Carrier
TRANSICOLD

OPERATION AND SERVICE MANUAL

TRAILER REFRIGERATION UNIT

MAXIMA 1000 / 1200 / 1200 Mt°

Carrier
A United Technologies Company

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MAXIMA 1000 / 1200 / 1200 Mt°

OPERATION AND SERVICE MANUAL

This operation and service manual has been prepared for the Carrier Transicold technicians who have to do maintenance services on the MAXIMA refrigeration unit.

All maintenance services must be done by a technician trained on Carrier products respecting all safety and quality standards of Carrier.

This manual contains operating data, electrical data, safety and service instructions which have to be done on this unit.

This refrigeration unit has been designed with the safety of the technician in mind. During normal operation, all moving parts are fully enclosed to prevent injury. During all pre-trip inspections, daily inspections and problem troubleshooting, you may be exposed to moving parts : **we advise you to take all required precautions in general and to wear adequate personal protective equipment (safety glasses, gloves and safety shoes) during all repair and services on this unit.**

TAKE EVERY SAFETY MEASURE WHEN ACCESSING THE UNIT : use standard ladders, working plateform with railing, safety belt etc...

At Carrier Transicold, we are continually working to improve the products that we build for our customers. As a result, specifications may change without notice.

SECTION 1

DESCRIPTION

1.1 INTRODUCTION

WARNING

Beware of unannounced starting of the fans and V-belts caused by the temperature controller and the start/stop cycling of the unit.

This manual contains Operating Data, Electrical Data and Service Instructions for the trailer refrigeration units listed in Table 1-1. Also Table 1-1 shows some significant differences between these models.

The Maxima 1000/1200 & 1200 Mt° models are one-piece units designed for semi-trailer applications.

The model/serial number plate is located inside of the unit on the frame, as shown in Figure 1-2.

The evaporator assembly consists of an evaporator coil, an expansion valve, two defrost thermostats (termination switches), a blower and a heat exchanger.

The evaporator is to be mounted inside a rectangular opening in the upper part of the front panel of the trailer. Once installed, the evaporator section is located inside the trailer and the condensing section on the outside at the front of the trailer.

A defrost cycle of the evaporator coil may be initiated automatically either by the air pressure drop inside the evaporator coil, as detected by the pressure differential switch, or by a defrost timer. Manual defrost may also be activated by a key on the control panel.

Heating is performed by allowing the hot gas from the compressor output to flow directly to the evaporator coil. Heating mode operation is ensured by a three-way valve.

The front part of the unit consists of the compressor, diesel engine, electric motor, condenser blowers, condenser coil, electric control panel, electrical box, tubing, wiring, defrost control and associated components.

The Maxima 1000 or 1200 model comprises a microprocessor controller located in the electrical box. A digital thermometer mounted on the panel indicates the box temperature at all times.

MAXIMA 1200 / 1200 Mt°

The control system comprises a temperature controller to control and maintain box temperature. Once the controller is set at the desired temperature, the unit will operate in continuous cool/heat control mode or in Start/Stop mode in order to maintain the temperature close to the set-point. The control system automatically selects high and low speed cooling or high and low speed heating as necessary to maintain the desired temperature.

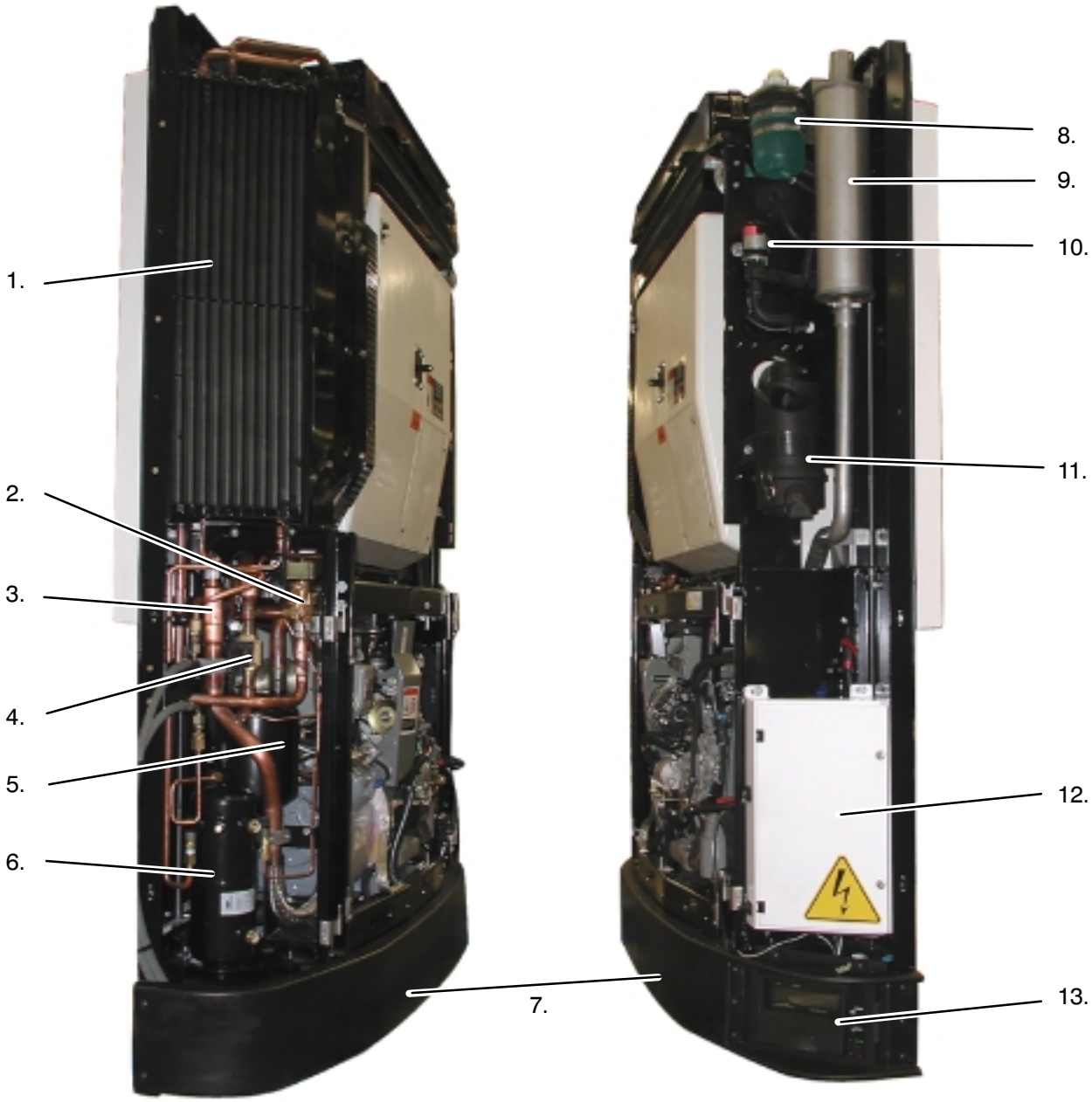
MAXIMA 1000

The MAXIMA 1000 is one speed running. The control system automatically selects cooling and heating mode as necessary to maintain the desired temperature.

Table 1-1 Model Chart

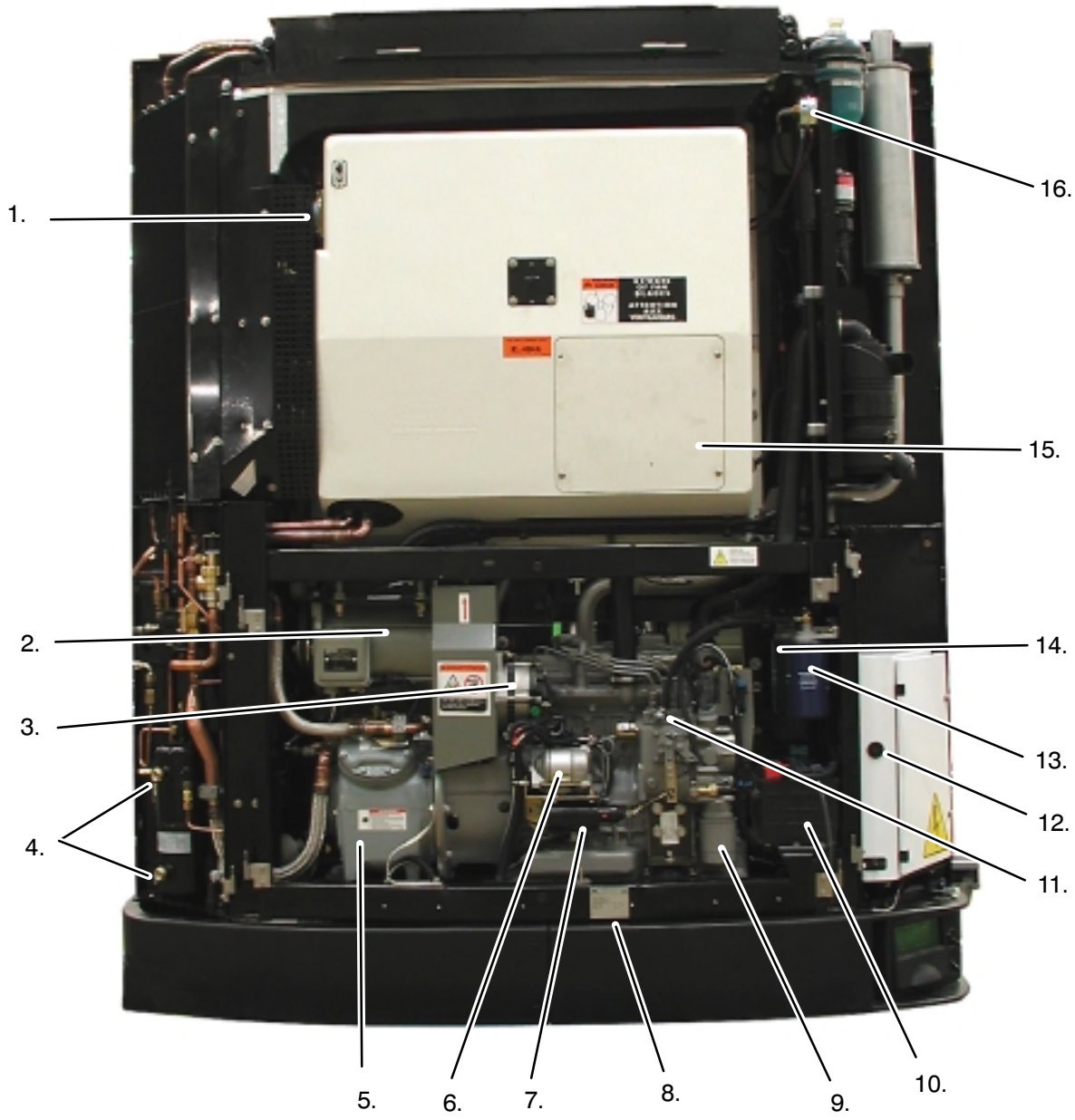
Model	Refrigerant	Engine	Compressor	Electric motor 380 V
Maxima 1000/1200/1200Mt°	R404a 6.5 kg	CT4.91TV	05K4	11kW/50Hz

MAXIMA 1200 / 1200 Mt°



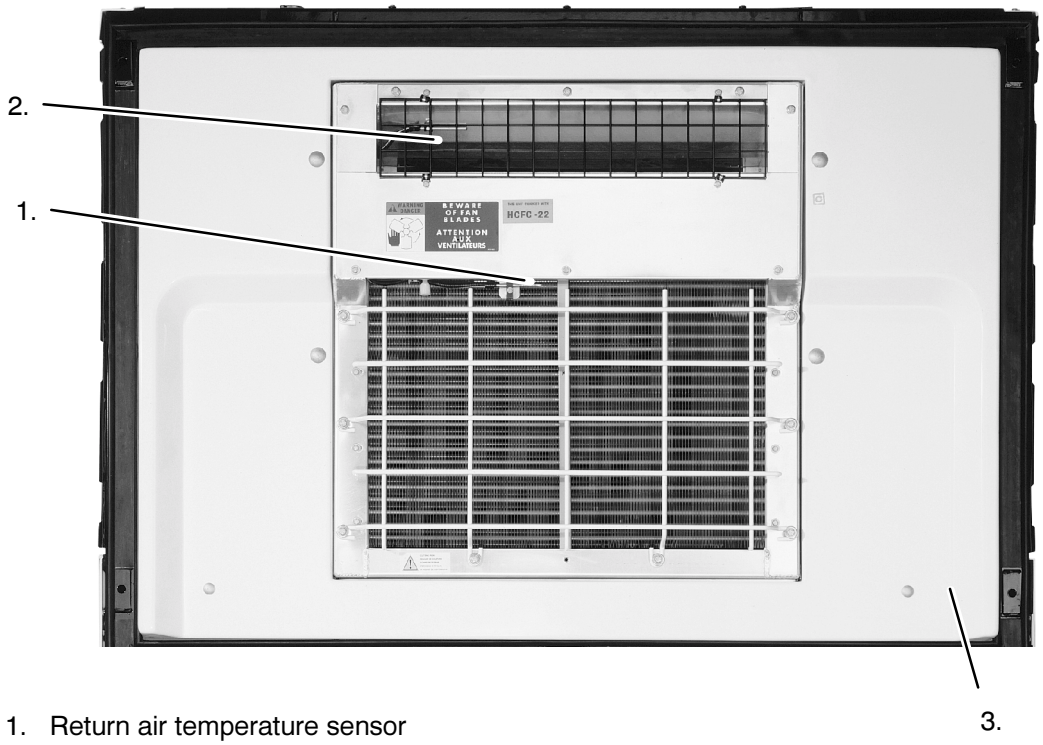
1. Condenser
2. 3-way valve
3. Compressor Pressure Regulating Valve
4. By-pass solenoid CPR valve
5. Suction accumulator
6. Liquid receiver
7. Bottom cover - **For MAXIMA 1200 & 1200 Mt° ONLY**
8. Coolant bottle
9. Exhaust silencer
10. Water pump (electric motor)
11. Air filter
12. Electrical box
13. Control panel

Figure 1-1 Left and right views



1. Electromagnetic clutch
2. Electric motor
3. Alternator and regulator
4. Sight glass
5. Compressor
6. Starter
7. Low/high speed solenoid (1200&1200Mt°)
8. Model/Serial number plate
9. Oil filter
10. Battery
11. Injection pump
12. Buzzer
13. Fuel filter
14. Bypass oil filter
15. Expansion valve trap door
16. Defrost pressure switch

Figure 1-2 Front view



1. Return air temperature sensor
2. Supply air temperature sensor (option)
3. Bulkead – ONLY for MAXIMA 1200 & 1200 Mt°

Figure 1-3 Evaporator – Front view

1.2 DIESEL ENGINE CHARACTERISTICS

Type : CT4 – 91 TV

1.2.1 Cylinder bore / Stroke

78 x 78.4 mm

1.2.2 Compression ratio

22/1

1.2.3 Engine cooling system

Capacity : 7.8 liters

Coolant : 50% ethylene glycol

Thermostat :

Starts opening between : 69° and 72°C (157° and 162°F)

Fully open at: 85°C (185°F)
Effective coolant temperature range: –35°C

1.2.4 Cylinders (number)

Four (4)

1.2.5 Displacement

1498 cm^3

1.2.6 Injection order

1 – 3 – 4 – 2

1.2.7 Fuel

Use only fuel

Do not use fuel without additives

1.2.8 Glow plug

4 A per plug under a continuous rated voltage of 12 V.

1.2.9 Power

21 HP at 1900 rpm

1.2.10 Injector calibration

140 to 150 kg/cm^2

1.2.11 Injection angle

Between 17 and 19°

1.2.12 Valve tappet clearance (cold condition) (intake and exhaust valves)

0.18 to 0.22 mm

1.2.13 Speed

	MAXIMA 1000	MAXIMA 1200&1200 Mt°
High speed	1600 rpm	1900 rpm
Low speed		1450 rpm

1.2.14 Lubrication circuit

Capacity *:*

13.5 liters, including oil filters

Oil pressure :

2.8 to 4.2 kg/cm^2 (high speed operation)

Closure setting for oil pressure safety switch*:*

1 bar ± 0.2 kg/cm^2

Oil change intervals *:* see table page 3–1.

1.2.15 Dry weight

	MAXIMA 1000	MAXIMA 1200&	MAXIMA 1200 Mt°
Dry weight	780	810	874

1.2.16 Torque values for metric pitch

M4	=	6 N.m
M5	=	8 N.m
M6	=	10 N.m
M8	=	30 N.m
M10	=	55 N.m
M12	=	70 N.m

1.3 DIESEL ENGINE DATA

1.3.1 Water safety switch

110°C ± 3°C

1.3.2 Recommended oils

Lube oil viscosity (API Classification CD or higher)

Outdoor temperature		SAE
Celsius	Fahrenheit	
Under 0°C	Under 32°F	10W or 10W30
0° to 25°C	32° to 77°F	20W or 10W30
Above +25°C	Above 77°F	30W or 15W40

1.3.3 Oil pressure safety switch (OP)

Closes at : 1 ± 0.2 bar

1.4 COMPRESSOR REFERENCE DATA

Model	05K ( ) 024
Displacement	400 cc (24.4 in3)
Nb. cylinders	4
Weight	49 kg (108 lbs)
Oil charge	2.6 L (5.5 pts)
Approved oil	Mineral oil Suniso 3GS for R22 POE Oil Mobil EAL 68 for R404A

1.5 REFRIGERATION SYSTEM DATA

1.5.1 Defrost timer

1.5, 3, 6 or 12 hours

1.5.2 Defrost pressure switch value

	MAXIMA 1000 MAXIMA 1200 &1200 Mt°
Initiated at :	0.80 inch

1.5.3 Defrost temperature controller

Opens at: 9° ± 3°C (48° ± 5°F)

Closes at: 3° ± 3°C (37° ± 5°F)

1.5.4 HP pressure switch

R404A

Cut-out at : 32 ± 0.7 bar (465 ± 10 psi)

Cut-in at : 24.1 ± 0.7 bar (350 ± 10 psi)

1.5.5 LP pressure switch

Closes at : 0.45 bar

Opens at : -0.45 bar

1.5.6 Compressor pressure regulating valve (CPR)

2.1 bar 29 psi R404A

1.5.7 Thermostatic expansion valve superheat

Setting for a box temperature of -20°C

4 ± 1°C (7.2 °F ± 1.8°F)

1.5.8 Quench valve

Opens at : 120°C

Max. at : 135°C

1.5.9 Refrigerant charge

R404A

MAXIMA 1000 & 1200 : 7 Kg

MAXIMA 1200 Mt° : 10 Kg

1.6 ELECTRICAL DATA

1.6.1 Standby motor

Proof bearings - factory lubricated, additional grease not required.

