1⅜	731
KD-3-26	15			88¾	38¾	34	93¼	43½	2⅛	1⅜	806
KD-4-31	15			58¾	78¾	35½	63¼	83½	2-1⅝	2-1⅛	991
KD-4-35	15			58¾	78¾	35½	63¼	83½	2-1⅝	2-1⅛	1081
KD-4-37	18			94½	48¾	45¼	99¼	53½	2-1⅝	2-1⅜	1176
KD-6-45	18			103½	68¾	39¾	108¼	73½	2-2⅛	2-1⅝	1923
KD-6-51	18			103½	68¾	39¾	108¼	73½	2-2⅛	2-1⅝	2078
KD-6-55	18			103½	68¾	39¾	108¼	73½	2-2⅛	2-1⅝	2233
KD-9-62	22			118½	88¾	42¾	123¼	93½	2-2⅛	2-1⅝	2315
KD-9-73	22			118½	88¾	42¾	123¼	93½	2-2⅛	2-1⅝	2520
KD-9-83	22			118½	88¾	42¾	123¼	93½	2-2⅝	2-2⅛	2735
KD-9-90	22			118½	88¾	42¾	123¼	93½	2-2⅝	2-2⅛	2960
KD-12-108	22			157	89¼	51¾	161¼	93½	2-2⅝	2-2⅛	3300

Specifications

Models KD/Direct Drive

Model Number	Total CFM	Condenser Fans No.	Dia.	RPM	Fan Motors No.	HP	Total Motor Amps 115V	230V
KD-1-¾	1440	1	16	1050	1	1/12	4.0	2.0
KD-1-1	1200	1	16	1050	1	1/12	4.0	2.0
KD-1-1½	2600	1	20	1050	1	1/6	5.6	2.8
KD-1-2	2500	1	20	1050	1	1/6	5.6	2.8
KD-1-3	2400	1	20	1050	1	1/6	5.6	2.8

Models KD/Direct Drive

Model Number	Total CFM	Condenser Fans No.	Diam.	RPM	Fan Motors* No.	HP	Total Motor Amps 200V-230V**		460V	**	Wiring Arrangement Stand.	Optional
KD-1-5	5750	1	24	1100	1	½	4.2		2.1		1 phase	
KD-1-6.5	5400	1	24	1100	1	½	4.2		2.1		1 phase	
KD-1-7.5	5150	1	24	1100	1	½	4.2		2.1		1 phase	
KD-1-8.5	4900	1	24	1100	1	½	4.2		2.1		1 phase	
KD-2-9.5	11500	2	24	1100	2	½	8.4	7.3	4.2	3.6	1 phase	3 phase
KD-2-13	10800	2	24	1100	2	½	8.4	7.3	4.2	3.6	1 phase	3 phase
KD-2-15.5	10300	2	24	1100	2	½	8.4	7.3	4.2	3.6	1 phase	3 phase
KD-2-17	9800	2	24	1100	2	½	8.4	7.3	4.2	3.6	1 phase	3 phase
KD-3-19	16200	3	24	1100	3	½	12.6	7.3	6.3	3.6	1 phase	3 phase
KD-3-23	15450	3	24	1100	3	½	12.6	7.3	6.3	3.6	1 phase	3 phase
KD-3-26	14700	3	24	1100	3	½	12.6	7.3	6.3	3.6	1 phase	3 phase
KD-4-31	21000	4	24	1100	4	½	16.8	11.1	8.4	5.6	1 phase	3 phase
KD-4-35	20000	4	24	1100	4	½	16.8	11.1	8.4	5.6	1 phase	3 phase
KD-4-37	19300	4	24	1100	4	½	16.8	11.1	8.4	5.6	1 phase	3 phase
KD-6-45	30200	6	24	1100	6	½	14.5		7.3		3 phase	
KD-6-51	29000	6	24	1100	6	½	14.5		7.3		3 phase	
KD-6-55	28400	6	24	1100	6	½	14.5		7.3		3 phase	
KD-9-62	49000	9	24	1100	9	½	21.8		10.9		3 phase	
KD-9-73	46500	9	24	1100	9	½	21.8		10.9		3 phase	
KD-9-83	44500	9	24	1100	9	½	21.8		10.9		3 phase	
KD-9-90	42000	9	24	1100	9	½	21.8		10.9		3 phase	
KD-12-108	56000	12	24	1100	12	½	29.1		14.5		3 phase	

* All motors are ½ HP, 200-230/1/60 or 460/1/60, 4.2 FLA or 2.1 FLA, Ball Bearing. 3 phase motors are also available.

