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CHO TRUK-CEL OPERATION & MAINTENANCE MANUAL

June 2002



CHO Truk-Cel

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Introduction

The purpose of this manual is to describe the Dole CHO Truk-Cel Eutectic Blower Unit and to present information related 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.

Dole CHO Truk-Cel Eutectic Blower Units Overview

Method of Operation-The Dole CHO Truk-Cel is a device designed to give maximum efficiency of Holdover Refrigeration in a compact and convenient package for truck bodies where temperatures above 32 degrees are required. It consists essentially of a series of Dole vacuum holdover plates mounted in a rigid frame and protected by a rugged aluminum tread-plate housing. At the top of the unit is a fan by which the air in the body is drawn over the plates and circulated through the load, thus maintaining the product at the proper transport and delivery temperature.

CHO Truk-Cels are available for either ammonia or direct expansion refrigerants. Ammonia models have 1/2" FPT inlet and outlet refrigerant connections. Direct expansion refrigerant models have 3/8" inlet and 5/8" outlet copper tube extensions. Direct expansion refrigerant models come equipped with built-in accumulator type Dole heat exchanger and thermostatic expansion valve(s).

Component Parts (built in)

Motor-Designed for DC operation with nominal ratings of 6.0 amps at 12 volts; DC; totally enclosed with replaceable brushes.

Fan-On models CHO-25 & CHO-26: 8" diameter fan rotates at 2315 RPM and delivers 1000 CFM; on all other models: a 10" diameter fan rotates at 2100 RPM and delivers 1000 CFM; the fan consists of four aluminum blades riveted to a cadmium plated spider and hub.

Conversion Unit-Consists of a compact aluminum tread plate housing mounted in the upper section of the CHO Truk-Cel, which contains the following parts:

Transformer-Converts available 220-volt single phase AC supply to 20 volts AC.

Alternating Current Relay-Power source switches from DC battery to AC when CHO Truk-Cel AC line is plugged into 110 or 220 volt AC circuit.

Direct Current Relay-Energizes or de-energizes motor in response to manual toggle switch, door switches, dash switch or thermostat.



Rectifier-Converts 20 volts AC to DC voltage required by motor.

Fuse Holder with 10 Amp Fuse-Protects motor circuit from overload.

Terminal Block-provides positive and convenient method for making required electrical connections as indicated on Conversion Unit Wiring Diagram. (See Figure)

Manual Toggle Switch-provides for de-energizing fan motor if desired, when the truck is opened, thereby preventing loss of refrigeration.

Component Parts (supplied separately)

Door Switch-when mounted in door jamb, breaks control circuit and stops fan when door of truck is opened, thereby preventing loss of refrigeration.

Dash Switch-when mounted on dash panel, allows driver to break control circuit and stop fan from cab, if desired to de-energize DC relay & pilot light and motor when CHO Truk-Cel is to be out of service for an extended period of time.

Pilot Light-when mounted on dash panel, indicates whether dash switch is on or off.

Drain Pan-for the CHO Truk-Cel unit is available if desired, as an accessory.



