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PHO WATER DEFROST
OPERATION & MAINTENANCE MANUAL

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PHO WATER DEFROST

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Introduction

The purpose of this manual is to describe the Dole Water Defrost Cold-Wel and to present information relative to its maintenance. An attempt has been made to offer as much practical assistance as might be required to troubleshoot and resolve problems that may arise.

Figure 1 illustrates the Cold-Wel ready for installation in a truck.

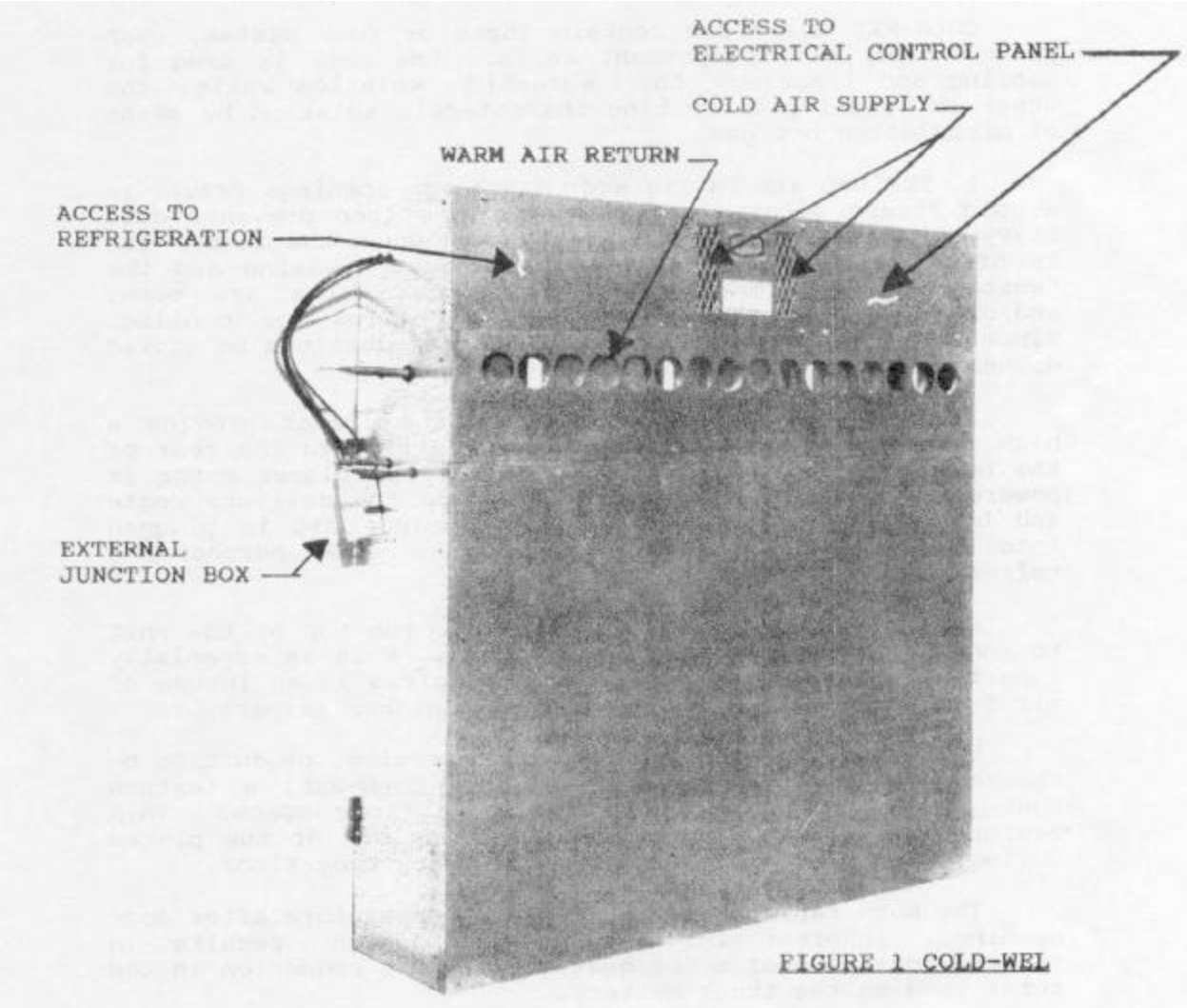

FIGURE 1 COLD-WEL

Cold-Wel Water Defrost Holdover Blower System

Features of Cold-Wel Water Defrost Holdover Blower Systems:

1. The zero degree F. holdover plates provide twice the plate surface to body air temperature difference as plus 18 degrees F. plates in other holdover blower systems. This feature results in Cold-Wels having the capacity to cool an enclosure at twice the rate of other systems.