Rotation speed: 2940 rpm - 50 Hz

Voltage (V) 3ph, 50 hz	Type of connection	Power KW	Full load amps (a)	Overload relay setting
220	Δ	11	35	38 A
240	Δ		34	
380	Y		21	24 A
415	Y		20	

cos phi : 0.89 (power factor)

Insulation Class F

According to IEC standards 85 and 34-1

1.6.2 Alternator

55 Amps - 12 VDC

1.6.3 Regulator

14.55 Volts ± 0.15 Volt

1.6.4 Generator (MAXIMA 1200 Mt°)

3 ph

1.7 SAFETY DEVICES

System components are protected from damage caused by unsafe operating conditions by automatically shutting down the unit when such conditions occur. This is accomplished by the safety devices listed in Table 1-2.

Table 1-2 Safety devices

	Safety devices		Device setting
1.	Fuse F1	60 A	Excessive current draw by glow plug circuit, control circuit, stater solenoid.
2.	Fuse F2	5 A	Excessive current draw by fuel heater – optional - electrical water pump fuel solenoid
3.	Fuse F3	25 A	Excessive current draw by alternator excitation, fuel solenoid, hot gas solenoid, evaporator fan clutch. Defrost light option – Bypass solenoid - Electrical water pump
4.	Fuse F4	15 A	Excessive current draw by hot gas solenoid - Heat light option.
5.	Fuse F5	15 A	Excessive current draw by speed control solenoid.
6.	Fuse F6	7.5 A	Excessive current draw by the auto restart light (option).
7.	Fuse F7	5 A	Excessive current draw by the fault light.
8.	Fuse F8	5 A	Excessive current draw by the phase detector.
9.	Fuse F12	25 A	Excessive current draw by the fuel heater.
10.	Overload thermic protection OTP		High temperature of standby motor windings
11.	WTS engine water temperature		High engine cooling water temperature.
12.	OP oil pressure switch		Low engine lubricating oil pressure.
13.	HP high pressure switch		Excessive compressor discharge pressure.
14.	LP low pressure switch		Low compressor suction pressure.
ATS			Ambient Temperature Sensor
RAS			Return Air Temperature Sensor
SAS			Supply Air Temperature Sensor
SPT			Suction Pressure Tranducer
FHT			Fuel Heater Thermostat - optional

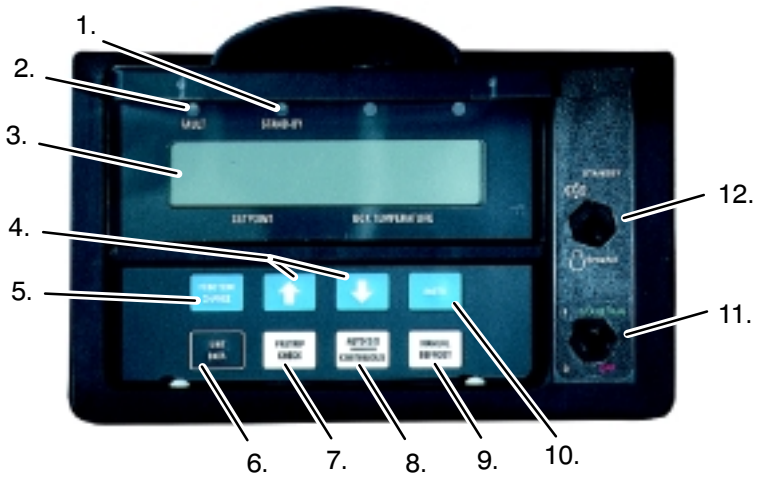
1.8 MICROPROCESSOR CONTROLLER

NOTE

Location of the display board :

- Maxima 1000 : fixed on the body trailer

- Maxima 1200 & 1200 Mt° : fixed in the bottom cover



1. ***Standby operation led (for Multi Temp only)***
2. ***Fault alarm led (for Multi Temp only)***
3. Display
4. Up and Down arrow keys
5. Function change key
6. Unit data key
7. Pretrip key
8. Auto Start/Stop-Continuous key
9. Manual defrost key
10. Enter key
11. Run/Stop switch
12. Engine/Standby switch

Figure 1-4 Microprocessor control panel

1.8.1 Introduction

The microprocessor controller is housed in the electrical box on the roadside corner of the unit. This controller consists of 2 control boards and a relay mo-dule :

1. The Processor Board includes the microprocessor, program memory, and necessary input/output circuitry to interface with the unit.
2. The Display Board is mounted in a control box and includes the LCD display, keypad and keypad interface.
3. The Relay Module contains replaceable relays, diode blocks and fuses along with the wiring harness.

The microprocessor is totally self-contained and does not contain any serviceable components.

WARNING

Under no circumstances should anyone attempt to repair the Logic or Display Boards. Should a problem develop with these component, contact your nearest Carrier Transicold dealer for replacement.

The Carrier Transicold microprocessor controller incorporates the following features :

a. Control supply or return air temperature to tight limits by providing refrigeration control, heat and defrost to ensure conditioned air delivery to the load.

b. Dual independent readouts of set point and supply or return air temperatures.

c. Digital readout and ability to select data. Refer to Table 1-3 for Function Code and Table 1-4 for Unit Data.

d. For alarm digital display identification refer to Table 1-5.

e. A pre-trip checkout of refrigeration unit operation. Refer to section 1.8.9.

f. A self-test check on program memory and data memory. The self-test is executed each time the system is switched from “Stop” to “Start.” Errors, if any, shall be indicated on the display as a ERR.X, where X is a number corresponding to the number of the test. The unit shall display this error for 5 seconds and then reset the micro.

ERROR	CAUSE
ERR. 1 ERR. 2 ERR. 3	Processor failure Check chip installation or Replace microprocessor.
ERR. 4 or DISPLAY	Display board to logic board communication failure. This can be caused by a defective ribbon cable or ribbon cable not plugged in properly.

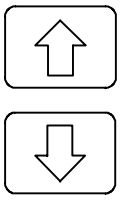
1.8.2 Display board description

DISPLAY WINDOW (3.) : shows set-point, box temperature, operating mode, alarm displays, as well as data on the unit itself (battery voltage, water temperature etc...).

FUNCTION CHANGE KEY

enables access to unit programming functions
(see p. Table 1-3 page 1-12).

ARROWS KEYS



These enable modification of the set-point. Press the Up and Down arrow keys until the requisite set-point is displayed on the left-hand side of the screen. When the correct set-point is displayed, press the ENTER key to validate. The ARROW KEYS also enable modification of unit functions, and scrolling of FUNCTION and UNIT DATA.

ENTER KEY

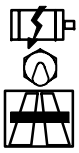
This confirms changes entered concerning unit functions. The key enables validation of a change in set-point made using the Arrow-keys. If the Enter Key is not used, the set-point reverts to its previous value.

The ENTER key also enables validation of a change made to a function parameter. If the Enter Key is not used, the function reverts to its previous parameterization.

MAIN ON/OFF SWITCH (RUN/STOP)

Controls unit operation. In the Run position, the unit starts up according to the operating mode previously specified (Road or Standby). The set-point is the last set-point entered via the keyboard.

ROAD OPERATION



When this switch is set to the ENGINE position, the unit operates in Road mode (diesel engine) when the unit was previously operating in Standby mode.

STANDBY OPERATION

When this switch is set to the STANDBY position, the unit operates in Standby mode (electric) when the unit was previously operating in Road mode (the unit must be connected to a suitable electricity supply). Pilot light is On..

STANDBY POWER ON PILOT LED

This led goes On when the unit is in Standby mode.

MANUAL DEFROST

The MANUAL DEFROST key switches the unit to defrost mode. It is not usually necessary to defrost the unit manually, since it is fitted with a defrost timer and defrost air switch. Manual defrost may be necessary if ice accumulates on the evaporator after frequency opening the trailer door in damp weather conditions (the DF message is displayed on-screen).

PRETRIP

The PRETRIP key initiates the pretrip check of all normal operating modes for Road operation. The temperature inside the trailer body must be lower than 3˚C ±1˚C

AUTOMATIC START/STOP CONTINUOUS

Switches the operating mode of the unit from Automatic Start/Stop to continuous operation in Road or Standby modes. When the unit is set to Automatic Start/Stop, it operates in this mode until the box temperature reaches the set-point, then stops (after operating for the minimum run time).

See page 1-12 (Function Parameters – FN3) until a heating or cooling cycle becomes necessary once again (after minimum off time – FN2).

In continuous run mode, the unit automatically cycles from heating to cooling modes as required to maintain the box temperature at the set-point. In the case where the latter is lower than –12˚C, the unit does not heat, but continuously operates in low speed cooling mode.

When set to continuous run mode, the unit only shuts off when the Run/Stop switch is moved to the Stop position, or a unit fault occurs.

UNIT DATA

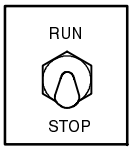
Pressing this key scrolls a display of the various operating conditions on-screen, for example the temperature of the engine coolant, or the battery voltage. A more detailed description of the function of this key is given later in this chapter.

FAULT

This led goes On when a fault has been detected at unit level (see Alarm Display table page 1-16) – For Multi Temp only.

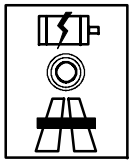
Important : If the screen display is blank, check the position of the RUN switch on the box.

11. Main ON/OFF switch (RUN/STOP)



Controls unit operation. In the Run position, the unit starts up according to the operating mode previously specified (Road or Standby). The setpoint is the last setpoint entered via the keyboard.

12. ENGINE / STANDBY switch



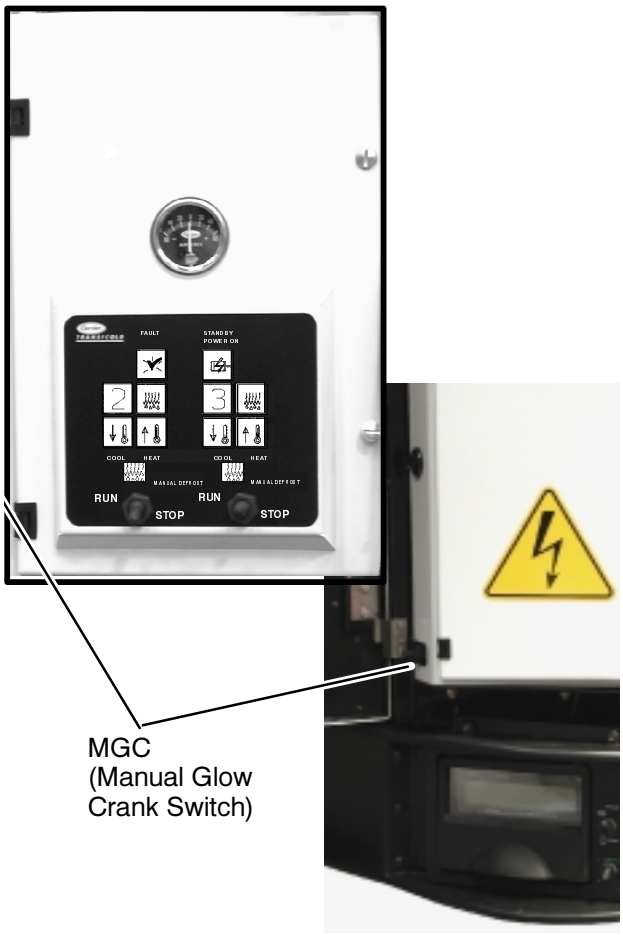
When this switch is set to the ENGINE position, the unit operates in Road Mode (diesel engine) when the unit was previously operating in Standby mode.

When this switch is set to the STANDBY position, the unit operates in Standby mode (electric) when the unit was previously operating in Road mode (the unit must be connected to a suitable electricity supply).

1.8.3 Control relay box - For MAXIMA 1200Mt° only

Located on the right-hand side of the unit.

This control panel allows the operation of each remote compartment.



1.8.4 Setpoint

Setpoints of -22°F to +86°F (-30°C to +30°C) may be entered via keypad. The controller always retains the last entered setpoint in memory. If no setpoint is in memory (i.e., on initial startup), the controller will lock out the run relay and flash "SP" on the left hand display until a valid setpoint is entered.

The setpoint may be changed up or down in whole numbers until the desired setpoint is displayed. The display will flash to indicate that the setpoint reading being displayed is a non-entered value. Each time the UP/DOWN Arrow key is pressed, the 5 second display timer will be reset.

Depressing the ENTER key will cause the new displayed setpoint value to become active. If the display is flashing and the new value is not entered, after 5 seconds of no keyboard activity, the display will revert back to the active setpoint.

1.8.5 Digital Display

The digital display has 9 digits. The default display is setpoint on the left and controlled air temperature on the right. The readout is keypad selectable for Degrees C or Degrees F.

Also digital displays are provided to indicate the following modes: COOL, HEAT, DEFROST, IN-RANGE, HI AIR, START/STOP.

On each power-up, the unit will display a Display Test for 5 seconds then display the default reading.

1.8.6 Functional Parameters

NOTE

If configuration CNF11 is "ON" functional parameters are lockout. The ability to change functional parameters from keypad are disabled.

The functional parameters will control selected operating features of the unit. These parameters can be displayed by pressing the FUNCTION CHANGE key. All functional parameters are retained in memory.

The following sections describe the list of functions which can be modified via the keypad. A description of the function will be displayed on the left side with the corresponding data on the right side.

The function parameter list can be scrolled through by pressing the FUNCTION CHANGE key or by using the UP/DOWN Arrow keys.

With each FUNCTION CHANGE key push, the list will be advanced one. If the function key is pressed and held for one second, the list will be advanced one item at a time. This list will be circular, meaning once the end of the list is reached the list will go to the first entry.

While the functional parameter is displayed, the data can be changed by pressing ENTER then pressing either the UP or DOWN Arrow keys. If the value is changed, the displayed data will then flash to indicate that the value has not been entered. If the new value is not entered in 5 seconds, the display will revert back to the last entered value. If the ENTER key is pressed, the display will stop flashing to indicate that the value has been entered. The new value will continue to be display for 5 seconds before reverting back to the default display.

Each time a key is pressed, the 5 second delay will be reset. To select a different functional parameter the FUNCTION CHANGE key must be pressed first.

Code Vs English Messages

The description messages of the functional parameters, unit status and alarms can be displayed in English or Codes through this function selection. The two choices will be displayed as, ENGLISH or CODES. With this parameter set to CODES, all display descriptions will be set to their code display. This parameter will not change due to this selection. Refer to each section for the alternate display description.

Manual Glow Override

The auto start glow time can be manually overridden through this function. The messages is displayed as NORM GLOW or ADD GLOW. If the ADD GLOW selection is entered, the control will add 30 seconds of glow to the glow times listed in section 1.8.12.

This feature must be selected before the 3 start attempts have been completed. At higher ambients, this override will only affect the second or third start attempt. The add glow time is deselected when the engine starts or fails to start. This parameter will not change due to the Code vs English selection.

Alarm Reset

Alarms can be reset through this function. The messages are displayed as ALARM RST or ALARM CLR. If the ALARM RST is displayed then there is at least one alarm present.

Pressing the ENTER key will clear all the alarms present. If the ALARM CLR is displayed then there are no alarms present. See section 1.8.8. This parameter will not change due to the code vs English selection.

Table 1-3 FUNCTION PARAMETERS

CODE	ENGLISH	AVAILABLE SELECTIONS
FN0	DEFR	Defrost interval 1.5, **3**, 6, or 12 hr
FN1 ON	HIGH AIR	High air flow
FN1 OFF	**NORM AIR**	**Normal air flow**
FN2	OFF T	Minimum off-time **10**,20, 30, 45 or 90 mn
FN3	ON T	On-time **4** or 7 min.
FN4 A	**REM PROBE**	**Controlling Probe-Return air**
FN4 B	SUP PROBE	Controlling Probe-Supply air (above12°C) (SAS)
FN5	Degrees °C or °F	Temperature Unit (**°C** or °F)
FN6 ON	TIME STRT	Maximum Off-time 30 min.
FN6 OFF	**TEMP STRT**	**Temperature based restarting (after minimum Off time)**
FN7 0	**MOP STD**	Mop selection
FN7 -5	MOP -	
FN7 +4	MOP +	
FN8	2SET	Set-point adjustment 2nd compartment - YES / **NO**
FN9	3SET	Set-point adjustment 3rd compartment - YES / **NO**
FN10 ON	**AUTO OP**	**Auto Start operation**
FN10 OFF	MAN OP	Manual Start operation
FN11	T RANGE	Out-of-Range 2, 3, or **4**°C
Code vs English = Code or **English** Display Format		
Manual Glow Override = **Normal** or Add 30 seconds		
Alarm RST = Alarm Reset Required Alarm CLR = No alarm active		
Selections in **BOLD** are factory settings.		

Defrost Interval

The defrost interval is displayed with the description DEFR or FN0. The data for the interval will be displayed with one decimal place and then the capital letter H for hours (i.e., DEFR 12.0H). The defrost intervals are 1.5, 3, 6 or 12 hours.

