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Manual & diagrams see - www.klingecorp.com
Service Parts see - www.reeferparts.com

DUAL CONTAINER REFRIGERATION UNIT
MODEL PFR- 582 EX

SERVICE AND PARTS MANUAL

MANUFACTURED BY KLINGE CORPORATION

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Serial numbers - Warrantee

The data plate machine serial number, the ISO container serial number and date of installation should be reported to engineering@klingecorp.com at the time of installation. In the event that the installation date, serial number of the machine, and the container number which the machine is installed on is not reported, the warrantee period will default to 18 months from the date of manufacture. Failure to report the above could result in the warrantee period being foreshortened.

Use of this Manual

The model number on all Klinge Corporation equipment may be found on the data plate. Reference the model number with any enquiries by contacting engineering@klingecorp.com or telephone **(USA) (1) 717 840 4500**.

The use of this manual is intended for the safe operation of the equipment described. It is therefore reasoned that persons who have the occasion to use this manual have knowledge of mechanical and electrical systems and components addressed by its contents. However, efforts have been made to enable persons less familiar with these systems to use this manual.

Suggestions as to improvement in content and format are welcome and should be addressed to engineering@klingecorp.com. Corrections and improvements will be included on dated revisions.

SECTION ONE – GENERAL DESCRIPTION

1.1 Refrigeration Unit

The Klinge Model PFR-582 Dual refrigeration unit is designed especially for hazardous cargo in world-wide ambient temperatures.

The unit is charged with R-404A refrigerant.

The unit, of light weight aluminum frame construction, is an all electrical, all-in-one cooling and heating unit. The unit is designed to fit into the front of a container and to serve as the container front wall. Forklift pockets are provided for the installation and removal of the unit.

The cargo space temperature is controlled by a microprocessor thermostat. Once the temperature is set at a desired container temperature, the unit will operate automatically to maintain a narrow temperature range.

Control system power is provided by a single-phase transformer which steps down the high voltage power source to 24 volt AC single phase.

A self-diagnostic function test checks the condition of the refrigeration unit automatically and is performed by the microprocessor thermostat. This saves labor costs and makes pre-trip inspections reliable.

A phase sequence sensing and control system is installed in the electrical control section; this system will automatically select the correct phase rotation, regardless of the incoming phase sequence.

All motors, including the compressor, are equipped with automatic reset thermal overload protection.

Air is discharged from the bottom of the unit and returns to the unit at the top of the container. The evaporator fans run continuously, except on the defrost cycle.

Heating and defrost functions are provided through the hot gas cycle.

Defrost is automatically activated by the microprocessor thermostat when the temperatures of the return air probe and the evaporator coil probe reach a determined difference. A defrost cycle can also be started manually from the control panel. In either case the termination is automatic, when the temperature of the evaporator coil probe rises to a preset temperature, approx. 35^{o}C (95^{o}F).

The unit is delivered complete with a charge of refrigerant, compressor lubricating oil, mode-indicating LEDs, microprocessor thermostat, factory tested and ready for operation upon installation.

A fresh air make-up vent is located at the upper left corner of the unit. The purpose of the vent is

to provide ventilation for commodities that require fresh air circulation and must be closed when transporting frozen goods.

SECTION TWO – REFRIGERATION SYSTEM

2.1 Refrigeration Theory

Refer to Fig 2.3. Theory piping diagram – this is a schematic piping diagram of a typical refrigeration circuit and will be referred to in the following explanation of refrigeration theory.

The method used to transfer heat from a place where it is not wanted to a place where it is not objectionable is the changing of a liquid to a vapor and changing of the vapor back to a liquid. See the piping diagram, Figure 2.3.

The following steps take place to produce cooling:

1. Starting at the receiver, where there is a supply of liquid refrigerant, liquid flows to the expansion valve. This liquid is at a high temperature and under high pressure.

2. As the liquid passes through the expansion valve, the temperature and the pressure of the liquid drop to the temperature and pressure found in the evaporator coil.

3. The cold liquid refrigerant in the evaporator coil absorbs the heat and changes it into a vapor state. The heat is removed from the air, which is moved over the evaporator coil by the fans.

4. The low pressure and low temperature vapor then goes from the evaporator coil to the compressor and is compressed to a high pressure, high temperature vapor.

5. Vapor then goes from the compressor to the condenser coil, where the condenser fan moves the air over the coil and removes heat from the vapor. This reduces the temperature to the point of condensation and the vapor changes into liquid.

6. The liquid then flows to the receiver to provide a supply for repeating the cycle.

2.2 Refrigerant

This system is designed to use R-404A refrigerant.

R-404A has an ozone depletion potential (ODP) of zero.

In order to use R-404A, the compressor oil has to be polyolester synthetic oil (POE).

A moisture indicator is installed in the liquid line immediately after the filter drier to indicate if there is moisture in the refrigerant charge.

- The element, which is located in the center of the indicator, will change color on contact with moisture in the refrigerant passing over it.
- A dry system will be indicated by a dark green color; a wet system will show from a

yellowish green to bright yellow, depending on the amount of moisture in the system.

- A colored leak detecting agent, added to the refrigerant, will permanently discolor the indicator and should therefore not be used.
- The moisture indicator will also become discolored if a compressor motor burn-out occurs, and should be replaced after the compressor has been changed.

The following is a brief explanation of a few of the components in the system and their functions.

The condenser fan and the evaporator fans move air across the heat exchange surface for the purpose of either absorbing heat (the evaporator) or rejecting heat (the condenser fan).

The purpose of the compressor is to provide a high temperature, high-pressure vapor to the condenser coil so that heat can be removed with the ambient temperature air. At the same time this causes a pressure differential between parts of the system and causes the refrigerant to repeatedly flow through the system.

2.3 Unit Piping Diagram (Figure 2.3)

The expansion valve is a device which provides liquid to the evaporator coil as needed. It is important to remember the parts of the system which are subject to high pressure and low pressure refrigerant. The high pressures will be accompanied by high temperatures, and the low pressure will be accompanied by low temperatures.

The common terminology used for these parts of the system is "the high side" and "the low side". The area from the discharge side of the compressor to the inlet side of the expansion valve is referred to as the high side. The area from the outlet side of the expansion valve to the suction side of the compressor is referred to as the low side.

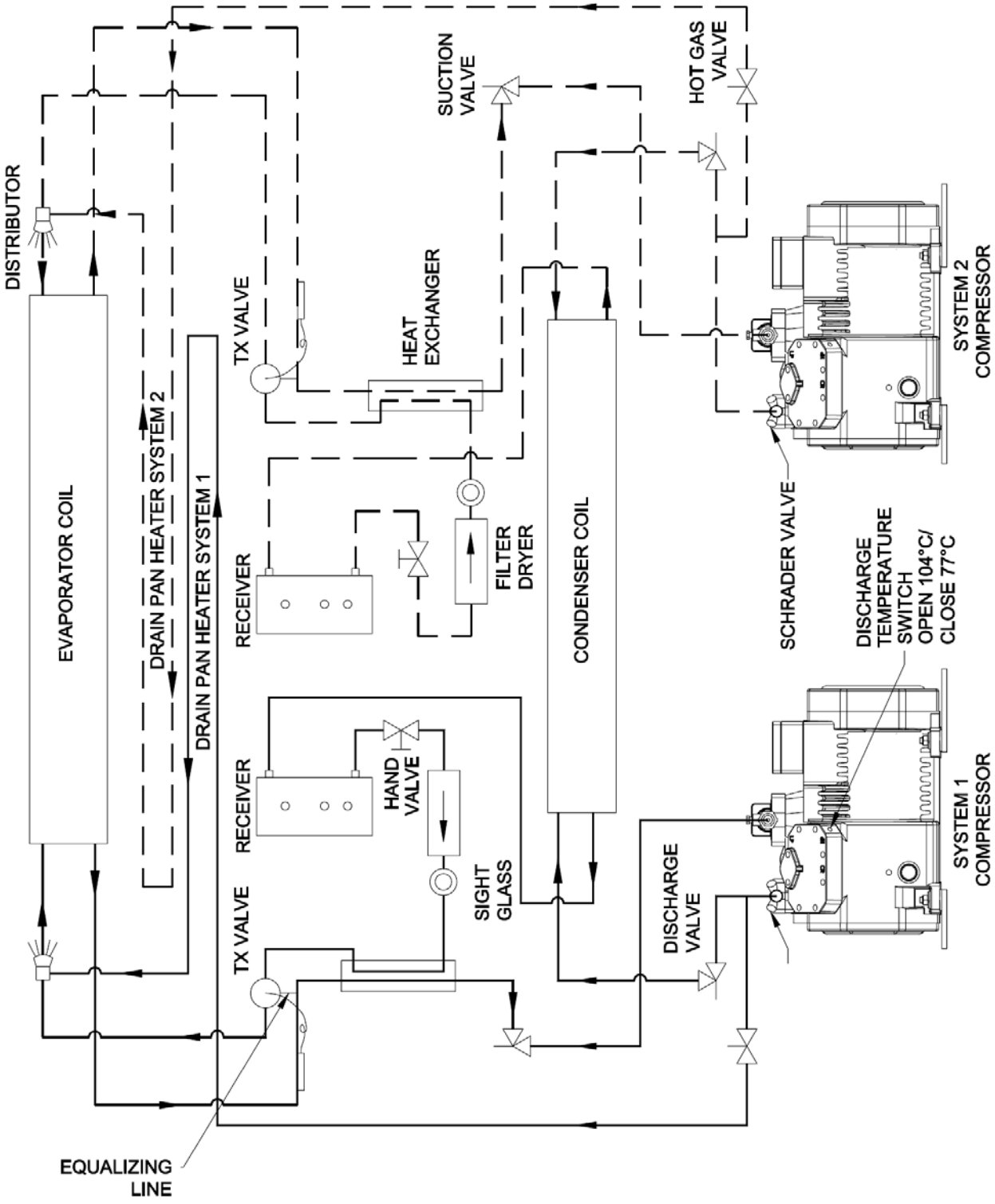


FIGURE 2.3

PIPING DIAGRAM
DUAL REFRIGERATION UNIT - PFR 582

SECTION THREE – OPERATION

DO NOT REMOVE the condenser grill or open evaporator or heater door before turning power off and disconnecting the power plug.

3.1 Pre-start Check

The following inspection should be made before the container is loaded as part of a pre-trip inspection.

a. Visually check unit for physical damage.

b. Visually check major hold-down bolts, etc.

c. Open the control box cover and check that all electric components are secure and that terminal connections are tight.

d. Be sure CB1 and CB2 circuit breakers are closed in the **ON** position.

e. Check gasket on control box and make sure that the cover is safely closed.

f. Check cleanliness of the condenser coil and clean if necessary.

g. Thoroughly check all refrigerant joints and connections for traces of oil, which could be caused by a small refrigerant leak.

3.2 Start Check

a. Connect **MAIN POWER PLUG** into receptacle to supply power to unit.

b. Initiate Function Test - hold **MANUAL DEFROST** switch closed and switch unit **ON/OFF** switch to the **ON** position. Unit will now begin the function test automatically. (See Section 5.5 Function Test).

c. After completion of the function test (approx. one minute), check the amperage of the compressor motor, condenser fan motor and evaporator fan motors. At the same time check all the indicating lights and direction of rotation of fans. (This can also be done during the function test, since all components will be initiated separately. Apply the ammeter on the amp-loop on CB1).

d. Adjust temperature set point to 0°C (32°F). Check refrigerant level in the receiver sight glass after approximately 15 minutes of continuous running with system fully loaded.

3.3 Running Unit

Fresh Air Circulation

The unit is equipped with a fresh air vent, which, if opened, will supply fresh air to the cargo space when needed. When fresh air is not needed, the fresh air vent must be closed.

Phase Selection

The phase sensor monitors the three-phase system for phase sequence and unbalance due to phase angle and phase voltage deviations such as a blown fuse or a bad connection.

When the unit's **ON/OFF** switch is put in the **ON** position, power feeds into the phase sensor. When the phase sensor is energized, it scans the phasing of the input power and will allow either **PC1** or **PC2** to become energized to ensure the correct rotation of the fans.

Temperature Controlling

The actual temperature control point is determined by the setting of the operator control panel. The sequence of events or cycles of the unit are governed by the controller in conjunction with the return air temperature probe and the set point on the operator panel.

When the cargo space temperature is such that maximum cooling is required, the compressor will operate, the evaporator fans will run and the condenser fan will operate to draw air over the air cooled condenser coil.

As the return air temperature starts falling and nears the set temperature, cooling capacity reduction (unloading) will occur at 2°C (3.6°F) above set point.

When the return air temperature falls to the set point, the compressor will stop.

If the temperature falls to 3°C (5.4°F) below the set point, heat will be energized.

As the return air temperature rises to 0.5°C (0.9°F) above the set point, the compressor will come back on with capacity reduction.

At 3°C (5.4°F) above the set point capacity reduction will be eliminated and full cooling will resume.

When the set point is set at -7°C (19°F) or below, the unload and heat cycles will be locked out.

Defrost Cycle

- Normally initiated when the temperature difference between the return air probe and coil temperature probe reaches a predetermined value. The temperature difference is measured when compressor has been running for at least (2) minutes and unit has initially reached set point.

- Evaporator fan, condenser fan and compressor are off and heat is on during defrost.

- Defrost probe terminates defrost at 35°C (95°F).

- If the compressor runs for 24 hours without a defrost cycle, defrost will be initiated automatically.

- If the defrost probe is out of range (open or shorted) defrost will occur automatically after compressor has run for 24 hours. An alarm light will be energized, and defrost and probe failure LEDs will flash. The 24 hour timer is always locked out if the temperature is above 7.2°C (45°F).

- If defrost is not terminated by probe, it will terminate after one (1) hour, and the alarm LED will light and the defrost LED will flash.

- Defrost can be initiated by manual defrost input (holding momentary toggle switch closed for 1 second) and terminated as indicated above.

- At initial start-up defrost will occur after 6 continuous hours of compressor running time, unless set point is reached.

- If the defrost cycle is initiated again within less than 1-1/2 hours since the last defrost, the alarm light will light and the defrost LED will flash.

3.4 Function Test

Follow the steps of the function test using the label on right side of thermostat.

1. To initiate function test, hold the defrost switch closed and switch the unit **ON/OFF** switch to **ON**. Each step will last (8) seconds.

    a. All LED indicators will flash.
    b. Energize the compressor contactor (Cooling LED will light, or flash if there is a problem).
    c. Energize unload valve (Unload LED will light, or flash if there is a problem).
    d. Energize hot gas solenoid (Heating LED will light, or flash if there is a problem).
    e. Energize evaporator fan contactor (Temperature LED will light, or flash if there is a problem).
    f. Energize the condenser fan contactor (Alarm LED will light, or flash if there is a problem).
    g. Check defrost probe (Defrost LED will light, or flash if there is a problem).
    h. Check return air probe (Return air probe LED will light, or flash if there is a problem).

NOTE

If there is a problem during any step of the function test, and an LED flashes, the function test will stop at this point. Flashes should be at 1/2 second intervals.

SECTION FOUR – ELECTRICAL AND ELECTRONIC FUNCTIONS

WARNING

Beware of high voltage in various parts of the unit, especially when CB1 is in the ON position. It is recommended that a thorough study of the wiring schematic be made to determine where high voltage will be encountered when electric power is being fed to the unit.

From this point the micro-processor thermostat will maintain the temperature. The microprocessor thermostat compares the temperature of the probe with the set point and calls for heating, cooling, or defrost as required.

4.1 General Information

When high voltage power is being fed to the unit and CB1 is in the **ON** position, power will pass along L1, L2 and L3 to the line of the compressor, the heater, transformer T1, the phase sensor and phase contactors. When the phase sensor is energized, PC1 or PC2 will be energized, and allow power to the evaporator fans and the condenser fan.

All wires have numbers printed at both ends.

4.2 Electrical Box

Electrical Schematics (figure 4.4) System 1 & (figure 4.5) System 2

Circuit Breakers

- Circuit breakers (CB1) System 1 & (CB2) System 2
  The 25-amp circuit breakers incorporate three breakers each, one for each line. It is reset manually and protects the entire unit against overload.

- Circuit breakers (CB3) System 1 & (CB4) System 2
  An 8-amp circuit breaker protects the 24-volt control circuit in case of possible short circuits.

Contactors

- Compressor motor contactors (C1) & (C2)
  This is a 3-pole 460-volt direct-on-line contactor with a 24 volt operating coil. It operates the compressor motor and is energized by the microprocessor thermostat. The 24-volt coil circuit can be interrupted by the high-pressure switch.

- Condenser Fan Contactors (CF1) & (CF2)
  This is a 3-pole 460-volt direct-on-line contactor with a 24 volt operating coil. It operates the condenser fan and is energized by the microprocessor thermostat.

Transformers

- Transformer 460-24V (T1)
  The primary coil is tied into the line between the 25-amp circuit breaker and the line starters. The secondary coil supplies 24 volts AC for the control circuit.

Phase Sensor (PS)

When power is applied to the unit, it automatically selects the proper motor rotation by energizing PC1 or PC2.

Test Procedure of Phase Sensor:

a. Put the unit **ON/OFF** switch to the **ON** position.

b. Check that the light emitting diodes (LED) are lit for L1-L2-L3 or for L3-L2-L1.

c. Check the rotation of the fan motors.

d. Press **TEST** button on the phase sensor for a minimum of 20 seconds.

e. Ascertain that one LED light goes out, and the other LED will light.

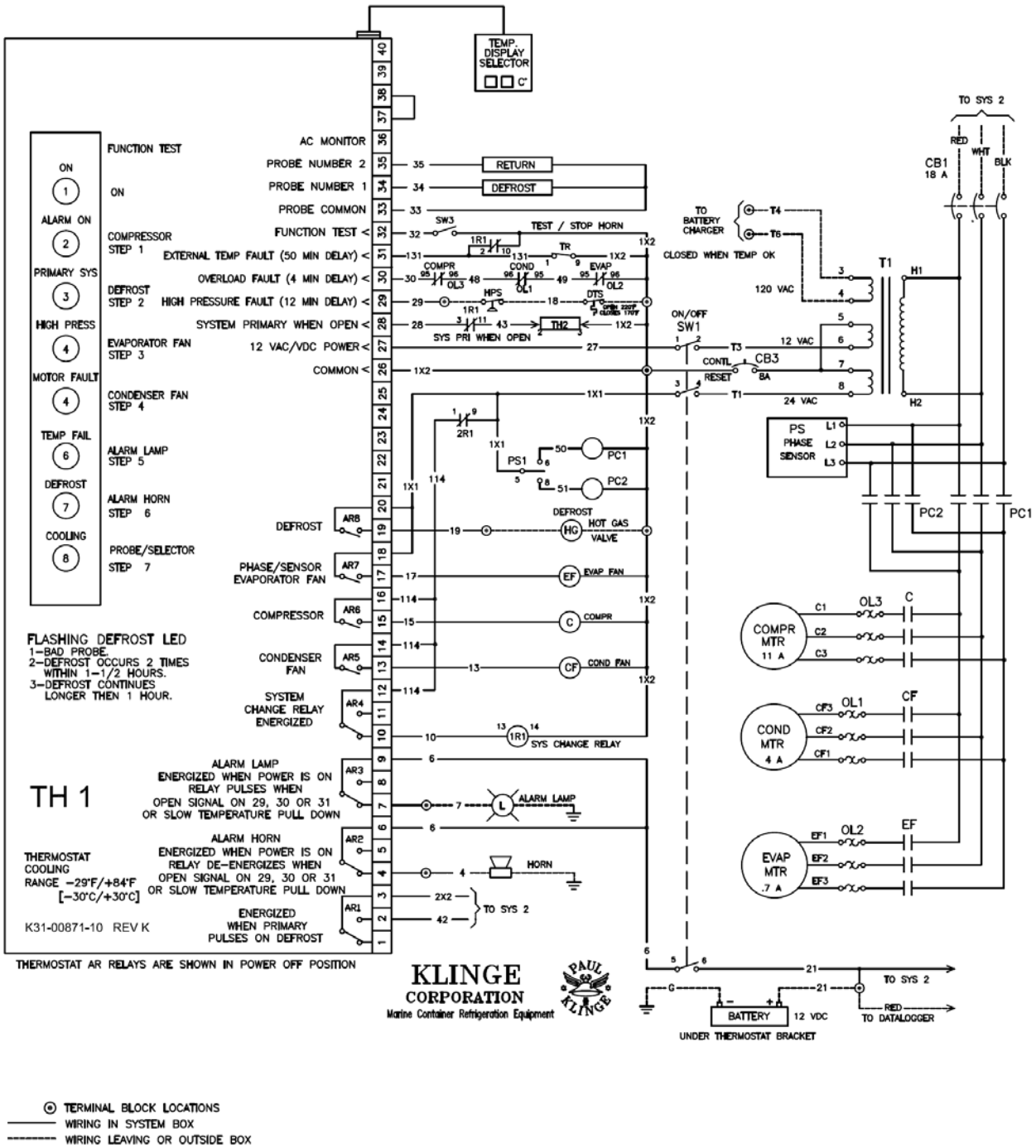
f. Check the rotation of fan motors (they should reverse).

g. Release the **TEST** button. The rotation of the fan motors should then return to the original rotation.