Cold-Wel units contain three plates, each having one coil used for cooling and freezing the eutectic solution.

2. The top air intake and discharge openings result in a cold "trap" within the Cold-Wel. This trap prevents cold heavy air from flowing out of the unit when the blower fan is off. This feature eliminates product freezing and the "waste" of holdover cooling when truck doors are open and/or the truck thermostat is not calling for cooling. Since the Cold-Wel frame is insulated, product can be stored up next to the unit without fear of freezing.

3. Dual blowers on a double-shafted motor provide a high velocity blast of air along the ceiling to the rear of the body for full product protection. The blower motor is powered from the truck battery while on the delivery route and by external power when the condensing unit is plugged into external power at dockside for the purpose of refreezing eutectic in the plates.

4. The air inlets are located near the top of the unit to receive the warmest air in the body. This is especially important after a door opening has resulted in an inrush of air from outside with its accompanying higher temperature.

5. The closed bottom of the unit permits product to be stacked against the exterior of the Cold-Wel, a feature that permits full use of available floor space. A drain, prevents water from flooding the truck body floor during defrosting.

6. The Cold-Wel design provides the capability of rapidly bringing the body temperature down to the desired temperature after door openings. This feature reduces blower motor running time and its associated load on the truck battery.

7. A winter heat option is available in all Cold-Wels. This option can prevent product freezing when the unit is plugged into external power at dockside in climates where heating may be required due to extremely low outside temperatures.

Cold-Wel Water Defrost System Configurations

Cold-Wel water defrost is offered in two different configurations:

-Water Defrost
-Water Defrost with Heat

The components in the Control Panel (Figure 2) will reveal which version of Cold-Wel is installed in a specific truck.

Water Defrost

In both configurations, the units are provided with a very efficient waterfall type of defrost system. A simple hose connection on the outside of the vehicle allows the use of tap water to defrost the plates. Water is uniformly distributed across the top of the plates and allowed to run down the plates and out a drain in the bottom of the truck body.

Because of the wide geographical use of the equipment, the humidity conditions and frequency of defrosts will vary from location to location. However, a daily water defrost of 5 to 10 minutes will normally eliminate any frost build up.

Water Defrost with Winter Heat

In this configuration, a manually operated selector switch is included which can place the unit in the Refrigerate or in the Heat mode. This unit is defrosted in the same manner as the Water Defrost just described. When placed in the Heat mode, a heater in the Cold-Wel is energized and air flows over the heater when the truck thermostat calls for heat. While in the Heat mode, the condensing unit is electrically locked out. Heat is available only at dockside since the heaters are 240VAC elements.

Water Defrost System Variations

The components in the Cold-Wel Control Panel will reveal which version of Water Defrost is installed in a specific truck.

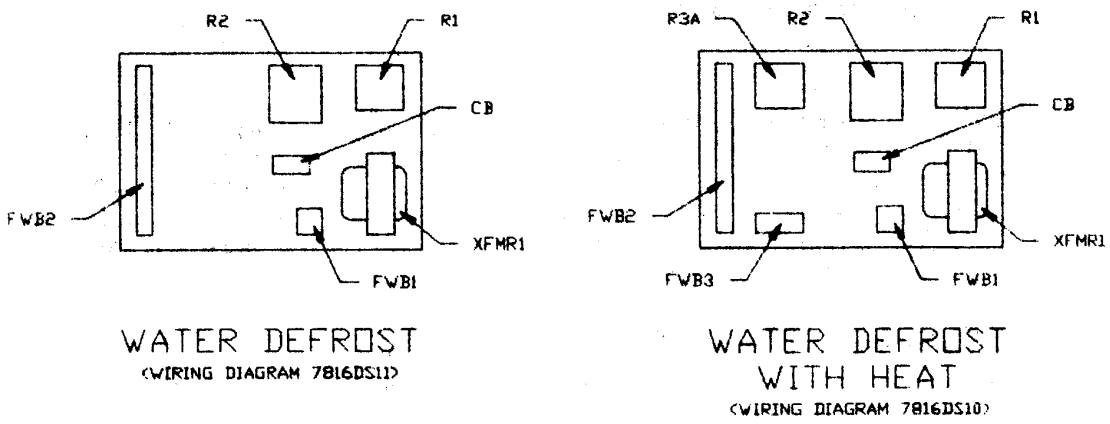

Figure 2 – Water Defrost Variations

Refrigeration System Description

A Dole Cold-Wel with Water Defrost contains three plates filled with a zero degree F. eutectic solution, and each plate has an internal refrigeration coil (9). (Refer to Figure 3)

The compressor discharge is routed through the discharge service valve (2) and to the Condenser (3). The condensed liquid is stored in the Receiver (4). At the same time, liquid refrigerant is routed through the King Valve (5). After passing through the Thermostatic Expansion Valves (6, 7 and 8), the cold liquid refrigerant flows through the internal refrigeration coils (9), is vaporized, and routed through the Suction Accumulator (10) and the suction service valve (11) to the Compressor (1).