Airflow

The status of the speed control solenoid override is displayed as HIGH AIR or NORM AIR. The code display is FN1. The high air setting is “ON” and the NORM AIR setting is “OFF.” If the display shows HIGH AIR, the unit is locked into high speed for setpoints above 10°F.

Off-Time

The off-time selection for the auto start mode is displayed with the description OFF T or FN2. The off-times are 10, 20, 30, 45 or 90 minutes. The data for the off-time will be displayed with two digits and then the capital letter M for minutes (i.e. OFF T 20M).

On-Time

The on-time selection for the auto start mode is displayed with the description ON T or FN3. With software revision less than 3.93 the on-times are 4 or 7 minutes. The data for the on-time will be displayed with two digits and then the capital letter M for minutes (i.e. ON T 4M).

Controlling Probe

The number of controlling probes is displayed with the following abbreviations: REM PROBE for a single probe (return air) control; SUP PROBE for a dual probe control (return and supply air). The code display is FN4. The 1-probe setting is “A” and the 2-probe setting is “B.”

Standard Units Select

The standard unit select will control how all parameters are displayed. The two choices are DEGREES F and DEGREES C. This parameter also will control units that data is displayed in psig or bars (i.e, Degrees F or Degrees C). The code display is FN5. The selections are “F” or “C.”

Maximum Off-Time

The description for the maximum off time is TEMP STRT OR TIME STRT. The code display is FN6 and the selections are “ON” or “OFF.” “ON” corresponds to TIME STRT. With the unit in time start, the control will force the engine to restart 30 minutes after shutoff.

MOP STD - Future Expansion

This function is not used at this time. The display is FN7.

Compartment 2 Setpoint

Setpoints of -22°F (-30°C) to +86°F (+30°C) may be entered through this function for the second compartment.

The setpoint function will be displayed with the abbreviated description 2SET. The code display is FN8.

The setpoint may be changed up or down in whole numbers until the desired setpoint is displayed. The display will flash to indicate that the setpoint reading being displayed is a non-entered value.

Each time the UP key or the DOWN key is pressed, the 5 second display timer will be reset. Depressing the ENTER key will cause the new displayed setpoint value to become active. If the display is flashing and the new value is not entered, after 5 seconds of no keyboard activity, the display will revert back to the active setpoint. The update rate is once every 0.5 seconds if the UP or DOWN keys are held down.

Compartment 3 Setpoint

Setpoints of -22°F (-30°C) to +86°F (+30°C) may be entered through this function for the third compartment. The setpoint function will be displayed with the abbreviated description 3SET. The code display is FN9. The setpoint may be changed the same as the 2nd compartment.

Auto / Manual Start Operation

The selection for starting the unit are displayed AUTO OP (code FN10 ON) for auto start operation or MAN OP (code FN10 OFF) for manual start operation.

To start the unit in manual start mode, the START/STOP CONTINUOUS selection must be in “continuous run” mode.

Out-of-Range Tolerance

The out-of-range temperature tolerance selection is displayed with the description T RANGE or code FN11. The selection are “A, B or C” 2, 3, or 4°C (3.6, 5.4, or 7.2°F) respectively.

When the out-of-range temperature is configured ON, the controller indicates out-of-range when the temperature has been within the tolerance band at least once, and then goes outside the tolerance band for 45 minutes. Also the unit will shut down.

When the out-of-range temperature is configured OFF, the controller indicates out-of-range when the temperature has been within the tolerance band at least once, and then goes outside the tolerance band for 15 minutes. Also the unit will continue to operate.

For set points below +10°F (-12.2°C) *frozen range* the unit is only considered out-of-range for temperatures above set point.

1.8.7 Unit Data

The UNIT DATA key can be used to display the unit operating data values. The data values will be displayed for 5 seconds and then the display will revert back to the normal display if no further action is taken. The following sections describe the list of data which can be displayed via the keypad.

The description of the data will be displayed on the left side with the actual data on the right side. The unit data list can be scrolled through by pressing the UNIT DATA key.

With each successive key push, the list will be advanced one. If the UNIT DATA, UP or DOWN Arrow key is held for one second, the list will change at a rate of one item every 0.5 seconds.

This list will be circular, meaning once the end of the list is reached the list will go to the first entry. Each time the UNIT DATA key or the UP/DOWN Arrow key is pressed, the display time will be reset to 5 seconds.

If the ENTER key is pressed, the display time will be set to 30 seconds. The position in the unit data list will remain at the last selected value except if power is removed. If the display were to time out and revert to the default display, the operator would only have to press the UNIT DATA key to display the same data again.

Table 1-4 UNIT DATA		
CODE	ENGLISH	DATA
CD1	SUCT	Suction pressure
CD2	ENG	Engine hours
CD3	WT	Engine temperature
CD4	RAS	Return air temperature
CD5	*SAS	Supply air temperature
CD6	*REM	Remote air temperature
CD7	ATS	Ambient temperature
CD8	EVP	Future expansion
CD9	CDT	Not used
CD10	BATT	Battery voltage
CD11	SBY	Standby hours
CD12	MOD V	Future expansion
CD13	REV	Software revision
CD14	SERL	Serial number low
CD15	SERU	Serial number upper
CD16	2RA	Return air T° comp.2
CD17	3RA	Return air T° comp.3
CD18	MHR1	Maintenance hour meter 1
CD19	MHR2	Maintenance hour meter 2
CD20	SON	Switch on hour meter

* SAS and REM are options. SAS is displayed when the SUP PROBE Function is selected. REM is displayed when the REM PROBE Function is selected.

Suction Pressure

The suction pressure is displayed with the description SUCT or CD1. The data is displayed with the proper unit designator P (psig) or B (Bars) (i.e. SUCT 25P). The display is in inches of mercury for readings below 0 psig. The display range is -20 HG to 420 psig (-0.7 Bars to 29.4 Bars).

Engine Hours

The number of diesel engine hours are displayed with the description ENG or CD2. The data is displayed with units designator H (i.e, ENG 5040H OR CD2 5040H). The display range is 0 to 99999.

Engine Temperature

The coolant temperature is displayed with the description WT or CD3. The data is displayed with the proper unit designator (Degree C or Degree F (i.e, WT 185F or CD3 185F). The display range is 10°F to 266°F (-12°C to 130°C).

Return Air Temperature

The return air temperature is displayed with the description RAS or CD4. The data is displayed with one decimal place and the proper unit designator, Degree C or Degree F (i.e. RAS 85.0F). The display range is -36°F to 158°F (-38°C to 70°C).

Supply Air Temperature

The supply air temperature is displayed with the description SAS or CD5. The data is displayed with one decimal place and the proper unit designator, Degree C or Degree F (i.e. SAS 85.0F). The display range is -36°F to 158°F (-38°C to 70°C). This unit data will be displayed only if the SUP PROBE is selected in the controlling probe functional parameter.

Remote Air Temperature

The remote air temperature is displayed with the description REM or CD6. The data is displayed with one decimal place and the proper unit designator, Degree C or Degree F (i.e. REM 85.0F). The display range is -36°F to 158°F (-38°C to 70°C). This unit data will be displayed only if the REM PROBE is selected in the controlling probe functional parameter.

Ambient Temperature

The ambient temperature is displayed with the description ATS or CD7. The data is displayed with one decimal place and the proper unit designator, Degree C or Degree F, (i.e. ATS 85.0F) . The display range is -36°F to 158°F (-38°C to 70°C). If there is no sensor, then the display will read - - - for the data.

Evp - Future Expansion

This unit data is not used at this time. The Code display is CD8.

Compressor Discharge Temperature

The compressor discharge temperature is displayed with the description CDT or CD9. The data is displayed with the proper unit designator, Degree C or Degree F, (i.e. CDT 85F) . The display range is -40°F to 392°F (-40°C to 200°C). If there is no sensor, then the display will read - - - for the data.

Battery Voltage

The battery voltage is displayed with the description BATT or CD10. The data is displayed with one decimal place and then the capital letter V for volts (i.e, BATT 12.2V or CD10 12.2V). The voltage reading is displayed with a "+" plus sign if the battery status is high enough to allow unit shut down in "Auto Start/Stop".

Standby Hours

The number of electric motor hours are displayed with the description SBY or CD11. The data is displayed in hours and units designator H (i.e, SBY 5040H or CD11 5040H). The display range is 0 to 99999.

Mod V - Future Expansion

This unit data is not used at this time. The Code display is CD12.

Software Revision

The Eprom software revision number is displayed with the description REV or CD13 on the left and Eprom software revision number on the right side. Pressing the ENTER key for 3 seconds will display REV U2 on the left and the board mounted software revision number on the right side.

Serial Number Low

The low serial number of the unit is displayed with the description SERL or CD14. The data is the lower 3 digits of the serial number burned in to the Eprom. (i.e, SERL 504 or CD14 504).

Serial Number Upper

The upper serial number of the unit is displayed with the description SERU or CD15. The data is the upper 3 digits of the serial number burned in to the Eprom. (i.e, SERH 001 or CD15 001).

Compartment 2 Air Temperature

The air temperature for the second compartment will be displayed with the abbreviated description 2RA on the left-hand side. The code display is CD16. The data will be displayed with one decimal place and the proper unit designator, Degree C or Degree F (i.e. 2RA85.0F).

Compartment 3 Air Temperature

The air temperature for the second compartment will be displayed with the abbreviated description 3RA on the left-hand side. The code display is CD17. The data will be displayed with one decimal place and the proper unit designator, Degree C or Degree F (i.e. 3RA85.0F).

Maintenance Hour Meter 1

The maintenance hour meter 1 setting is displayed with the description MHR1 or CD18. The maintenance hour meter is compared to one of the hour meters (diesel, standby, or switch on) determined by its mode. If the hour meter is greater than the maintenance hour meter an alarm will be generated.

Maintenance Hour Meter 2

The maintenance hour meter 2 setting is displayed with the description MHR2 on the left side or CD19. The maintenance hour meter is compared to one of the hour meters (diesel, standby, or switch on) determined by its mode. If the hour meter is greater than the maintenance hour meter an alarm will be generated.

Swich On Hour Meter

The number of switch on hours is displayed with the description SON or CD20 (i.e. SON 2347H or CD20 2347H). The display range is 0 to 99999.

1.8.8 Alarm Display

The fault light (FL) is turned on only for alarms that specify it. The default display will be overridden if a alarm is generated. When an alarm is generated, the display will alternate the default display (setpoint/air temperature) and the active alarm(s). Each item will be displayed for 3 to 10 seconds, and will continue to scroll through the list. See section 1.8.6 for the procedure on resetting alarms.

Table 1-5 Alarm display

CODE	ENGLISH	ALARM DESCRIPTION
AL0	ENG OIL	√ **Low Oil Pressure** The low oil pressure alarm is displayed with the description ENG OIL or AL0. This alarm is generated if the control senses low oil pressure under the proper conditions. The fault light (FL) is turned on. Engine will shut down.
AL1	ENG HOT	√ **High Coolant Temperature** The high coolant temperature alarm is displayed with the description ENG HOT or AL1. This alarm is generated if the control senses a high coolant temperature 230 to 240°F (110 to 116°C) for 5 minutes or immediately if over 240°F (116°C). The fault light (FL) is turned on and engine will shut down.
AL2	HI PRESS	√ **High Pressure** The high pressure alarm is displayed with the description HI PRESS or AL2. This alarm is generated if the high pressure switch opens. The fault light (FL) is turned on and engine will shut down.
AL3	STARTFAIL	√ **Auto Start Failure** The start failure alarm is displayed with the description STARTFAIL or AL3. This alarm is generated if the engine fails to start. The fault light (FL) is turned on. If function MAN OP (manual start mode) is selected the start failure alarm will be generated if the engine fails to start in 5 minutes.
AL4	LOW BATT	√ **Low Battery Voltage** The low battery voltage alarm is displayed with the description LOW BATT or AL4. This alarm is generated if the battery voltage falls below 10 vdc. The fault light (FL) is turned on and engine will shut down.
AL5	HI BATT	√ **High Battery Voltage** The high battery voltage alarm is displayed with the description HI BATT or AL5. This alarm is generated if the battery voltage is above 17 vdc. The fault light (FL) is turned on and engine will shut down.
AL6	DEFRFAIL	**Defrost Override** The defrost override alarm is displayed with the description DEFR FAIL or AL6. This alarm is generated if the unit is in a defrost override mode (See Sections 1.8.11 and 4.2).
AL7	ALT AUX	√ **Alternator Auxiliary** The alternator auxiliary alarm is displayed with the description ALT AUX or AL7. This alarm is generated if the alternator auxiliary signal is not present with the engine running. (See Section 1.6.3) The fault light (FL) is turned on.
AL8	STARTER	√ **Starter Motor** The starter motor alarm is displayed with the description STARTER or AL8. This alarm is generated if the starter motor input signal is not present with starter solenoid energized. The fault light (FL) is turned on.
AL9	RA SENSOR	√ **Return Air Sensor** The return air sensor alarm is displayed with the description RA SENSOR or AL9. This alarm is generated if the return air sensor is open or shorted. The fault light (FL) is turned on if the unit shuts down because there is no controlling probe.
AL10	SA SENSOR	**Supply Air Sensor** The supply air sensor alarm is displayed with the description SA SENSOR or AL10. This alarm is generated if the supply air sensor is open or shorted. This alarm will be disabled if the REM PROBE is selected in the controlling probe functional parameter.
AL11	WT SENSOR	**Coolant Temperature Sensor** The coolant temperature sensor alarm is displayed with the description WT SENSOR or AL11. This alarm is generated if the coolant temperature sensor is open or shorted.
AL12	HIGH CDT	Not used
AL13	CD SENSOR	Not used
AL14	SBY MOTOR	√ **Motor Overload** The standby motor overload alarm is displayed with the description SBY MOTOR or AL14. This alarm is generated when the MOL input is sensed open with the Run Relay energized in electric mode (Diesel/Electric Relay energized).
AL15	FUSE BAD	√ **Fuse** The fuse alarm is displayed with the description FUSE BAD or AL15. This alarm is generated when the FUSE input is sensed low. The fault light (FL) is turned on. The engine will shut down.

CODE	ENGLISH	ALARM DESCRIPTION
AL17	DISPLAY	**Display** When no communications exist between the main board and the display board for 8 seconds, the display alarm description is DISPLAY or AL17.
AL18	SERVICE 1	**Maintenance Hour Meter 1** The maintenance hour meter alarm 1 is displayed with the description SERVICE 1 or AL18. This alarm is generated when the designated hour meter is greater than maintenance hour meter 1.
AL19	SERVICE 2	**Maintenance Hour Meter 2** The maintenance hour meter alarm 2 is displayed with the description SERVICE 2 or AL19. This alarm is generated when the designated hour meter is greater than maintenance hour meter 2.
AL20	OUT RANGE	√ **Main Compartment Out-of-range** The out-of-range alarm is displayed with the description OUT RANGE or AL20. This alarm is generated when the main compartment is out-of-range refer to section 1.8.6. The fault light (FL) is turned on.
AL21	2RA OUT	√ **Remote Compartment 2 Out-of-range** The Code display is AL21. This alarm is generated when the remote compartment 2 is out-of-range refer to section 1.8.6. The fault light (FL) is turned on.
AL22	3RA OUT	√ **Remote Compartment 3 Out-of-range** The Code display is AL22. This alarm is generated when the remote compartment 3 is out-of-range refer to section 1.8.6. The fault light (FL) is turned on.
AL23	CLUTCH	√ **Clutch Failure** The clutch alarm is displayed with the description CLUTCH or AL23. This alarm is generated if the clutch fails.
√ = FAULT LIGHT ON **WARNING : AL0 (ENG OIL) could come up if alternator is bad connected.**		

1.8.9 Pre-trip

The PRETRIP key is for checking unit operation and evaluating operation of all modes and indicating a failure when detected. The following details the sequence :

a. Unit operating and box temperature is below 40°F (4.4°C).

b. Operator presses the PRETRIP key. If the defrost thermostat (DTT) is closed, the controller will display "PPPP." If DTT is open, no response – end of test.

c. Controller displays "PPPP" Pre-trip mode is started.

d. After 30 seconds in high speed cool, unit cycles to low speed cool - MAXIMA 1200/1200Mt ° ONLY

e. After 30 seconds, unit cycles to low speed cool - MAXIMA 1200/1200Mt ° ONLY

f. After 30 seconds, unit cycles to low speed heat - MAXIMA 1200/1200Mt ° ONLY

g. After 30 seconds, unit cycles to low speed heat - MAXIMA 1200/1200Mt ° ONLY

h. After 30 seconds, unit cycles to high speed heat and displays coolant temperature - MAXIMA 1200/1200Mt ° ONLY

i. After 30 seconds, unit cycles to high speed cool and displays defrost interval selected for 30 seconds, then unit cycles to defrost if DTT is closed - MAXIMA 1200/1200Mt ° ONLY

j. After standard defrost cycle, Pre-trip is terminated and unit returns to normal operation.

1.8.10 Heat / Cool Mode

There are two control ranges, Frozen and Perishable. The Frozen range is active with set points at or *below +10°*F *(-12°C*) and the Perishable range is active at set points *above +10°*F *(-12°C*).

The system is configured for cooling mode for engine start and during the oil pressure delay.

Hot gas heating is applied by energizing the HR1 relay which will energize the three-way valve. This relay will control the remote heat and cool lights (optional lightbar).

Default Mode

When in frozen range (setpoint at or below +10 °F), unit shall default to low speed if a loss of control (bad sensor) is detected - MAXIMA 1200/1200Mt ° ONLY

Since electric driven units have no low speed, the default in the frozen range shall be high speed cooling. When in perishable range (setpoint *above +10°*F), the unit shall shut down. The proper alarm indication shall be displayed when this mode is active.