Phase contactors (PC1 or PC2)

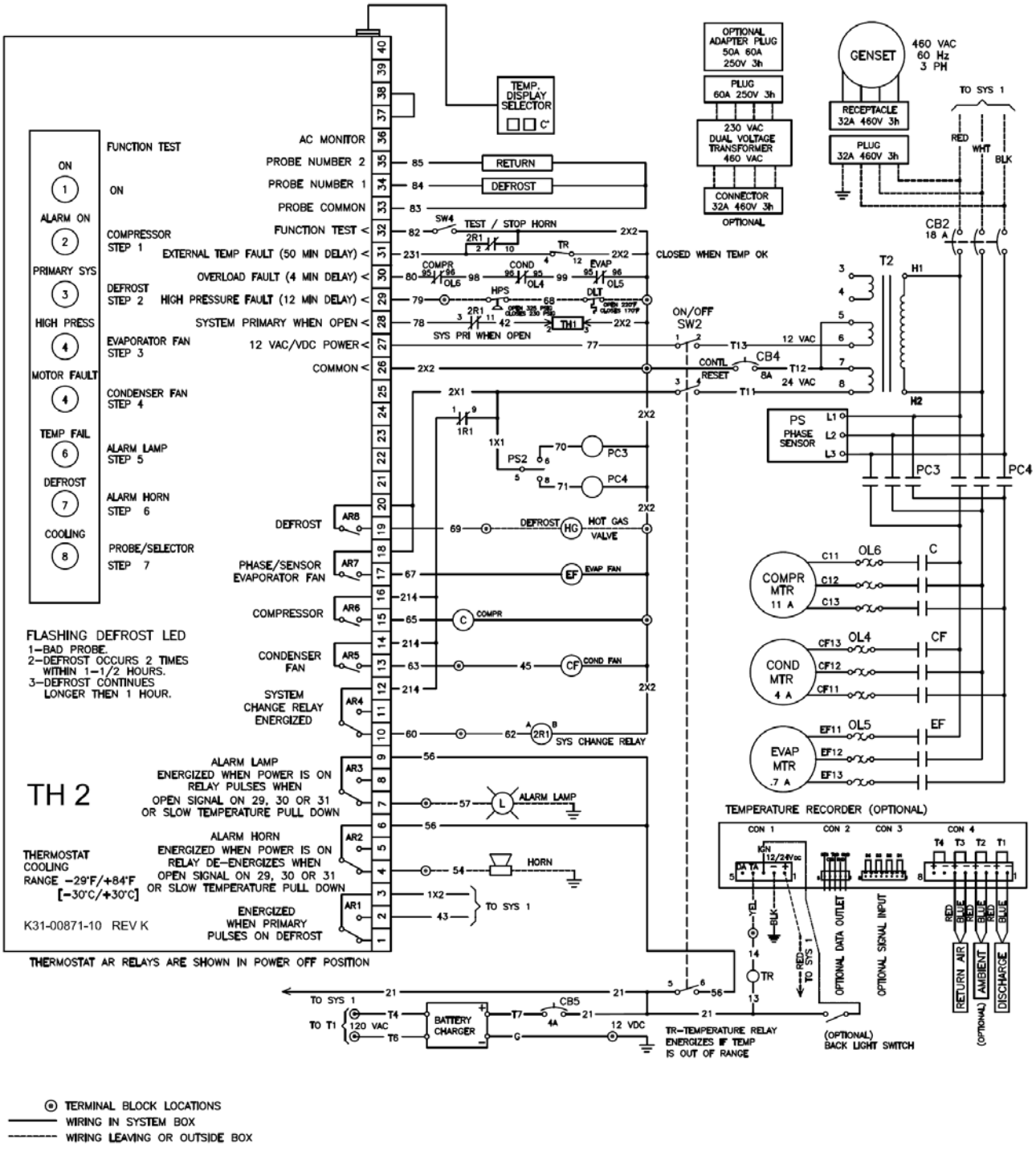
There are two 3-pole 460-volt direct-on-line contactors with 24 volt operating coils. These connect the power to the condenser fan contactor and evaporator fans. The contactor (PC1 or PC2) is energized by the phase sensor.

4.3 Electrical Schematic System 1



4.4 Electrical Schematic System 2

SYSTEM 2 (RIGHT SIDE)



SECTION FIVE – MICROPROCESSOR THERMOSTAT

5.1 General Information

The microprocessor thermostat is an electronic solid state device consisting of three parts:

- The microprocessor board.
- The temperature probes.
- The display panel.

All parts are mounted in the control box except the temperature probes, which are mounted in the return air stream and the evaporator coil (defrost system).

The display shows the temperature of the controlling probe. Indicator lights are provided to determine correct functions and as an aid to servicing the unit. The indicator lights are mounted on the thermostat and are visible from the front of the unit. The LED indicator lights will indicate which function is being called for by the microprocessor thermostat, and which particular contactor or holding coil should be energized.

The defrost function is controlled by the microprocessor thermostat, which energizes the hot gas coil.

Defrost can also be activated manually by holding the momentary "defrost" toggle switch closed for 5 seconds.

The heating cycles are automatically locked out by the microprocessor thermostat when the set point is in frozen mode.

When the unit **ON/OFF** switch is in the **ON** position, the display will show return air probe temperature.

If the display is not in the normal mode and the operator buttons have not been operated within 5 seconds, the display automatically switches to normal mode, return air probe temperature.

The temperature setting (set point) is stored in a nonvolatile memory and will always be intact - even in case of power failure.

In order to prevent false entry or changes of values, both selector buttons have to be depressed simultaneously for new settings to be entered into the nonvolatile memory.

Before describing the microprocessor thermostat sequence, it will be beneficial to explain the function of each component part separately, to allow you to become very familiar with the microprocessor.

5.2 Display Panel

General Description

The front panel consists of three switches and a three position numerical LED display as indicated in **Figure 5.2**. The display normally indicates the actual box temperature as reported by the return air temperature probe. The temperature is indicated in 0.1 degree for values above -10.0ºF and in whole degree increments for values below – 9.9ºF.

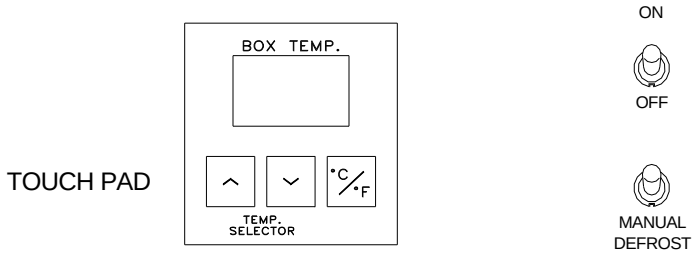


Figure 5.2

5.3 Display Panel Operation

Creating a Temperature Set Point:

- Pressing the **UP** (∧) or **DOWN** (∨) key causes the display to show the current set point.
- Each pressing of one of these keys will increment or decrement the display by one whole degree.
- Holding a key pressed will cause the display to change one degree each half second.
- Simultaneously pressing both keys causes the current set point to be saved. This set point will be used until another set point is chosen even if power is removed from the thermostat.
- The display automatically returns to normal mode approximately five seconds after the last key press.

Changing Temperature Mode:

- The thermostat can operate either in degrees Centigrade (C) or Fahrenheit (F).
- Pressing the **C/F** key causes the display to indicate the current mode. This is indicated by a C or F in the right character of the display. The right most decimal point is also lit when in F mode.

- Each pressing of the **C/F** key causes the mode to change.

- Pressing either the up or down key will cause the currently selected mode to be saved and the display immediately returned to normal mode.

- The display automatically returns to normal mode approximately five seconds after the last key press.

5.4 Temperature Sensor

The temperature sensing probe is a thermistor placed in a sealed metal tube, which is connected to a two conductor shielded cable.

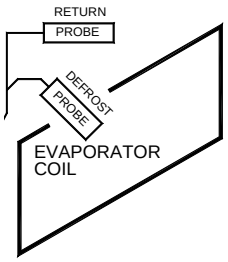
The temperature signal from the probe is connected through this cable. (See diagram on following page.) One probe is mounted in the center of the evaporator, measuring the temperature of the refrigerant in the copper tubes. The second probe is mounted in the return air duct, measuring the temperature coming back from the container.

WARNING

It is important that the sensor is properly mounted. Use an ohmmeter to check probes. A short circuit indicates 0 ohms resistance. An open circuit indicates infinite ohms resistance. ohms readings should agree with the chart below:

PROBE RESISTANCE CHART		
Probe at Ambient Temperature		**K-Ohms** (Approx.)
°C	°F	
+ 25	+77	10.0
+ 20	+68	12.4
+ 15	+59	15.7
+ 10	+50	19.9
+ 5	+41	25.3
0	+32	32.6
- 5	+23	42.6
- 10	+14	55.3
- 15	+5	72.9
- 20	- 4	97.0
- 25	-13	130.3

5.5 Microprocessor Thermostat



VIEW
SHOWING THE PROBE
LOCATIONS IN THE
EVAPORATOR SECTION

General Description

This device contains all circuits necessary to select those functions required to maintain an accurate temperature. The selection is based on the signals received from the probes, and the display panel. It is designed to operate in ambient temperatures of -40ºC (-40ºF) to 70ºC (185ºF). It will control temperature settings (set point) of -29ºC (-20ºF) to 29ºC (84ºF), to an accuracy of 0.1ºC (0.2ºF).

LED Indicators

The narrow edge of the device contains 8 **LEDs** indicating serving a dual purpose.

- During normal operation to show power to the device, function being called for, alarm and probe or temperature failure. Use the labels on the narrow edge above each LED.
- During the **Function Test** to test the thermostat or locate a problem.
- Use the label on the side of the device.

Inputs

Input signals to the device consist of:

- Return air temperature probe
- (Defrost) coil temperature probe
- (Set point) temperature setting from display panel
- Signal to initiate manual defrost or function test from SW2

Outputs

Output signals from the device are by means of 8 relays.

- 4 relays are single pole, single throw, normally-open

- 4 relays are single-pole, double-throw

Outputs used in this system are:

- Compressor ON (Cooling)
- Condenser Fan On
- Phase Sensor (For Evaporator Fans ON)
- Heat ON (For Heat or Defrost)
- Compressor Unload (Capacity Reduction)

Each output relay has an LED lamp mounted on the circuit board adjacent to the relay to indicate the relay is energized.

These LEDs are visible only from the side of the device and are for diagnostic purposes only.

Microprocessor Thermostat Functions

Temperature Falling:

- Compressor unloads 2°C (3.6°F) above set point.
- Compressor cycles **OFF** at set point.
- Heat cycles **ON** at 1°C (1.8°F) below set point.

Temperature Rising:

- Heat cycles **OFF** at set point.
- Compressor and unload cycle **ON** at 0.5°C (0.9°F) above set point. There is a one minute delay of the compressor before it can cycle **ON** again, regardless of the temperature rise.
- Compressor unload cycles **OFF** at 3°C (5.4°F) above set point.

Other Functions

- When the set point is set at -7°C (19°C) or below the heat cycle and unload will be locked out.
- If the temperature pull down rate or rate of rise (Heating) is less than 0.16°C (0.3°F) per hour the alarm LED will light and the temperature failure LED will flash. This function is locked out within +/- 2°C (3.6°F) of set point.

- After reaching the set point, if the temperature varies more than 2°C (3.6°F) for more than 120 minutes the alarm LED will light and the temperature failure LED will light.

- Alarm LED indicators are reset by turning the control system power **OFF** or if the set point temperature has been reached.

Defrost

- Normally initiated when temperature difference between return air probe and the coil temperature probe reaches a predetermined value. The temperature difference is measured when compressor has been running for at least (2) minutes.

- Evaporator fans, condenser fan and compressor OFF and heat ON during the defrost cycle.

- The defrost probe terminates defrost at35°C (95°F).

- If the compressor runs for 24 hours without defrost cycle, defrost will be initiated automatically by a timer.

- If defrost probe is out of range (open or shorted) defrost will occur automatically after compressor has run for 24 hours and alarm light will be energized, and the defrost and probe failure LED will flash. The 24 hour timer is locked out if the temperature is above 7.2°C (45°F).

- If the defrost probe is not terminated by the coil probe, it will terminate after 1 hour, the alarm light will light and the defrost LED will flash.

- Defrost can be initiated by manual defrost input (hold momentary toggle switch closed for 5 seconds) and will be terminated as indicated above.

- At initial start up defrost will occur after 6 continuous hours of compressor running time unless the set temperature is reached.

- If defrost lasts for more than 1 hour, the alarm light will light and defrost LED will flash.

- If defrost cycle is initiated in less than 1-1/2 hours since the last defrost ended, the alarm light will light and defrost LED will flash.

Function Test (LABELS ON RIGHT SIDE OF THERMOSTAT)

1. To initiate function test hold defrost switch closed and switch unit **ON/OFF** switch to **ON**. Each step will last (8) seconds.

   a. Flash all indicator LEDs.

b. Energize the compressor contactor (Cooling LED will light or flash if there is a problem).

c. Energize unload valve (Unload LED will light or flash if there is a problem).

d. Energize heat contactor (Heating LED will light or flash if there is a problem).

e. Energize evaporator fan contactor (Temperature LED will light or flash if there is a problem).

f. Energize the condenser fan contactor (Alarm LED will light or flash if there is a problem).

g. Check the defrost probe (Defrost probe LED will light or flash if there is a problem).

h. Check the return air probe (Return air probe LED will light or flash if there is a problem).

NOTE

If there is a problem and the LED flashes, the function test will stop at this point, and continue flashing at the rate of 0.5 seconds.

SUMMARY OF THERMOSTAT FAULT SIGNALS

FAULT	SIGNAL
Return Air probe open or closed.	Probe failure LED flashes & alarm LED on.
Defrost probe open or closed.	Probe failure LED flashes, defrost LED flashes, alarm LED on.
Unit defrosts too frequently (2 times in 1-1/2 hours).	Defrost LED flashes & alarm LED on.
Unit fails to pull down faster than 0.3ºF/hour or is outside the temperature range for 120 minutes or more.	Temperature failure LED flashes and alarm LED is on.

SECTION SIX – MAINTENANCE AND SERVICE INSTRUCTION

This section provides procedures for establishing preventative maintenance and systematic servicing schedules, which are the keys to successful operation.

ALL SERVICE AND MAINTENANCE PROCEDURES SHOULD BE PERFORMED IN ACCORDANCE WITH SECTION 608 OF THE CLEAN AIR ACT (CAA), PROHIBITING THE VENTING OF REFRIGERANTS INTO THE ATMOSPHERE AND PROVIDING FOR THE USE OF REFRIGERANT RECYCLING AND RECOVERING EQUIPMENT TO BE USED WHENEVER A SYSTEM IS OPENED.

6.1 Safety

- When any work is to be done on the components of the refrigeration system, always make sure that the equipment cannot be started automatically or accidentally. If valves are closed and/or circuits interrupted during service procedures, the control switches should be suitably tagged with such notations.

- Use proper tools and correct size of wrenches.

- Do not exert excessive pressure when tightening flare nuts, as it may result in a rupture of the flare or stripped threads.

- Always wear approved goggles or eye shields when working with refrigerant to prevent eye injury if refrigerant is accidentally discharged into the face of the service engineer.

- **NEVER** under any circumstances apply heat to a refrigerant cylinder by using a naked flame. Should it be considered necessary to apply heat to a cylinder to create a refrigerant flow when recharging a system, place the cylinder in a container of hot or warm water to a point about 3/4 of the height of the cylinder.

    - Even this method requires that a pressure gauge is in use in the charging line to indicate the pressure in the cylinder at all times.

    - Also, never close the shut off valve on the cylinder while the cylinder is being heated.

    - The use of a manifold gauge set will permit compliance with having a gauge in the line and a shut off valve on the manifold to stop the flow of refrigerant into the system and allow the gauge to read cylinder pressure.

- Always replace refrigerant cylinder valve and connection caps after using the cylinder, and do not permit a cylinder to be dropped or hit severely by another object.

- Due to the height at which the refrigeration unit is placed in the container, always use

safe and secure means to service the unit and to allow a platform for tools and a refrigerant cylinder.

- **NEVER** loosen a refrigerant line rapidly if there is positive pressure in the line because:

    a. It is illegal to vent refrigerant into the atmosphere per the Clean Air Act.

    b. Liquid refrigerant may give you a severe cold burn or other injury.

    c. Gas refrigerant may cause oil to discharge, leaving the compressor short of oil, and creating an oily mess over the unit and service engineer.

CAUTION

A gauge manifold should always be used when charging unit with refrigerant.

WARNING

Refrigerant R-404A: As with any refrigerant chemical, ALWAYS refer to the manufacturer's MSDS information for the safe handling, storage and disposal of refrigerant chemicals.

6.2 Checking Refrigerant Charge

The receiver sight glasses are equipped with a ball which floats when the liquid level is in the sight glass or above. It should be noted and remembered that the only requirement of liquid level is that a seal be maintained at the outlet of the receiver. At low refrigerant flow rate the liquid refrigerant may not accumulate in the receiver to a point where a liquid level will show on the sight glass. Many times the liquid will hang up in the condenser; therefore, caution should be taken before adding refrigerant. Air in the receiver may also prevent the level from coming up into the sight glass. This can be rectified by purging air from the system. If the ball is not floating, it is recommended that the pressure be checked according to the suction and discharge pressures noted on the graphs provided for R-404A before determining that the charge is low. It is just as possible to do harm to the system by overcharging as it is to run it undercharged.

It is important to have the correct amount of refrigerant in the system. If there is too little, the expansion valve will pass vapor and reduce the capacity of the evaporator. Too much refrigerant will result in higher head pressures and oil dilution.

Check the refrigerant level at 0ºC (32ºF) container temperature with unit fully loaded.

CAUTION

It should be understood that an air cooled system is designed to operate at many different ambient temperatures and the performance of the system will vary accordingly. Therefore, before adding any refrigerant (or making any other adjustments), the current operating conditions must be taken into consideration. For example, whether the unit is running with a low or high temperature load, running in cold or hot ambient temperatures and most importantly, whether the suction and discharge pressures are in line for existing conditions.