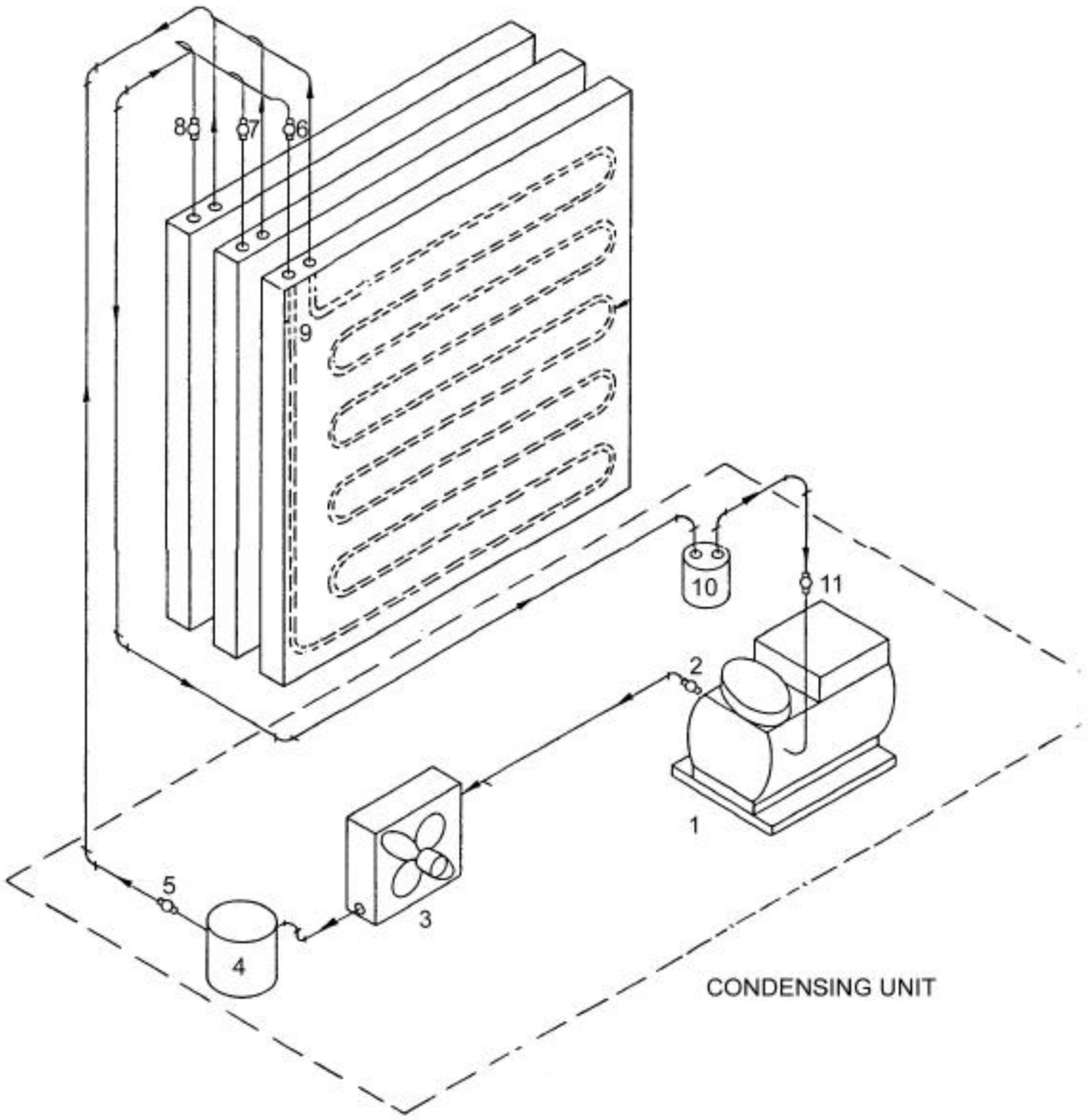

Figure 3 – Cold-Wel Blower Unit

Equipment Items (Refer to Figure 3)

Ref.No.