1.8.11 Defrost Cycle

Defrost is an independent cycle overriding cooling and heating functions to de-ice the evaporator as required. The controller displays “DF” during defrost mode on the right hand temperature display. The left hand display will continue to display the setpoint.

a. Defrost Timer Initiation

A defrost timer initiation is a keyboard selection (Refer to Section 1.8.2). The defrost timer is reset to zero whenever a defrost cycle is initiated. The controller holds in memory the last entered defrost interval.

b. Defrost Air Switch Initiation

An external defrost signal (DA) may be supplied as a set of normally open switch contacts closing to initiate the defrost cycle.

c. Manual Defrost Initiation

The defrost cycle may be initiated by pushing the MANUAL DEFROST key.

d. Defrost Function

The defrost mode is initiated upon expiration of the defrost timing interval with the presence of a signal from the defrost termination thermostat (DTT).

It may also be initiated by the presence of a momentary manual defrost signal. Defrost may also be initiated by an external defrost signal from a device such as an air switch.

The defrost mode terminates when the defrost termination thermostat (DTT) opens indicating the defrost cycle is complete. The defrost timer runs only when the DTT is closed.

The defrost interval timer resets to zero when defrost is initiated by any means. The timer does not accumulate time during defrost mode, during standby off cycles or auto-start off cycles.

A defrost output is energized during defrost mode to de-energize the clutch to prevent hot air circulation to the load.

In addition, the heating outputs (SR, HR1) are enabled to apply high-speed heat for hot gas heating - MAXIMA 1200/1200Mt ◦ ONLY

The compressor operates at maximum capacity on diesel and diesel/electric units during defrost.

e. Fail safe Defrost Termination

Should the defrost cycle not complete within 45 minutes or if the external defrost signal does not clear at defrost termination, the defrost cycle is terminated. The internal timer is reset for 1.5 hours and the external defrost signal is ignored for defrost initiation.

The manual defrost switch will override this mode and start a new 45 minute cycle. When defrost override is active, the appropriate alarm will be indicated. If the run relay is de-energized during defrost, defrost will be terminated.

f. Defrost Termination at Low Speed

The defrost terminates with HR1 **(for MAXIMA 1000/1200)** and speed relay de-energizing **(for MAXIMA 1200 ONLY).**

The defrost output will de-energize 5 seconds after HR1 to engage the clutch. If the temperature control requires high speed, it will energize 2 seconds after defrost relay is de-energized.

1.8.12 Auto Start / Stop Operation

Automatic start/stop is provided to permit starting/restarting of the diesel-driven compressor as required.

This feature fully enables automatic control of the diesel engine starting and stopping. The main function of automatic engine cycling is to turn off the refrigeration system near setpoint to provide a full efficient temperature control system and to initiate a restart sequence after conditions are met.

System shut-off is allowed only if the battery condition signal is good. The engine coolant temperature shall override the minimum off time and out-of-range condition to force engine restarting when the engine coolant temperature drops below 34°F (1°C).

A restart will also be initiated if the battery voltage falls below 12.2 Vdc or / and if box temperature is more than 11°F (6°C) from set point.

a. Start / Stop - Continuous

A key is provided to select between continuous run and auto start/stop operating mode. In the continuous run mode, the diesel engine will not shut down except for safeties or if the engine stalls. This function also apply to the operation of the electric motor.

b. Auto Mode Indicator

The message “Start/Stop” will be displayed when unit runs in Start/Stop mode.

c. Auto Start Failure

If the unit fails to start, shuts down on a safety, or fails to run for the minimum run time, three consecutive attemps, the “Auto Start/Failure” is activated.

d. Continuous Run Mode

In continuous run mode, the engine is started but not allowed to shut off except for safeties or if the engine stalls.

e. Auto Start Sequence

When the starting conditions are met, the start sequence will begin by energizing the run relay, and after 5 seconds energize the glow plug relay (GPR) to supply power to the glow plugs, unit with buzzer will sound for 5 seconds than the starter is energized.

On initial power-up, the control will delay 5 seconds before the starting sequence begins. If the required glow time is zero, the control will energize the starter after a 5 second delay.

After a period of time , the starter solenoid (SS) is energized to crank the engine. The engine will crank for 10 seconds or until engine operation is sensed by the alternator signal. The glow relay will be de-energized after the auxiliary input is sensed on.

A 15 second null cycle will elapse before subsequent start attempts. The run relay will remain energized until the next starting sequence.

Before the next starting sequence, the oil pressure is checked to determine if the engine is running and the alternator auxiliary has failed.

For the second and third start attempts the glow time is increased by 5 seconds over the glow time of the first attempt listed below. The control allows three consecutive start attempts before the starting is locked out and the start failure alarm is activated.

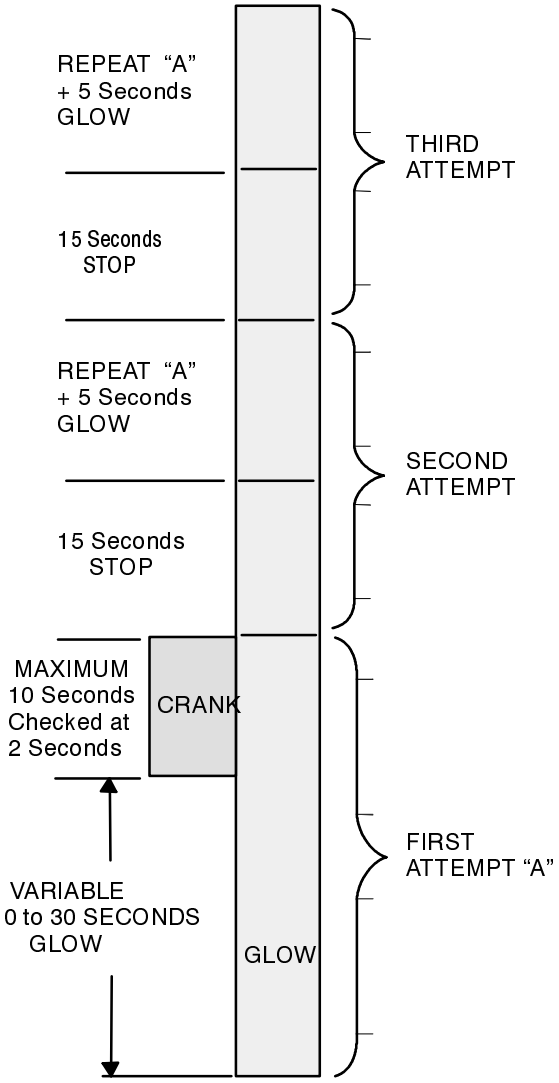


Figure 1-5 Auto Start Sequence

f. Variable Glow Time

The glow time for the first start attempt will vary in duration based on engine coolant temperature and the engine as follows :

Engine Coolant Temperature Glow Time		
Ambient Temperature	Glow Time in Seconds	
	TV	DI
Less than 32°F (0°C)	15	55
33°F to 50°F (1°C to 10°C)	10	40
51°F to 77°F (11°C to 25°C)	5	25
Greater than 78°F (26°C)	0	10

The second and third start attempts have a glow time that is 5 seconds greater than the table amount. The glow time can be manually overridden through the function parameters. If the coolant temperature sensor is defective the control assume a temperature of less than 0°C (32°F) for the glow timing.

g. Minimum On-Time

The engine is allowed to turn off only after a minimum of 4 or 7 minutes of run time.

After the minimum on-time, the unit will go to fully loaded for setpoints greater than -12°C (10°F) **– for Maxima 1000&1200** – and high speed loaded for setpoints of -12°C (10°F) or less – **for Maxima 1200 only.**

The unit will not cycle off if the engine coolant temperature is less than 50°C (122°F) or the battery voltage is not good. If the unit can not cycle off, it will operate normally in continuous mode. If all temperature probes fail and the setpoint is -12°C (10°F) or less, the unit will not shut down.

The unit will shut down when the box temperature is within ± 0.3°C (± 0.5°F) of setpoint for setpoints in the Perishable range or ± 0.3°C (± 0.5°F) above setpoint for setpoints in the Frozen range.

h. Minimum Off-Time

Keypad provision is provided to select the minimum off-time of 10, 20, 30, 45 or 90 minutes.

After the minimum off-time, the unit will restart for temperatures beyond ± 2.0°C (± 3.6°F) of setpoint for the Perishable range or above ± 2.0°C (± 3.6°F) of setpoint for the Frozen range.

The minimum off-time is overridden if the temperature is more than ± 6°C (±11°F) from setpoint.

i. Battery Voltage

Provisions are made to sense when the battery is good. A good battery is defined as having 13.4V at 24°C (75°F). This condition is used to allow shut- off of the diesel engine.

If the battery voltage falls below 10V during glow cycle, the starter will not engage and the start sequence will continue, this is considered a failed start. The start sequence will be repeated until the unit starts or three consecutive start attempts have failed.

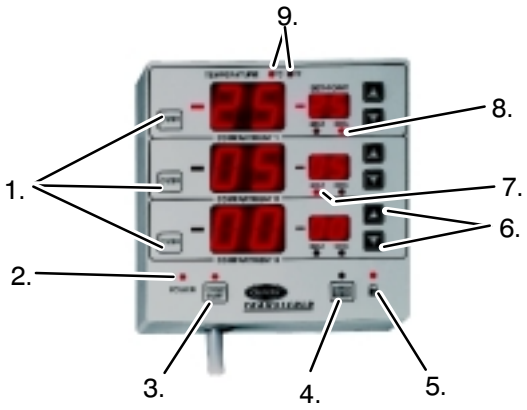
1.8.13 Optional control panel

User-friendly indicator and operator control panels clearly show individual compartment temperatures with easy-to-read displays.

These compact panels can be mounted to suit the individual operator's preferences.

(Example : on the front bulkhead, in the cab or in the refrigerated compartment – including mounting in the truck wall itself.)

- Control panel



1. Compartment ON/OFF key
2. Control panel power on
3. Control panel ON/OFF key
4. Manual defrost key
5. Control panel locking
6. Up and down arrow keys
7. Heating operating mode light of a compartmer
8. Cooling operating mode light of a compartmer
9. Temperature indicated in °C **or** °F

From this control panel (option) you can :

- switch on the 1st, 2nd or 3rd compartment
- check compartement 1, 2 or 3 temperatures
- change setpoints
- energize a manual defrost

1.9 REFRIGERATION COMPONENT OPERATION

1.9.1 Compressor suction pressure regulating valve (CPR) and bypass valve (BPV)

Specific feature: This valve is by-passed during low temperature operation (the by-pass valve is normally closed and controlled by a klixon (BPT) on the suction line. The klixon closes at -18°C, and opens at -14°C).

The CPR pressure regulating valve on the compressor suction line adjusts the suction pressure entering the compressor. The regulator is set to limit the maximum suction pressure mainly when the box temperature is high and on start-up. To adjust the CPR regulator, see sections 1.5.6 and 3.16.

1.9.2 Hot gas valve (Three-way)

a. Operation

The operation of the three-way valve is governed by the position of the piston located in the head of the three-way valve. The user is reminded that this valve is operated electrically and assisted by the suction pressure of the compressor.

b. Cooling (See Figure 1-6)

In this position, the solenoid is not energized and the valve therefore operates in normal cooling mode, and allows the refrigerant gas to pass from the compressor to the condenser. Operation of the upper part of the piston is governed by the suction pressure of the compressor. This difference in pressure at the level of the piston assembly forces the plunger towards the top of the valve, thereby shutting the heat port and opening the condenser port.

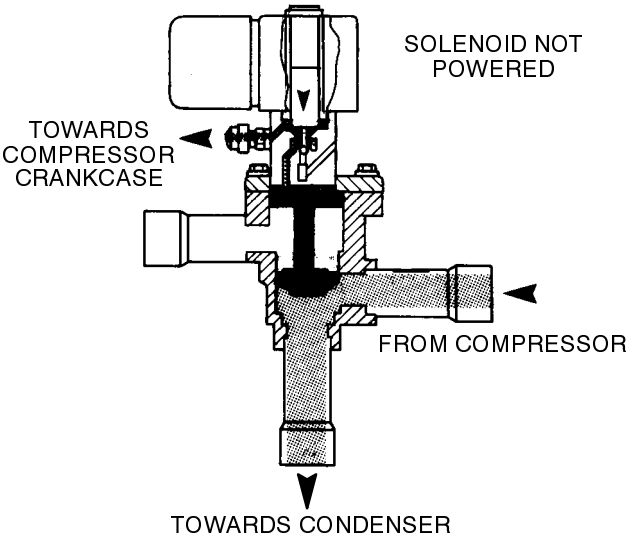


Figure 1-6 Hot gas valve - Cooling

c. Heating and defrost cycles (See Figure 1-7)

The movement of the hot gas towards the defrost circuit is a result of the valve solenoid being energized. In this way, the discharge pressure is applied to the top of the piston through an orifice in the valve body.

The pressure on both sides of the piston assembly is identical and the spring above the top of the piston pushes the plunger downwards. The condenser port is thus closed and the evaporator port is opened.

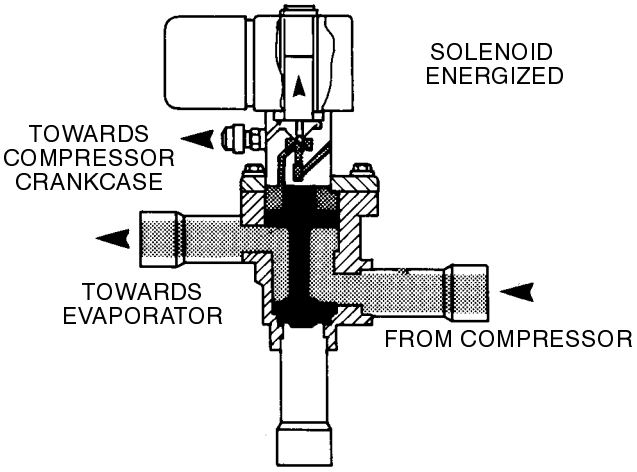


Figure 1-7 Hot gas valve - Heating and defrost cycles

1.9.3 Suction accumulator

The suction accumulator consists of a tank located on the suction line between the evaporator and the compressor. The purpose of the accumulator is to prevent the entry of any liquid refrigerant into the compressor (via the suction line), which would damage the compressor.

The compressor draws in the refrigerant in vapour form from the upper part of the suction accumulator and the oil (which accumulates at the bottom) is drawn in via an oil return hole.

1.9.4 Torque values of refrigeration system

Description	Torque
Connection 3/8" , 1/2"	30 N.m
Connection 1/4"	15 N.m
Compressor valve	13 N.m
Check valve 1/4"	15 N.m
Check valve 3/8"	30 N.m
Oil relief valve	25 N.m

NOTES

- Only use original O-rings.

- On each maintenance or service intervention, use new O-rings.

1.9.5 Battery charging alternator

a. Alternator operation

WARNING

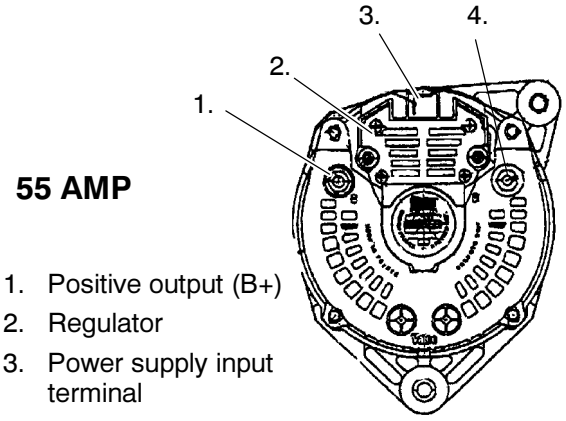
Check that polarity is correct when installing the battery. The negative terminal must be grounded. Reverse polarity will destroy the rectifier diodes in the alternator. As a precautionary measure, disconnect the positive terminal when charging the battery.

The alternator converts the mechanical and magnetic energy into alternating current and voltage, by the rotation of a electromagnetic field (rotor) inside a three-phase stator assembly. Six silicon rectifier diodes are used to convert the alternating current and voltage into direct current and voltage (See Figure 1-8 and section 1.6.2).

b. Operation of the integral voltage regulator (14 Vdc)

The regulator is an all-electronic transistorized device. No mechanical contacts or relays are used to perform the voltage regulation of the alternator system. The electronic circuitry needs no adjustment and the semi-conductor active elements used have proved reliable enough to warrant a sealed unit. The system is temperature compensated to enable a ideal charging rate at all temperatures.

The regulator is an electronic switching device. It senses the voltage appearing at the auxiliary terminal of the alternator, and supplies the necessary field current to maintain the system voltage at the output terminal. The output current is determined by the load.



1. Positive output (B+)
2. Regulator
3. Power supply input terminal
4. Ground terminal

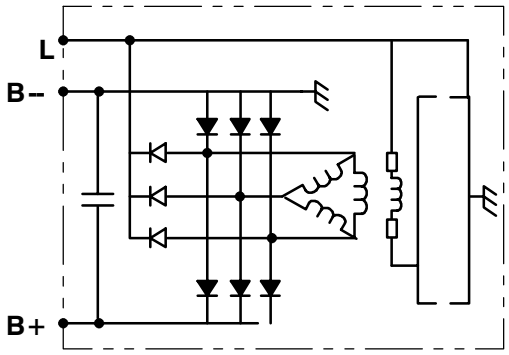


Figure 1-8 ETO Alternator and regulator

1.10 REFRIGERANT CIRCUIT

1.10.1 Cooling mode

During cooling, the unit operates as a vapor compression refrigeration system. The main components of the system are the reciprocating compressor, the air-cooled condenser, the thermostatic expansion valve, the direct expansion evaporator, and the hot gas valve (three-way).