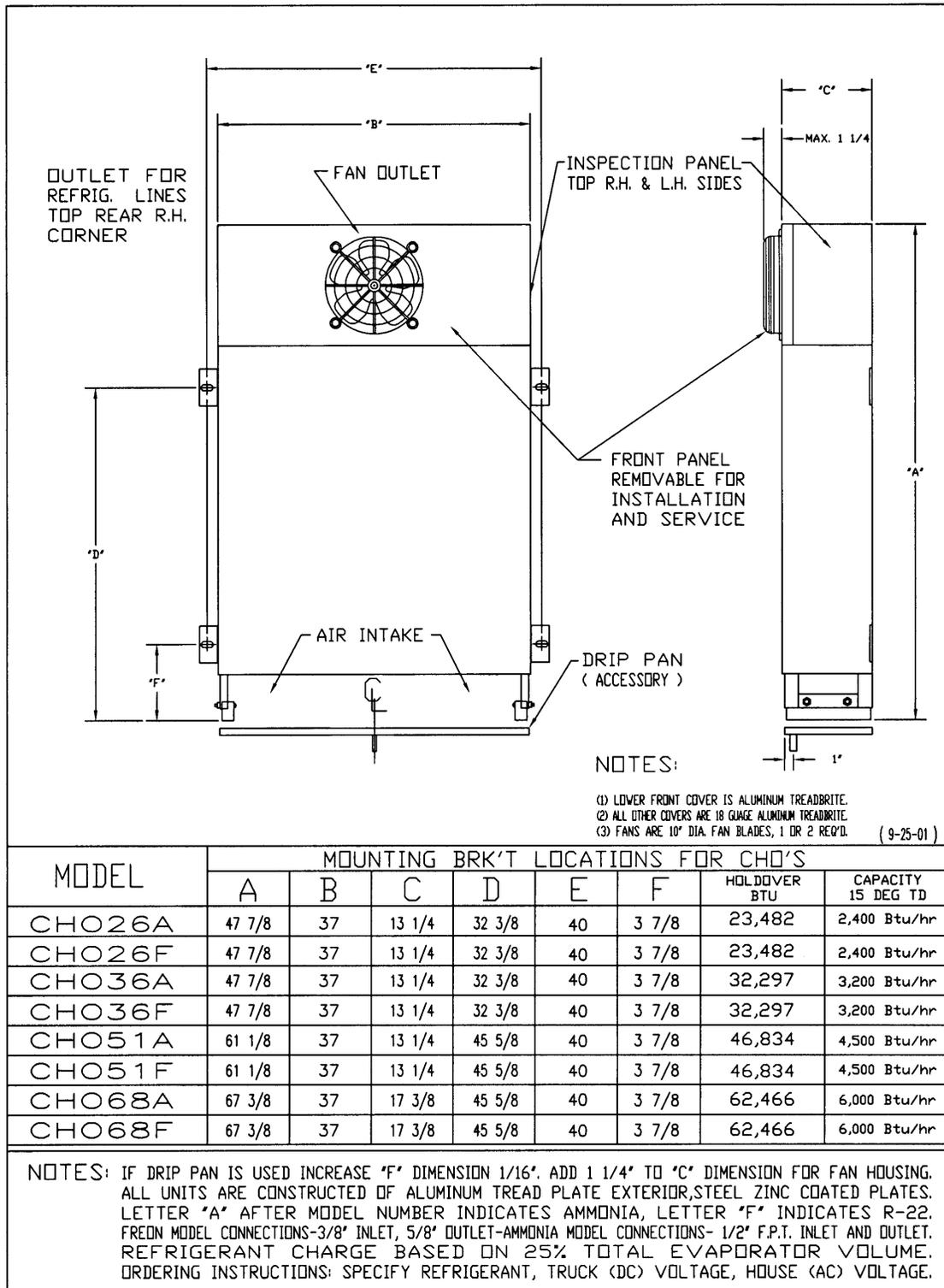


Figure 1 – CHO Truk-Cel System



Installation Instructions

Uncrate CHO Truk-Cel and examine for damage in transit. If such has occurred, notify carrier immediately. Consignee must make claims. Remove package containing 1 door switch, 1 dash switch and 1 pilot light, checking to make sure there has been no loss or damage in shipment.

Check Voltage shown on nameplate of CHO Truk-Cel against both that of the truck and available alternating current for nighttime use.

Provision For Drain-If accessory drain pan is used, drill hole in floor of body for drain tube.

Inspections Panels-Located on the front of the CHO Truk-Cel unit, near the top, are readily removed by loosening the wing-screws holding them in place. Upon removal, the expansion valve(s), fan motor and conversion unit are accessible. If necessary the top front panel can also be removed. (See Figure 1)

Truck Body Temperature Control-It is recommended, if truck body temperature is critical, that a thermostat control the fan. In attempting to control the body temperature by condensing unit pressurestat only, there is a possibility of too low a temperature under some circumstances. Conversely, if the pressurestat setting is high enough to prevent this from happening, it may result in the unit cutting off before the eutectic solution in the plates is completely frozen. Control of the fan with a thermostat will keep the temperature above the danger point, while allowing the condensing unit to continue to store up holdover in the plates of the CHO Truk-Cel. The low-pressure control should be used as a safety switch, with a setting 25 degrees colder than the plate temperature. A cut in pressure of 10 psi or higher should be sufficient. For example, an 18 degree (F) plate using R22, the low pressure control should be set at 19 psig and the cut in should be 30 psig. Should short cycling occur after initial cut out, the low pressure cut in should be raised to provide an acceptable cycle time.

Refrigeration Diagram

Make and Break System

Remote Ammonia Compressor-This type of hook-up is illustrated by the dotted lines in the "Refrigeration Diagram" (Figure 1). One-half inch ammonia piping is brought from the inlet and outlet connections (1/2" FPT) at the top of the CHO Truk-Cel to some convenient location where Make and Break Valves are installed.