1. Compressor
2. Discharge Service valve
3. Condenser
4. Receiver
5. Liquid Line King Valve
6. Thermostatic Expansion Valve No. 1
7. Thermostatic Expansion Valve No. 2
8. Thermostatic Expansion Valve No. 3
9. Internal Plate Refrigerant Coils
10. Suction Accumulator
11. Suction Service Valve

Parts supplied by others

Sporlan TEVs--28-429 (R502, R404a, R507) and 28-431 (R22)
Alco TEVs--28-423 (R502, R404a, R507) and ~8-427 (R22)

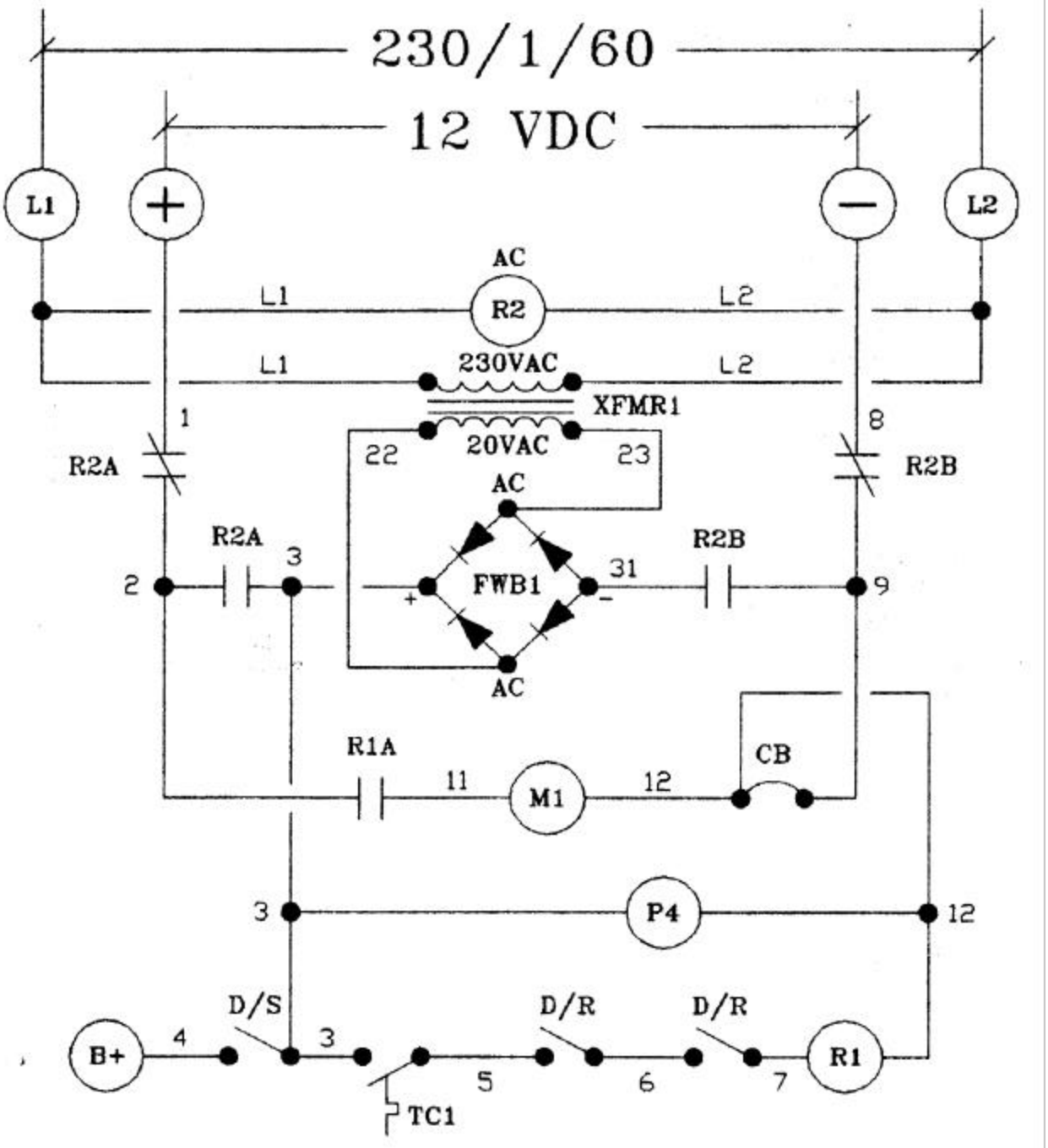
230/1/60
12 VDC
L1
+
—
L2
AC
R2
L1
L2
230VAC
XFMR1
20VAC
22
23
1
8
R2A
R2B
AC
R2A
R2B
2
3
FWB1
31
9
+
-
AC
R1A
CB
11
M1
12
3
P4
12
D/S
D/R
D/R
B+
4
3
5
6
7
R1
TC1

Figure 4 – Water Defrost Electrical Schematic

Water Defrost Operation (Refer to Figure 4)

The "Ready Loop" is the important part of a Water Defrost System circuit and it must be closed to permit blower operation. The ready loop includes a Dash Switch (D/S) on the truck dash, a Truck Thermostat (TC1), two Door Switches (D/R) and a DC Relay (R1).