The compressor raises the pressure and the temperature of the refrigerant, and forces it into the condenser. The condenser fan circulates surrounding air over the outside of the condenser tubes. Heat transfer is thus established between the refrigerant gas (inside the tubes) and the air in the condenser. The condenser tubes have fins designed to improve the transfer of heat. This removal of heat causes the refrigerant to liquefy; liquid refrigerant then flows from the condenser through a check valve to the receiver.

The receiver stores the additional charge necessary for all operating modes.

The refrigerant leaves the receiver and flows through the shutoff valve (king valve). The refrigerant then flows through the subcooler. The subcooler occupies a portion of the main condensing coil surface, and gives off further heat to the passing air; the liquid thus obtained ensures the expansion valve is only supplied with liquid refrigerant.

The refrigerant then flows through a filter-drier, where an absorbent keeps it dry and clean.

The refrigerant passes through the heat exchanger which enables the transfer of heat between the liquid line (hot fluid) and the suction line (cold fluid), thereby improving the efficiency of the refrigeration unit by subcooling the liquid input to the expansion valve.

The liquid then flows towards a thermostatic expansion valve (with external pressure equalizer) which regulates the flowrate of refrigerant towards the evaporator in order to optimize the use of heat transfer surface.

The evaporator tubes have aluminum fins to increase heat transfer; the heat is removed from the air circulating through the evaporator. This cold air is ventilated through the box in order to maintain the cargo at the desired temperature.

The transfer of heat from the air to the low temperature liquid refrigerant causes the liquid to evaporate. This low temperature and low pressure vapor passes into the accumulater and is then drawn in by the compressor.

The refrigerant then enters the compressor pressure regulating valve (CPR), which regulates the suction pressure of the compressor, where the cycle recommences.

On units operating with R22, the quench valve opens (injection starts at 120°C - the valve is completely open at 140°C) in order to maintain a maximum acceptable discharge temperature.

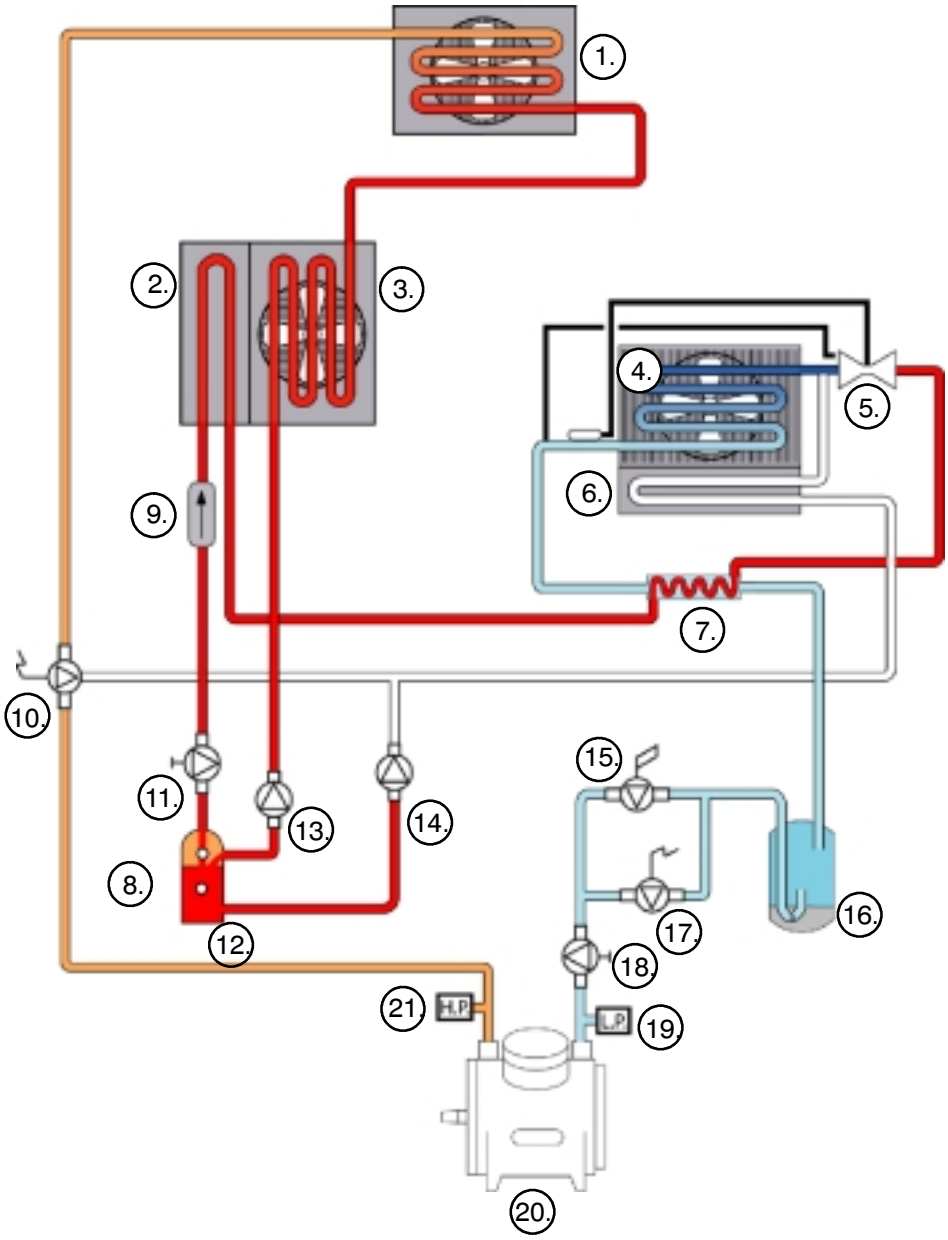
1.10.2 Heat and defrost mode

When refrigerant vapor is compressed to a high pressure and temperature in reciprocating compressors, the mechanical energy necessary to operate the compressor is transferred to the gas during compression. This energy is referred to as the "heat of compression", and is used as the source of heat during the heating cycle.

When the temperature controller triggers heating or defrost cycle, the hot gas valve (three-way) solenoid is energized, closing the condenser port and opening a port enabling the heated refrigerant vapor to flow directly to the evaporator coil.

The main difference between the heat and defrost cycles is that during heating, the fan of the evaporator continues to operate, circulating the air over the hot tubes in order to heat the product, whereas in a defrost cycle the fan of the evaporator stops, allowing the heated vapor to defrost any ice build-up there may be.

The function of the by-pass line from the hot gas valve to the receiver is to allow the discharge pressure to enter the receiver. Under pressure, the liquid refrigerant flows from the receiver through the expansion valve to the evaporator. This forces all the refrigerant out of the receiver and into the evaporator to be used for heating.



High pressure vapor

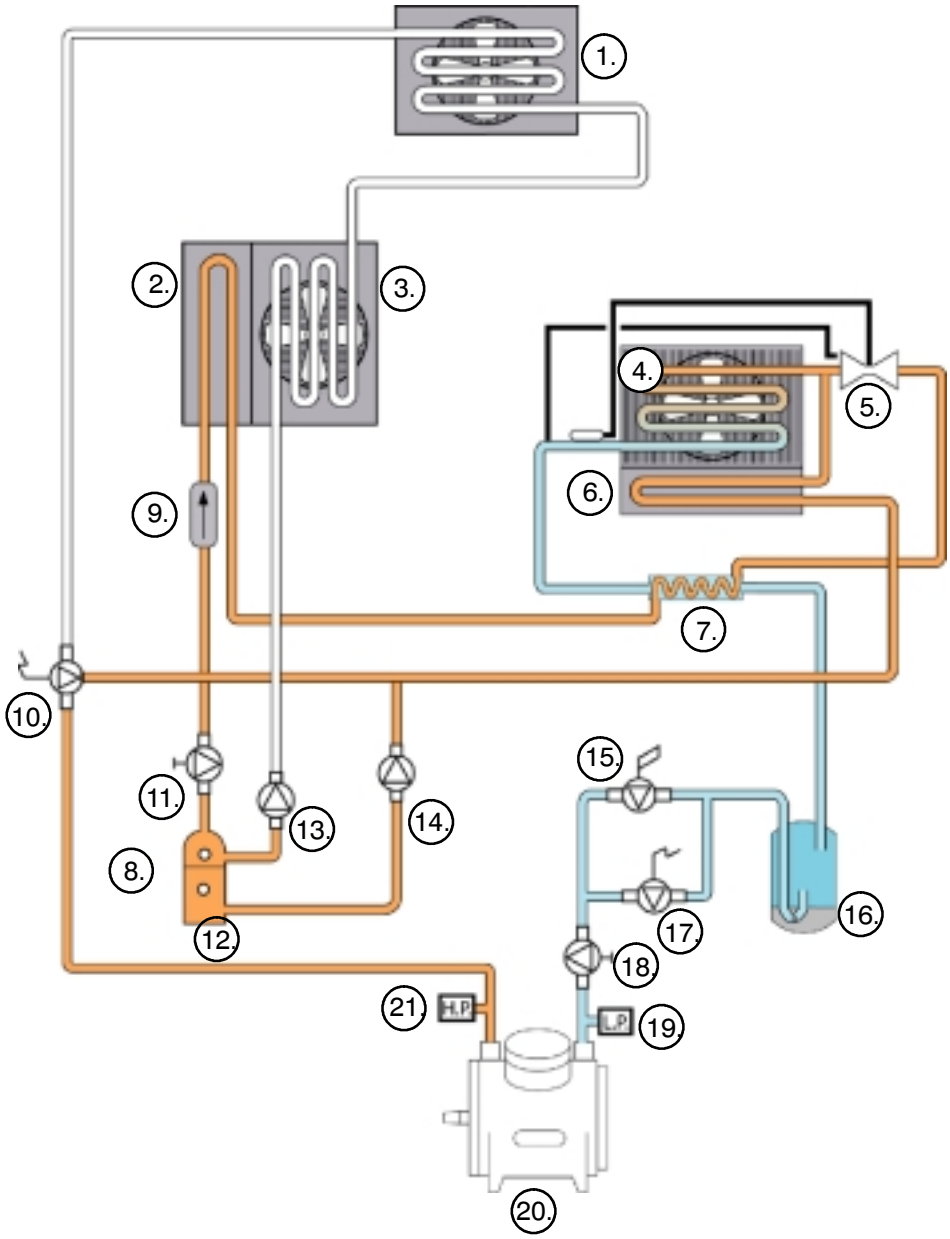
High pressure liquid

Low pressure vapor

Low pressure liquid

1. Upper condenser
2. Subcooler
3. Side condenser
4. Evaporator
5. Thermostatic expansion valve
6. Defrost element
7. Liquid vapor exchanger
8. Liquid sight glass
9. Filter drier
10. Three-way valve
11. Shut-off valve
12. Receiver
13. Check valve
14. Check valve
15. Compressor regulating valve (CPR)
16. Accumulator
17. Bypass valve
18. Discharge service valve
19. Low pressure switch
20. Compressor
21. High pressure switch

Figure 1-9 Cooling mode



High pressure vapor

High pressure liquid

Low pressure vapor

Low pressure liquid

1. Upper condenser
2. Subcooler
3. Side condenser
4. Evaporator
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6. Defrost element
7. Liquid vapor exchanger
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10. Three-way valve
11. Shut-off valve
12. Receiver
13. Check valve
14. Check valve
15. Compressor regulating valve (CPR)
16. Accumulator
17. Bypass valve
18. Discharge service valve
19. Low pressure switch
20. Compressor
21. High pressure switch

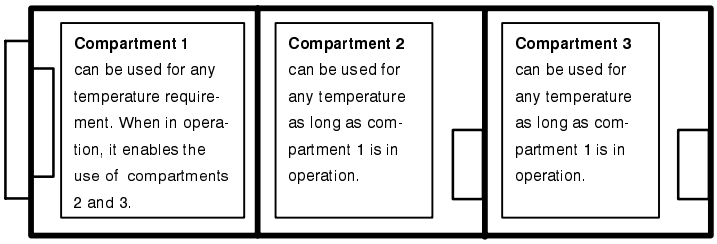
Figure 1-10 Heating and defrost mode

SECTION 2

OPERATION

MAXIMA 1200 Mt° ONLY

The MAXIMA 1200 Mt°, multiple compartment refrigeration systems offer the versatility of two or three compartment temperature control. The Multi-Temps allows the shipper to ship frozen and perishable commodities in the same load under separate refrigeration control. The Genesis Multi-Temps allows any compartment to be any temperature.



*The three compartments are controlled by the MAXIMA 1200 Mt° microprocessor control panel.

***COMPARTMENT 2 OR 3 ONLY OPERATES IF COMPARTMENT 1 IS IN OPERATION.**

MAXIMA 1000 - MAXIMA 1200 & MAXIMA 1200 Mt°

The MAXIMA 1000/1200 & 1200 Mt° are equipped with a diesel engine and an electric motor.

If necessary, the unit can operate as a heater simply by using the thermostat: its control is the same as for the refrigeration cycle.

The START/STOP system automatically cycles the unit on and off during engine operation, regulating refrigeration or heating output to meet the temperature requirements of the products being transported.

2.1 PRE-TRIP INSPECTION

2.1.1 Before starting engine

1. Drain water and sediment from fuel tank pump. Then fill tank with diesel fuel. (Refer to section 3.2.7)
2. Check radiator coolant level. (Add pre-mixed 50/50 permanent antifreeze-water as required.) USE ETHYLENE GLYCOL ONLY. (Refer to section 3.2.1)
3. Check evaporator and condenser coil for cleanliness.
4. Check engine lubrication and fuel filter, oil lines, and connections for leaks. (Tighten connections and/or replace gaskets.)
5. Check engine oil level. (Refer to section 1.2.14)
6. Check V-belts for proper tension, fraying or cracks. Adjust belt or replace.
7. Check battery terminals for cleanliness and tightness. Clean and coat with a mineral type grease (such as Vaseline).
8. Check condenser/evaporator fan shaft bearing for excessive gap.
9. Check engine air cleaner for cleanliness and condition of air cleaner hose.
10. Check oil level in compressor sight glass.
11. Check defrost drain pan hoses. (Should be clear of debris.)
12. Check defrost air switch tubes and connections for humidity, breaks or air leaks.

2.1.2 After starting Refrigeration unit

1. Check water temperature (Should be 160 to 180°F = 71 to 82°C.)
2. Check ammeter (Should indicate +2 to +10 amps after start-up.)
3. Check engine speed (Refer to section 1.2.13)
4. Listen for abnormal noises (Refer to section 4.3.7)
5. Check compressor oil level (Refer to section 3.10)
6. Observe any signs of lube or fuel oil leaks.
7. Check radiator hoses for leaks.
8. Check refrigerant level. (Refer to section 3.6)

9. Feel filter-drier. Excessive temperature drop across drier indicates restriction. (Refer to section 3.11)

10. Check clutch/gearbox for excessive noise.

11. Start microprocessor Pre-trip Inspection. (Refer to Section 1.8.9)

2.2 STARTING AND STOPPING INSTRUCTIONS - ENGINE DRIVE

WARNING

Under no circumstances should ether or any other starting aids be used to start engine.

NOTES

1. **Whenever starting the engine, in order to reduce starter cranking and engine loads, the microprocessor always starts and operates in low speed - Maxima 1200 & 1200Mt° ONLY.**

2. **From software 3.93 the unit will remain in low speed for 10 minutes after engine start-up when: Auto Start/Stop is at any setpoint or Continuous Run setpoint is below 10°F (-12°C) - Maxima 1200 ONLY.**

2.2.1 Automatic Start

a. Starting Instructions

1. Place the RUN-STOP switch in the RUN position. The microprocessor will perform a self-test (all display messages will appear in display window). Then setpoint and box temperature will be displayed.

2. The microprocessor will energize glow cycle (length of time depends on engine temperature). Units with buzzer will sound for 5 seconds before starting the engine.

3. To change the setpoint press the UP or DOWN arrow key and ENTER key.

4. Pressing the AUTO S/S-CONTINUOUS key changes the operation of the unit between automatic start/stop (unit will automatically start and stop in response to changing box temperature) or automatic start continuous run (unit will operate continuously after starting).

b. Stopping instructions

Place RUN-STOP switch in the STOP position to stop unit.

2.2.2 Manual Starting

a. Starting Instructions (Manual Starting)

1. To start the unit manually, place Run/Stop Switch to RUN position.

2. Press the AUTO S/S-CONTINUOUS key (if necessary) to erase START/STOP from the display.

3. Press the FUNCTION CHANGE key until AUTO OP or MAN OP appears on the display.

If AUTO OP appears :

- Press the ENTER key.

- Press the UP or DOWN arrow key to make MAN OP appear on the display.

- Press the ENTER key. The unit is in MANUAL START mode.

If MAN OP appears : the unit is in MANUAL START mode.

- Use the Manual Glow/Crank switch to start the unit refer to section AUCUN LIEN .

NOTE

Once the unit is programmed for Man OP, the AUTO S/S - CONTINUOUS key can be used to toggle between Auto Start/Stop and Continuous Run

Table 2-1 Manual Glow Time

Ambient Temperature	Glow Time in Seconds for	
	TV	DI
Less than 0°C (32°F)	15	55
1°C to 10°C (33°F to 50°F)	10	40
11°C to 25°C (51°F to 77°F)	5	25
Greater than 26°C 78°F	0	10

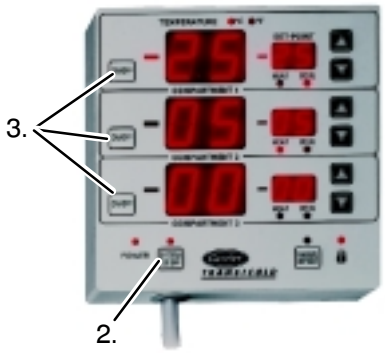
b. Stopping Instructions

Place RUN-STOP switch in the STOP position to stop unit.