As shown in "Typical Remote Compressor Hookup." (Figure 2)

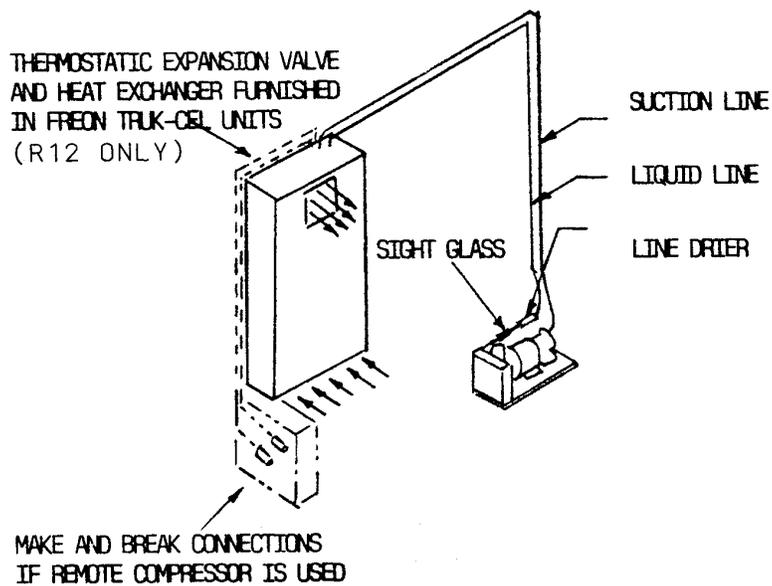


Figure 2
Refrigeration Diagram

Refrigeration Instructions

Condensing Unit-Self Contained

Liquid and suction lines of copper tubing, usually 3/8" and 5/8" respectively, are run between the outlet on the receiver of the condensing unit to the inlet of the CHO Truk-Cel, and from the outlet of the CHO Truk-Cel to the suction shut-off valve on the compressor. Tubing lines should be securely fastened to the body by clamps to prevent vibration and protected against the possibility of damage by running them through rigid conduit at points where such damage could occur. Flared or soft soldered joints are not recommended. Accepted procedures are to be followed with respect to evacuating, purging, leak testing, and charging this system. The solid lines in the "Refrigeration Diagram" indicate this hook-up. (Figure 1)

(Figure 2) A shut-off valve and thermal expansion valve are mounted in the liquid line. A flexible hose is installed downstream of the valve. A hand valve is also installed in the suction line. Since the expansion valve temperature-sensing bulb is exposed to ambient temperatures, it should be insulated.

To eliminate the possibility of making the wrong connections when tying into the refrigeration system at night, either one of the following suggestions is recommended: (a) Paint the liquid line valve one color and the suction line another. (b) Mount one male half and one female half Make and Break Valve on the truck. With this arrangement, shown on the "Typical Remote Compressor Hookup", a short length of flexible hose (approx. 18") used with one of the valves, allows the two halves to be connected together while the truck is on the road, making dust caps necessary.

The corresponding halves of the valves on the flexible lines at the dock may be connected in a similar manner. Some provision should be made to eliminate the possibility of damage due to trucks being driven away from the dock while the refrigerant lines are still connected. Release chain type Make and Break Valves are available, whereby a chain, fastened to the dock or wall, disconnects the valve if the truck should pull away. Another method often used is to have the ignition key on a ring or chain through which the flexible lines are passed when hooking up at night. This requires the refrigerant lines to be disconnected before the truck can be started. This method is illustrated in "Typical Remote Compressor Hook-Up." (Figure 2)

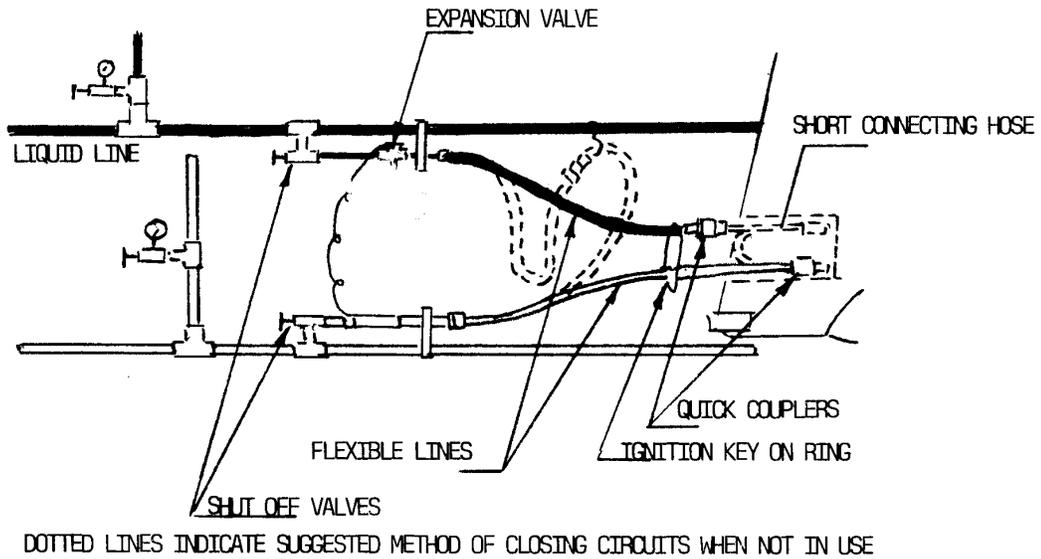


Figure 3
Typical Remote Compressor Hook Up

Compressor-While it is not general practice to have a compressor installed as a remote unit, in some cases it may be desirable or necessary. In this case, the same general instructions under "Remote Ammonia Compressor" will apply. In an ammonia (NH₃) system copper tubing may be used in place of pipe, and the expansion valve and heat exchanger should be removed from the CHO Truk-Cel and installed remote. The CHO Truk-Cel may be ordered with the two latter items not built in, if desired.