NOTE

Unit capacity will be greatly reduced when high ambient temperatures are experienced; therefore, a careful check should be made of unit performance before making any adjustments or adding refrigerant to the system.

Before adding refrigerant, always determine the reason for the low charge and remedy the cause. Test for leaks thoroughly with an electronic leak detector and check also for traces of oil.

CAUTION

When the refrigerant charge is added, it is important initially to purge the air from the transfer tubes of the manifold gauge set.

For the full charge weight of refrigerant for the system; see Section 8.8.

6.3 Procedure for Adding Refrigerant

To add small quantities of refrigerant to the system, it is preferable to add gas to the low or suction side of the system. This will allow the system to operate with little or no disturbance of the refrigeration cycle while the refrigerant is being added.

Check the refrigerant level at 0˚C (32˚F) container temperature.

NOTE

Care should be taken to ensure that only gas is extracted from the refrigerant cylinder, when charging into the low side.

1. Remove the compressor suction service valve cap and backseat the valve.
    a. This closes the charging port.

2. Remove the cap from the port and loosely attach the suction gauge line of a manifold set.

3. Connect the center charging line to refrigerant cylinder and tighten the connection.

4. Crack open the cylinder valve and the manifold suction gauge valve and allow the entire line to purge the air, then tighten the connections at the compressor.

5. With the system still operating and the suction pressure being 20 psig or below, and the cylinder pressure at 70 psig (dependent upon room temperature), open the refrigerant cylinder valve completely and the manifold suction valve and crack open the compressor suction service valve, 1 to 2 turns.

6. Allow refrigerant into the system and observe the receiver sight glass (20-30 seconds bursts with a 5 minute interval).

7. If the pressure in the refrigerant cylinder equalizes the suction pressure of the system, charging will cease until the cylinder pressure is raised by heating it. To speed this, a container of hot water or an electric blanket (made for this purpose) can safely be used; if care is taken, a metal shielded heat lamp can be used as well.

8. If the pressures equalize and no heating is available, partially 'frontseat' the compressor suction service valve and allow the system to pump down to a pressure slightly below the cylinder pressure. This will create a pressure difference between the system and the cylinder, allowing refrigerant to flow again. However, remember to close the cylinder or manifold valve before opening the compressor service valve or R-404A will be forced back into the cylinder. Also, the system should be allowed to cycle for at least 5 minutes after each shot of refrigerant, to allow it to settle down so that an accurate reading can be taken at the receiver sight glass.

9. When it is determined that the system has an adequate refrigerant charge, close the refrigerant cylinder valve (if not already closed) and the manifold suction gauge valve, and backseat the suction service valve, in that order. Remove the manifold lines and replace caps securely.

6.4 Non-Condensable Gases

Air and non-condensable gases in any system gather in the receiver above the liquid. These can be removed during operation by purging through the valve provided for this purpose at the receiver. To purge, use recycling equipment and open inlet a small amount. Note any significant difference from the initial pressure when the valve is again closed. Repeat the operation until the pressure is approximately equal to the refrigerant vapor pressure corresponding to the temperature of the receiver.

Before purging the system the unit should be stopped for 5 to 10 minutes. This will allow time for air and non-condensable gases to rise to the top of the receiver.

This is only a short term emergency measure. To insure satisfactory operation, the system should be evacuated and re-charged as soon as possible.

6.5 Opening the System

Whenever it is necessary to open a charged or functioning system to make repairs or replacements, it is necessary to comply with the Clean Air Act by using recovery and recycling equipment.

The use of "**EASY FLOW**" silver solder and flux, or equivalent, is recommended in the refrigerant system piping. **DO NOT USE SOFT SOLDER.**

Prior to disturbing any connections, the type of solder originally used should first be verified. By taking this precaution, the contamination of the joint will be avoided.

6.6 Testing for Leaks

The preferred method for finding leaks is by use of an electronic leak detector. There are several different makes available and they all use the same method of detecting a leak through an exploring tube, which will detect from large to extremely small leaks depending on the setting used on the detector.

Leak testing with soapsuds will reveal only the large leaks, and is therefore ineffective in determining the tightness of a system.

To provide the best possible condition for leak checking the system, it is recommended that the system pressure of the refrigerant be increased by adding dry nitrogen to create a pressure suitable for checking.

CAUTION
Never use air.

6.7 Evacuating the System

CAUTION
Do not use the compressor as a vacuum pump or as an air compressor.

The compressor is not designed to handle air and will not pull down to as low a vacuum as a pump designed for that purpose. Similarly, if used to compress air, serious overheating and consequent damage may be the result.

Connect a pump capable of drawing a vacuum of 0.15 mm HG or greater to that part of the system which has been opened. Continue until all air and moisture has been removed.

The final evacuation may be accelerated by manifolding the connections to the vacuum pump and evacuating simultaneously the high and the low sides of the system, the vacuum should be broken by introducing pure refrigerant.

It is not possible to place too much emphasis on the importance of keeping the system free of moisture. Slight amounts of water in the system will inevitably lead to trouble in the following forms:

- Corrosion of steel parts.
- Copper plating of the shaft and bearing.
- Slugging or gumming of the oil.

- Plugging of the strainers and driers.
- Freezing and plugging of the expansion valve.

Whenever it is necessary to open the system for any reason, always take precautions to prevent the entrance of air into the system, as air always contains some water vapor.

Isolate as much of the system as possible from the portion to be opened by closing suitable valves.

SECTION SEVEN – SERVICING COMPONENTS

7.1 Compressor Assembly

Compressor Motor Protection

The compressor motor of the PFR-582 is equipped with an internal overload device. This device will break the star-point and stop the compressor if a problem arises which causes the motor to overheat. When the motor cools sufficiently the overload will reset automatically.

If the overload stops the compressor due to overheating, **DO NOT** jumper / short out the overload to make the compressor operate. This will allow the motor to burn out and contaminate the system. The cause for the over-heating must be determined and corrected before the unit is put into service again.

Compressor Lubrication

The compressor used in the PFR-582 is equipped with an oil pump and will operate in either direction of rotation. In order to check the oil level in the compressor, a sight glass is provided in the front of the shell, allowing the oil inside the crankcase to be visible at all times.

Since the oil level will vary with operating conditions, it should be checked only after the compressor has been running long enough for the crankcase to warm up to operating conditions. The level will be maintained at 1/2 minimum to 2/3 maximum of the sight glass while running. If the level is low, oil should be added.

Adding Oil

CAUTION
This unit uses R-404A refrigerant. Therefore, **mineral oil lubricant cannot be used.**

The only oil approved by the compressor manufacturer is polyolester (POE) lubricant, "Mobil EAL Arctic 22 CC" (Approximate charge 5 qt (4.7L)).

If the compressor is not evacuated or charged, oil may be added thru a crankcase port by pouring.

If the compressor is charged and the system can be run, oil should be added thru the suction service valve.

Although this procedure is relatively simple, some preparations and care **MUST** be taken as follows:

1. Connect manifold gauge to suction service valve port and start unit. Frontseat suction

service valve partially until a suction pressure of approximately 0.1 bar (1.45 psi) is maintained.

2. With a can of oil opened, measured, and ready, carefully open the manifold suction gauge valve until a positive pressure can be felt at the outlet of the center charging hose.

3. Now place the end of the charging hose into the can of oil and control the bubbling with the manifold valve. Continue to frontseat the case pressure a mild vacuum (10" vacuum) and pull the oil into the crankcase. By opening the manifold valve a little more, the oil can be sucked into the crankcase faster.

4. As soon as enough oil has been transferred to the compressor, shut off the manifold valve. If the can being used is almost empty, be careful that air is not sucked in with the oil.

5. Backseat the compressor suction service valve. Remove gauge, manifold hoses, and replace caps securely. Allow the unit to run 30 minutes before rechecking the oil level in the compressor sight glass, immediately after the compressor has been shut off.

NOTE

Always keep commercial oil stored in sealed containers. Oil exposed to the atmosphere will absorb moisture, which can cause trouble when introduced into the system. Use only the grades of oil which are suitable and recommended for compressor lubrication and have been especially processed so as to have the necessary low moisture content.

Compressor Motor Burnout

When a hermetic motor burnout occurs, the stator winding insulation decomposes, forming carbon, water, and acid. To prevent contamination of the refrigerant system and a repetition of motor failures, definite steps **MUST** be taken to ensure that the refrigerant circuit is kept clean from contamination.

Important: Damage to a compressor caused by failure to clean the system properly after burnout constitutes abuse and is not covered by the terms of the warranty.

NOTE

After it has been observed that a hermetic motor has failed either by observing an obvious electrical fault or by a strong burnt odor to the refrigerant gas released at the discharge valve port, the following procedure must be followed to clean the system and thus prevent failure of a replacement compressor.

CAUTION

Acids are formed during a motor burnout. (Use rubber gloves and eye protection when working on the system or handling contaminated parts.)

Moisture is a normal product of decomposition and is very harmful in a refrigeration system. However, it is one of the easiest products to remove. Acids are generated and are highly corrosive.

NOTE

The acid, most of which concentrates in the compressor oil, **MUST** be removed to prevent failure of the replacement compressor.

System Cleaning Procedure After Hermetic Motor Burnout

The filter drier procedure has proven to be very economical, especially when the refrigerant in the system is recovered using safe recovery techniques. This can be easily accomplished if the compressor is fitted with a service valve.

1. Recover refrigerant from the system.
    a. In order to avoid air and moisture entering the system close the compressor service valve to isolate the system. At that point, remove the inoperative compressor, and install the replacement.

2. Since the normal color of refrigerant oil varies from oil to oil, take a sample of oil from the replacement compressor and seal in a small glass bottle for comparison purposes after the cleaning operation is complete.
    a. Suitable two ounce bottles are obtainable at any drug store.

3. Evacuate the compressor only, using the procedures previously outlined, since the rest of the system will be isolated.

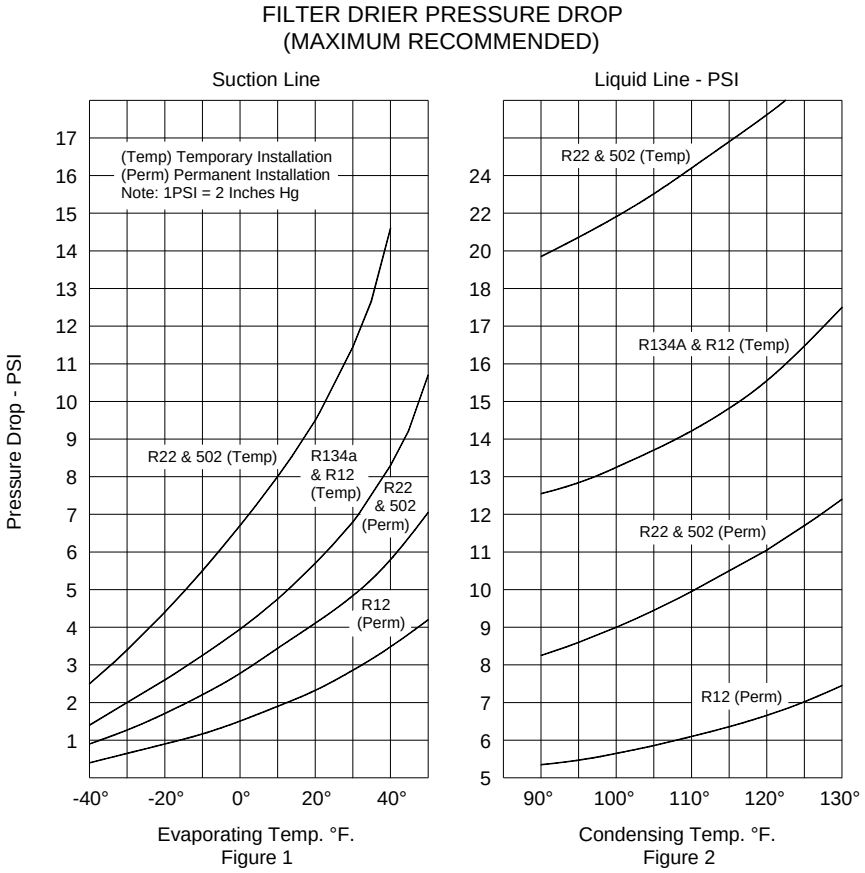
4. Inspect all system controls, such as expansion valve and solenoid valve.
    a. Clean or replace if necessary.
    b. Remove or replace any filter driers previously installed in the system, and clean or replace any filters or strainers.

5. Install the recommended size filter drier in the suction line, and an oversized filter drier in the liquid line.

6. Charge through a filter drier with the refrigerant which was removed and recovered.
    a. Add additional refrigerant as necessary.

7. Start the compressor and put the system in operation. As the contaminants in the system are filtered out, the pressure drop across the filter drier will increase.
    a. Observe the pressure differential across the filter driers for a minimum of 4 hours, preferably by means of one gauge and a manifold to eliminate gauge error.
    b. If the pressure drop exceeds the maximum limits shown on the curves on Figures 1 and 2, replace the filter drier and restart the system.

8. After completion of step 7, allow the unit to operate for 48 hours.
    a. Check the odor (**warning: smell cautiously**) and compare the color of the oil with the sample taken in Step 2.
    b. If an acid test kit is available, test for acid content.
    c. If the oil is discolored, has an acrid odor, is acidic, or if the moisture indicator indicates high moisture content in the system, change the filter driers.
        i. The compressor oil can be changed if desired.
    d. Allow the system to operate for an additional 48 hours, and recheck as before.
        i. Repeat until the oil remains clean, odor free, and the color approaches that of the original sample.



9. Replace the liquid line filter drier with one of the normally recommended size.
    a. Remove the suction line filter drier.

10. After the cleaning procedure is completed, re-check in approximately two weeks to ensure that the system condition and operation is completely satisfactory.

7.2 Condenser and Evaporator Fan Motors

These totally enclosed motors are equipped with shielded ball bearings, which require no lubrication under normal service conditions. The motors are designed to operate satisfactorily with line voltages which are within 10% of nameplate values, and are protected by an automatically reset Klixon, which is normally closed. In case of overheating, the Klixon will open and the motor will stop.

NOTE

The evaporator fan motors are equipped with four drain holes and those which are **NOT** pointing downward **MUST** be closed with plugs.

7.3 Condenser and Evaporator Fan

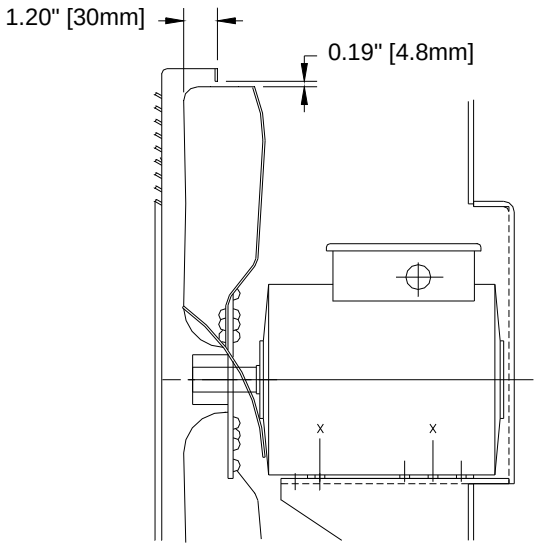
CAUTION

Replacement fan motors may be manufactured for opposite rotation from what is required.

Always check for proper rotation and if required, reverse 2 leads.

Condenser Fan

If a motor fan has to be removed from the motor shaft for any reason, be sure that the fan dimensions for relocating the fan are used in accordance with the fan positioning sketch.



CONDENSER FAN LOCATION

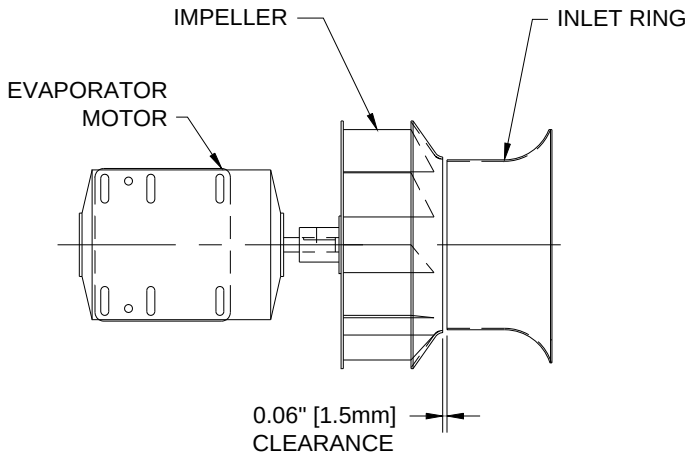
Evaporator Fan

Opening of the upper access door will permit the removal of the evaporator fan and motor assembly if it becomes necessary to replace a defective fan wheel or motor.

Before replacement of the assembly, the fan wheel **MUST** be positioned and secured to the motor shaft as indicated on the sketch.

Install assembly in the unit but do not tighten the cap screws holding the motor to the motor mount.

Extreme care **MUST** be taken to align the fan wheel and the inlet ring to be concentric and spaced with 1.5mm(l/16") clearance as shown on the sketch.



EVAPORATOR FAN POSITION

When all alignments are made, secure the assembly by tightening the motor mount cap screws.

7.4 Filter Drier Assembly

NOTE

A replaceable type of filter drier is installed in the liquid line.

To replace a drier:

1. Close the liquid line shut-off valve and pump down the system until the suction pressure stabilizes between 0 and 0.1 bar (0 and1.5 psig).
   a. Remove all power to the unit, then frontseat the suction service valve.

2. Loosen flare nuts on drier slowly to release any refrigerant that may be left in the lines.
   a. Remove drier from clamp.

3. Remove caps from new drier and install immediately. If the changeover of driers is accomplished quickly enough, there will be no need to purge air from the lines.

4. Connect the liquid line correctly to the drier (See flow arrow on the drier.).

5. Tighten flare nuts and clamp on new drier cartridge securely.

6. Open shut-off valve and suction service valve, and the unit is ready to run again.

7.5 High Pressure Switch

The high pressure switch functions automatically to open or close the compressor contactor coil circuit upon increase or decrease in discharge pressure.

NOTE

When replacing a high pressure switch or unloader pressure switch which is located on the compressor head, the compressor refrigerant pressure MUST be reduced to 0 to 0.1 bar (0 to 1.5 psi).

To replace the high pressure switch:

1. Close the suction service valve and run the compressor until the pressure is stabilized at 0 to 0.1 bar (0 to 1.5 psi).

2. Switch OFF unit.

3. Close compressor discharge service valve.

4. Release any remaining pressure in the compressor by slowly loosening the gauge port caps on the service valve.

5. Replace defective switch. If the switch exchange is completed within 5 minutes, purging the compressor for air will not be necessary as the refrigerant mixed in the compressor oil

will continue to boil off and create a positive pressure in the compressor, which will prevent air from entering.

6. Close and tighten all gauge port caps.

7. Open suction and discharge service valves and replace stem caps.

8. Reconnect wires with splice connectors.

7.6 Thermal Expansion Valve

The thermal expansion valve automatically maintains constant superheat of the refrigerant gas leaving the evaporator coil. The only maintenance that the valve may require is to check that the bulb is making good contact with the suction line. The thermal bulb is secured to a pre-selected point on the suction line positioned at 4 or 8 o'clock, by a perforated metal strap. If, for any reason, these bulbs are removed from the suction line, care **MUST** be taken to be sure that the bulbs are correctly replaced and insulated.