2.3 COMPARTMENT OPERATION

2.3.1 Operation with auxiliary control panel

1. Start the unit.



2. Press the SYSTEM ON/OFF key. Power light will go ON.

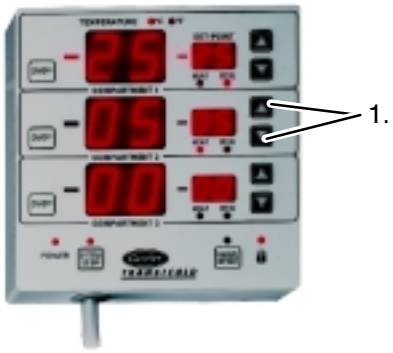
3. Press the ON/OFF key to energize selected compartment.

4. DISPLAY

--	waiting for communication with unit
-20	compartment temperature display
-20	setpoint temperature display
	evaporator status (heat or cool or null)
OF	compartment shut-down via remote control
dF -20	defrost compartment
-- -20	temperature sensor malfunction

2.3.2 Changing setpoint

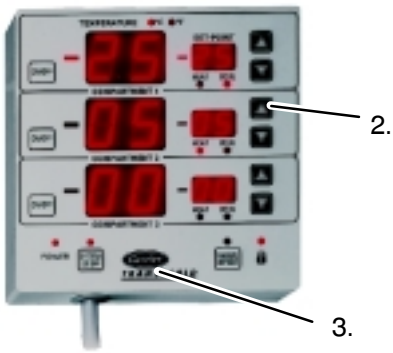
Setpoint change can be made from control panel or cab control.



1. Press the UP or DOWN ARROW key to increase or decrease setpoint. This is the same operation for each compartment.

2.3.3 Set pre-set setpoint

The control panel allows the user to pre-set 5 differents temperatures on each compartment.



1. Switch main RUN/STOP switch and required remote compartment switches on the unit to RUN.

2. Press Carrier logo and the lock light will be displayed.

3. Press host compartment UP ARROW key for 10 seconds. P1 will be displayed in all compartments.

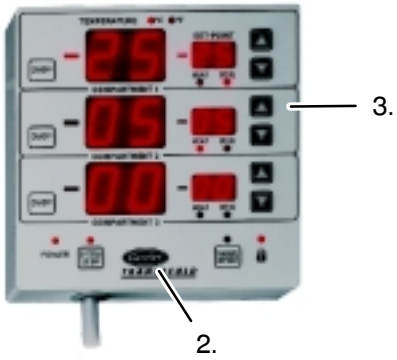
4. Set lowest setpoint temperature required.

5. Press Carrier logo and P2 will be displayed.Set next lowest temperature required up to five pre-set setpoints are available.

6. Pressing the second compartment up or down arrow will allow the lowest temperature required to be preset in the second compartment. Pressing Carrier logo will then move on to the nest lowest (up to five).

7. Press the Carrier logo for 10 seconds and this will remove the lock light and store the pre-set setpoints in memory.

2.3.4 Remove pre-set setpoint



1. Switch main RUN/STOP switch and required remote compartment switches on the unit to RUN.

2. Press Carrier logo and the lock light will be displayed.

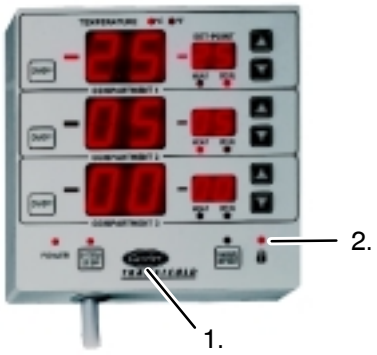
3. Press host compartment up arrow for 10 seconds. P1 will be displayed in all compartments.

4. Set temperature to lowest possible and OFF will be displayed.

5. Press the UP ARROW key on remote compartments will display the presets, take the temperature to the lowest possible and OFF will be displayed.

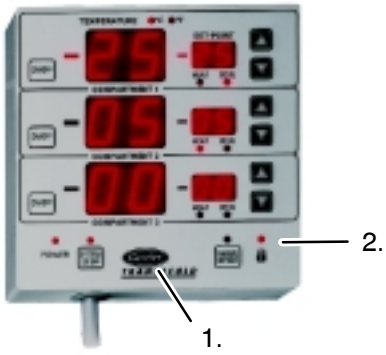
6. Press the Carrier logo for 10 seconds and the new information will be stored in memory.

2.3.5 Lock the control panel



1. Press the CARRIER logo 1 s.
2. The indicator comes on.

2.3.6 Unlock the control panel



1. Press the CARRIER logo for about 10 s.
2. The indicator goes off.

REMARK

IT IS NOT NECESSARY FOR THE COMPARTMENT TO BE RUNNING IN ORDER TO MODIFY OR SEE THE SET-POINT VALUE AND THE TEMPERATURE OF THE COMPARTMENT.

THE UNIT CAN BE SHUT DOWN BOTH WITH THE CAB COMMAND AND THE GENERAL SWITCH.

2.4 STARTING AND STOPPING INSTRUCTIONS - STANDBY MOTOR DRIVE

WARNING

Beware of unannounced starting of fans and V-belts caused by thermostatic cycling of unit during Standby operation.

2.4.1 Starting instructions

1. Place the Run/Stop Switch in the STOP (0) position.
2. Plug in the power plug.
3. Place the Engine/Standby Switch in the STANDBY position.
4. Place the Run/Stop Switch in the RUN (I) position. Buzzer will sound for 5 seconds before starting.
5. Check for proper motor rotation. Condenser air must be drawn into unit. To reverse rotation, stop unit, disconnect power cord and change polarity of plug.

2.4.2 Stopping instructions

WARNING

When changing from standby operation, first turn the unit OFF, turn OFF main power and remove power plug.

Place the Run/Stop Switch in the STOP (0) position.

2.5 CONTROL CIRCUIT OPERATION – ENGINE DRIVE

2.5.1 Introduction

NOTE

The schematic in this manual has map coordinates added to the margins. For example, to locate the 12VDC alternator (ALT) on the MAXIMA 1000&1200 schematic, it would follow the component designation by the designation. This would indicate that it is closest to lines E and 1 on the schematic. These locations have been added to the legend.

The controller boards shown on the electrical schematic that interface with unit components are the pro
cessor board on the left and the relay module on the right.

Connections to these boards are made through 3 multiple-pin plug connectors HC, HC2, & MP. The address system (example HCD2-MPW2) indicates a wire between plug HC, pin D2 and microprocessor MP & pin W2.

The processor board connections are mainly inputs and outputs for control switches, temperature sensors, safety, and auto start functions that control the operation of the unit. The processor board also controls the operation of the relay board through plug connections.

The relay module, which contains plug-in interchangeable relays provides the microprocessor with a means for switching the unit components to achieve a desired operating mode.

2.5.2 Cooling

MAXIMA 1200 / 1200 Mt°

There are two control ranges, Frozen and Perishable. The Frozen range is active with set points at or *below -12°C (+10°*F) and the Perishable range is active at set points *above -12°C (+10°*F).

If the unit is in high speed cool, the microprocessor will pull terminal N3 low to energize the speed relay. A set of normally open contacts (SR) close to energize the speed control solenoid (SCS). The engine will be in high speed.

When the unit is running in high speed cool and with the evaporator coil temperature below 4.4°C (40°F) to close at least one defrost termination thermostat, a pre-trip may be initiated by depressing the PRETRIP key. The operator now may verify the pre-trip sequence. (Refer to Section 1.8.9)

As the box temperature falls toward set point, the microprocessor will place the unit in low speed cool. The temperature at which this occurs is not fixed but depends upon the operating conditions.

The speed relay (SR) de-energizes to open the circuit to the speed control solenoid (SCS). Engine speed decreases from high speed to low speed.

For setpoints above -12°C (10°F) and with decreasing temperature, the unit will shift to low speed heat.

Unit will remain in various stages of heating until the box temperature increases enough to place the unit in the low speed cool mode. As the box temperature increases, the unit will shift to high speed cool mode (speed relay energizes).

MAXIMA 1000

When the unit is running in cool and with the evaporator coil temperature below 4.4°C (40°F) to close at least one defrost termination thermostat, a pre-trip may be initiated by depressing the PRETRIP key. The operator now may verify the pre-trip sequence. (Refer to Section 1.8.9)

As the box temperature falls toward set point, the microprocessor will place the unit in heat mode.

Unit will remain in heating until the box temperature increases enough to place the unit in cool mode. As the box temperature increases, the unit will shift to cool mode.

2.5.3 Heating

MAXIMA 1200 / 1200 Mt°

Refer to section 1.10.2 for description on heating cycle.

The unit will only heat when the controller is set above -12°C (+10°F) as the heat relays are electronically locked out with set points at or below -12°C (+10°F).

The controller automatically selects the mode necessary to maintain box temperature at set point. The heating modes are as follows with descending temperatures:

(a) Low Speed Heating, (b) High Speed Heating.

The controller will shift the unit into low speed heat when the box temperature falls below set point. The microprocessor pulls terminals MP51 low to complete the ground paths for the heat relays HR1.

If more heating capacity is required, the unit will shift to high speed heating. The microprocessor energizes the HR1 and speed relay (SR) coils. Terminals MP51, MP38 and N3 will be pulled low. SR contacts close to energize the speed control solenoid (SCS). The engine will be in high speed.

MAXIMA 1000

Refer to section 1.10.2 for description on heating cycle.

The unit will only heat when the controller is set above -12°C (+10°F) as the heat relays are electronically locked out with set points at or below -12°C (+10°F).

The controller automatically selects the mode necessary to maintain box temperature at set point. The heating modes are as follows with descending temperatures.

The controller will shift the unit into heat mode when the box temperature falls below set point.

2.5.4 Defrost

Refer to section 1.10.2 for the heat and defrost cycle.

NOTE

The unit will be in high speed in the defrost mode - MAXIMA 1200 ONLY

The defrost mode may be initiated by three different ways if the evaporator coil is below 1.7°C (35°F) (Refer to section 1.6).

Method one to initiate defrost is by pressing the MANUAL DEFROST key.

Method two is that defrost may be initiated automatically at preset intervals by the defrost timer in the microprocessor. (Refer to section 1.8.2). The manual defrost key and defrost timer are part of the microprocessor and are not shown on the schematic.

The third means of defrost initiation is by the defrost air switch (DA). The switch is an air pressure differential switch which measures air pressure differential across the evaporator coil and initiates the defrost cycle when the air pressure differential increases enough to close the DA contacts, such as would happen when excessive frost builds up on the evaporator coil surface.

When the defrost air switch contacts close, there is a 12 vdc potential to terminal MP33 on the microprocessor. The microprocessor looks for voltage at terminal MP31. Voltage at MP31 indicates that defrost termination thermostat is closed. The unit will shift to the defrost mode if voltage is present at MP31.

If defrost thermostat (klixon) is open (no voltage at MP31), defrost cannot be initiated by any means.

In defrost the microprocessor pulls terminals MP51, MP38 and N3 low to shift the unit into high speed heat. The processor also pulls terminal MP41 low to energize the defrost relay coil. This closes the N.O. defrost relay contacts to energize the defrost light on the remote light bar. The defrost and heat display will also be illuminated.

Also N.C. defrost relay contacts open to stop the evaporator fan blower.

The unit will remain in defrost until both defrost termination thermostats open to remove voltage from the defrost relay. If the thermostats fail to open in 45 minutes, the microprocessor will terminate defrost and shift between normal control and defrost at 1 1/2 hour intervals. This will also occur if the defrost air switch is stuck closed.

If the problem corrects itself, (thermostats opens for example), the unit will automatically resume its normal functions).

The defrost termination starts with HR1 and speed relay de-energizing. The defrost output will de-energize 5 seconds after HR1.

If the temperature control requires high speed, it will energize 2 seconds after defrost relay is de-energized - MAXIMA 1200 ONLY.

MAXIMA 1200&1200 Mt° CONTINUOUS MODE

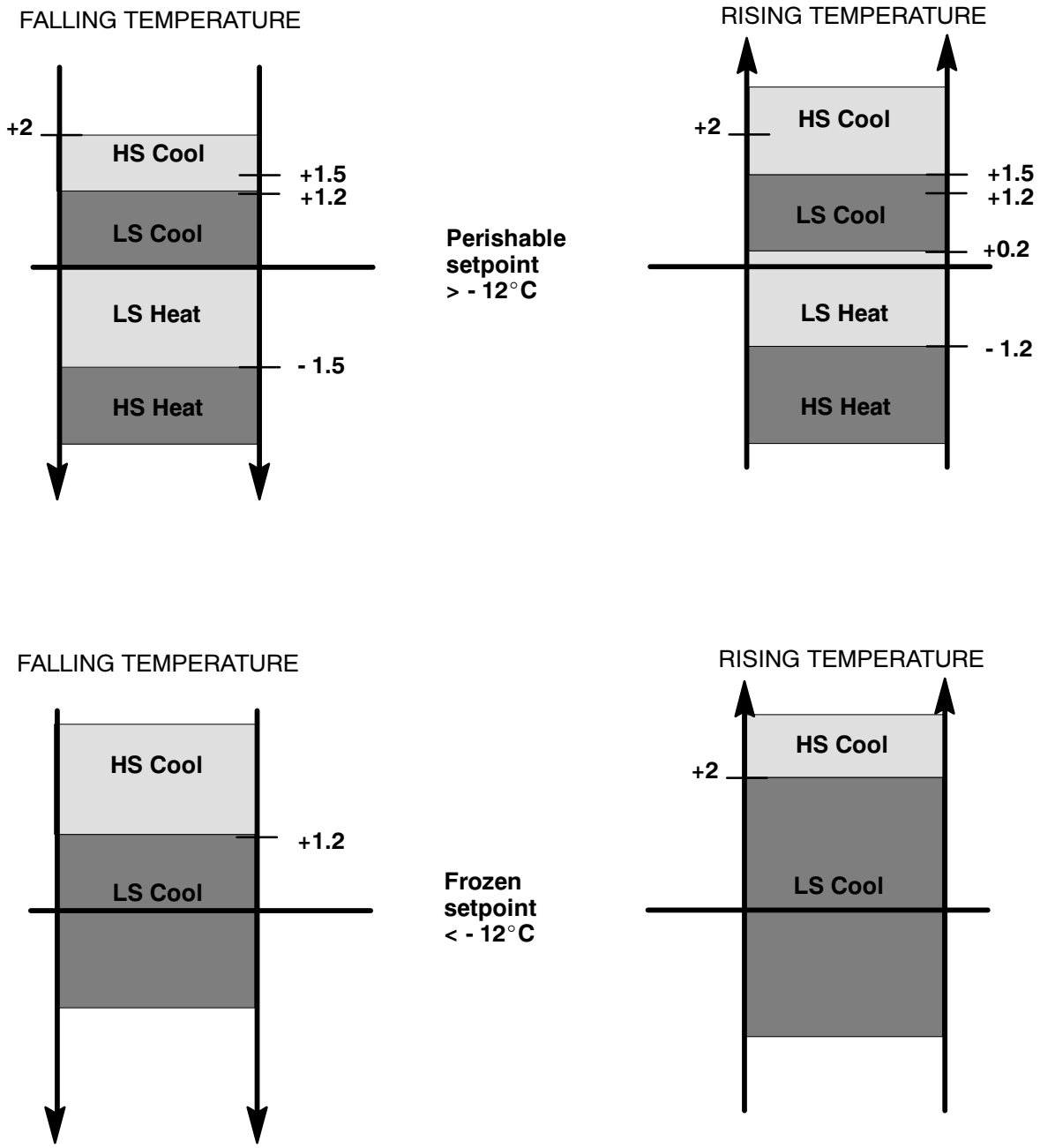


Figure 2-1 MAXIMA 1200&1200 Mt° Temperature controller sequences

MAXIMA 1000 CONTINUOUS MODE

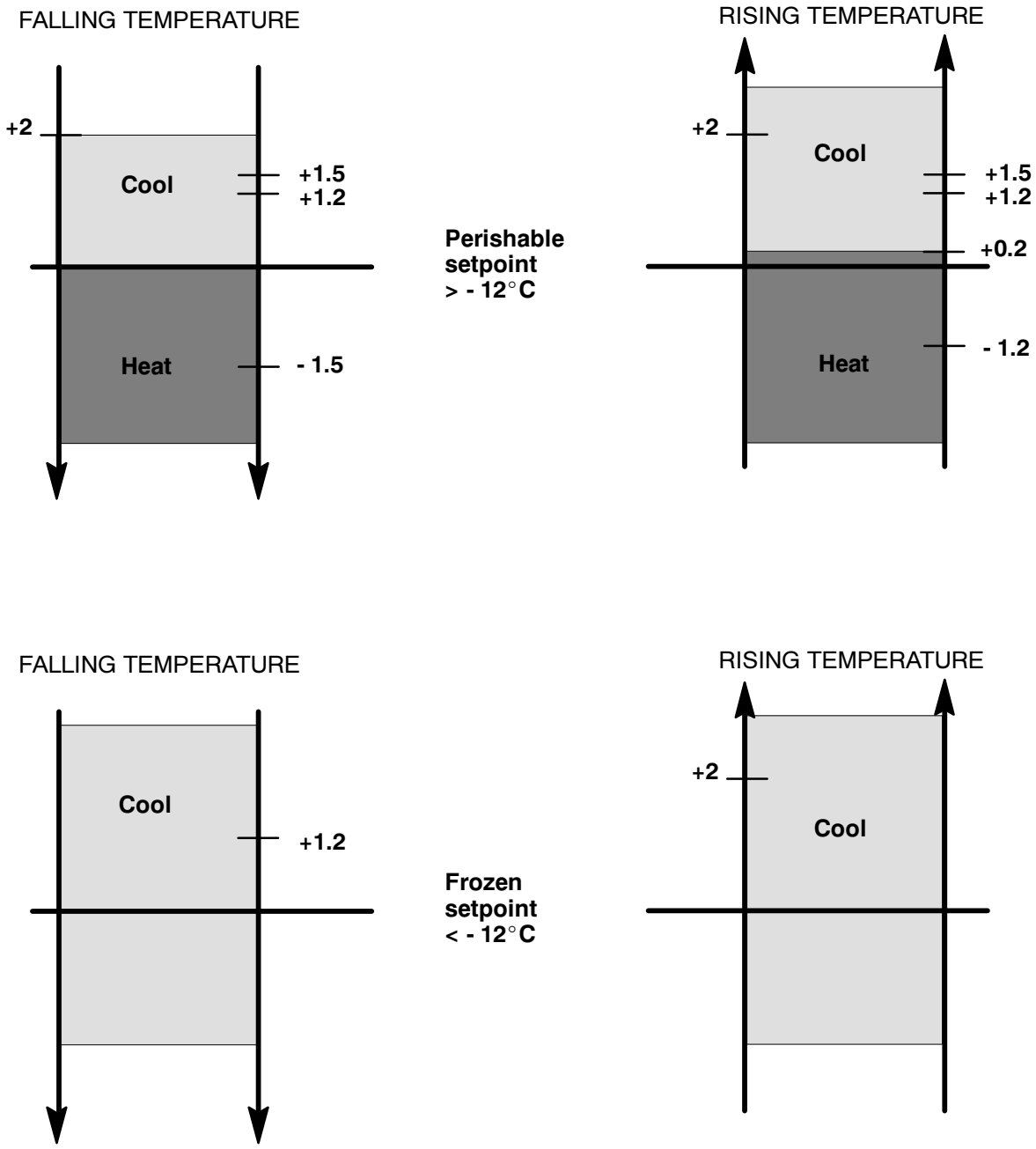


Figure 2-2 MAXIMA 1000 Temperature controller sequences

2.6 CONTROL CIRCUIT OPERATION – STANDBY MOTOR DRIVE

NOTE

To make it easier to locate the schematic components referred to in the written text, the schematic in this manual has map coordinates added to the margins. These locations have also been added to the legend.