Electrical Instructions

Electrical Hook-Up-Careful study of the “Conversion Unit Wiring Diagram” is suggested. Most of the connections shown are already made in the conversion unit, with those left to be made in the field indicated in the diagram by the notation “Connections to be Made by the Customer”. In those cases where no one is responsible for the “plugging in” of the system, the optional wiring diagram may be used. This method will prevent the battery from becoming drained should the truck be parked (and not plugged into the AC power) for any prolonged period of time causing the system to revert to DC operation.

Control Circuit-consisting of the wiring of the body, with the door switch, thermostat, if used, and dash switch hooked in series. The purpose of this control circuit is to actuate the DC relay. The amperage draw is small (about 0.1 amps on 12v). The pilot light is connected between the appropriate pole of the dash switch and ground, and lights when the dash switch is closed.

Power Line Circuit-bringing single phase 110 or 220 volt alternating current to the CHO Truk-Cel. If the condensing unit is self contained, the same power supply may be used, but the line to the CHO Truk-Cel must be taken off ahead of the compressor starter as current to the CHO Truk-Cel would be cut off when the compressor stops.

Battery Circuit bringing 12v direct current to the CHO Truk-Cel. As specified in the diagram, one lead must come directly from the positive(+) side of the battery. It must NOT be connected through the negative(-) side of the ignition switch or voltage regulator since the DC relay must be energized for the fan motor to operate.

Holes are located in the top of the CHO Truk-Cel housing through which the electrical lines are passed to the conversion unit.

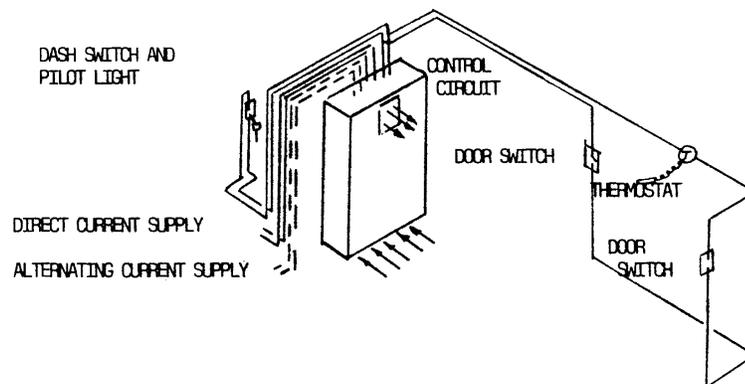


Figure 4
Electrical Diagram

Electrical Instructions
(CHO Ignition and Dome-light Control Option)

Initiate dock power operation by turning the truck ignition OFF, and plugging the condensing unit power cord into the designated appropriate power receptacle. CAUTION: During the dock power operation the ignition must be in the OFF position or the truck's accessory circuits may be damaged. Dock power energizes the condensing unit along with the transformer and relay coil C2 in the CHO control box. The CHO transformer steps down the primary dock power voltage to 16 volts alternating current (AC) on the secondary side. The secondary side of the transformer is connected to the diode rectifier that converts AC current to direct current (DC). Relay C2 opens the circuits to the truck battery and closes the 16 volts DC circuit from the diode rectifier. Power from the diode now serves the thermostat control circuit, the door switch control circuit, the dome light power circuit, and the CHO fan power circuit.

The thermostat control circuit receives power from the truck's accessory circuit or the diode rectifier and consists of a thermostatically controlled switch, the normally open contact of relay, C3, and the coil of relay, C1. Once the circuit is energized, the circuit controls the operation of the fans based on temperature of the thermostat set point, and door position. Fan(s) will operate when the thermostat is closed or unsatisfied and the door is closed. If the thermostat has been satisfied or the door is opened the fans will not operate. Additionally, if the truck's ignition is placed in the off position while the truck is in route, the fans will not operate, because the thermostat control circuit will not be energized. CAUTION: During the dock power operation the ignition must be in the OFF position or the truck's accessory circuits may be damaged.

The door switch circuit alternates either dock power or truck power from the CHO fan(s) to the truck box dome light. When the box door is open, the door switch opens and relay, C3, coil is de-energized, opening the fan power circuit and closing the dome light power circuit.

The dome light power circuit is energized by either truck power or dock power through a normally closed contact on relay, C3. When relay C3 is energized the power circuit is opened and the dome light will not illuminate.