NOTE

If the body has to be changed for any reason, it is not necessary to disassemble the new tx-valve, but use extreme care to prevent warping of the new valve body due to excess heat applied during brazing. To prevent warping it is necessary to use wet rags to reduce heat buildup of the valve body. Maximum heat is 100ºC (212ºF) for the element, and 150ºC (302ºF) for the body.

Replacement of Defective Thermal Element (Bulb)

1. Before disassembling the valve, be sure the refrigerant pressure in the valve area of the system has been reduced to a safe pressure (0 psig).

2. Remove the seal cap and turn the adjustment stem counter-clockwise to relieve the spring force.
   a. Count and record the number of turns so adjustment can be returned to its original position.

3. Install the new thermal element.
   b. When installing the new element the sealing surfaces should be free of any foreign material or nicks that might prevent a leak tight joint.
   c. A few drops of refrigerant oil on the element threads will help assembly and removal.

4. Return the superheat spring adjustment to its original position.

5. Replace the seal cap tightly.

Measuring of the Superheat

1. Adjust the set point to -15°C (5°F) and run the unit until the return air temperature is

about -10°C (14°F).

2. Control the superheat according to the chart below.

3. Measure the temperature of suction line at the point the TXV bulb is clamped.

4. Obtain the suction pressure that exists in the suction line at the bulb as follows:
    a. Read the gauge at the suction valve of the compressor.
    b. To the pressure add the estimated pressure drop through the suction line between bulb location and compressor suction valve.
    c. The sum of the gauge reading and the estimated pressure drop will equal the approximate suction line pressure at the bulb.

5. Convert the pressure obtained in 4 to saturated evaporator by using the temperature/pressure chart provided in this manual.

6. Subtract the temperatures obtained in 5 from temperature obtained in 3, the difference is the superheat.

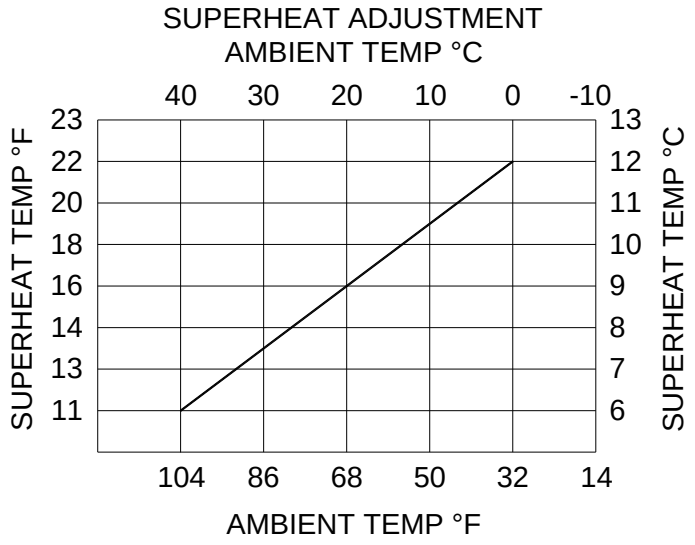
Adjusting the Expansion Valve

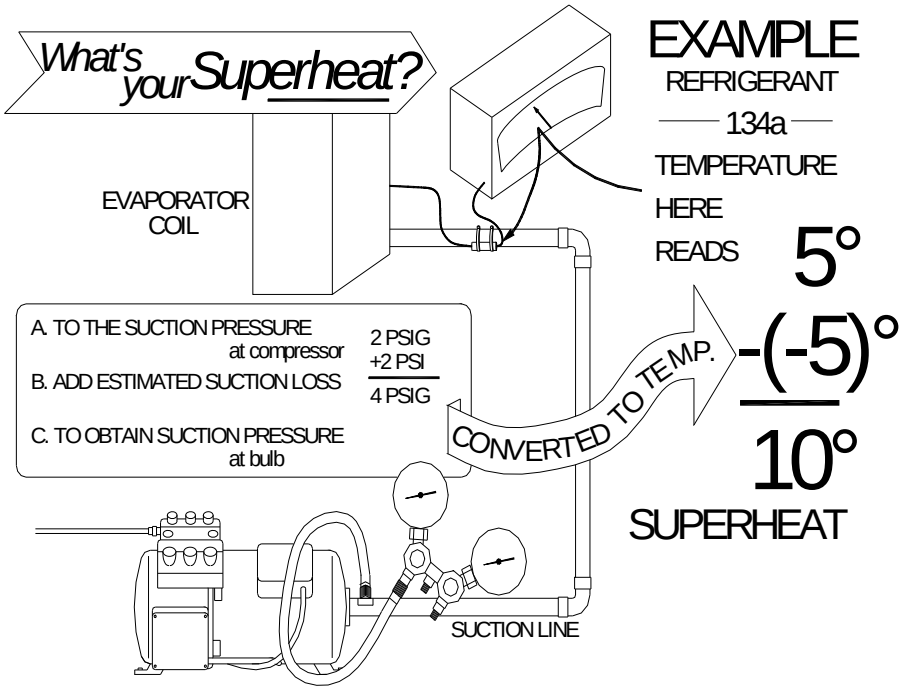
1. Remove the adjusting cap.

2. Turn the adjustment screw until the correct superheat is reached.
    - Clockwise increases superheat, and counter-clockwise reduces superheat. See chart below for correct figure.

3. Allow the unit to stabilize (20 minutes) and recheck the superheat setting.

4. Tighten the adjusting cap.





Positioning Thermal Bulb of TXV

1. Be sure that the point of contact of the bulb on the suction line is free from corrosion and oxidation (clean copper tube with emery cloth).

2. Be sure that the bulb is replaced in exactly the same position that it was removed from.

3. Be sure that the perforated clamps are evenly tight around bulb and suction line.

4. Be sure that at least 3 layers of "Presstite" no-drip tape is wrapped around bulb and suction line and sealed from surrounding air flow.

7.7 Overheat Switch

A 54ºC (130ºF) safety overheat switch is attached to an evaporator coil support and will open the heating circuit if overheating occurs.

To Replace Overheat Switch:

1. Disconnect wiring.

2. Remove two screws from the overheat switch.

3. Insert new switch.

4. Connect wiring and make sure the wire is firmly connected.

7.8 Suction Solenoid Valve

The valve is a solenoid valve, which is open when not under power. It is mounted in the suction line. The location of the solenoid valve permits easy access for servicing parts of the valve. If the body (or base) of a valve is damaged to the extent that it should be replaced, then remove all other parts from the body before applying heat to unbraze the body. Use extreme care to prevent warpage of the new valve body due to excess heat applied during brazing. To prevent warpage, it is necessary to use wet rags to reduce heat buildup of the valve body.

Do not attempt to reassemble the solenoid valve until the body has cooled down after brazing.

A factory pre-determined hole is drilled in the valve body. This permits a small amount of refrigerant to pass to the compressor when the valve is energized.

SECTION EIGHT – TROUBLE SHOOTING

8.1 General Information

Several components are incorporated into the unit to assist the serviceman in finding the cause of problems concerning the operation and efficiency of the unit.

LED indicator lights on the display indicate which cycle the microprocessor thermostat is calling for. These lights should be used in conjunction with the pressure gauges to determine if certain cycles are operating.

8.2 Service Components

- Sight glasses are mounted in the liquid receiver or optional water cooled condenser/receiver to determine if the refrigerant charge is correct. Check the refrigerant charge at 0ºC (32ºF) container temperature.

- The sight glass moisture indicator mounted in the liquid line will show if the refrigerant system is dry or wet.

8.3 Microprocessor Thermostat

The microprocessor thermostat will indicate faults during the function test mode and also during normal cooling/heating modes by use of each LED marked alarm, probe failure and temperature failure during normal modes. (See Section 5.5.)

Alarm indicators are reset when power is removed from the thermostat.

During the function test, LEDs on the thermostat for steps (a) through (f) will indicate a fault within the thermostat only.

The service technician will need to listen for each function to occur or use an amprobe to detect current draw in the case of heaters or unload solenoid.

Steps (g) and (h) will indicate a fault in the respective temperature probe and wiring.

The temperature output relays each have an LED located at the base of the relay, visible only from the side of the thermostat. When the LED is lit, the output relay should be energized and an output signal should occur.

8.4 Trouble Shooting Chart

The following trouble shooting chart is by no means complete, but covers the more general type of problems, which would be most likely if a breakdown is experienced.

PROBLEM	POSSIBLE CAUSE	CORRECT ACTION SUGGESTED
Power to unit but unit will not start	CB2 Tripped	Reset
	CB1 Tripped	Reset
	No control circuit voltage at T1	Check primary side for 460 volts @ T1
		Check for proper connections at T1
		Replace T1 if defective
	No control circuit voltage at TH term 27, 26 (12V), term 20, 26 (24V)	Faulty SW1, toggle switch, Replace SW1
Thermostat will not do a function test	No voltage (12V) between term 27 & 32 when SW2 is depressed	Faulty SW2, replace SW2
Compressor will not run	Compressor contactor "C" coil faulty or mechanical failure of contactor	Replace contactor
	High Pressure Switch (HPS) open discharge pressure too high	Remedy reason for high discharge pressure
	Defective HPS	Replace
	Open compressor windings due to thermal protection switch being open	Remedy cause of overheating
	Open compressor windings when compressor is cool	Replace compressor
	Compressor trips CB1 but does not run due to mechanical restriction	Replace compressor
"U" Unloader valve will not operate	Unloader valve coil open	Replace valve coil
	"ULS" Unloading pressure switch defective	Replace
Heaters fail to come on	"H" Heater contactor coil faulty or mechanical failure of contactor	Replace contactor
	"OHS" over heat switch open due to contact failure	Replace OHS switch

continued

8.4 CONTINUED

PROBLEM	POSSIBLE CAUSE	CORRECT ACTION SUGGESTED
Evaporator fans do not run	Faulty phase sensor "PS"	Replace
	"PC1" or "PC2" phase changing contactor faulty	Replace contactor
One evaporator fan will not run	Motor internal overload protection open or windings open	Replace motor
Condenser fan and evaporator fans do not run	See - Evaporator fans **DO NOT RUN**	- - - - - - - - - - - -
Condenser fan only will not run	"CF" Condenser fan contactor faulty	Replace
	Motor internal overload protection open or motor windings open	Replace motor
One of the 3 fans runs backwards	Motor or condenser fan, "CF" contactors may be wired incorrectly	Correct wiring
3 fans run backwards	Phase Sensor "PS" faulty does not change phase check with test button	Replace "PS
	Circuits 14 & 15 from PS to PC1 & PC2 cross-wired	Correct wiring
Unit runs on 460V but not on 230V	T2" transformer faulty or wired incorrectly	Replace "T2" or correct wiring
	Faulty 230V plug or Faulty460V connector	Replace or repair
Box temperature too high	Return air probe circuit open	Check wiring Replace probe
	Faulty thermostat	Replace
Box temperature too low	Return air probe circuit shorted	Check wiring Replace probe
	Faulty thermostat	Replace
Defrost too often	Airflow too low or no airflow	Check evaporator fans for operation and rotation
	Coil probe circuit open	Check wiring Replace probe
	Return air probe circuit shorted	Check wiring Replace probe
	Faulty thermostat	Replace
Defrost duration too long	Defective heaters	Replace
	Faulty coils probe	Check & replace

continued

8.4 CONTINUED

PROBLEM	POSSIBLE CAUSE	CORRECT ACTION SUGGESTED
Cooling capacity problem	"U" Unload capacity reduction valve stuck closed	Check & replace if defective
	Refrigerant level too low	Check & add refrigerant if required
	Partially or completely blocked filter drier	Check & replace
	Low airflow, fans not running or not running in the proper direction	Check & correct
	Non-condensables (air) in refrigerant system running in the proper direction	Purge condenser coil and receiver
	Faulty TXV	Replace
	One or both kazoos missing from condensate drain hose	Install where required
	Air vent improperly set	Readjust
	Severe lubrication oil overcharge	Remove excess oil. Check oil level. (allow oil level to be within sight glass when compressor is hot and has been running for 10 to 15 minutes).
	Compressor mechanical problem reducing pumping capacity	Replace defective compressor
Heating capacity problem	Faulty heaters	Replace
	Low or no air flow	Check evaporator fans for operation and proper direction of rotation

8.5 Unit Information Electrical

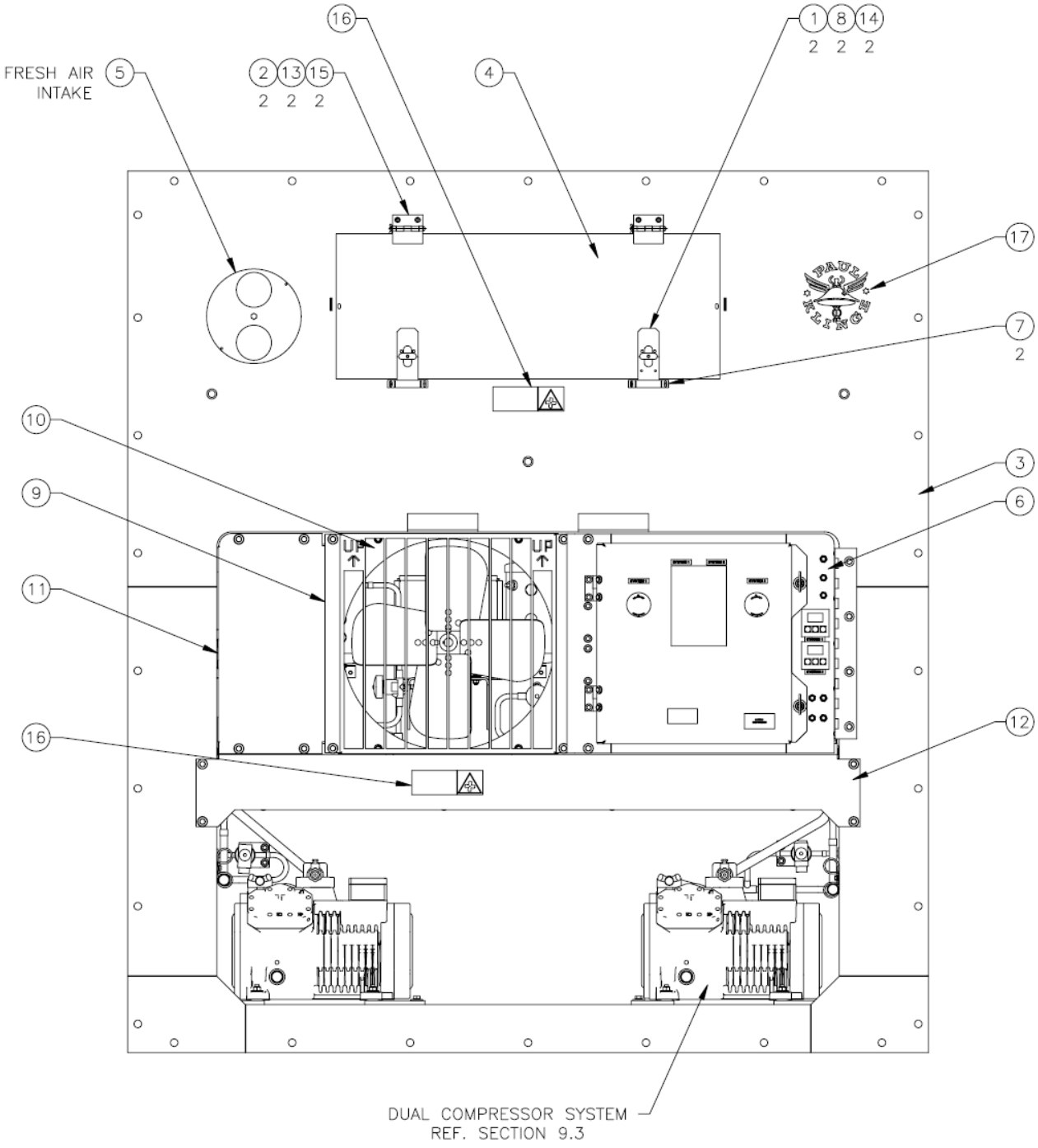
Input power	3 x 230V +/- 10% 60 Hz +/- 2.5% 3 x 380/460V +/- 10% 50/60 Hz +/- 2.5%
Compressor full load at 0.8 bar(12 psig) suction and 12.65 bar(185 psig) discharge	8 amps
Condenser fan motor 0.6 KW 1140 RPM	1.4 amps
Evaporator fan motor 0.6 KW 1725 RPM	1.3 amps
Heaters cross each of the three phases at the heater contactor	6 amps
Full load current	12 amps
Total start current	60 amps
Total power consumption	7.3 amps

8.6 Unit Information Refrigeration

System R-404a charge Check at 0°C (32°F) container temperature	4.2 kg (9.1 lbs.)
Compressor oil charge	5 Qt. (4.7L) Polyester oil only
High pressure switch Open approximate Close approximate	 325 psig (22.4 bar) on rise 230 psig (15.9 bar) on fall
Overheat switch Open approximate Close approximate	 54°C (130°F) 32°C (90°F)
Fusible plug in receiver blows at the approximate temperature	 100°C (212°F)
Expansion valve superheat setting point	See TXV adjustment in section seven
Unload Pressure Switch Close approximate Open approximate	 290 psig (20 bar) on rise 230 psig (15.9 bar) on fall
Unit weight	528 kg (1157 lbs)

SECTION NINE – SERVICE PARTS PFR 582

9.1A PFR-582 Unit (Front View)

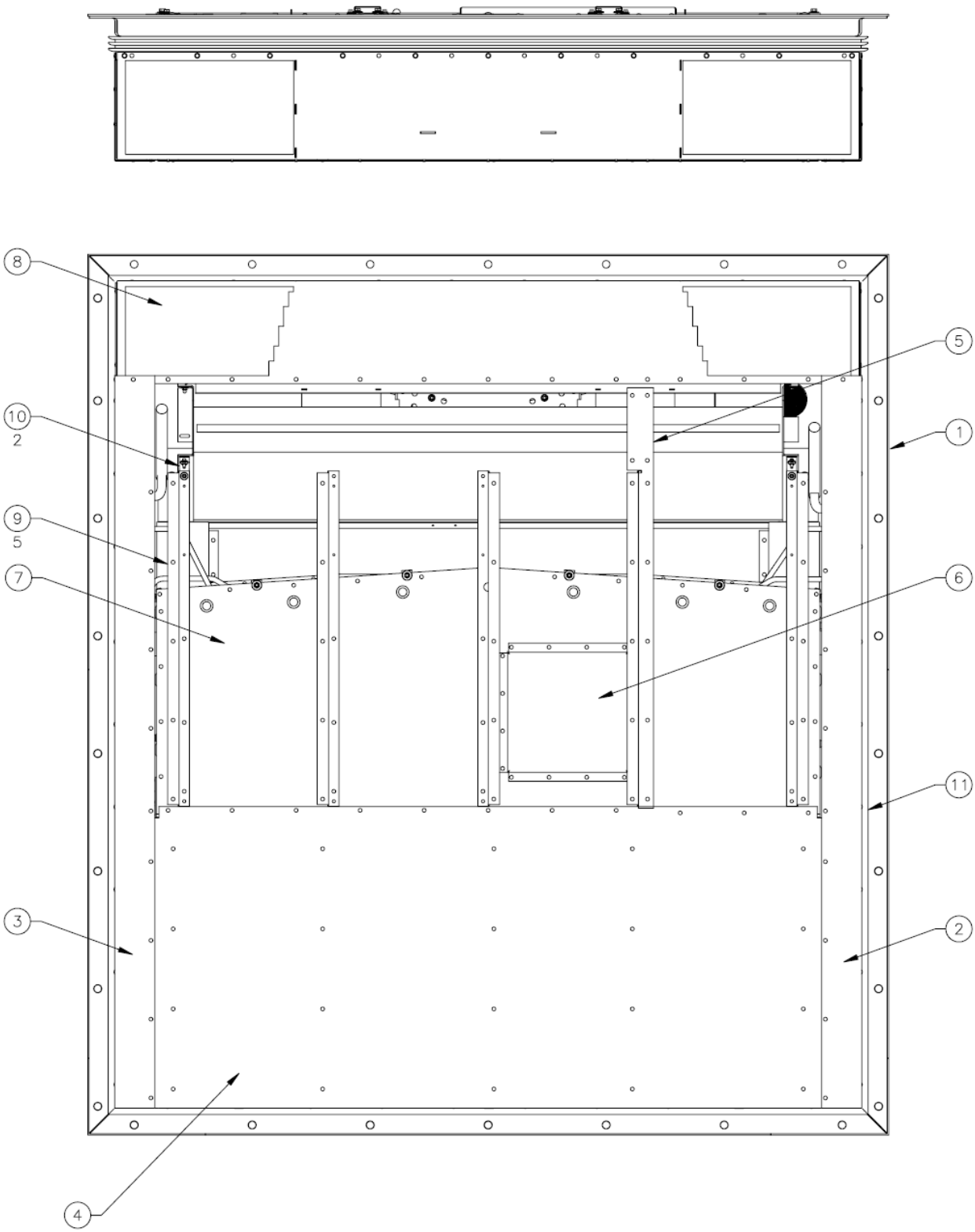


SECTION 9.1A
PFR 582 DUAL REFRIGERATION UNIT ASSEMBLY - FRONT VIEW

9.1A Parts List – PFR-582 Unit (Front View)