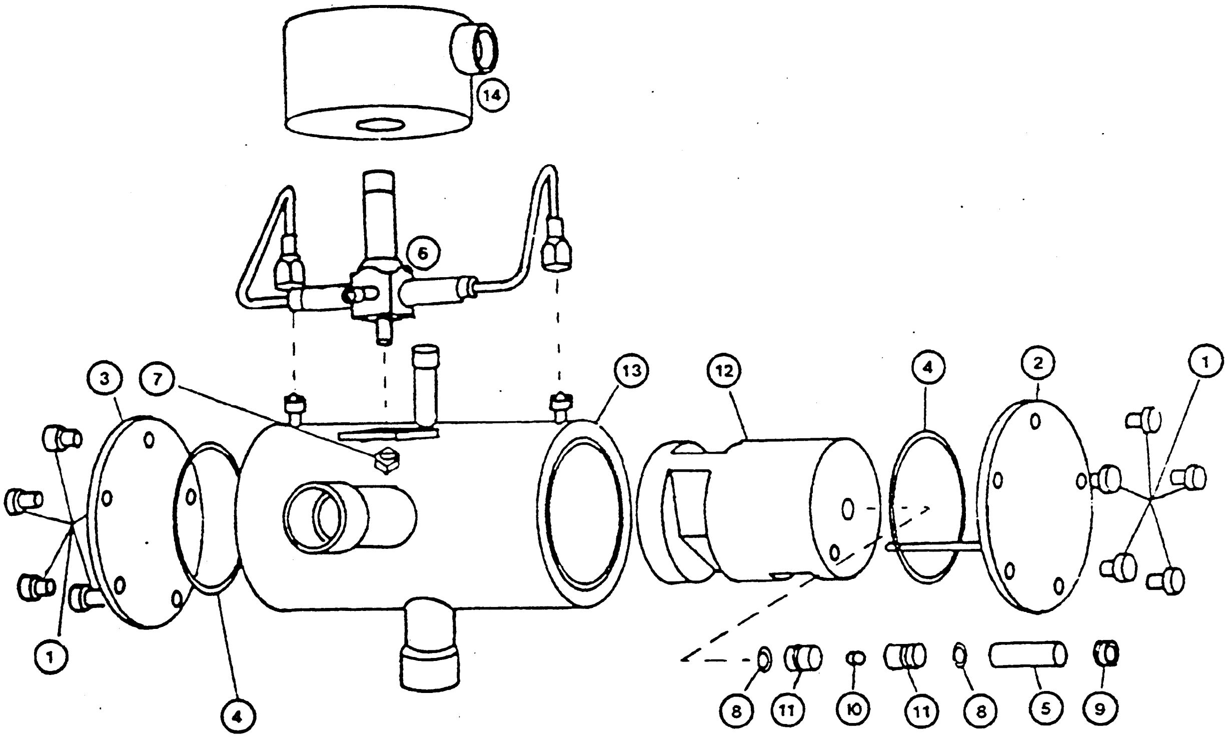
** For optional 3 phase wiring, units shown 3 phase have 1 phase motors arranged 3 phase delta.

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.

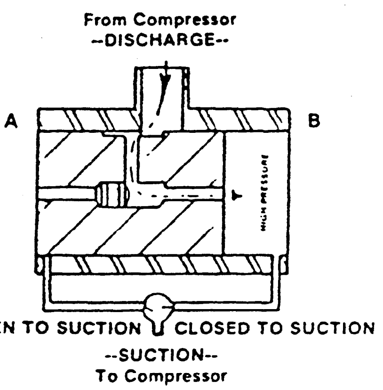


NO	DESCRIPTION	QTY	-06-	-07-	-090-	-12-
*#+ 1	CAP SCREWS	( )	(10) 40-06	(10) 40-07	(12) 40-09	(12) 40-12
2	PIN CAP	1	60-06	60-07	60-09	60-12
3	END CAP	1	61-06	61-07	61-09	61-12
*#+ 4	'O' RING	2	50-06	50-07	50-09	50-12
+ 5	SLAVE SPACER	1	06-1-9	07-1-9	09-1-9	12-1-9
# 6	PILOT ASSEMBLY	1	P200-2- (VALVE 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)			

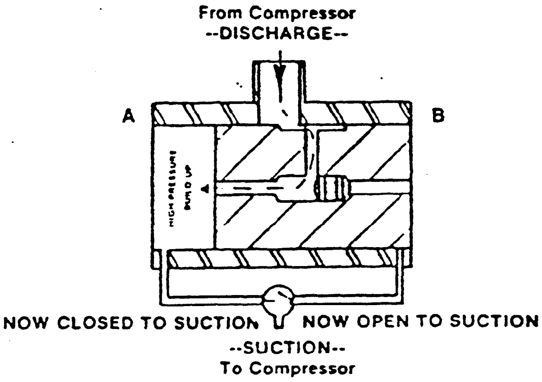
*These items included in Inspection Kit.
#These items included in Pilot Kit.
+These items included in Slave Pilot Kit