- Similarly, the fan power circuit is energized by either truck power or dock power, although the circuit is closed by relay, C1. The thermostat control circuit controls relay, C1. The door must be closed and the thermostat unsatisfied for the fans to operate.

FIGURE 5 - CHO TRUK-CEL CONVERSION UNIT
SCHEMATIC & WIRING DIAGRAM (1 FAN UNIT)

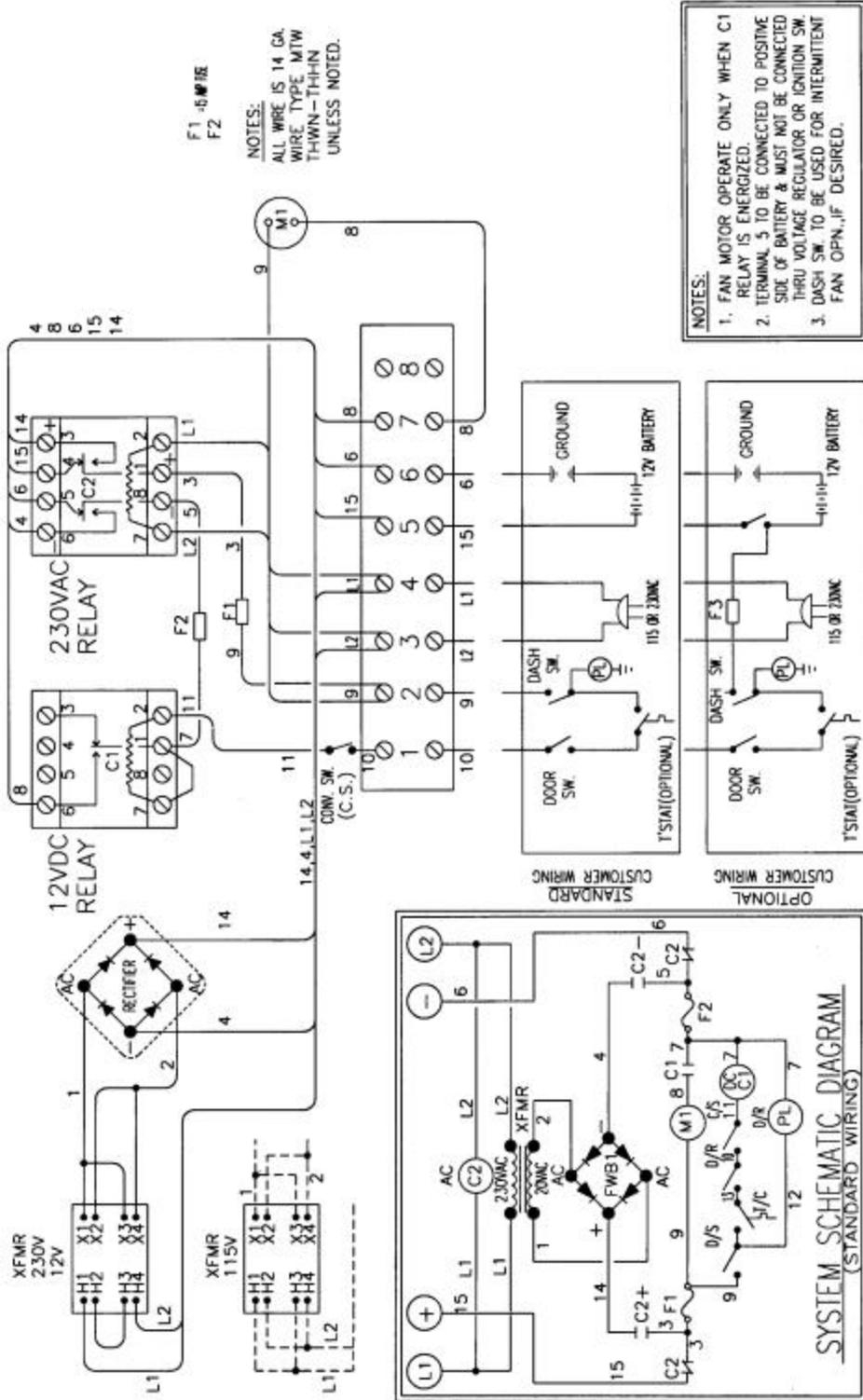


FIGURE 6 - CHO TRUK-CEL CONVERSION UNIT
SCHEMATIC & WIRING DIAGRAM (2 FAN UNIT)