ITEM	PART NO.	DESCRIPTION	QTY.
	460-16050-00	**ASSEMBLY REFRIGERATION UNIT (PFR 582)**	
1	360-07969-00	LATCH, EVAPORATOR DOOR	2
2	360-10929-00	PIN, HINGE	2
3	360-10996-20	FRAME ASSEMBLY, WELDED	1
4	360-11105-00	DOOR, EVAPORATOR ASSEMBLY	1
5	360-11106-00	VENTILATION DISK ASSEMBLY	1
6	360-13289-20	ELECTRIC BOX ASSEMBLY - COMPLETE	1
7	060-07964-00	KEEPER, EVAPORATOR DOOR LATCH	2
8	060-07971-00	KNOB, EVAPORATOR DOOR LATCH	2
9	060-10954-00	GRILL, CONDENSER FAN	1
10	060-10955-00	PANEL, FAN ORIFICE	1
11	060-10963-00	PANEL, TRANSFORMER COVER	1
12	060-53070-01	PANEL, CONDENSER COIL COVER	1
13	K21-16286-02	PIN, HITCH COTTER	2
14	K28-10873-00	INSULATOR, EVAPORATOR DOOR LACTCH	2
15	K29-18539-01	HINGE, LOOSE HALF	2
16	K35-04602-00	LABEL - "CAUTION FAN STARTS AUTOMATIC"	2
17	K35-51577-00	LABEL LOGO - "PAUL KLINGE"	1

9.1B PFR-582 Unit – (Rear View)



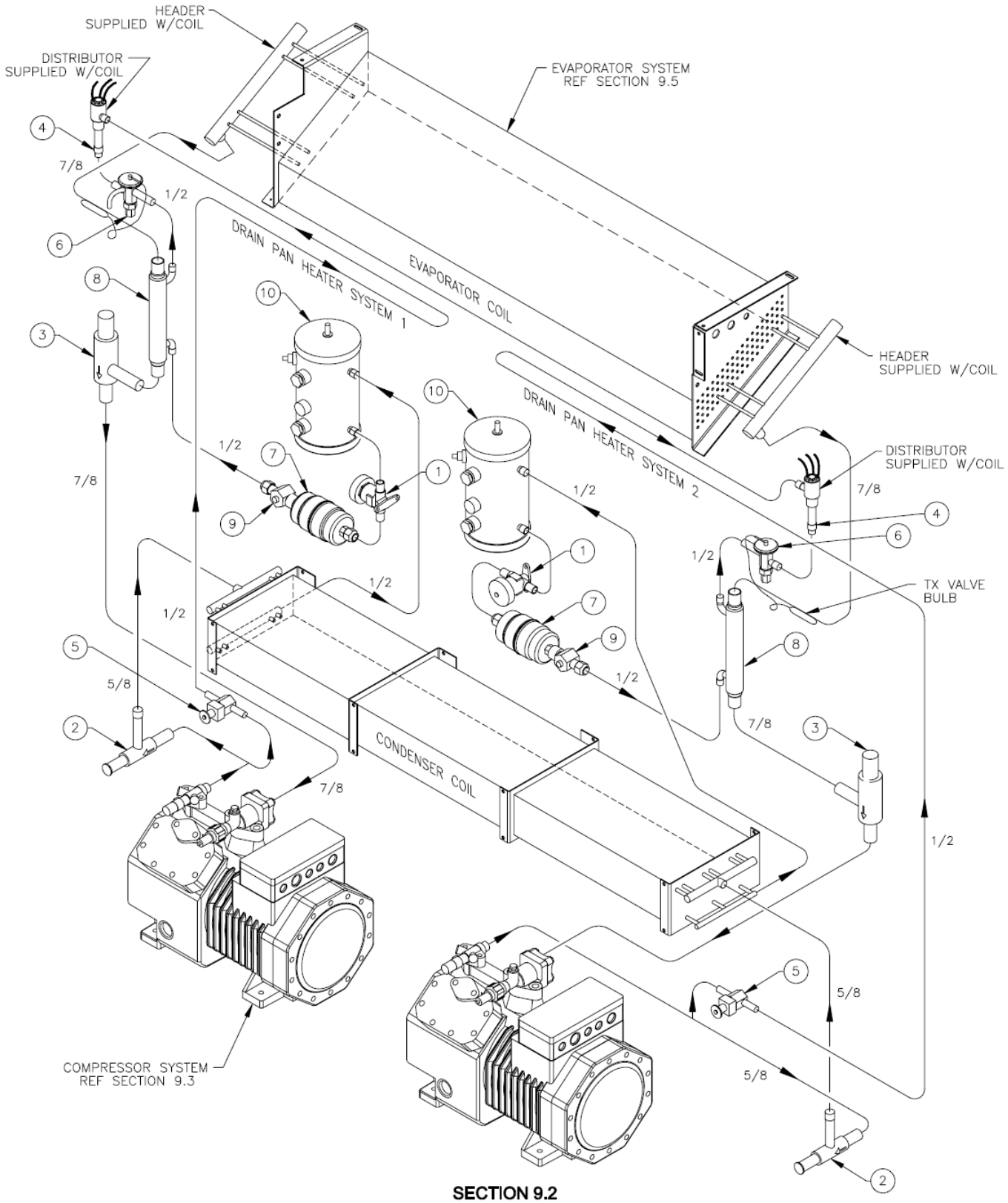
SECTION 9.1B
PFR 582 DUAL REFRIGERATION UNIT ASSEMBLY - REAR VIEW

9.1B Part List – PFR-582 Unit – (Rear View)

SECTION 9.1B **PARTS LIST - PFR 582 UNIT (REAR VIEW)**

ITEM	PART NO.	DESCRIPTION	QTY.
1	360-10996-20	FRAME ASSEMBLY, WELDED	1
2	060-11134-00	PANEL, SIDE RH	1
3	060-11135-00	PANEL, SIDE LH	1
4	060-11137-00	PANEL, BOTTOM REAR	1
5	060-12321-00	ANGLE, RECORDER PROBE ACCESS	1
6	060-16086-00	COVER - CONDENSER MOTOR	1
7	060-54301-20	PANEL, TOP REAR	1
8	060-54334-00	PANEL, REAR BLOWER COVER	1
9	060-54344-00	SUPPORT, AIR DUCT "Z" TOP	5
10	060-54345-00	BRACKET, EVAPORATOR MOUNT	2
11	K28-10858-00	GASKET,	30FT

9.2 Piping Schematic Dual Refrigeration Unit

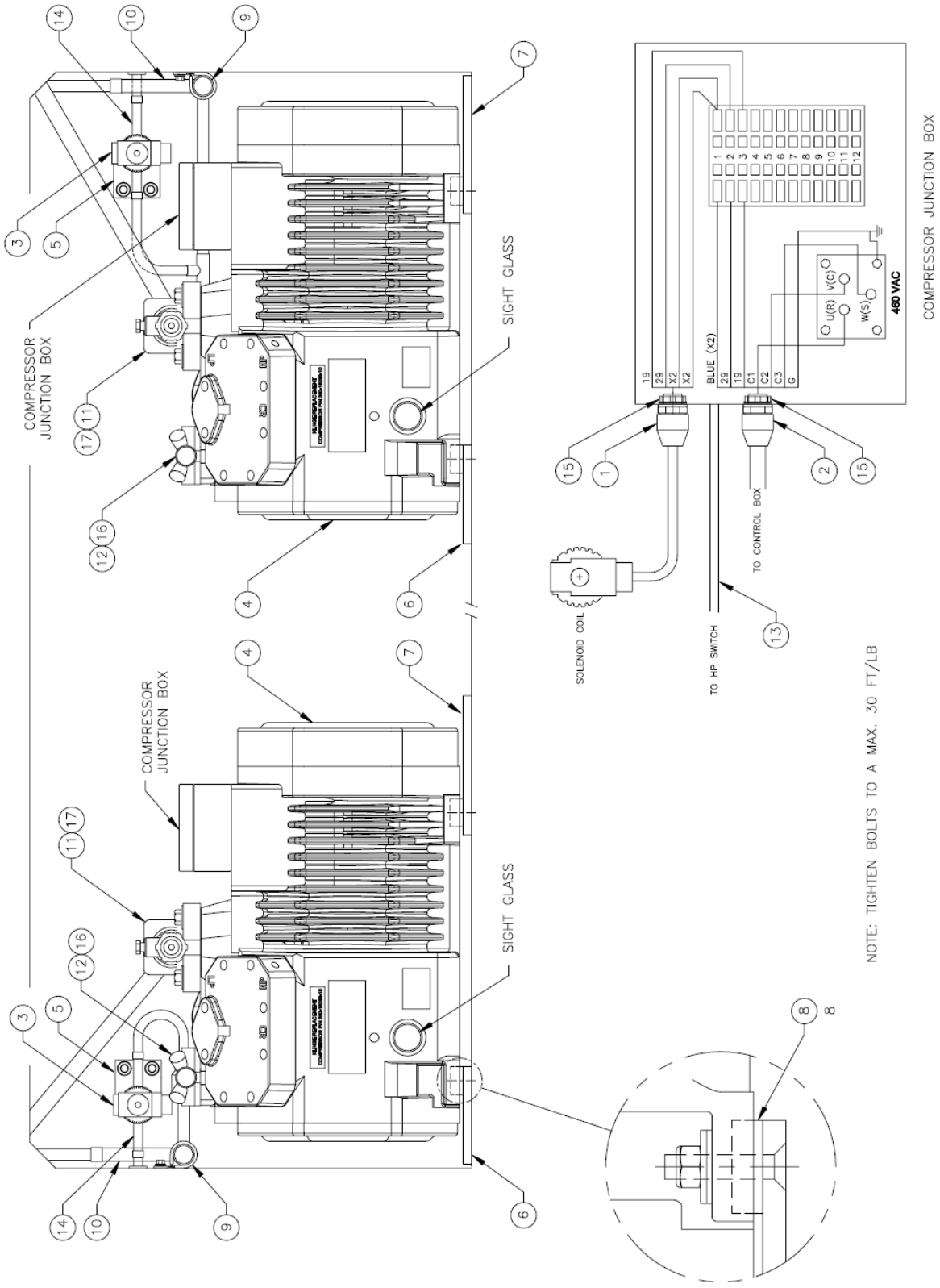


SECTION 9.2
PIPING LAYOUT
DUAL REFRIGERATION UNIT - PFR 582

9.2 Parts List – Piping Schematic Dual Refrigeration Unit

ITEM	PART NO.	DESCRIPTION	QTY.
	K35-06027-20	PIPING SCHEMATIC	
1	K22-01672-00	VALVE, HAND SHUT-OFF 1/2C BRASS	2
2	K22-06911-13	VALVE, DISCHARGE PRESSURE 5/8C 120 PSI	2
3	K22-06950-11	VALVE, SUCTION 7/8C 35 PSI SHORT LEGS	2
4	K23-13160-08	REDUCER COUPLING, 5/8C X 1/2C	2
5	K25-26089-00	VALVE, SOLENOID 1/2 ODF NORMAL CLOSED	2
6	K25-26093-00	VALVE, TX 1/2C X 1/2C 2.5-3.0 TON	2
7	K26-10795-00	FILTER DRIER, 1/2 MFL	2
8	K26-17451-01	HEAT EXCHANGER, 7/8C X 1/2C	2
9	K26-22196-00	MOISTURE INDICATOR, 1/2MFL X 1/2FFL	2
10	K26-51758-00	RECEIVER, 5.0" OD X 10.0" LG W/ SIGHT GLASSES	2

9.3 Dual Compressor Assembly

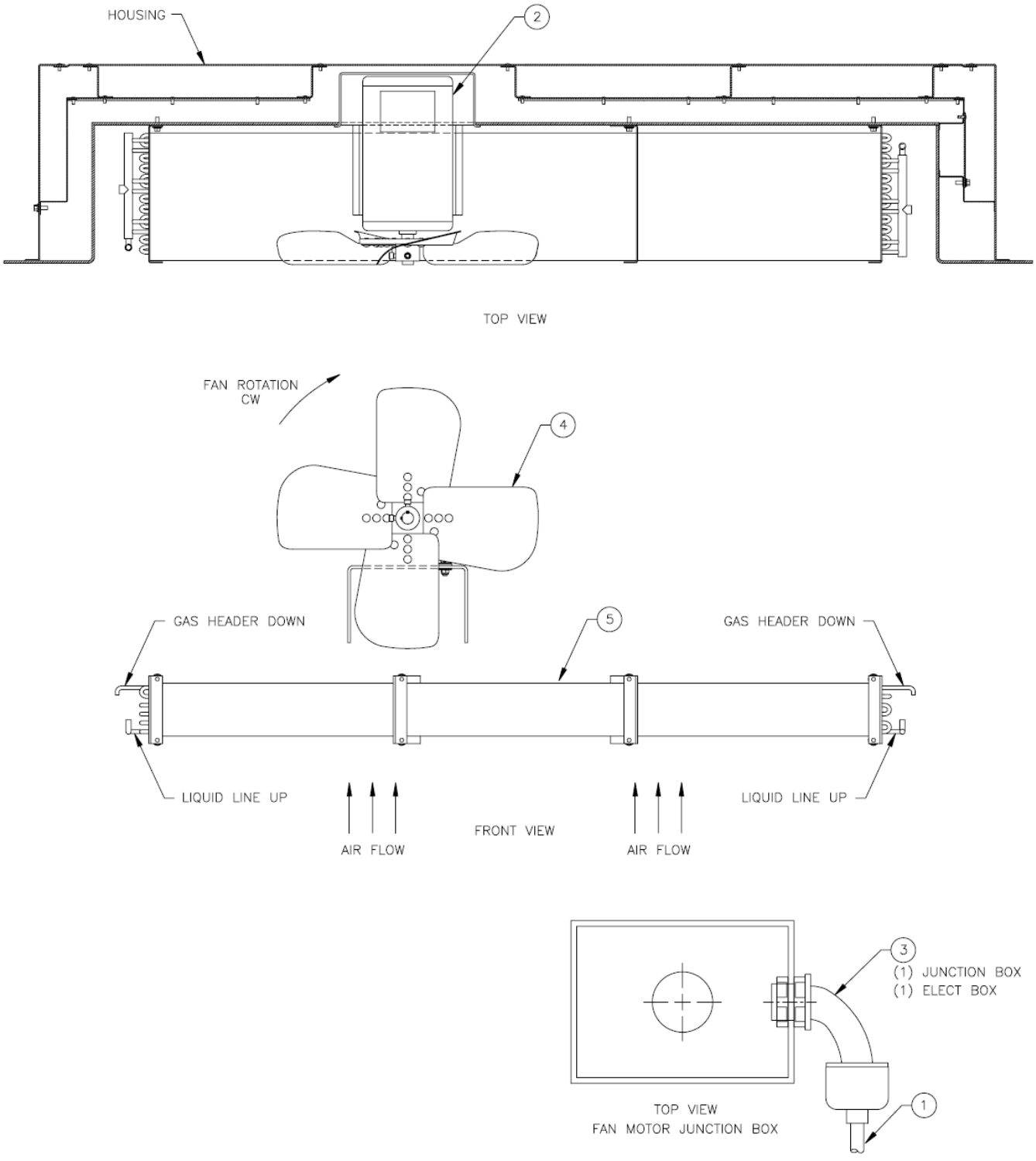


SECTION 9.3
DUAL COMPRESSOR ASSEMBLY - PFR 582

9.3 Parts List - Dual Compressor Assembly

ITEM	PART NO.	DESCRIPTION	QTY.
	360-16099-01	COMPRESSOR ASSEMBLY (PFR-582)	
1	360-10893-00	CABLE, COMPRESSOR TO HOT GAS	2
2	360-11786-40	CABLE, COMPRESSOR TO ELECT. BOX	2
3	360-14789-00	COIL SOLENOID, 1/2 NPT	2
4	360-16099-00	COMPRESSOR, 4 CYL 4 POLE	2
5	060-14897-00	BRACKET, HOT GAS VALVE	2
6	060-15716-01	MTG PLATE, LEFT HAND	2
7	060-15716-02	MTG PLATE, RIGHT HAND	2
8	060-15716-03	SPACER	8
9	K21-15649-15	CLAMP CUSHION, SS 1-1/4 ID	2
10	K22-06911-13	VALVE, DISCHARGE PRESSURE REG. 5/8C 120 PSI	2
11	K22-06914-01	VALVE, SUCTION 7/8	2
12	K22-06954-00	VALVE, DISCHARGE 5/8	2
13	K25-22382-01	CONDUIT, PLASTIC SPLIT 0.35 ID	FT
14	K25-26089-00	VALVE, SUCTION 1/2 ODF NORMAL CLOSED	2
15	K25-26340-02	LOCKNUT CONDUIT, BLK PLASTIC 1/2" ID	2
16	K28-04836-00	SEAL, TEFLON 0.88" ID 1.00" OD 0.06" TK	2
17	K28-10889-00	GASKET DISCHARGE, 2 HOLE	2