--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

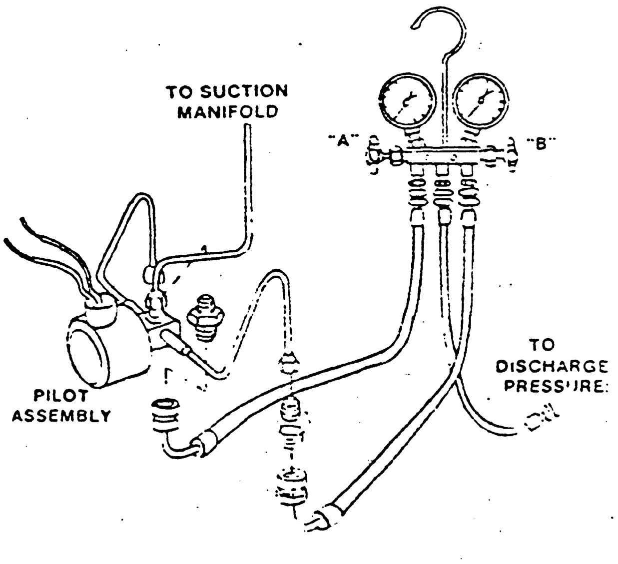
A. Check valve and stubs for binding, valve installed in a bind will not function.
B. Check connections on main valve body and pilot assembly and tighten or solder any leaks.
C. Check both end caps for leaking and tighten if necessary; if leak persists, replace 'o' ring. (Refer to G)

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 1/4" 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 bad. (Two 'highs' mean the pilot assembly needs cleaning and/or replacing.)



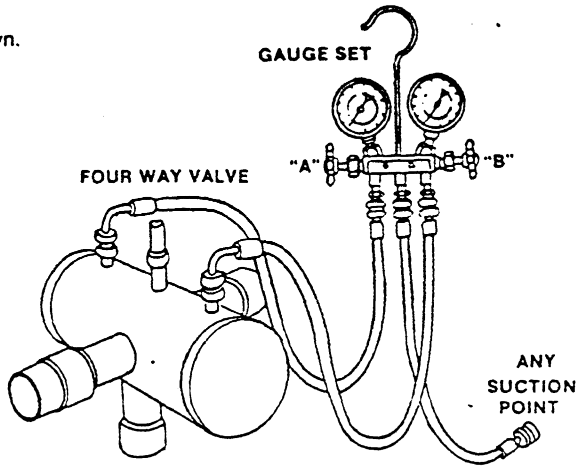
NOTE: TO CLEAN THE PILOT ASSEMBLY

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 1/4" SAE flares in main body. (Fig. 4) Hand valves A & B should be closed.
5. Connect the center hose 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 hose 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 hose 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 hone fit with its own body.

To disassemble the valve, loosen all the end cap screws between 1/8" and 1/4" 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 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 'o' ring 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 drilled so that 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 use new 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.

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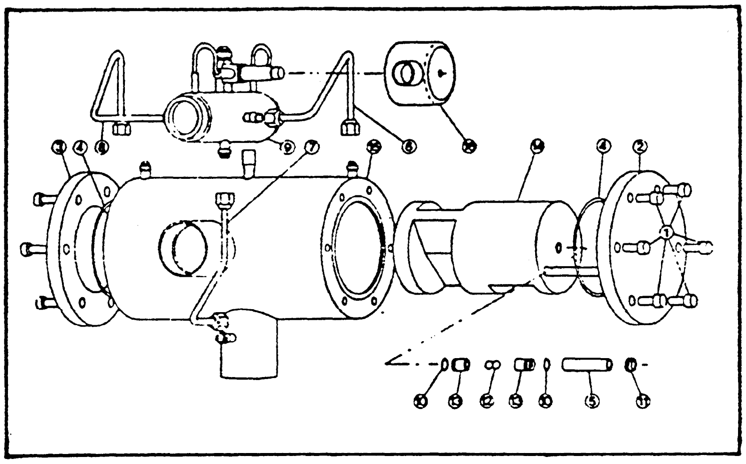
Product Engineering Corporation

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.