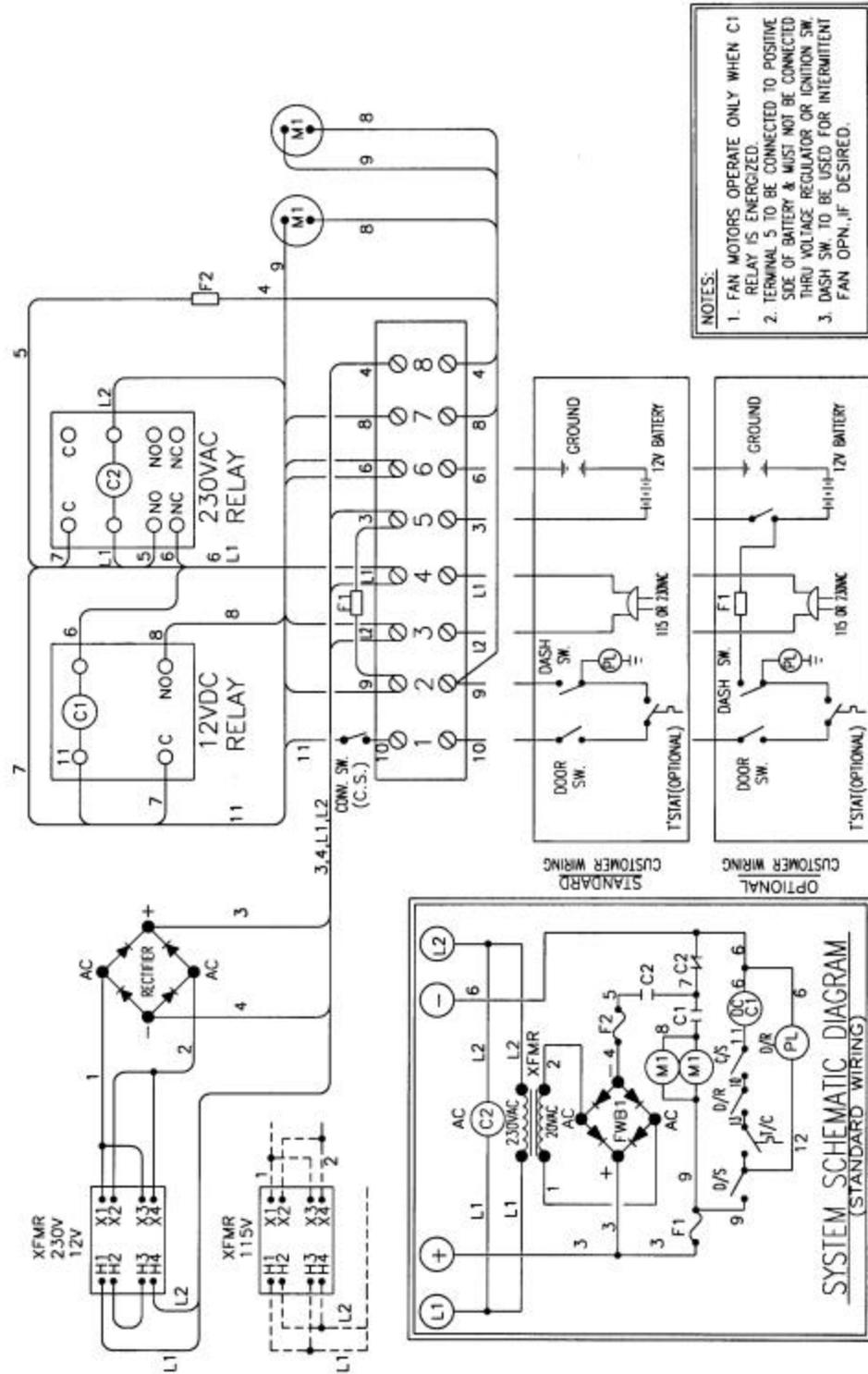
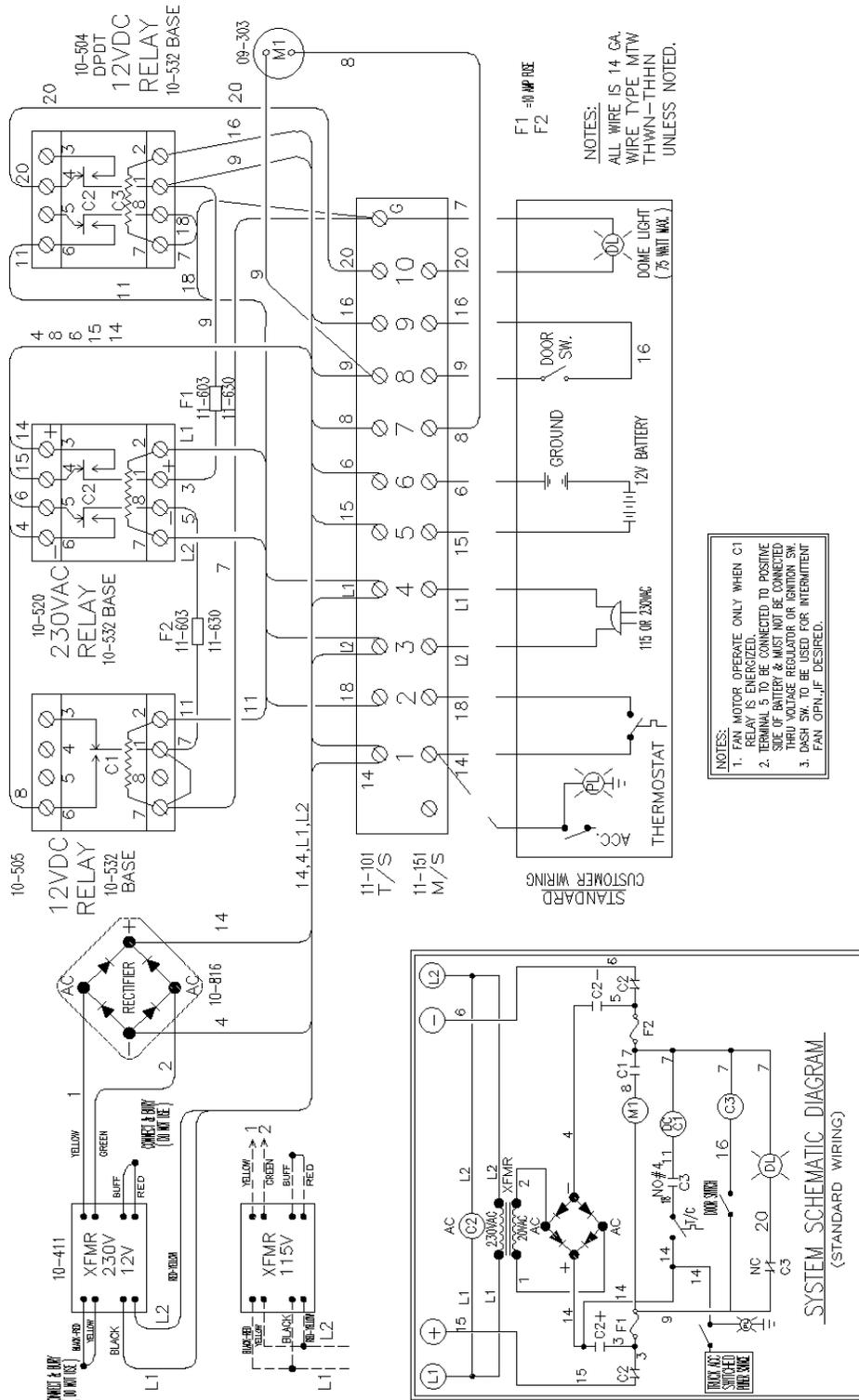