When all items in the ready loop are in the closed position the blower operates on battery power (DC). When external power (AC) is connected to the truck, Relay (R2) will be energized and DC power will be available to the Blower Motor (M1) from the
Rectifier (FWB1) and not the Battery (+ & -). This is true whether or not the Dash Switch (D/S) is closed.

NOTE: Dash switch should be turned off, whenever truck will be taken out of service, so that the truck battery will not be drained. Indicator light (P4) will be on when Dash Switch (D/S) is closed.

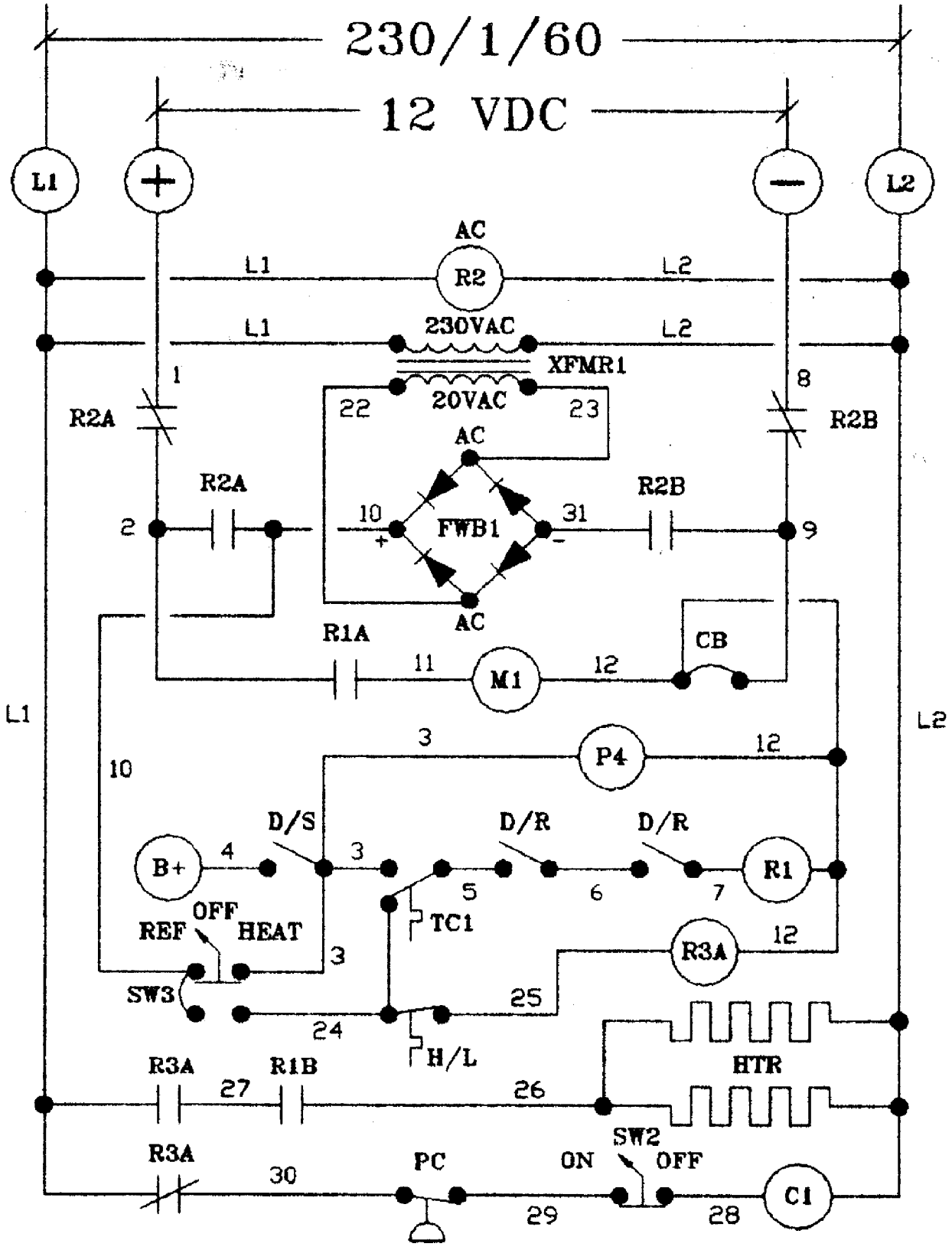

Figure 5 – Water Defrost with Heat System Schematic

Water Defrost With Heat Operation (Refer to Figure 5)