The relay module, which contains plug-in interchangeable relays provides the controller with a means for switching the unit components to achieve a desired operating mode.

2.6.1 Electric Standby Features

1. Two Operating Modes
2. Minimum "ON" Time (5 Minutes)
3. Minimum "OFF" Time (5 Minutes)
4. Low Battery Protection
5. Two operating modes: Electric Standby can operate in the Start/Stop mode or the Continuous Run mode.

During Start/Stop operation, (Perishable Range) the unit will operate in 3 modes: A) "Cool" cycle B) "Off" cycle C) "Heat" cycle.

During Start/Stop operation, (Frozen Range) the unit will operate in 2 modes: A) "Cool" cycle B) "Off" cycle.

In the Start/Stop mode, when the box temperature gets close to setpoint, the controller will cycle the Standby Motor(SBM) off to conserve energy. The microprocessor automatically locks out heating for entered setpoints below –12.2°C (10°F). Therefore, it is possible for the box temperature to fall below setpoint in the frozen range.

6. Minimum "ON" time (5 minutes): The unit *must* run for the minimum run-time before it can consider shutting off. This minimum run time is to prevent short cycling and ensure adequate air flow through the load to allow the controller to accurately sense load temperature and bring the battery up to minimum voltage level. It also prevents "hot spots" in a properly loaded box.

After the minimum run time is complete, the microprocessor will look at the remaining conditions that must be satisfied to allow a shutdown. These are :

A) Battery condition – Battery voltage must be above 13.4 volts. (measured at MP35)

B) The box temperature (active probe) must be satisfied :

Perishable Range Setpoints +/– 0.3°C (0.5°F)

Frozen Range Setpoints + 0.3°C (0.5°F)

If *ALL* of these conditions are not satisfied, the motor will continue to run until they are. This prevents rapid cycling of the electric drive motor.

7. Minimum "OFF" time (5 minutes): Once the motor has cycled off, it will remain off for the minimum "off time". This prevents the motor from rapid cycling due to changes in air temperature. Air temperature in the box can change rapidly, but it takes time for the product temperature to change.
8. Low battery voltage protection: The microprocessor will restart the unit if the battery voltage drops below 12.2 volts to recharge the battery after the minimum off-time delay.

NOTE

When in Continuous Run, perishable range, the unit will cycle between cool and heat to maintain box temperature at setpoint. In frozen range the unit will run in cool only. Continuous Run is normally used for perishable products that require constant air flow.

2.6.2 Standby Cool

When in standby cool, Start/Stop, the microprocessor will energize the following circuits :

First the microprocessor will energize (ARR), this will close a set of N.O. (ARR) contacts, energizing the Auto Restart Light (ARL) on the light bar, indicating to the operator that the unit is in the START/STOP mode and may start at any time. After a 5 second delay the Diesel Electric Relay (DER) will be energized, this will open the N.C. (DER) contacts to prevent the Fuel Heater Relay (FHR), Fuel Pump (FP) and the Fuel Solenoid (FS) from being energized during standby operation. At the same time the N.O. (DER) contacts will close. This will energize the Power Light (PL) on the light bar indicating to the operator that the unit is in the standby mode of operation, and also energize the Motor Contactor (MC). With the motor contactor energized, the N.O. (MC) contacts will close, supplying voltage to energize the standby motor.

At the same time, (RR) will be energized, closing the N.O. (RR) contacts supplying voltage to the refrigeration control circuitry.

2.6.3 Standby OFF

In the start/stop mode,after the standby motor has run at least five minutes and the controller is ready to switch from cool to heat (box temperature near setpoint), the microprocessor will de-energize the (RR) causing the standby motor to cycle off.

When the unit is "OFF," the microprocessor keeps (ARR) energized. The unit will remain off for at least 5 minutes before restarting. If after 5 minutes, the battery voltage drops below 12.2 volts or the box temperature drifts out-of-range, +/– 2.0°C (3.6°F) from

setpoint for perishable range and +2.0°C (3.6°F) above setpoint for frozen range, the standby motor will restart.

2.6.4 Standby Defrost

Standby defrost operates the same as engine drive defrost refer to section 2.5.4.

Table 2-2 Relay Operation – Microprocessor controls

RELAY OPERATING - MICROPROCESSOR CONTROLLER													
Mode	**DER**	**GPR**	**RR**	**SSR**	**SR***	**HR1**	**R**	**BPR**	**DR**	**OR**	**ARR**	**FR**	**FHR**
Shut-down	O	O	O	O	O	O	O	O	O	O	O	O	O
Pre-heating	O	I	I	O	O	I	I	I	O	O	O	O	I
Start-up	O	I	I	I	O	I	I	I	O	O	O	O	I
High speed cool	O	O	I	O	I	O	O	I	O	O	O	O	I
Low speed cool	O	O	I	O	O	O	O	I	O	O	O	O	I
OFF cycle	O	O	O	O	O	O	O	O	O	O	I	O	O
Low speed heat	O	O	I	O	O	I	O	O	O	O	O	O	I
High speed heat	O	O	I	O	I	I	O	O	O	O	O	O	I
Defrost	O	O	I	O	I	I	O	O	I	O	O	O	I
High Ambient Defrost Stage	O	O	I	O	O	O	O	O	O	O	O	O	I
STANDBY OPERATION													
Cool	I	O	I	O	O	O	O	I	O	O	O	O	O
OFF cycle	O	O	O	O	O	O	O	O	O	O	I	O	O
Heat	I	O	I	O	O	I	O	O	O	O	O	O	O
Defrost	I	O	I	O	O	I	O	O	I	O	O	O	O

I = Output ON

O = Output OFF

* SR : only for MAXIMA 1200 & 1200Mt°

SECTION 3

SERVICING

WARNING

Beware of V-belts and belt-driven components as the unit may start automatically. Before servicing unit, make sure the Run-Stop switch is in the Stop position. Also disconnect the negative battery cable.

NOTE

To avoid damage to the earth's ozone layer, use a refrigerant recovery system whenever removing refrigerant.

3.1 MAINTENANCE SCHEDULE

Regular maintenance should be performed in order to maximize the service life and reliability of your unit. Maintenance includes oil drains, air and fuel filter replacement, coolant replacement, belts, etc...

Maintenance should be performed according to the following schedule:

MAXIMA 1000 / 1200 & 1200 Mt°	**Required service**							
With by-pass oil filter	A	A	A B	A C	A B	A	A B C	A
Hours	400	1500	3000	4500	6000	7500	9000	10500

Servicing operations require the use of approved oils and regular inspections before running the unit.

Required servicing operations are described in the following table:

Servicing Operations	
Servicing A	Drain the engine oil and replace air filter oil. Lubricate the diesel engine control axes. Replace the oil filter cartridge and the by-pass filter cartridge. Replace fuel filter cartridge. Clean fuel pump filter. Check coolant level, refrigerant level in the expansion pressurized bottle. Check battery electrolyte level. Drain water from fuel tank. Check alternator charge. Check temperature controller for proper operation. Check manual/auto defrost. Check three-way valve solenoid for proper operation. Check defrost klixons for timely cut-out. Check defrost water draining. ***Check speeds of engine in HS/LS - ONLY FOR MAXIMA 1200 & 1200Mt°*** Check all bolts for tightness. Check unit mounting bolts for tightness. Check belts and belt tension pulleys. Check all lights and switches. Check seals on all piping and connections. Check all relays, electrical connections and sheaths. Clean condenser and radiator coils. Compressor oil level Check refrigerant charge Check clutch wears

Servicing Operations	
Servicing B	Grease blower and hinges. Replace the belts. Check clutch wear Wash air cleaner element
Servicing C	Replace bearings and brushes in 12 VDC alternator. Check and adjust the clutch. Calibrate fuel injectors (140 kg/cm2). Check and adjust rocker arms.

3.2 SERVICING DIESEL ENGINE COMPONENTS

3.2.1 Cooling system

The radiator is located in the upper part of the condenser.

The condenser and radiator can be cleaned at the same time.

The radiator must be cleaned internally as well as externally to maintain adequate cooling.

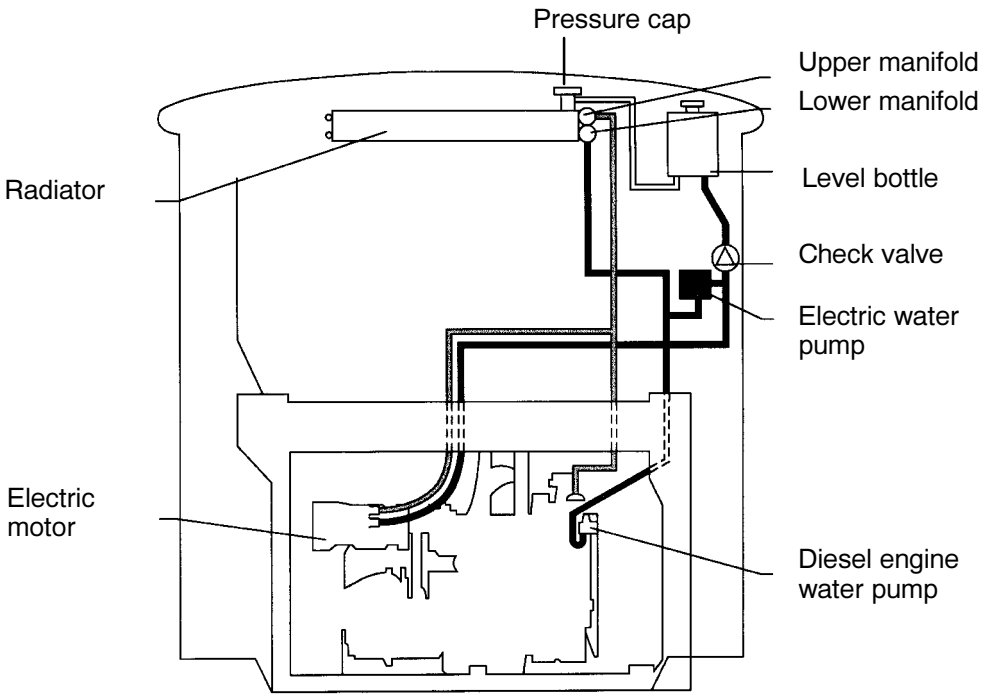


Figure 3-1 Unit cooling circuit diagram

CAUTION

Use only ethylene glycol anti-freeze, as glycol by itself will damage the cooling system.

Always add pre-mixed 50/50 anti-freeze and water to radiator/engine.Check the level through the expansion pressurized bottle. Never exceed more than a 50 % concentration of anti-freeze. Use a low silicate anti-freeze.

a. Compressed air or water may be used as a cleaning agent.

b. Drain coolant by opening drain cock (located at the lower rearside of the engine) and removing radiator cap.

c. Re-install hose and fill system with clean, untreated water to which 3 to 5 % of an alkaline-based radiator cleaner should be added (150 g to 3.8 liters of water).

d. Run engine 6 to 12 hours and drain system while warm. Rinse system three times after it has cooled down. Refill system with water.

e. Run engine to operating temperature. Fill with treated water/anti-freeze. (See Caution above and refer to section1.2.3). NEVER POUR COLD WATER INTO A HOT ENGINE.

3.2.2 Changing lube oil and lube oil filters

After warming up the engine, stop the engine, remove drain plug from oil crankcase and drain engine lube oil.

CAUTION

When changing oil filters, the new filters should be primed with clean oil. If the filters are not primed, the engine may operate for a period with no oil supplied to the bearings.

Replace the filter(s), lightly oil gasket on filter before installing and add lube oil. Warm up engine and check for leaks.

3.2.3 Checking the speed control solenoid and the gear rod assembly - *only MAXIMA 1200 & 1200Mt°*

1. Disconnect wiring to solenoid.
2. Disconnect linkage rod from solenoid.
3. Remove mounting hardware and solenoid.
4. Loosely install the replacement solenoid and its mounting hardware.
5. Attach linkage to new solenoid and install the clip to the linkage rod.
6. Slide the injection pump lever far enough from the solenoid until it rests against the pump stop and hold it in this position (high speed position). The solenoid lever must be fully down.
7. Tighten solenoid mounting hardware.
8. Reconnect the solenoid wiring.
9. Check engine speed. Speed may be verified by a strobe-tachometer.
10. Adjust the temperature controller to the trailer temperature then start the engine. Engine speed should be 1450 rpm. Then adjust the temperature controller to 5.5°C (10°F) below box temperature. The engine should be in high speed (Refer to 1.2.13). If engine speed is not correct (i.e. if pump lever is not against stop), unscrew mounting screws and move the solenoid towards the lever (the mounting plate has oblong holes).
11. If speed adjustment is not correct after step 10. above, stop engine and disconnect the linkage rod. Pull the solenoid shaft outward (sufficiently to loosen the locking nut on the shaft). Energize the solenoid to obtain maximum force (pulling) then turn the shaft clockwise to shorten it.
12. De-energize the solenoid, re-tighten the nut onto the shaft and replace the cover. Connect the linkage rod and repeat steps 9. and 10. above.

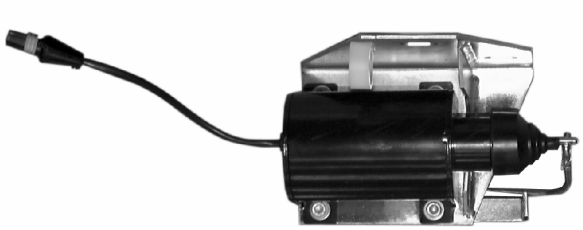


Figure 3-2 Solenoid

CAUTION

When replacing the Start/Stop solenoid, check the 2-second timer for proper operation.

- **Disconnect the power wiring.**
- **Remove mounting screws and then the solenoid.**
- **Install the replacement solenoid and the mounting screws, then reconnect the power wiring.**
- **Check Start/Stop solenoid comsumption.**

3.2.4 Engine air cleaners

1. **Inspection**

The engine air cleaner, its hose and connections should be inspected for leaks. A damaged air cleaner or hose can seriously affect the performance and life of the engine. If housing has been damaged, check all connections immediately.

When inspecting the air cleaner, check its housing, hoses and connections for leaks, and look for fractures in the inlet and outlet hoses. When leakage occurs, re-tighten or replace necessary parts or gaskets. Swollen or distorted gaskets must always be replaced.

2. **Service intervals and procedures**

The air cleaner is designed to effectively remove contaminants from the air stream entering the engine. An excessive accumulation of these contaminants in the air cleaner will impair operation; a service schedule therefore must be set up and followed.

3.2.5 Oil bath air cleaner

1. **Oil cup**

Service intervals: according to operation conditions. Never allow more than 10 mm of dirt deposit to accumulate in the oil cup. More than 10 mm of accumulation could cause oil and dirt to enter the engine, causing accelerated engine wear. Heavily contaminated oil will not allow the air cleaner to function properly.

CAUTION

Always cover the engine inlet tube while the air cleaner is being serviced.

How to service: stop the engine and remove the oil cup from the air cleaner. Dump the oil from the oil cup. Remove and clean the oil cup.

Reassemble and fill the oil cup to the indicated level with SAE #10 oil (for temperatures below freezing), or SAE #30 oil (for temperatures above freezing). It is recommended to use the same oil as required in the engine crankcase.

CAUTION

Do not underfill or overfill the oil cup: overfilling means loss of capacity; underfilling means lack of efficiency.

2. **Air cleaner body**

When to service: The lower portion of the fixed element should be inspected each time the oil cup is inspected or serviced. If there is any sign of contaminant build-up or plugging, the body assembly should be removed and back flushed. At least once a year or at regular engine service periods remove the entire air cleaner and perform the following:

a. Remove the oil cup. Check and clean center tube. NEVER USE GASOLINE TO CLEAN.

b. Pump solvent through the air outlet with sufficient force and volume to produce a hard, even stream out of the bottom of the body assembly. Reverse flush until all foreign material is removed.