FIGURE 7 - CHO TRUK-CEL CONVERSION UNIT WITH DOME AND IGNITION CONTROL SCHEMATIC AND WIRING DIAGRAM (1 FAN UNIT)



Operating and Maintenance Instructions

The Dole CHO Truk-Cel will give many years of satisfactory service with a minimum amount of maintenance. The following suggestions will add to the performance and life of your CHO Truk-Cel.

- A. The product load should be so arranged that the air supply is not restricted at either top or bottom of the CHO Truk-Cel.
- B. Fans should operate whenever refrigeration is required.
- C. Periodically, at the end of a run remove one of the side panels and check for frost buildup on the plates. If frost buildup is greater than 1/4" it should be removed. This is accomplished by (a) continuing to operate the fans but leaving the compressor off or (b) washing down plates with warm water (150 degree maximum) for more rapid defrost.
- D. With a Make & Break System the liquid line valve must be shut off at least one hour before the truck is to be disconnected to allow the compressor to pump the refrigerant out of the CHO Truk-Cel plates. The suction line hand valve is closed just before disconnecting the system and shutting down the compressor.
- E. Check length of motor brushes every 6 months- if under 3/16", replace with new brushes (available from Dole); otherwise re-insert old brushes in same relationship to commutator as before.
- F. For longer motor life, dress commutator after two sets of brushes have been used.
- G. Clean fan blades periodically.
- H. Keep control switches clean and free from excessive moisture.
- I. Assure that wiring is protected adequately at wear points and does not run through moisture traps.
- J. If a CHO Truk-Cel fan motor should fail to operate, the following steps should be taken in an effort to locate the difficulty.
 - 1. Make sure the control, AC power line, and DC battery circuits are connected to terminal block as shown on wiring diagram. With



respect to latter circuit, make sure that terminal 5 is connected to the positive(+) side of the battery (not through the voltage regulator or ignition switch) and terminal 6 is connected to ground.