The operation of this version of Water Defrost is identical to that of the system just discussed when cooling is called for in the truck. However, there is an additional circuit, the winter heat circuit that affects the operation of the system when heating is required

The winter heat circuit includes a Refrigerate/Heat Switch (SW3), an On/Off Switch (SW2), a Heater (HTR), a High Limit Switch (H/L), a Truck Thermostat (TC1), and a Heat Initiate Relay (R3A). With the Refrigerate/Heat Switch in the Refrigerate position, the system operates in the same manner as the one just discussed.

The heater is actuated when the Refrigerate/Heat Switch is placed in the Heat position. Since the Heater operates only off of AC power, this circuit is only effective when the truck is connected to external power at dockside. As long as R3A is energized, the Compressor Contactor (C1) sees an open circuit, rendering the Compressor incapable of operating. Whereas, the Truck Thermostat (TC1) calls for cooling on temperature rise when in the refrigerate mode, it will call for heating on temperature decrease when in the heat mode.

Control Settings

	High Low Pressure Control			Fan Switch			
Refrigerant	Low Cut Out	Low Cut In	High Cut Out	High Cut In	Cut Out	Cut In	Crankcase Pressure Regulating Valve
R-22	2.2 psig	10.7 psig	368 psig	309 psig	199 psig	243 psig	24.0 psig
R-502	6.0 psig	16.0 psig	394 psig	333 psig	219 psig	265 psig	31.1 psig
R-404A	7.5 psig	17.8 psig	394 psig	333 psig	219 psig	265psig	33.5 psig
R-507	7.6 psig	18.6 psig	394 psig	333 psig	219 psig	265psig	35.2 psig

For maximum condensing efficiency, the crankcase pressure-regulating valve should be adjusted as follows:

1) Use the values indicated in the above table as a starting point for the adjustment.

2) Adjust the valve setting while reading the current draw (amps) of the compressor.

3) The setting will be correct when the current draw equals 125% of the RLA (Rated Load Amps) found on the nameplate of the condensing unit.

Troubleshooting

Refer to the applicable Figure (4 or 5) for the discussion that follows.

Troubleshooting (Blower motor fails to run over the road)

In transit, assuming truck doors are closed and TC1 calls for cooling, the Blower Motor (M1) should run off truck battery power (B+ to B-). Failure of the motor to run under these conditions can produce the following symptoms:

1. Warm product and truck body temperature.
2. No noticeable movement of air in truck.

If such is the case, the following should be checked:

1. The toggle switch (D/S) mounted on the truck dash should be in the "on" position.
2. If M1 runs when contact arm of R1 is depressed probable cause of trouble is the R1 coil circuit.

If the motor fails to run when the R1 contact arm is depressed, check for the following:

1. Open Circuit Breaker (CB).
2. No voltage between B+ at M1 and Ground.

If M1 runs at reduced speed, check for the following:

1. Brushes making poor contact.
2. Worn brushes and/or low brush spring tension.
3. Check voltage across motor (M1). If low, find cause (loose connection, etc.).

Troubleshooting (Blower motor will not operate on AC power)

If M1 operates on DC power, but not on AC, two circuits must be checked: 230VAC and 12 volt rectified circuit.

1. All Door Switches (D/R) should be closed.
2. TC1 should be set low enough to call for cooling.
3. R1 should be energized.
4. 230 VAC should be available at the L1 and L2 terminals of FWB2, Terminal Strip in the control panel.
5. Press R1 contact arm down with an insulated object.
6. If M1 does not run, check CB. Replace if open.
7. If M1 runs, check R1 for 12V DC. If available across the coil, replace R1.
8. Check position of R2 contact arm. It should be in a downward position

when operating off of AC power.

9. Check Primary and Secondary voltage across XMFR1 (wires L1 and L2 for primary and 22 and 23 for Secondary). Primary voltage should be nominally 230 volts and Secondary should be between 12 and 15 VAC.
10. Check FWB1 output. If less than 12 volts, replace.

Troubleshooting (Battery drained while operating on AC)

When external power is applied to the system, (R2) will be energized. This will open the circuit from the Battery and close the circuit from the Rectifier (FWB1). If R2 is defective, M1 will continue to operate off the battery power even though external power is available. If allowed to continue, the truck battery could be completely drained.