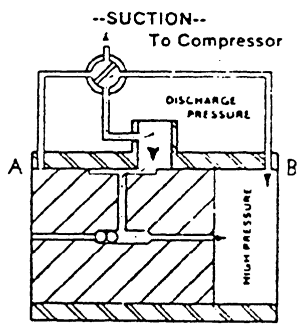
	NO.	DESCRIPTION	QTY	15	18	21
• +	1	CAP SCREWS	12	40-15	40-18	40-21
	2	PIN CAP	1	60-15	60-18	60-21
	3	END CAP	1	61-15	61-18	61-21
• +	4	'O'-RING	2	50-15	50-18	50-21
+	5	SLAVE SPACER	1	15-1-9	18-1-9	21-1-9
	6	HIGH PILOT LINE	1	15-1-14	18-1-14	21-1-14
	7	MID PILOT LINE	1	15-1-15	18-1-15	21-1-15
	8	LOW PILOT LINE	1	15-1-13	18-1-13	21-1-13
#	9	PILOT VALVE	1	P300		
+	10	SLAVE 'O'-RING	2	P200-50		
+	11	LOCKING SCREW	1	P200-1-4	SAME ON ALL VALVES	
+	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.
· These items included in the Slave Pilot Kit.

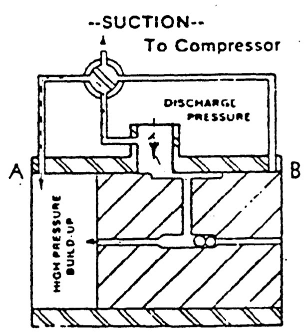
--OPERATION--

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 remote pilot

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 seat, thereby pressurizing end 'A' of the valve and starting the spool moving toward end 'B'. When the spool clears the pilot connection at end 'A', additional high pressure gas will flow into that end, and will accelerate the shift of the spool toward 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 the connections will make the brazing more difficult. A thick consistency flux is required to ensure that no flux enters the valve. Use silver solder only, when brazing steel stub valves. DO NOT USE WET RAGS FOR COOLING: steam will be drawn into the valve and cause rusting. It is suggested that one play the brazing torch more on the system tubing than on the valve connections.

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

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

B. Check the connections on the main valve body and the pilot assembly, and tighten or solder any leaks.

C. Check both end caps for leaking and tighten if necessary; if leak persists, replace the neoprene 'o'-rings. Unit must be shut down, or valve isolated from pressure. Loosen all end cap screws 1/8" to 1/4", and tap end caps lightly with something soft (a piece of nylon or soft clean wood) to release any vapor still in the valve. (CAUTION: If the removing of the spool is not done in this way, the vapor in the valve could 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 vapor in the valve, remove end caps and replace the 'o'-rings.

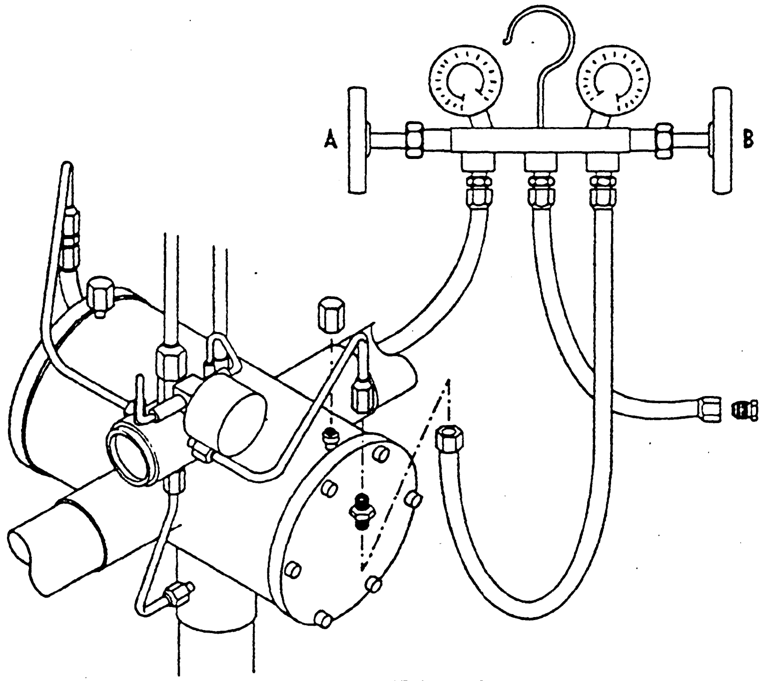
D. CHECK THE SOLENOID COIL

The only way to check the solenoid coil 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

Required Equipment:
- (1) Serviceman's gage set with hoses
- (2) 1/4 X 1/4 SAE Unions
- (2) 1/4 SAE Flare Cap
- (1) 1/4 SAE Plug

1. With the unit shut down, attach the gage set hoses to the pilot lines as shown in Fig. 3. Use the Flare Caps on main-valve-body-to-pilot connections, and plug the gage set middle hose.
2. With hand valves fully open and the valve de-energized, gage A should read discharge pressure, and gage B should read suction pressure.
3. When the coil is energized, gage B should read discharge pressure and gage A should read suction pressure.
4. Repeat steps 3 and 4 several times. If the pilot valve is faulty, it cannot be cleaned or repaired, and should be replaced with the appropriate P.E. Pilot Assembly.