9.4 Condensing Section Assembly

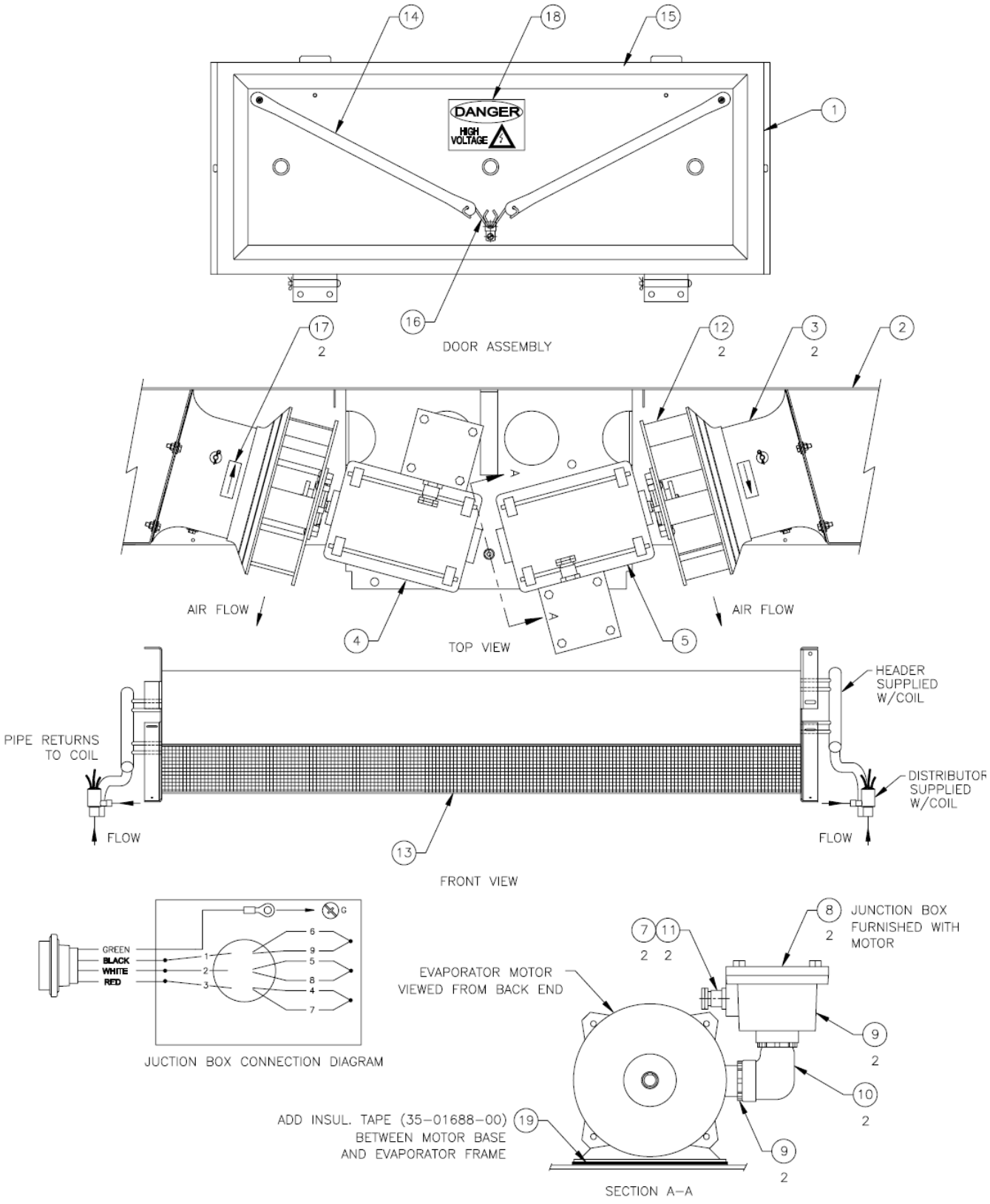


SECTION 9.4
CONDENSING SECTION ASSEMBLY - PFR 582

9.4 Parts List – Condensing Section Assembly

ITEM	PART NO.	DESCRIPTION	QTY.
1	360-16102-00	WIRE HARNESS, FAN TO ELECT BOX 7 WIRE	1
2	K24-22151-01	MOTOR, CONDENSING FAN	1
		2.5 HP, 1750 RPM, DUAL, 368/460VAC	
3	K25-26113-02	CONNECTOR, 90 DEGREE PLASTIC LIQUID TIGHT	2
4	K26-24874-00	FAN, 4 BLADE, 20.75 DIA, 7/8 BORE, CW	1
5	K26-25153-00	COIL, CONDENSER, DUAL	1

9.5 Dual Evaporator Blower Assembly

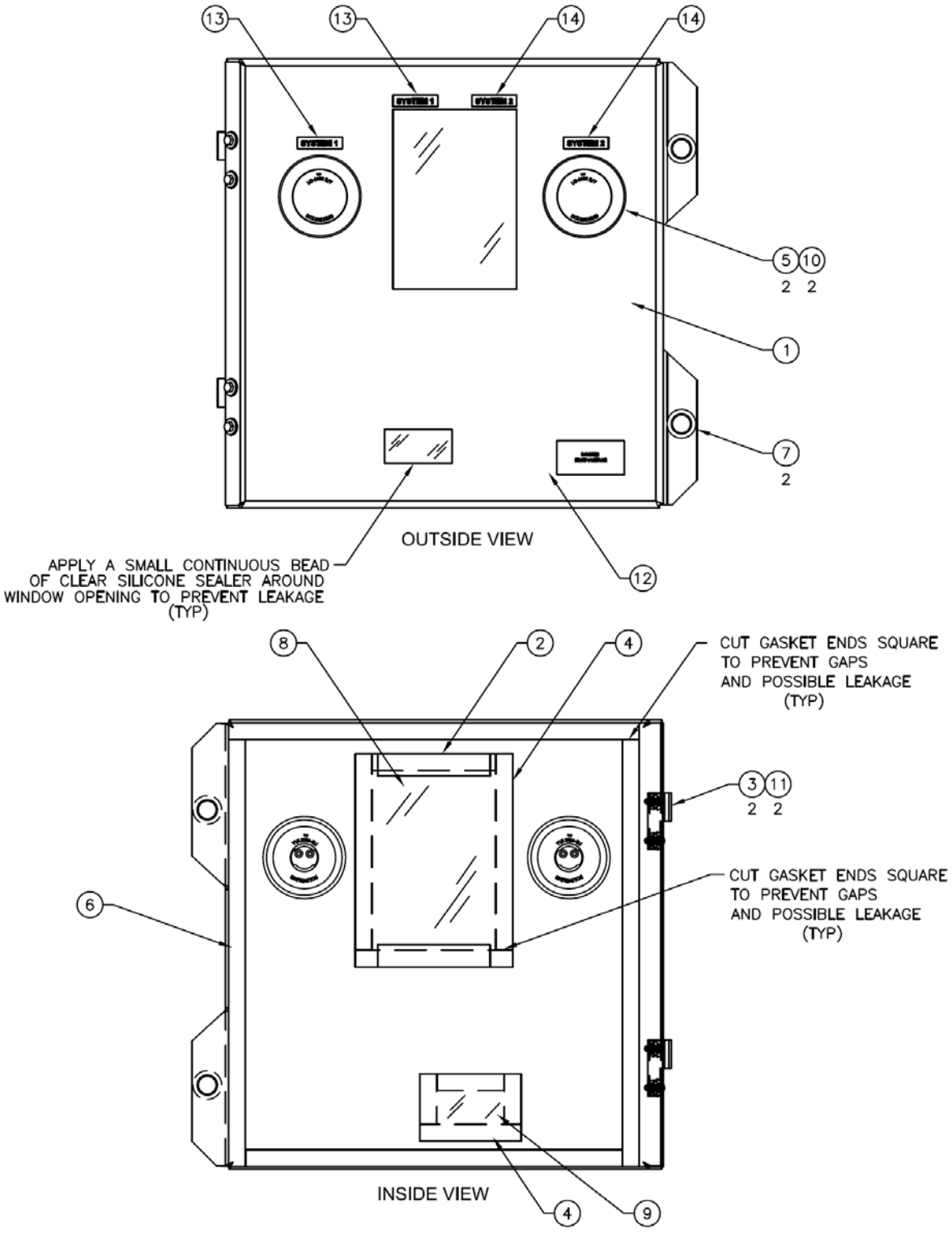


SECTION 9.5
DUAL EVAPORATOR BLOWER ASSEMBLY - PFR 582

9.5 Parts List – Dual Evaporator Blower Assembly

ITEM	PART NO.	DESCRIPTION	QTY.
	360-12398-20	EVAPORATOR BLOWER ASSEMBLY (PFR-582)	
1	360-11104-00	DOOR, EVAPORATOR WELDED AND INSULATED	1
2	360-11394-00	FRAME, EVAP BLOWER WELDMENT	1
3	360-16089-00	EVAPORATOR BLOWER RING AND DAMPER	2
4	360-16103-01	MOTOR EVAP FAN SYS, 1/4 HP 1800RPM LH CCW	1
5	360-16103-02	MOTOR EVAP FAN SYS, 1/4 HP 1800RPM RH CCW	1
6	K21-15610-05	CLAMP CUSHION, SS 1/2 ID	1
7	K23-13042-11	BUSHING, PIPE HEX BRASS 1MPT	2
8	K24-22422-00	JUNCTION BOX, INCLUDED WITH MOTOR	2
9	K25-11013-00	LOCKNUT, CND CS 1.00" DIA	4
10	K25-26511-03	ELBOW, CONDUIT 90 1.00" NPT	2
11	K25-26570-02	GLAND, CABLE ATEX BRASS 1/2MPT	1
12	K26-25139-00	IMPELLER CENTRIFUGAL, 11" DIA 1-1/4" SHAFT DIA	2
13	K26-25191-00	COIL EVAPORATOR SLANTED	1
14	K28-10691-00	STRAP, 15in LONG (NO HOOKS)	2
15	K28-10860-00	GASKET, EVAPORATOR DOOR	9.0FT
16	K29-18490-00	STRAP HOOK, SS .125 WIRE	2
17	K35-05606-00	LABEL, ARROW	2
18	K35-05683-00	LABEL, "DANGER HIGH VOLTAGE"	1
19	K35-01688-00	TAPE INSUL, 2" WIDE	1.5FT

9.6 Electrical Box Door Assembly

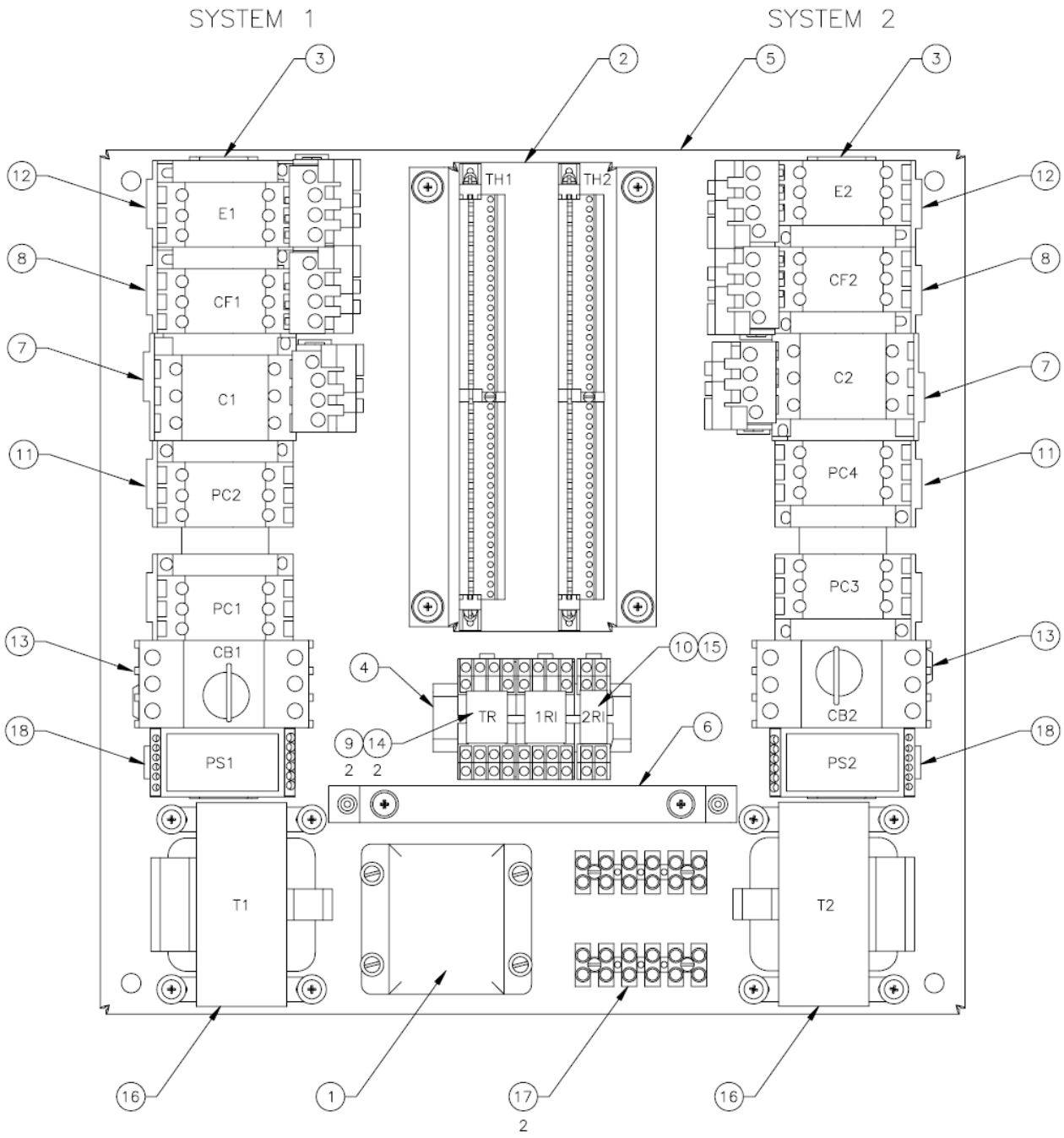


SECTION 9.6
ELECTRICAL BOX DOOR ASSEMBLY -PFR 582

9.6 Parts List – Electrical Box Door Assembly

ITEM	PART NO.	DESCRIPTION	QTY.
	360-13249-20	ELECTRICAL BOX DOOR ASSEMBLY (PFR-582)	1
1	060-13251-20	DOOR, PAINTED & SILKSCREENED	1
2	060-07422-07	STRIP SPONGE 1.0"W x 3/4 TK x 5.0" LG	2
3	060-09113-00	INSULATOR HINGE	2
4	K13-02951-00	TAPE, ADHESIVE DBL SIDED 3M 3/4" W	5FT
5	K25-26579-00	LAMP, ALRM RED	2
6	K28-10813-00	STRIP SPONGE, ADHESIVE BACK 3/4" W X 3/8" TK	8FT
7	K28-10847-04	GROMMET, 7/8 ID	2
8	K28-10849-01	WINDOW, ELECT BOX DOOR (PFR-872)	1
9	K28-11036-00	WINDOW, DATA LOGGER	1
10	K28-11052-00	GROMMET, ELECT ALARM LIGHT	2
11	K29-17880-01	HINGE, STAINLESS STL 9/32 HOLES MTG HOLES	2
12	K35-05899-00	LABEL, "DANGER HIGH VOLTAGE"	1
13	K35-06041-00	LABEL, "SYSTEM 1"	2
14	K35-06042-00	LABEL, "SYSTEM 2"	2

9.7 Electrical Sub-Panel Assembly

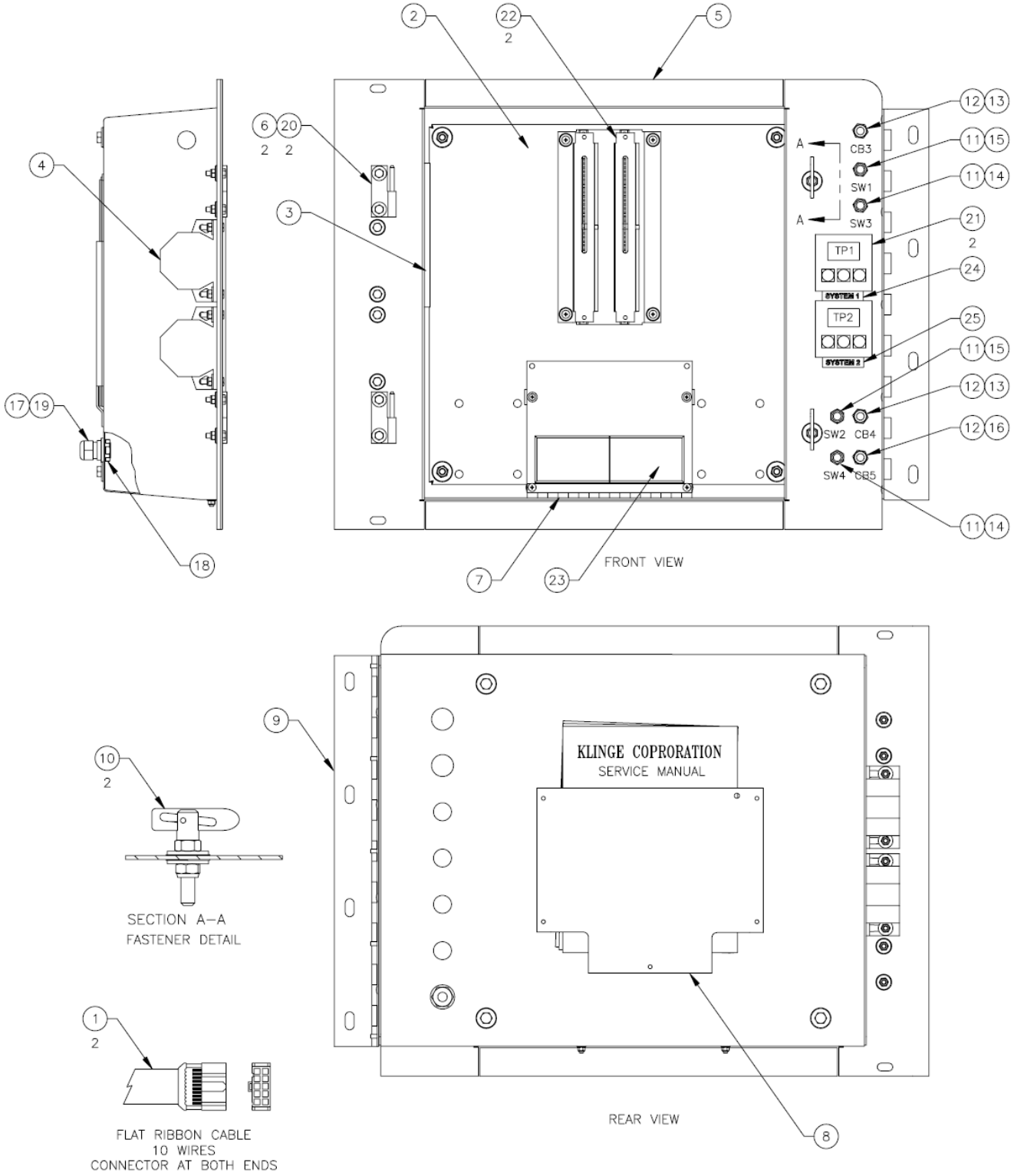


SECTION 9.7
ELECTRICAL SUB-PANEL ASSEMBLY - PFR 582

9.7 Parts List – Electrical Sub-Panel Assembly

ITEM	PART NO.	DESCRIPTION	QTY.
	360-13249-20	ELECTRICAL SUB-PANEL ASSEMBLY (PFR-582)	1
1	360-12473-18	CHARGER BATTERY, 12VDC 3A 115VAC	1
2	360-15907-01	BRACKET THERMOSTAT ASSEMBLY (PFR-582)	1
3	060-13054-00	RAIL MOUNTING DIN, #3 X 13.00in LG	2
4	060-13055-03	RAIL MOUNTING DIN, #3 X 4.00in LG	1
5	060-13247-20	SUB-PANEL, (PFR-582)	1
6	060-15906-01	BRACKET, (DATA LOGGER)	1
7	K21-22147-00	STARTER, 16AMP, 3 POLE, 24VAC, 50/60HZ	2
8	K21-22149-00	STARTER, 9AMP, 3 POLE, 4-620L, 24V	2
9	K24-22264-00	RELAY, 24VAC COIL, MINI 4PDT, 5AMP	2
10	K24-22264-01	RELAY, 12VDC COIL, MINI DPDT, 3AMP	1
11	K24-22321-00	CONTR REVERSING, 12A, 6 POLE, 24VAC	2
12	K24-22326-00	STARTER, 9AMP, 3 POLE, 4-620L, 24V	2
13	K24-22363-25	CIRCUIT BREAKER, IEC, 3 POLE, 19-25 AMP	2
14	K25-26265-00	SOCKET RELAY, 4PDT, 1/8 DIN MTG	2
15	K25-26265-02	SOCKET RELAY, DPDT, 1/8 DIN MTG	1
16	K25-26404-00	TRANSFORMER, 180VA 460V 110/24/12 LAB	2
17	K25-26488-06	TERMINAL BLOCK, 6 POLE	2
18	K31-00809-00	SENSOR PHASE, 440V W/LABEL	2