To check the R2 Relay coil circuit, proceed as follows:

1. Check Secondary output of Transformer (XMFR1). If 12 VAC minimum is not available across the two AC terminals of FWB1, check voltage across the Transformer Primary. If 230 VAC is not available, check main power source to truck.
2. If 230 VAC is available across the coil of R2 and the coil is not energized, replace R2.
3. If 230 VAC is not available across the coil of R2, check for 230 VAC to-L1 and L2 terminals on XFMR1.
4. If 230 VAC is not available, locate the source of power failure.

Troubleshooting (Reduced air flow from blower)

Symptoms of reduced airflow can be warm body and product temperature and/or no noticeable air movement in truck. It can result from the following:

1. Dirty commutator or worn brushes cause motor to run at reduced speed.
2. Defective Rectifier (FWB1).
3. Excessive ice buildup on the plates due to improper defrosting.

If reduced airflow is detected, the following should be checked:

1. Toggle Switch (D/S) on truck dash should be "on", (P4) lit.
2. Depress contact arm of R1 Relay. If M1 begins to run, fault is in the R1 Relay circuit.
3. If M1 does not run, check CB for open circuit.
4. Check voltage across M1; should be 12VAC minimum. If lower, check for loose connections.
5. If M1 continues to operate at reduced speed, check for brush wear and reduced spring tension.
6. Check fan for proper rotation. Blades should be moving downward as viewed from in front of the unit. See "Troubleshooting (Blower motor reverses direction)".

Troubleshooting (Blower Motor reverses direction)

If the Blower Motor (M1) runs in one direction when on Battery Power (DC) and in the opposite direction when on External Power (AC), check for the following:

1. Determine correct fan rotation (fan rotation on DC or on AC power). The air should be expelled from the two vertical rectangular outlets in the front of the Cold-Wel when rotation is correct
2: If rotation on DC power is correct, reverse wire to the Positive (+) and Negative (-) terminals of the Rectifier (FWB1) in the Control Box. (Wires 31 and 3 in units without winter heat. Wires 31 and 10 in units with Winter Heat).
3. If rotation on AC power is correct, and if wires 31 and 3 (or 10) are routed to the Rectifier (FWB1) per the Schematic, reverse wires 1 and 8 at the most convenient location, i.e. the Battery Terminals (B+ and B-), at the Control Box Terminal Strip (FWB2), or at the External Junction Box (FWB5).
4. If rotation on AC power is correct, and if wires 31 and 3 (or 10) are routed incorrectly to the Rectifier (FWB1), reverse wires 31 and 3 (or 10) to conform to the Schematic and reverse the motor leads (wires 11 and 12) to the Circuit Breaker, (CB) and to the DC Relay (R1) in the Control Box.

Troubleshooting (Winter heat failure)

Evidence of heater failure can be one or more of the following:

1. Lower than desired temperatures in truck.
2. Product beginning to freeze.
3. Blower inoperative.
4. Very cold air exiting the Cold-Wel.

If low temperature is indicated, check for the following:

1. External 230VAC power available to truck. The heaters operate off 230VAC power only.
2. Check for heat in the vicinity of the Heaters. Do not touch the Heaters. If no heat is detected, check for 230VAC across the Heaters. If voltage is present, disconnect external power from truck and check for continuity across the Heaters. If Heater(s) is open, replace defective unit(s).
3. Door Switches (D/S) should be in closed position and operable. Blower will not operate otherwise.
4. The Refrigerate-Heat Switch (SW-3) should be in the Heat position.
5. Check the setting of the Truck Thermostat (TC1). It has two circuits, one for cooling and one for heating. Check to determine if the heat circuit is closed and calling for heating. Adjust or replace as appropriate.
6. Check the setting of High Limit Switch (H/L). It is set to open at 80 degrees F. and close at 65 degrees F. Replace if appropriate.
7. If the High Limit Switch (H/L) is closed, check the status of the Heater Relay (R3A). It should be energized and its normally open contact should be closed. If this contact is

closed, check the status of the normally open contacts of the DC Relay (R1). These contacts (R1A & R1B) should be closed when R1 is energized. If R1 is de-energized, check for the presence of 12VDC across the output of the Rectifier (FWB1). Check for presence of 12 VAC across the AC terminals of the Rectifier.

a. If 12VAC is not present across the Rectifier (FWBI), check the Secondary voltage of XFMRI. At least 12 to 15 VAC should be available from the Secondary.

b. If Blower (M1) is inoperative, check Troubleshooting (Blower motor will not operate on AC power.