(FIGURE 3)

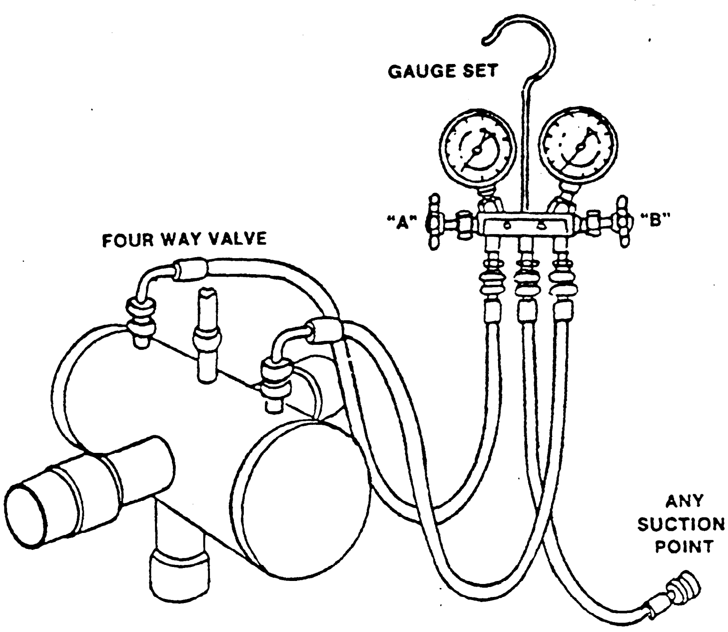
F. CHECK THE MAIN VALVE

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.

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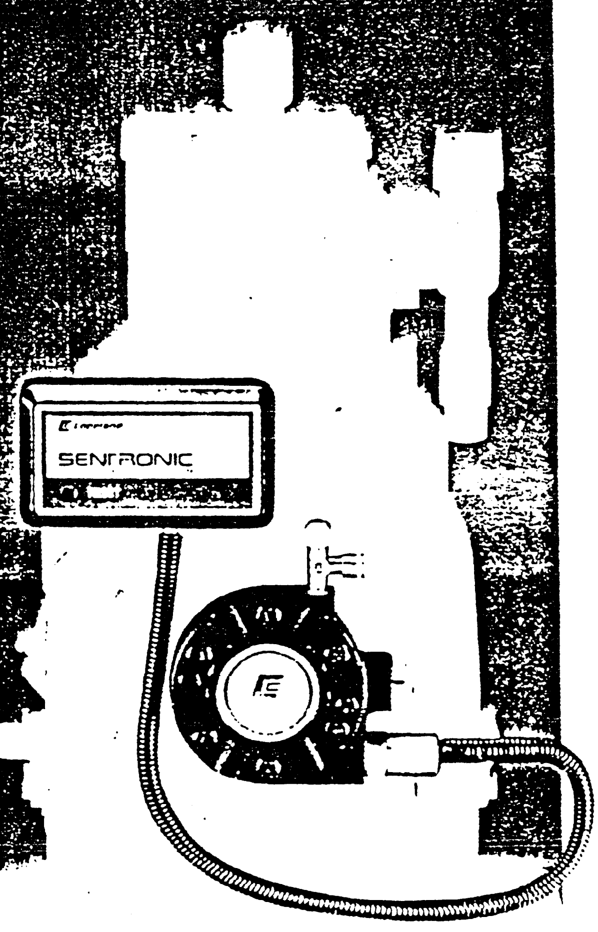
The Copeland Sentronic Oil Pressure Control