2. Make sure that AC and DC voltages being supplied to CHO Truk-Cel correspond to voltages shown on the CHO Truk-Cel nameplate.
3. Make sure that manual toggle switch is in “on” position (toggle toward removable cover of conversion unit).
4. Make sure that all switches in the control circuit are in the “on” position. (closed)
5. Check for free rotation of motor shaft by manually turning fan blade.
6. Check conversion unit fuse (F1).
7. Check that AC and DC relay markings correspond to voltages shown on CHO Truk-Cel nameplate.
8. Check AC relay by connecting and disconnecting CHO Truk-Cel AC line to outside source of AC power. A light in the relay will come on when relay is energized. Field repair of AC and DC relays is not recommended.
9. With CHO Truk-Cel AC line disconnected from outside source of AC power:
 - a. Check that 12v DC is being supplied to conversion unit by connecting voltmeter across terminals 5 and 6. If optional wiring circuit is used, be sure ignition switch is in the “on” position.
 - b. Check continuity of control circuit by connecting voltmeter across terminals 1 and 6.
 - c. Check manual toggle switch by removing electrical tape from the line between exposed wire and terminal 6.
 - d. Check DC relay (C1) by turning to manual toggle switch off and on and observing presence or absence of a light in the relay housing.
 - e. Check DC operation of motors by connecting terminal 7 to terminal 6 with a jumper wire; non-operation indicates defective motor.
 - f. In the previous step, if motor runs only when jumper wire is used, defective internal wiring or a defective relay is

indicated, despite apparent operation of relays in steps 8 and 9d.

10. With CHO Truk-Cel AC line connected to outside source of AC power:

- a. Check that AC current (110v or 220v) is being supplied to transformer (XFMR) primary unit by connecting voltmeter across terminals 3 and 4.
- b. Check transformer output (approx. 20v AC) to rectifier by connecting voltmeter across rectifier terminals AC.
- c. Check output of rectifier by connecting voltmeter across terminals 5 & 8.
- d. In the previous step, if motor runs only when jumper wire is used, defective internal wiring or a defective relay is indicated, despite apparent operations of relays in steps 8 and 9d.

If the above procedures do not reveal the source of difficulty, the conversion unit should be returned to Dole for complete checkout and repair.

Troubleshooting

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 C1 coil circuit.

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

1. Open Blown Fuse (F1 or F2).
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 Terminal Strip in the control panel.
5. Press C1 contact arm down with an insulated object.
6. If M1 does not run, check Fuse. Replace if blown.
7. If M1 runs, check C1 for 12V DC. If available across the coil, replace C1.
8. Check position of C2 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 1 and 8 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, (C2) will be energized. This will open the circuit from the Battery and close the circuit from the Rectifier (FWB1). If C2 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 C2 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 C2 and the coil is not energized, replace C2.
3. If 230 VAC is not available across the coil of R2, check for 230 VAC to-L1 and L2 terminals on FWB2.
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".
2. Depress contact arm of C1 Relay. If M1 begins to run, fault is in the R1 Relay circuit.
3. If M1 does not run, check fuse 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 CHO 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 4 and 14.
3. If rotation on AC power is correct, and if wires 4 and 14 are routed to the Rectifier (FWB1) per the Schematic, reverse wires 15 and 6 at the most convenient location, i.e. the Battery Terminals (B+ and B-), at the Control Box Terminal Strip, or at the External Junction Box .
4. If rotation on AC power is correct, and if wires 4 and 14 are routed incorrectly to the Rectifier (FWB1), reverse wires 4 and 14 to conform to the Schematic and reverse the motor leads (wires 8 and 9) to the Fuse (FB1,FB2) and to the DC Relay (C1) in the Control Box.

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.

Replacement Parts For CHO Truk-Cel

Part No.	Description
7299-CS-----	Complete Conversion Kit (230v/12v DC) (1 fan kit)
7462-CS10-1-----	Complete Conversion Kit (2 fan unit)
09-304-----	Brush & Spring Ass'y 12v
09-303-----	12v DC Fan Motor
10-206-----	Toggle Switch
10-207-----	Toggle Switch Plate
10-224-----	Door Switch Assembly
10-411-----	Transformer 125/250v Primary
10-419-----	Transformer 230v Primary
10-505-----	12v DC Relay (1 fan unit)
10-506-----	115v AC Relay
10-520-----	220v AC Relay (1 fan unit)
10-521-----	220v AC Relay (2 fan unit)
10-532-----	Relay Socket
10-814-----	Heat Sink for Diode
10-816-----	Diode
11-107-----	Terminal Block
11-412-----	Pilot Light 12v (Green)
11-603-----	Fuse Holder
11-630-----	Fuse 10 AMP
16-007-----	10" Dia. Fan Blade (1 or 2 req'd)
16-108-----	10" Fan Guard (1 or 2 req'd)
28-434-----	Expansion Valve (R404A) (1 or 2 req'd)
28-427-----	Expansion Valve (R22) (1 or 2 req'd)



Warranty

CHO Truk-Cel Eutectic Blower Unit

The Company warrants this Dole Truk-Cel 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 Truk-Cel or any part thereof is returned to the Company, transportation charges prepaid.

CHO 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 its liability shall be limited to the value of the Dole Truk-Cel 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.