Troubleshooting (Ice buildup on compressor)

When a compressor starts, it is normal for moisture and/or frost to form on the Suction Line Accumulator and on the suction line to the Compressor. This moisture and/or ice will normally disappear after a few minutes of compressor operation. However, if ice continues to accumulate on the Suction Line Accumulator and the Suction line to the Compressor, it is an indication that one or more of the Thermostatic Expansion Valves is malfunctioning.

To determine whether or not a Thermostatic Expansion Valve is malfunctioning, check for the following:

-Check the temperature of each suction line where it exits from a plate and before it enters the common suction manifold. The line with the lower temperature is most probably the valve that is hanging open.

NOTE: Before replacing a Thermostatic Expansion Valve that is suspected of being faulty, check to assure that the valve's thermal bulb is tightly clamped to the suction line and properly insulated. DO NOT ALLOW THE SYSTEM TO CONTINUE OPERATING WITH AN ACCUMULATION OF ICE ON THE COMPRESSOR.

To charge the system proceed with the following:

1. Disconnect one wire from the high-low suction pressure control and tape the end.
2. Apply power to the unit.

NOTE: With high-low suction pressure control out of the circuit, the compressor is inoperative. When power is supplied to the unit the Liquid Solenoid valve is energized and liquid is free to flow through the plate cooling coils.

3. Connect a drum of refrigerant to the system. Allow refrigerant vapor to enter system, equalizing on both the high and low sides.
4. Disconnect the refrigerant drum. Connect a drum of nitrogen. Allow nitrogen to enter system, building pressure to approximately 265 psig.
5. Leak test the system.
6. Purge all gases from the system.
7. Attach vacuum pump. Pull vacuum on system.
8. Charge system with refrigerant until a full sight glass is observed.
9. Re-check sight glass toward the end of the recharging or plug-in cycle, add refrigerant if necessary.

Ref.	Part No.	Nomenclature	Heat	No Heat
R1	10-522	Relay, 12V DC SPST	X	
R1	10-527	Relay, 12V DC DPST		X
R2	10-521	Relay, 230VAC	X	X
R3A	10-528	Relay, 12VDC		X
CB	11-709	Circuit Breaker, 12 VDC	X	X
FWB1	10-816	Rectifier, 15VAC/15VDC	X	X
H/S	10-814	Heat Sink (for 10-816)	X	X
FWB2	11-115	Terminal Strip	X	X
M/S	11-116	Marker Strip for (11-115)	X	X
FWB3	11-109	Terminal Strip		X
M/S	11-152	Marker Strip for (11-103)		X
FWB5	11-101	External Terminal Strip	X	X
M/S	11-151	Marker Strip for (11-101)	X	X
TC1	06-064	Thermostat, Truck	X	X
SW-3	10-213	Switch, Ref.-Off-Heat		X
D/P	27-606	Plate for 10-213		X
M1	09-317	Blower Motor	X	X
D/S	10-206	Dash Switch	X	X
D/P	27-605	Dash Plate for 10-206	X	X
HTR	24-113	Heater, 230VAC		X
H/L	06-060	High Limit Switch		X
XFMR1	10-423	Transformer	X	X
P4	11-412	Light, 12VDC	X	X
	28-423	R404A	X	X
	28-427	R22	X	X
	28-429	R502	X	X

Warranty

PHO Water Defrost Eutectic Blower Unit

The Company warrants this Dole Water Defrost Unit to be well made, of good material and free from defects. It is guaranteed against any defect in material or workmanship for the following period of time, providing, if claimed defective, the Water Defrost or any part thereof is returned to the Company, transportation charges prepaid.

PHO Water Defrost Models

FAN MOTORS & VOLTAGE CONVERSION UNIT – 90 DAYS
BALANCE OF UNIT – 1 YEAR
PLATES- 5 YEARS. If Dole Plates should prove defective after TWO years and prior to the lapse of THREE years, the Company will replace said Dole Truck Plate for 45% of prices in effect at time of exchange, and if said Dole Plate shall become defective at the end of THREE years and prior to the lapse of FOUR years, the Company will replace said Dole Plate for 60% of prices in effect at time of exchange, and if said Dole Plate shall become defective at the end of FOUR years and prior to the lapse of FIVE years, the Company will replace said Dole Plate for 75% of prices in effect at time of exchange.

The Company shall not be liable for any damage of any nature caused by defects in workmanship or material or for any other reason, but is liability shall be limited to the value of the Dole Water Defrost Unit guaranteed, and correction of any defects in workmanship or material shall constitute a fulfillment of its guarantee. The Company's liability in all events shall be limited to replacing or repairing the defective part, whichever it seems advisable.