- 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

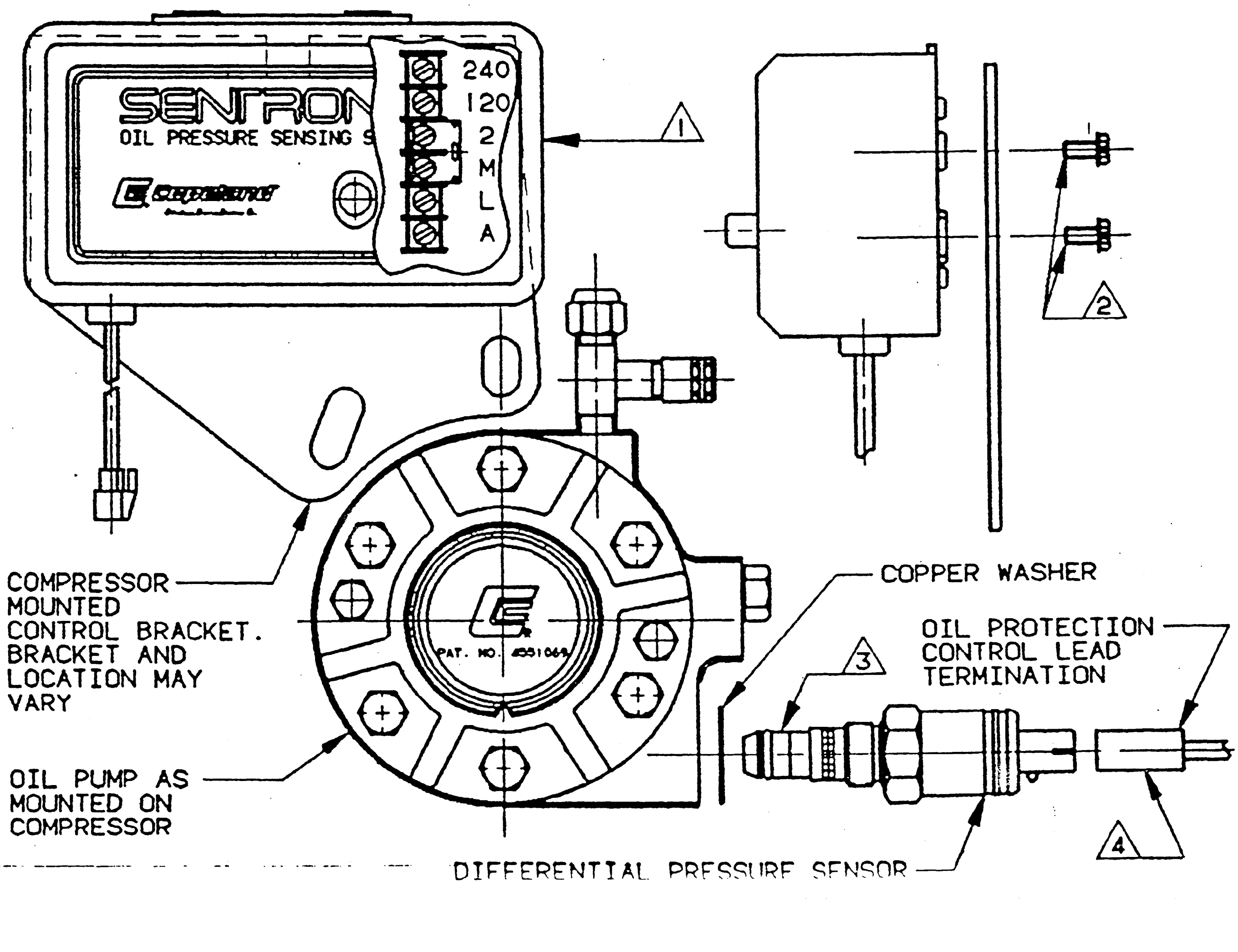
The Sentronic oil differential pressure sensor mounts directly into the oil pump. **The same sensor is used for all model Sentronics.** The sensor measures oil pump differential pressure, i.e., the difference between oil pump outlet pressure and crankcase pressure. The sensor sends an operating signal 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

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

This test must only be performed by qualified service personnel (see next page for further information and a bench test procedure for the Sentronic module).

Important! Before energizing this system, make sure the Sentronic is wired correctly. Refer to the wiring diagrams in the Sentronic brochure. Failure to do so may result in a damaged control unit.