9.8 Electrical Box Assembly



SECTION 9.8
ELECTRICAL BOX ASSEMBLY - PFR 582

9.8 Parts List – Electrical Box Assembly

ITEM	PART NO.	DESCRIPTION	QTY.
1	360-12540-04	CABLE RIBBON SHIELD, 24in LG 10 WIRES	2
2	360-13246-20	SUB-PANEL ASSEMBLY, (PFR-582)	1
3	360-13396-01	BATTERY ASSEMBLY, 12V 2.3AH RECHARGEABLE	1
4	360-15965-20	HORN ASSEMLY	1
5	360-53077-20	ELECTRICAL BOX WELDMENT, PAINTED	1
6	060-09113-00	INSULATOR HINGE	2
7	060-14268-00	HINGE, DATA LOGGER MTG	1
8	060-14785-00	HOLDER DOCUMENT	1
9	060-16081-00	HINGE MOUNTING, ELECTRICAL BOX	1
10	K21-16313-00	FASTENER BABY ANTILUSE, 8M-1.25	2
11	K24-17239-00	BOOT, TOOGLE SWITCH	4
12	K24-18164-00	BOOT, CIRCUIT BRK 3/8-27 THD	3
13	K24-20565-00	CIRCUIT BREAKER, 8 AMP 250V 1 POLE	2
14	K24-21355-00	SWITCH TOGGLE, SPDT #6 SCR	2
15	K24-22144-00	SWITCH TOOGLE, 3PST ON-OFF #6 SCR	2
16	K24-22330-00	CIRCUIT BREAKER, 4 AMP 250V 1 POLE	1
17	K25-26129-03	CONNECTOR STRAIGHT PLASTIC SHORT 1/2x.17-.45	1
18	K25-26147-01	SEAL RING PLASTIC, 1/2"	1
19	K25-26340-02	CONNECTOR LOCK NUT, CONDUIT 1/2	1
20	K29-17880-02	HINGE, SS SLIP W/PIN 9/32 MTG HOLES	2
21	K31-00811-00	THERMOSTAT TOUCH PAD	2
22	K31-00871-10	THERMOSTAT W/SAT COOL	2
23	K31-00902-22	TEMPERATURE RECORDER, (DATA LOGGER)	1
24	K35-06041-00	LABEL, "SYSTEM 1"	1
25	K35-06042-00	LABEL, "SYSTEM 2"	1

SECTION TEN - TEMPERATURE RECORDER

10.1 Introduction – Version 6 Temperature Recorder

This manual is a guideline for the installation and use of the Version 6 temperature recorders. To avoid guarantee exclusion due to improper installation, it is essential to follow the instructions and recommendations of this manual.
Version 6 recorders are developed and produced to conform to the applicable European and National norms, for the delivery of chilled and frozen foods in transport vehicles.
Version 6 recorders can provide evidence of correct temperatures for every trip in the form of a delivery ticket; numerical or graphical print out. All data is stored with a date / time stamp in a large memory. Data will not be lost if power is lost. The real time clock is powered by an internal back-up battery.

This recorder will record the cargo temperature and has adjustable high and low temperature limits that the customer can set. The temperature limit control is inside the recorder. On our schematic this signal comes out of Euroscan com 1 and controls a double pole relay TR on our systems, the relay coil is shown on our schematic system 2 (See the electrical schematic for the PFR-582 system 2 this located on the system 2 door and manual pages 35 & 36) and is the (external temperature relay). If the temperature is within the adjustable limits (see manual section 10.13) of the external recorder (Euroscan) the relay contacts will be closed, but if there is a problem they will be open.

On the TR relay one set of contacts is used for each system and the signal goes to terminal 31 at the thermostat (see the electrical schematic) manual pages 35 & 36. If the temperature is outside the limits set in the recorder, the relay contact will be open. This will cause a timer in the thermostat to begin (the temp fail LED on the thermostat will come on) after 1 hour the unit alarms will activate and the horn and large lamp will flash. The system on primary will now become secondary and the secondary will now be primary. The alarms in the failed system will continue (the LED that caused the alarm will also be on - this should be noted before the unit is turned off) until the system is turned off and then on (reset).

See Section 1 for Alarm signal 5 (for addition information)

Turning the PFR-582 system off that shows an alarm will turn off and reset all the alarms in this system.

IMPORTANT: Data Security

Although the Version 6 recorder has been specifically designed and tested for use in the harsh vehicle environment, there are certain circumstances beyond our control. For example lightning strikes, theft, manipulation, etc.., could cause data loss. Because the temperature data might be crucial to providing evidence in the case of food losses, we strongly advise you to take the following precautions:

- Print or download data to a PC on a weekly basis as back up.
- For a long-term storage of data we recommend to down-load the data using the

supplied cable 360-12360-02 & free computer software down-load basic data from the internet at www.klingecorp.com\ manuals\ temperature recorders\ recorder version 2 & 3 download software tool.
OPTIONAL
data logging software K31-009003-12 and infrared scanner K31-00903-13

- Check the correct functioning of recorder frequently
- Check recording system every 12 months to see if the measurement is within the legal error limit.
- Do not weld without disconnecting the power from the recorder or vehicle.
- Do not take the power supply from a generator system without extra filter protection against high voltage peaks. Preferably always take power from the vehicle of fridge battery.
- Follow the installation and user instructions in this manual.

10.2 General description

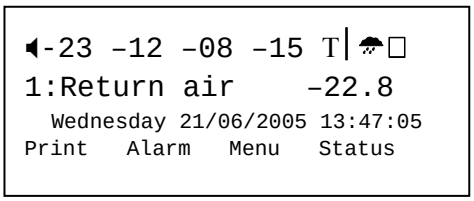
The control panel of the Recorder consists of three main components:

1. LCD display
2. Keyboard
3. Printer (optional)

10.2.1 LCD display

When checking the temperature, use a thermometer of known accuracy. Position the test thermometer sensing bulb or probe adjacent to the recorder's thermal sensing bulb.
The display has four lines of information, showing the following content in the operating mode.

Line 1: Alarm activated; temperatures; status of digital inputs
Line 2: Rotating display of each temperature to an accuracy of 1 decimal point with sensor name
Line 3: Day, date, and time with indication of summer/wintertime
Line 4: Description of the actual button functions



In every other mode the content of the display is dependent on the actual menu in use.

10.2.2 Keyboard

The recorder is completely menu controlled. All functions can be carried out via the four colored buttons (like printing, activate alarms or change parameters). The actual function of the buttons are always displayed on the bottom line (chapter 2). To navigate through the menus and change settings, two different kinds of button functions are applicable.

To navigate through the menus and to select in the edit mode a parameter from a table, use the buttons as described below:

Blue	↑	Previous item of the menu
	<	In edit mode: Next item from the list
Yellow	↓	Next item of the menu
	>	In edit mode: Previous item from the list
Green	**edit**	Menu select, change to edit mode or one menu level down
	accept	In edit mode: accept input and go to next menu point
Red	**<-Menu**	One menu level up
	<-Cncl	In edit mode: cancel input and display the non changed value. Press 2 seconds for rejecting input and go back to previous menu.

When entering free programmable text like names the button functions are as follows:

8

Blue	↑	Next character from the list
Yellow↓		Previous character from the list
Green	**<**	One character to the left
Red	**>**	One character to the right
Blue + Yellow	**<-cncl**	Cancel input and display the non-changed value. Press for 2 seconds to reject the input and go back to the previous menu.
Green + Red	**accept**	Accept input and go to next menu point.

10.2.3 Printer (optional)

The optional thermal printer is installed in the right side of the recorder. Due to the so called "Plug and Play concept" the printer can be retrofitted at any time without disconnecting the recorder from power. For retrofit, the existing mechanism will be exchanged for a mechanism with printer. To remove the printer or the housing, pull down clear plastic flap (in front of the printer). Printer slides forward and can be pulled out. After changing the paper please install the printer with the flap open and close the flap only after the printer is fully inserted.

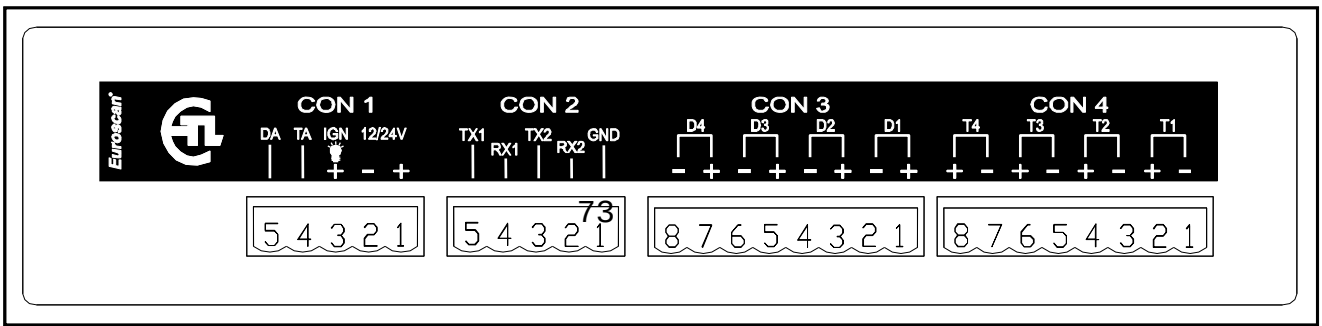
Note: a printout must be torn downwards over the edge of the bottom plastic part. A colored line on the last meter of a roll indicates that the paper roll needs to be replaced (Attachment B).

10.3 Power supply

The power supply must be connected directly to the vehicle or fridge battery. The included 10A (T) floating fuse must be fitted in the +power line as close as possible to the power connection. The recorder is suitable for a voltage between 10 - 36 Volt DC.

10.4 Connectors

As both versions are provided with identical PCBs the connections for temperature sensors, digital inputs and power supply are the same for both versions. On the back of the recorder you will find four connector blocks (see picture) each of them being described in detail in the next



paragraphs.

10.4.1 Connector block 1 (power supply and outputs)

Power supply

Connect power supply on pin 1 (+) and pin 2 (-). The recorder is suitable for a voltage between 10-36 Volt DC. Power consumption when printing is 25W.

Display background light (preferable for the R-version)

Usually the display background light switches on after pressing any key and switches off automatically after some seconds if no further key is pressed. If a permanent background light is required while driving connect pin 3 to a vehicle ignition +signal. (Warning: never connect directly to vehicle battery).

Alarm outputs

Pin 4 and 5 are digital alarm outputs, pin 4 for a temperature alarm and pin 5 for a status alarm. Both outputs switch to ground in case of an alarm situation and are limited to 1A output current.

10.4.2 Connector block 2 (serial port)

The temperature recorder has two serial communication ports. These are used for a permanent connection with external devices. To be connected with a suitable connector (connector block 5-way, P/N ET-0300-15).

10.4.3 Connector block 3 (digital inputs)

The recorder offers the possibility to connect up to 4 digital inputs. Pins 1-8 are accordingly marked with D1-D4 (D1=Pins 1+2, ...). At every opening or closing of the input circuit a status change will be recorded into memory, but only if the input has been activated and configured correctly in the parameter settings. All four inputs as standard are de-activated, the next functions are pre-programmed: D1 = refrigeration, D2 = back door, D3 = defrost, D4 = side door. For the status inputs the polarity must be considered. Pins 2, 4, 6, and 8 are internally connected to ground. Pins 1, 3, 5, and 7 are signal inputs.

10.4.4 Connector block 4 (temperature inputs)

The recorder offers the possibility to connect up to 4 temperature sensors. Pins 1-8 are accordingly marked with T1-T4 (T1 = Pins 1+2, ...). Pins 2, 4, 6, and 8 are signal inputs and pins 1, 3, 5, and 7 are internally connected to ground. The polarity of the sensor cable is not relevant. In the factory settings inputs 1 and 2 are activated and pre-programmed as follows: T1 = return air,T2 = rear. Please note that a used input always has to be activated and configured in the parameter menu.

10.5 Configuration

After finishing the physical installation of the temperature recorder it should now be configured. All parameters are stored in a parameter file. After every standard installation a number of parameters need to be either checked or changed. Time and date are directly accessible in the user menu, all other settings are accessible via the pin code protected parameter menu. (Factory settings see Attachment C):

- Time, menu 3.1/Date, Menu 3.3
- Temperature inputs, menu 5, input T1 is preset as „return air“ and input T2 as “rear”. Both inputs are also activated for recording and printing.
- Vehicle ID, menu 10.4
- Header text, menu 10.5
- Sample rate, menu 10.3

10.6 Final testing standard installation

The following features must be checked after installation:

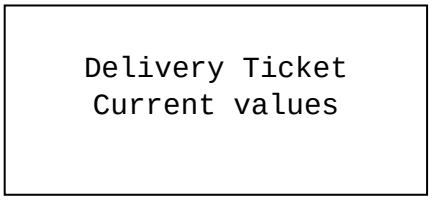
Power supply
The supplied power voltage is between 10V and 36V DC and protected with a 10A floating fuse. The power supply must be sufficient to offer 25W (if applicable check by printing any ticket).
Display/keyboard
The background light of the display must switch on after pressing any key (except if using the permanent background light function) and an acoustic signal can be heard. The display shows the actual temperatures of the activated temperature inputs.
Temperature sensors
After approximately 5 minutes the temperature must be correctly displayed. A value of -40°C indicates the possibility of a non connected sensor or a cable failure. A value of +50°C indicates a possible short circuit between the connector pins.

Additional installation
The following items are to be checked if applicable:
Printer
Test the printer by printing any ticket.
Status inputs
For each activated status input a small box appears in the top right hand of the display (pre-defined symbol, indicating that the corresponding input has been activated).
If the status of the input changes a symbol can be chosen instead of the box. This symbol appears and disappears according to the change of the status.
Alarm signal
The internal alarm signal (persistent buzzer) can be heard as soon as a defined temperature limit has been exceeded. In the case of an alarm an external signal is also activated if this is installed. Furthermore the corresponding temperature input will flash on the display. The internal signal buzzer can be switched off by pressing the yellow (alarm) key. The external signal and the flashing display will only stop after the temperature is back within the defined limits.

10.7 User menus

The recorder has four different user menus which are directly accessible via the keyboard:
- Print menu
- Alarm menu
- User settings menu
- Status menu

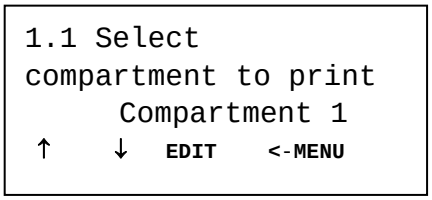
Print menu



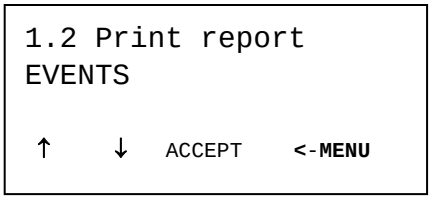
Pressing the blue button. The last selected print choice will be displayed. Printing starts after 2 seconds. Repeatedly pressing the blue button will scroll between the available print options: delivery ticket, journey ticket graphical, journey ticket numerical.

By pressing the blue button for more than 2 seconds the following sub-menus are reached:

Select compartment to print.
By pressing the green button you confirm that you wish to change the settings. The chosen compartment can be selected by pressing [↑] / [↓] and your choice can be confirmed with [edit].

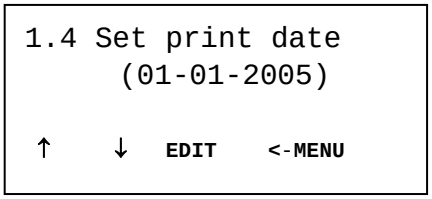


Print event report
By pressing the green button [ACCEPT] printing of the event report will start.

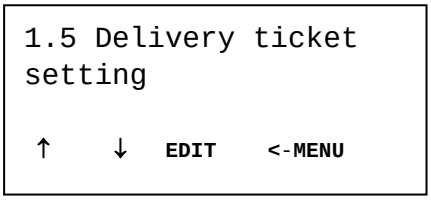


Print parameter report
By pressing the green button [ACCEPT] the parameter report will be printed after entering the correct pin code (1-2-1-2).

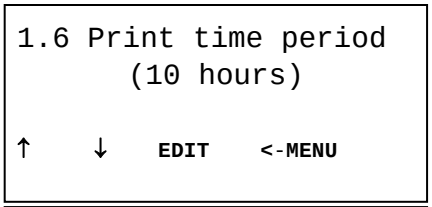
Set print date
With [EDIT] you can select a historical date for printing. After confirmation of the date with [ACCEPT] you can select the required report with the blue button. Printing starts after a delay of 2 seconds.



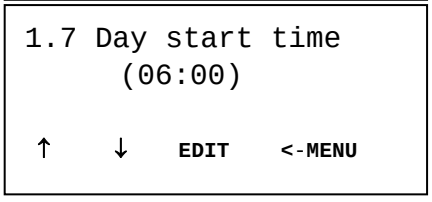
Delivery ticket settings
With [EDIT] you can set the desired information printed on the delivery ticket. You can select “actual value”, “actual + average” or “actual, average and min-max values”. By pressing the green button you confirm your choice.



Print time period
With this option you define the total print period.

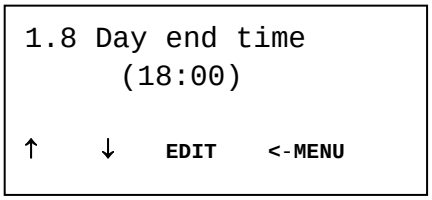


Day start time
This option defines the time which is taken as start time for the printout (printout is done backwards till this time).



Day end time

This option defines the time from which the printout is done backwards (please note that printout is always done backwards, i.e. from the day end time till start time).



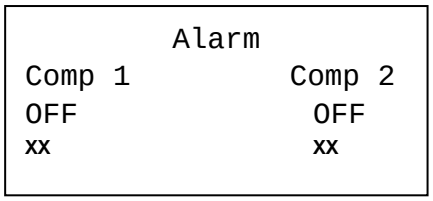
Examples:

- You want to make a printout for a certain date in the past for a time period which exceeds the day start time. Please change day start time to 0:00 h and enter the desired time period.
- You want to make a printout for 2 days. Please change time period to 2 days, day start time to 0:00 h and day end time to 0:00 h.

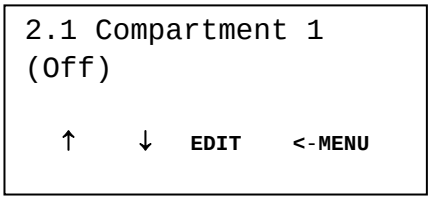
10.8 Alarm menu

Up to four different alarm types can be allocated to up to four different compartments. The various alarms (and compartments) are only available if the supervisor has preset and configured them in the parameter menu.