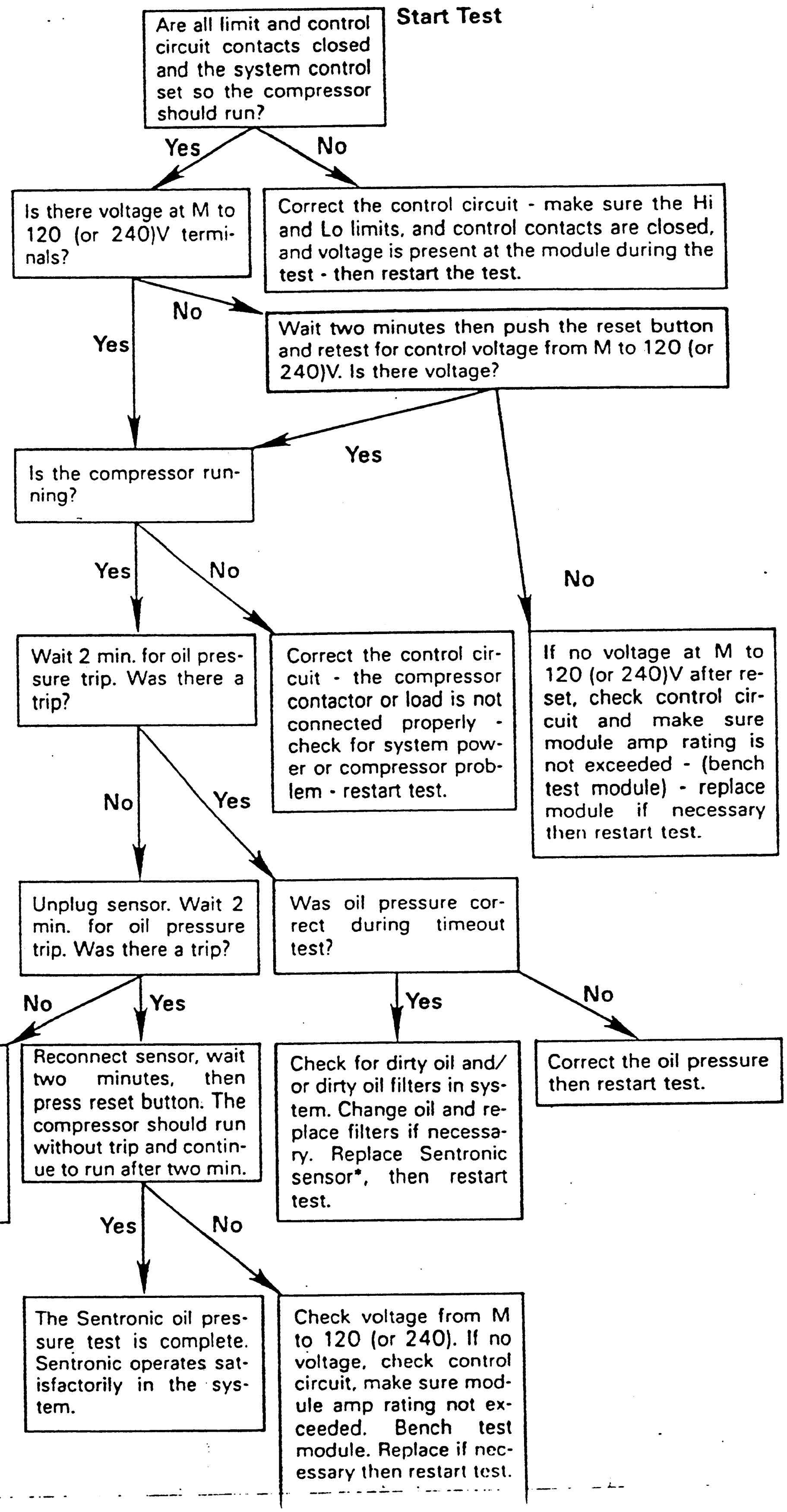
This test is to be performed with the Sentronic oil pressure module and sensor connected to the system, and the system energized at the start of the test.

If 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.

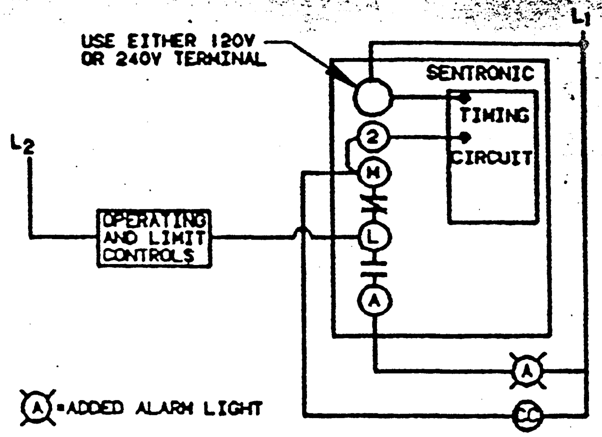


Diagram No. 2

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.

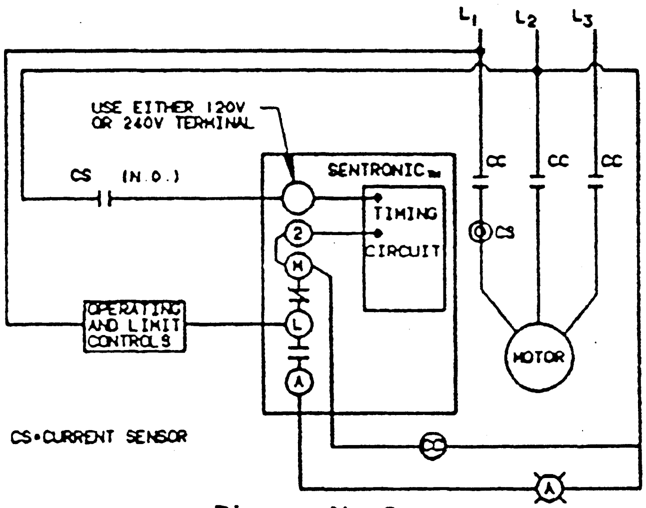


Diagram No. 3

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).

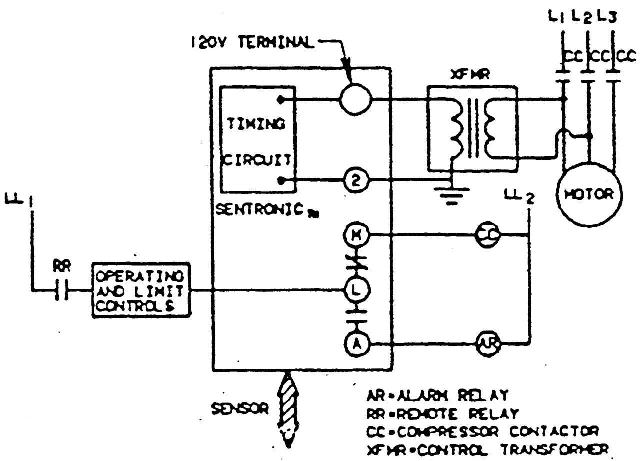


Diagram No. 4

Application Engineering Bulletin
AE-1281-R1

April 1, 1988

OIL CHARGES FOR COPELAMETIC COMPRESSORS

Copelametic compressors are manufactured with an oil sight glass in the crankcase to observe oil level in the compressor. A Copelametic compressor is considered to be properly charged with oil if the oil level in the sight glass is at the level indicated in Table 1. It is important to always check oil level while the compressor is running. This is the most reliable method to ensure proper lubrication during operation. After prolonged off periods, the oil level in a compressor can be misleading due to refrigerant which is dissolved in the oil.

Effective with new and remanufactured compressors produced after November 1987, the factory oil charge will provide the recommended oil level for close-coupled single compressor systems. Some compressor models produced before this date may have oil levels slightly above or below these values due to cumulative minor manufacturing changes or specific customer requests.

Column 1 in Table 2 lists the oil charge provided with new and remanufactured compressors as supplied from the factory after November 1987. Column 2 lists the amount of oil required for a field recharge of the compressor oil. The Column 2 (recharge) value is slightly lower than the Column 1 (new and remanufactured) value since some oil will remain in the compressor when the oil is drained. The Column 2 value should always be used for field recharge.

Some applications, especially those with long lines, may require additional oil to be added in order to maintain the recommended sight glass levels. However, it should be noted that adding too much oil can result in serious damage (broken rods and valves) to the compressor due to slugging of oil in the cylinders, as well as increased oil circulation in the system. On the other hand, in many installations, especially existing systems where a remanufactured compressor is

Table 1
Recommended Oil Levels for Copelametic Compressors

Compressor Models	System Type	Oil Level			
		Idle		Running	
		Nom.	Tol.	Nom.	Tol.
H, K, E, 3, L (Air Cooled)	All	¾	+¼ -0	½	+¼ -0
E, N, 3, 2D, M, 9, 3D, 4,6 (Refrigerant Cooled)	Single Compressor Systems	¾	+0 -¼	½	+0 -¼
	Multiple Compressor Racks with Oil Equalization Systems	½	+¼ -0	¼	+¼ -0
8	All	½	+0 -⅛	¼	+0 -⅛

installed, we find that excess oil, which was resident in the system when the replacement compressor was installed, must be removed to achieve the proper oil level in the compressor.

Note that the direction of rotation of the crankshaft affects the oil level in the sight glass. This is due to splashing of the running gear in the oil. Rotation in one direction pushes oil toward the sight glass while rotation in the other direction pushes oil away from the sight glass. This normally does not affect compressor operation as long as the oil level is within recommended levels.

The final guidelines in all cases should be to maintain the oil level recommended in Table 1.

COPELAMETIC OIL CHARGE
(Fl. Ozs.)

MODEL		Column 1 INITIAL FACTORY CHARGE	Column 2 FIELD RECHARGE
H		22	16
K		22	20
E		60	58
N		70	65
3		70	65
L		70	65
M		80	70
M	Deep Sump	110	95
9		115	105
9	Deep Sump	165	155
3D		115	105
3D	Deep Sump	165	155
4	10 HP	140	130
4	15/20 HP	135	120
4	Deep Sump 15/20 HP	250	235
4	22 HP	130	120
4	25 HP	130	120
4	Deep Sump 25 HP	245	235
4	30 HP	140	125
4	Deep Sump 30 HP	255	240
6	10 HP	145	135
6	Deep Sump 10 HP	260	250
6	20 HP	155	145
6	Deep Sump 20 HP	270	260
6	15/27 HP	140	130
6	Deep Sump 25/27 HP	255	245
6	30 HP	140	130
6	Deep Sump 30 HP	255	245
6	35/40 HP	140	130
6	Deep Sump 35/40 HP	255	245
8	Deep Sump 50/60 HP	255	245