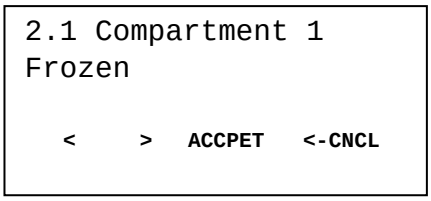
By pressing the yellow button you go to the alarm menu. You will get first information whether an alarm has been set for the two compartments.



When pressing the yellow button a second time you reach the options which can be changed. With [↑] / [↓] you toggle between the compartments available. The value given in brackets shows the actual setting. By pressing [EDIT] you can change alarms for the compartment which has been chosen before.



With [<] / [>] you select the desired alarm type (including alarm off). By pressing [ACCEPT] the chosen alarm will be activated. The display changes to the prior menu "Compartment 1"

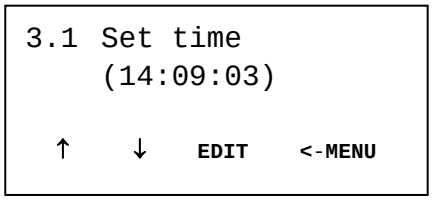


In case of an alarm condition an acoustic signal will be audible and on the display the corresponding temperature input will flash. After an alarm is accepted with the yellow button the acoustic signal will stop but the alarm remains active until the temperature is again within the limits (for each compartment a separate alarm can be activated).
By pressing the yellow key for more than 3 seconds you define a starting point for a dedicated journey (JOURNEY START – PRINT MARKER SET)

10.9 User settings menu

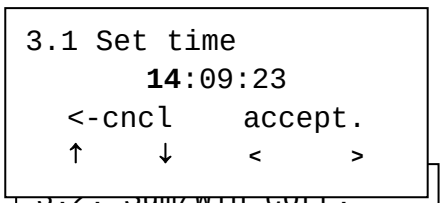
With the user settings several adjustments can be done to offer the user a maximum of user convenience. By pressing the green button the user setting menu will be activated.

Toggle with [↑] / [↓] between the available menu options (3.1; 3.2; 3.3; …). Between brackets „(..)" the actual setting is displayed. With [EDIT] you enter the edit mode in order to change the settings to your convenience. The following pictures show the display in the edit mode.

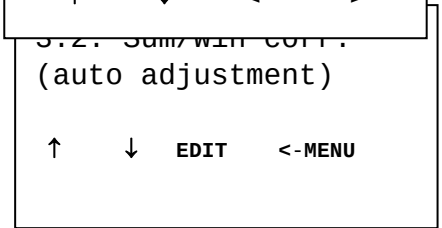


Set time

Select hours, minutes, and seconds with [<] / [>] and adjust with [↑] / [↓]. Confirm the setting with [accept] (green-red).



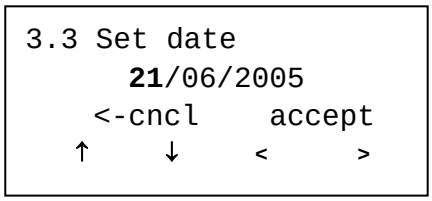
Summer/Winter time correction



If you do not want an automatic adjustment of summer and winter time you could define this here.

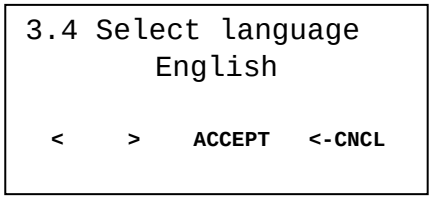
Set date

Select date, month, and year with [<] / [>] and adjust with [↑] / [↓]. Confirm setting with [accept] (green-red).



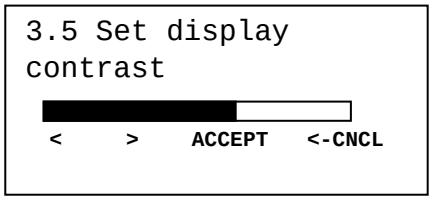
Select language

Select the desired language with [<] / [>] and confirm with [accept].



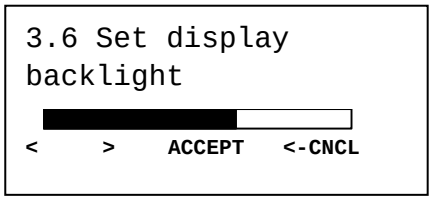
Set display contrast

Set the desired display contrast [<] / [>] and confirm with [ACCEPT].

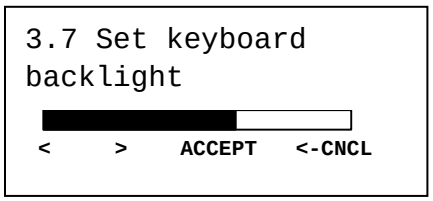


Set display backlight

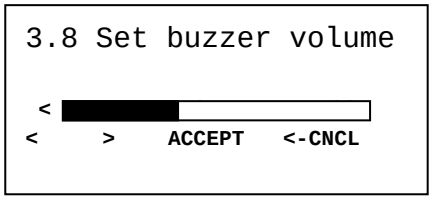
Set the intensity of the backlight to your convenience [<] / [>] and confirm with [ACCEPT]. The light switches on when you press any button and switches off after 30 seconds



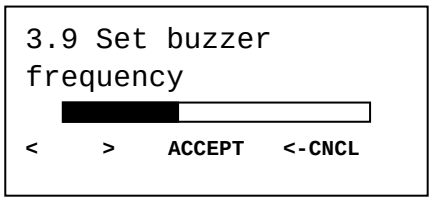
Set keyboard backlight
Set the intensity of the backlight to your convenience with [<] / [>] and confirm with [ACCEPT]. The light switches on when you press any button and switches off after 30 seconds.



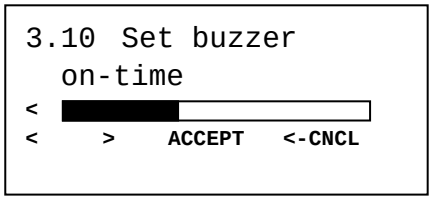
Set buzzer volume
Change the buzzer volume with [<] / [>] and confirm with [ACCEPT].



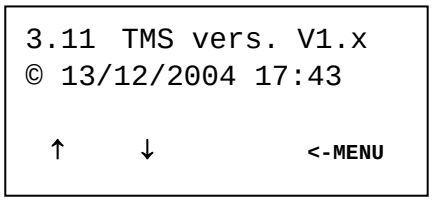
Set buzzer frequency
Change the buzzer frequency with [<] / [>] and confirm with [ACCEPT].



Set buzzer on-time
Change the buzzer on-time with [<] / [>] and confirm with [ACCEPT].

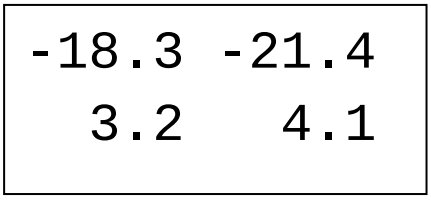


TMS Vers. V1.x
Displays the actual software version of the recorder



10.10 Status menu

Press red button. The display mode will change between full menu information or only showing actual temperatures enlarged:



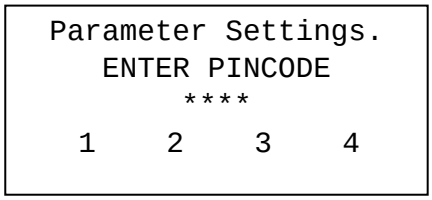
T1 T2
T3 T4

In order to return to the main display please press either the blue, yellow or green button.

10.11 Parameter menu

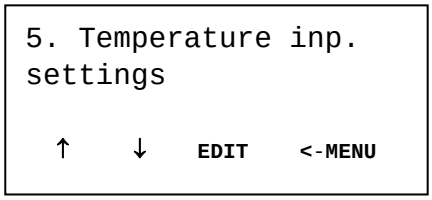
The recorder has been designed to enable a multiple number of desired applications for individual customers. By using the corresponding parameter settings you can adjust the recorder functionality to the required needs. This chapter gives an overview and structure of the various parameters available.

To enter the parameter menu press the green button for 2 seconds. The display will show: "ENTER PINCODE"
The factory setting of the pin code is 1111 but can be adjusted by the supervisor at any time (Item 10.6).



After entering the correct pin code you have access to the parameter menu and the first menu level is displayed. Select the desired item with [↑], [↓] and press [EDIT] to enter one of the following options:

Temperature inputs settings
Digital inputs settings
Compartment settings
Alarm settings
Printer settings
General settings
Communication settings

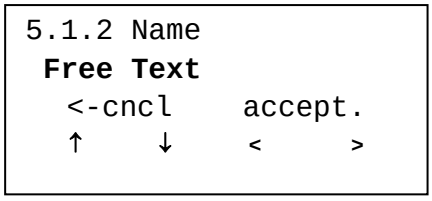


10.12 Temperature inputs settings

4 inputs for temperature measurements, you can switch on/off each input and assign a name depending on the sensor position. Standard input 1 is preset as "Return air" and input 2 as "Rear".

T1 Input >on/off
If „on" input 1 will be measured, displayed and stored into memory. Printing of input 1 is assigned in the compartment setting (menu item 7). **If „off" go to item 5.2.**

Type >Temperature
You can select a sensor type (temperature or relative humidity)
Name >Return air
You can select a sensor name from the table or enter a free text (free text is not translated when changing the language).
***Name* for** >free text
Enter a text as desired via the four buttons



T2 input >on/off, menu structure as 5.1.

T3 input >on/off, menu structure as 5.1.

T4 input >on/off, menu structure as 5.1.

10.13 Digital inputs settings

4 inputs for status recording, any input can be switched on/off, assigned with a name and inverted polarity. A number of names are available as a factory setting, to be selected from a list.

In the operating mode you can see on the display which inputs are activated. An empty small box indicates that the input is active and the status "low". When the status is "high", depending on the assigned function a corresponding symbol is displayed (Refrigeration =], Defrost=☂, Door contact=▏, Other=▤)

Digital input 1 >on/off

If „on" every input status change on D1 will be displayed and recorded with a date/time stamp.

Name >Refrigeration

Select a sensor name from the list or enter a free text (free text is not translated when changing the language).

Active >high/low

Input polarity switch. Switch function if "high": contact closed = input active. If "low": contact open = input active (applicable for door contacts, active = open)

Alarm >on/off

ON in order to activate alarm for this input. In this case you get the following option:

Delay time >10 minute(s)

Alarm delay time given in minutes

Digit. input 2 >on/off, menu structure as 6.1

Digit. input 3 >on/off, menu structure as 6.1

Digit. input 4 >on/off, menu structure as 6.1

10.14 Compartment settings

In this menu you have to configure the print and alarm functions for up to maximum 4 compartments. Per compartment one name can be assigned like FRONT, BACK, SIDE. The user is able to print a ticket or activate an alarm per compartment

Compartment 1 >on/off

Activates or deactivates compartment 1.

Compart. name >compartment 1

The name for a compartment needs to be set as a free text and will not be translated when changing the language

Print T1 >on/off

Alarm on T1 >on/off

Print T2 >on/off

Alarm on T2 >on/off

Print T3 >on/off

Alarm on T3 >on/off

Print T4 > on/off

Alarm on T4 > on/off

Print D1 > on/off
Print D2 > on/off
Print D3 > on/off
Print D4 > on/off

Compartment 2 > on/off, menu structure as menu 7.1

Compartment 3 > on/off, menu structure as menu 7.1

Compartment 4 > on/off, menu structure as menu 7.1

10.15 Alarm settings

4 groups – each with a name to assign, upper and lower temperature limit and a delay time. Each enabled alarm type can be activated by the user for any compartment, although per compartment only one alarm group can be set at the same time.

Alarm Group 1 >on/off

Name >Frozen

You can select a preset alarm group from a list or enter a free text (free text is not translated when changing the language).

Upper limit >-15 °C

Lower limit >-30 °C

Delay time >45 minutes, delay time for alarm activating

Alarm Group 2 >on/off, menu structure as menu 8.1

Alarm Group 3 > on/off, menu structure as menu 8.1

Alarm Group 4 > on/off, menu structure as menu 8.1

10.16 Printer settings

Following settings enable you to configure the printer functions as desired:

Graph upper limit >15 °C

Upper limit for graphical printout

Graph lower limit >-30 °C

Lower limit for graphical printout

Please note: If the total temperature range between upper and lower limit can be divided by 9 you achieve an optimal result for the printout

Graph mm per hour >10 mm

A graphical printout consumes a lot of paper. This parameter enables you to set the scaling of the printout (mm of paper per hour). Set a value to avoid wasting paper.

User menu >yes/no

If set to „yes“the following 4 parameters will be available for the user in the print menu (see chapter 3.1 for detailed description).

Delivery ticket setting

Actual only/Actual + average/Actual + average + min/max.

Print time period >10 hours
Set time period (see chapter 1.6)

Day start time >06:00
Set day start time for printing (see chapter 1.7)

Day end time >18:00
Set day end time (see chapter 1.8)

10.17 General settings

General settings for the unit can be entered:

Temperature unit °C/°F
Date format TT/MM/JJJJ
Sample rate >10 minute(s)
The interval time in minutes (1, 2, 3,..,15, 20, 25, 30,.., 60 minutes) for storing a temperature measurement into memory

Vehicle ID >ABCDEF
16 characters are available for assigning vehicle identification. It is necessary to enter an identification like registration number or chassis number in the case of a trailer. The vehicle ID will be shown on every printout in the header together with the serial number and header text.

Header text >Abcdef
16 characters are available for assigning a header title (usually the company name). The header text will be shown on every printout.

Pin code >1111
The pin code is intended to avoid having unauthorised people access to changing parameters which can influence a correct recorder operation. Select a code between 1111 and 7777 (**7 highest possible number!**). The factory setting is 1111 (digit „0“ is not available).
Please note: Do not forget to write down the new pin code and store it in a safe place. There is no master code available to get later access to the parameter menu.

Correct. factor (Example): Recommended: +4 / Setting: +4

Serial number >00112233
Displays the serial number of the recorder. The number will be set at factory and cannot be changed. The serial number will be on every printout.

10.18 Communication settings

Com 1 - setting
The following options are available:
- No protocol
- Old ES protocol
- TMS protocol 9k6
- DECT protocol
- GSM protocol
- GPRS protocol

- TMS protocol 38k4
- Bluetooth protocol
- Frigoblock protocol

Com 2 – setting

The following options are available:

- No protocol
- Old ES protocol
- TMS protocol 9k6
- GPS protocol
- TMS protocol 38k4
- Bluetooth protocol
- Frigoblock protocol

Attachment A Technical data

a) Technical specification:
   - Operating voltage: 10-36 V, protected against alternator load shedding
   - Power consumption: nominal value 0.6W, max. 25W (while printing)
   - Temperature: -20°C / +70°C (in operation), -40°C / +85°C (maximum)
   - Humidity: 97% relative humidity at 25°C
   - Memory size: 512kB, minimum 1 year with 2 sensors and logging interval 15 min.
   - Inputs:
     - 4 x temperature sensors: measuring range –40°C to +50°C
     - 1 x digital for display background light, active >5V
     - 4 x digital, closed circuit
   - Ouptputs:
     - 2 x open input, switched to ground and current limited to 1A
     - Data ports:
     - Infra red for data transmission and service/parameter programming
     - 2 RS-232 connectors for external devices

b) Ventilation:
   No special requirements. Recorders are designed for use in an automotive environment.

c) IP rating: IP65

d) Dimensions: 245 W x 202 H x 110mm D

e) Maintenance:
   Use for cleaning a moistened duster, without alcohol or other volatile cleaning products.

f) Circuit protection :
   For protection a 10A floating fuse must be fitted in the positive (+VE) power line as close as possible to the power connection (contained in installation kit).

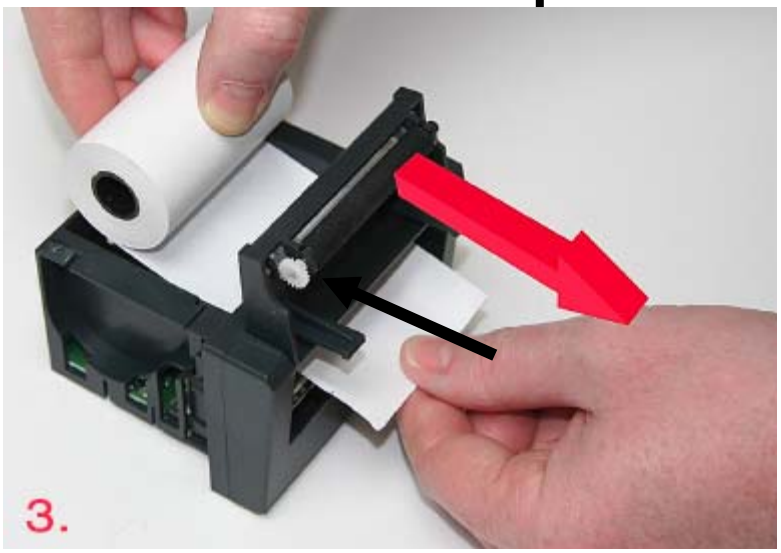
g) Battery:
   Unit contains a lithium battery, please remove before discarding and dispose separately

Attachment B Replace paper roll

A coloured line appears on the last meter of paper and indicates that the paper roll needs to be replaced.

To change a paper roll please proceed as follows:

– Pull down clear plastic flap (in front of the printer). Printer slides forward and can be pulled out.



– Remove empty roll.
– Put new paper roll into the printer and make sure that the paper is fed in the correct way.
– After changing the paper please install the printer with the flap open and close the flap only after the printer is fully inserted.

Attachment C Factory settings

Temperature inputs .. Factory settings

T1 input..... On
Type ..... Temperature
T2 Input ..... On
Type ..... Temperature
T3 Input ..... Off
T4 Input ..... Off

Digital inputs

D1 input ..... Off
D2 input ..... Off
D3 input ..... Off

D4 input ..... Off

Compartment settings

Compartment 1 ..... On
Compartment name ..... Comp. 1
Print T1 ..... Yes
Alarm on T1 ..... Yes
Print T2 ..... Yes
Alarm on T2 ..... Yes
Print T3 ..... No
Alarm on T3 ..... No
Print T4 ..... No
Alarm on T4 ..... No
Print D1 ..... No
Print D2 ..... No
Print D3 ..... No
Print D4 ..... No
Compartment 2 ..... Off
Compartment 3 ..... Off
Compartment 4 ..... Off

Alarm settings

Alarm group 1 ..... Off
Alarm group 2 ..... Off
Alarm group 3 ..... Off
Alarm group 4 ..... Off

Printer settings

Graph upper limit ..... +15 °C
Graph lower limit ..... -30 °C
Graph mm. per h. ..... 5 mm
User menu ..... Yes
Delivery ticket setting ..... Actual only
Print time period ..... 10 hour(s)
Day start time 00:00
Day end time 18:00

General settings

Temp. unit ..... °C
Date format ..... dd/mm/yyyy
Sample rate ..... 10 min.
Vehicle ID AB-1234
Header ..... Abcdef
Pin code 1111
Corr. Factor ..... +4
Serial number

Communication settings

COM 1
Settings
No protocol

Old ES protocol
TMS protocol 9k6
DECT protocol
GSM protocol
GPRS protocol
TMS protocol 38k4
Bluetooth protocol
Frigoblock protocol

COM 2
No protocol
Old ES protocol
TMS protocol 9k6
GPS protocol
TMS protocol 38k4
Bluetooth protocol
Frigoblock protocol

Attachment D Error codes
If the display shows one of the following values:

OC (I) the input is activated but no sensor is connected
(ii) the sensor has an open circuit (sensor or wire failure)

SC (I) the sensor has a short circuit (sensor or cable failure)