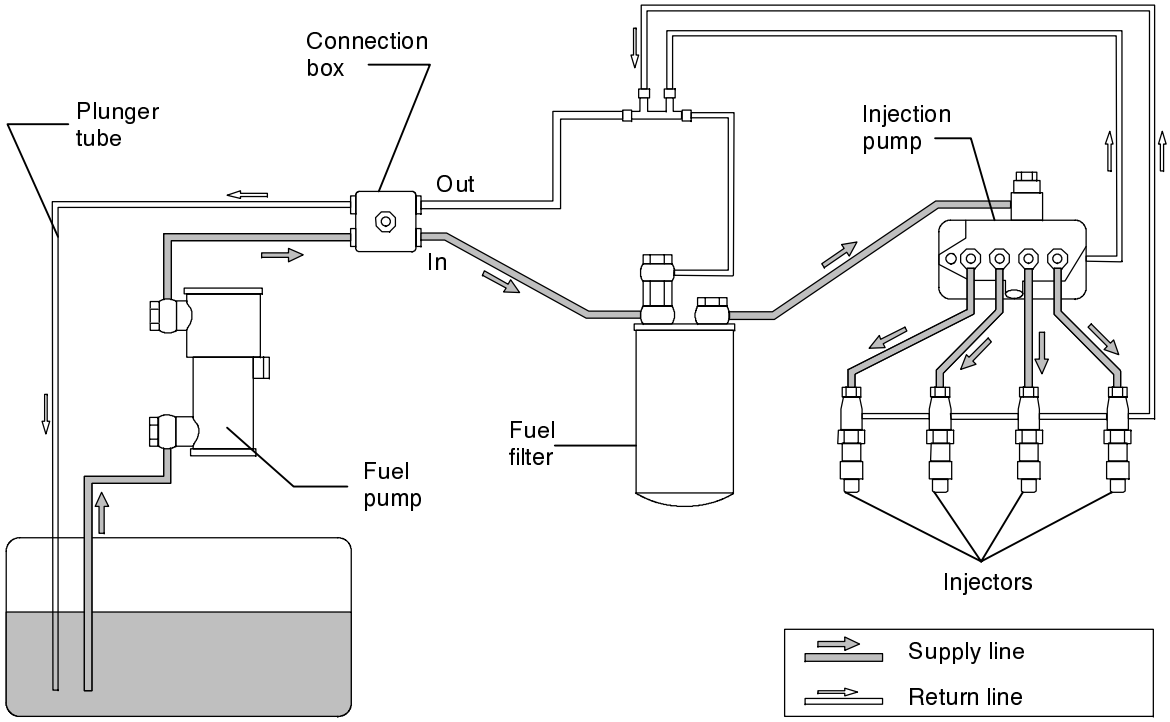


Figure 3-3 Diesel fuel delivery system

3.2.6 Replacing the Diesel filter

1. Unscrew the cartridge.
2. Put in a new cartridge after filling it with diesel fuel.
3. Purge the circuit by manually preheating, so that the diesel pump can evacuate the air that has entered the circuit.

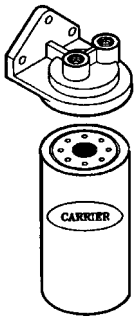


Figure 3-4 Fuel filter

3.2.7 Servicing fuel pump

a. To check or to replace

1. Remove 3 screws from cover (Figure 3-5).
2. Remove cover, gasket and filter.
3. Wash filter in cleaning solvent and blow out with air pressure. Clean cover.

Protect carefully your eyes from solvent.

4. To install reverse above steps.

1. Fuel pump
2. Filter
3. Gasket
4. Cover

Figure 3-5 Electric fuel pump

b. Verify fuel pump capability

1. Remove fuel pump from the system. Connect the manometer to pump outlet. Energize fuel pump with a small quantity of fuel.
2. At zero flow, the fuel pump should provide about 0.7 bars of pressure at the pump outlet.
3. When running correctly the fuel pump generates noise according to pulsation of the inner piston.

   - pulsation frequency high : fuel circuit has low pressure drop - high flow.

   - pulsation frequency low (or null) : high pressure drop inside the circuit - low or zero flow. Check for restriction inside the circuit.

3.2.8 Glow plugs

The glow plugs, when energized, draw a nominal 4 or 5 amps at 12 Vdc. When servicing, the glow plugs are to be fitted carefully into the cylinder head to prevent any damage. Torque value must be 0.8 to 1.5 mkg (6 to 11 ft-lb.).

Checking for a defective glow plug.

a. One method is to place an ammeter in series with each glow plug and energize the plugs. Each glow plug (if good) should show amperage draw.

b. A second method is to disconnect the wire connection to the glow plug and test the resistance from the plug to a ground on the engine block. The reading should be 0.7 to 1.2 ohms if the plug is good.

3.3 CLUTCH REPLACEMENT PROCEDURE

1. Install the service gauges.
2. Frontseat the HP and LP valves on the compressor (In the case of leaking valves, transfer the refrigerant into the refrigerant cylinder).
3. Pump down refrigerant from compressor.
4. Remove the alternator housing.
5. Loosen the alternator.
6. Remove the belt of the alternator.
7. Loosen the belt tension pulley between the electric motor and the condenser fan bearing.
8. Remove the belt between the electric standby motor and the fan bearing.
9. Loosen and lower the electric motor.
10. Remove the belts from the electric motor pulley.
11. Remove the HP and LP valves from the compressor and plug the compressor.
12. Remove the compressor rear mounting screw.
13. Remove the 6 screws from the clutch and insert it into the compressor pulley.
14. Remove the coupling screws from the compressor on the diesel engine.

15. Withdraw the compressor and the clutch assemblies.
16. Replace the clutch and reassemble it by following the operations described above through to n° 4 in reverse order.
17. Connect the vacuum pump, vac out the compressor for approximately 1 hour to 500 microns.
18. Switch of gauges and vac pump, check for risc in pressure.
19. Disconnect the pump.
20. Backseat the HP and LP valves releasing refrigerant into compressor.
21. Start up - Check the refrigerant charge and the temperature pull-down.

3.4 SERVICING AND ADJUSTING V-BELTS

3.4.1 Replacing the alternator V-belt

a. Make sure the negative battery terminal is disconnected.

b. Place the V-belt on the alternator sheave and the driving pulley.

c. Pivot the alternator to exert a tension on the belt using hand force only. Warning: excessive force or the use of a pry bar can cause bearing failure. Tighten the pivot and adjustment bolts.

3.4.2 Water pump Belt tensioner

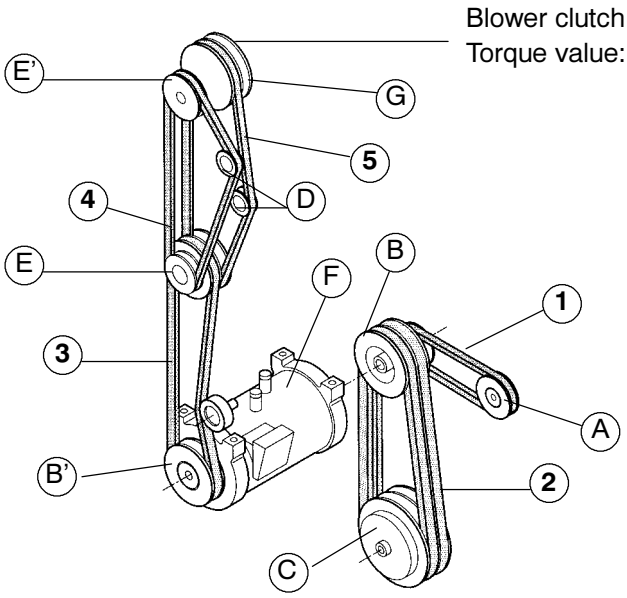
The water pump belt is driven by the crankshaft pulley of the diesel engine. The automatic belt tensioner ensures belt tension is correct.

To change the water pump belt, proceed as follows:

a. To compress the tensioner spring, place a threaded bolt or rod into the hole and turn clockwise. This will draw the spring up and slacken the V-belt, making it easier to remove.

b. After replacing the V-belt, remove the bolt in order to release the spring, enabling the idler to revert to the proper tension.

3.4.3 Standby motor - compressor V-belt



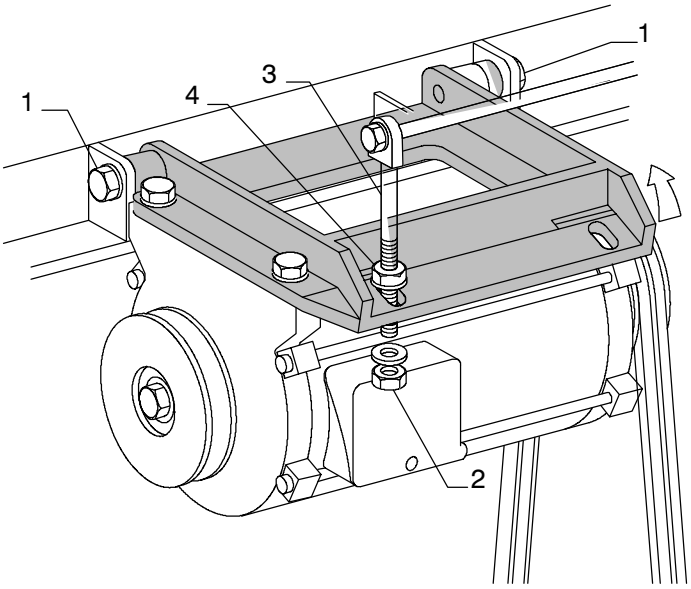
A	:	Alternator
B.B'	:	Standby motor pulley
C	:	Clutch/Compressor/Diese
D	:	Belt tension pulleys
E.E'	:	Condenser blower
F	:	Tensioner
G	:	Electromagnetic clutch

1. Alternator/ Standby motor
2. Standby motor/compressor (two
3. Standby motor - blowers (main v
4. Condenser blowers (one belt)
5. Evaporator blower (one belt)

BELT TENSION								
4	:	SPZ	(Width	:	10 mm)	Tension per belt span	<	10kg
1 - 5	:	SPA	(Width	:	13 mm)	Tension per belt span	<	13kg
2 - 3	:	SPB	(Width	:	17 mm)	Tension per belt span	<	25kg

Figure 3-6 V-belt arrangement

3.4.4 Replacing Standby Motor belts to Motor-compressor clutch



a. Slightly loosen screws 1 holding the standby motor mount.

b. Loosen nuts 2 of linkage rods 3

The belts now being slackened, follow procedure A.

Once the new belts have been installed :

a. Tighten the nuts 4 a few turns on the threaded part of linkage rods 3.

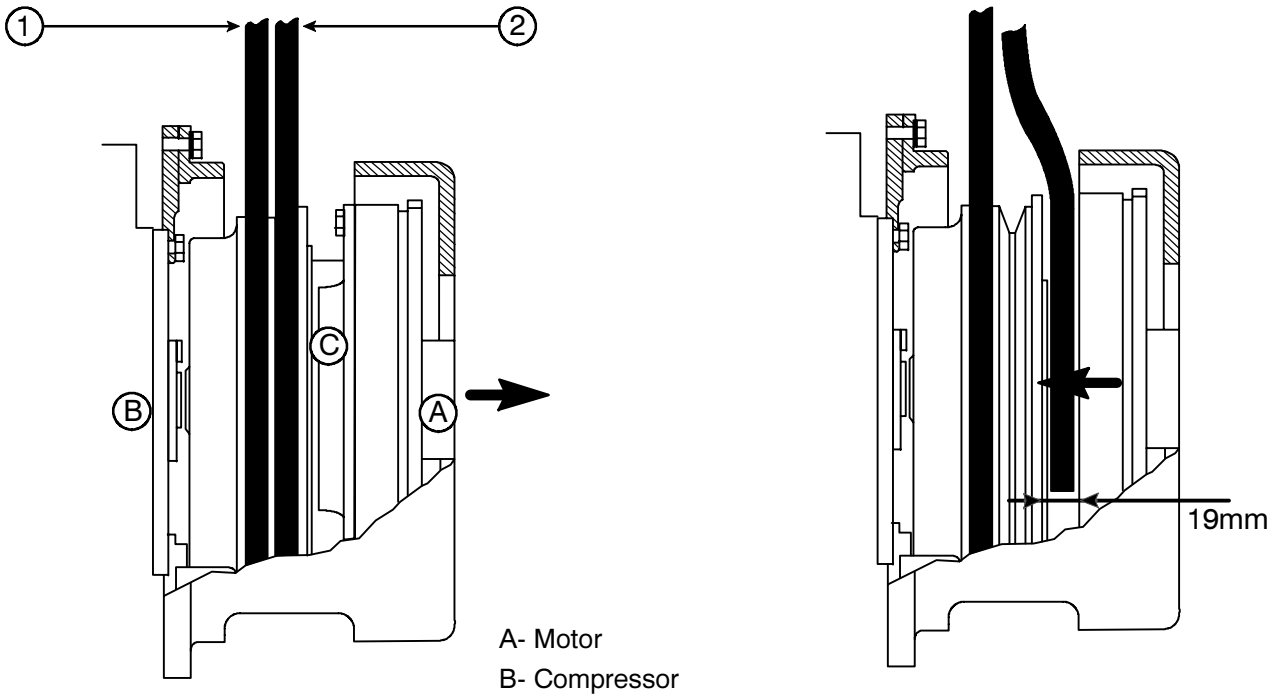
b. Tighten shims and nuts 2 until tension is correct.

c. Fully tighten nuts 4 to lock into place as well as screws 1.

Torque value (item 1): 30 Nm

Figure 3-7 Standby motor belts to Moto-compressor clutch

3.4.5 Replacing V-belts 1 and 2 between Motor-compressor coupling to Standby motor



A- Motor
B- Compressor
C- Clutch flange on starter ring

Procedure A

1. Loosen the six screws of sheave C on the flywheel.
2. Push the sheave towards the compressor in the direction of the arrow (left-hand diagram)
3. Change the belts using the space thus obtained.

Figure 3-8 Replacing V-belts

Figure 3-9 V-belt inspection - Checking belt tension

It is recommended to use a belt tension gauge whenever V-belts are adjusted or checked.

A belt tension gauge provides an accurate and easy method of adjusting belts to their proper tension. Properly adjusted belts give long lasting and efficient service. Too much tension shortens belt and bearing life, and too little tension causes slippage and excessive belt wear.

It is also important to keep belts and sheaves free of any foreign material which may cause belts to slip.

Belt tension gauges can be used to adjust most belts. The admissible values given for CARRIER TRANSICOLD units are only valid for our V-belts and applications, since the tension required depends on the size of belt and the distance between pulleys. When using the gauge, it should be placed as close as possible to the midpoint between two pulleys.

The V-belts must be kept in good condition with the proper tension to ensure an optimized unit opertion.

WARNING

V-BELTS AND COMPONENTS DRIVEN BY THEM ARE DANGEROUS BECAUSE OF THE RISK OF AUTOMATIC START-UP.

3.5 REMOVING THE REFRIGERANT CHARGE

NOTE

To avoid damage to the earth's ozone layer, use a refrigerant recovery system whenever removing refrigerant.

a. Pumping the unit down

To service the filter-drier, expansion valve, quench valve, compressor pressure regulating valve (CPR) or the evaporator, pump most of the refrigerant into the condenser coil and receiver, proceeding as follows:

1. Install service gauges.
2. Open the service valves two turns (clockwise). Purge the gauge line.
3. Close the receiver outlet (king) valve by turning it clockwise. Start the unit and run in high speed cooling. Place the Run-Stop switch in the Stop position when the unit has reached a pressure of 0.1 kg/cm^2 (1 psi)
4. Frontseat the suction service valve; the refrigerant is trapped between the suction service valve of the compressor and the receiver outlet (king) valve.
5. Before opening any part of the system, the pressure gauge should indicate a slightly positive pressure.
6. When opening up the refrigerant system, certain parts may frost. In this case, allow the part to warm to ambient temperature before dismantling it. This avoids internal condensation.
7. Proceed to vac out down the part of the line which has been subjected to atmospheric pressure.
8. Backseat the receiver outlet (king) valve and the suction service valve (LP).
9. Check for leaks in connections using a leak detector. (See section 3.6)
10. Start the unit in cooling mode and check operating pressures.
11. Check the refrigerant charge (See section 3.8.3)

NOTE

Store the refrigerant charge in an evacuated container if the system must be opened between the compressor discharge valve and the receiver.

Whenever the system is opened, it must be evacuated and dehydrated (See section 3.7).

b. Removing the refrigerant charge

Connect a refrigerant recovery system to the unit in order to remove the refrigerant charge. Refer to the instructions provided by the manufacturer of the refrigerant recovery system.

3.6 REFRIGERANT LEAK CHECKING

Once the recovery system has been opened and the repairs made, check for system tightness by proceeding as follows.

a. The recommended procedure for finding leaks consists in using a halide torch or electronic leak detector. Testing joints with soap suds can only be used for locating large leaks.

b. If the system contains no refrigerant, charge the system with refrigerant to build up a pressure of between 2 and 3 bars, then using a neutral gas (oxygen free), pressurize the refrigeration circuit to obtain a pressure of 18 bars. Leak check all connections.

NOTE

<u>Important</u> : only a correct refrigerant cylinder must be connected in order to pressurize the system. Any other gas or vapor will contaminate the system, which will require additional purging and evacuation of the high pressure (discharge) side of the system.

c. Remove the refrigerant using a refrigerant recovery system, and repair any leaks. Pump down and dry the circuit. (See section 3.7) Charge the circuit with refrigerant. (See section 3.8)

3.7 EVACUATION AND DEHYDRATION

3.7.1 General

Moisture is the deadly enemy of refrigerant systems. The presence of moisture in refrigeration system can have many undesirable effects. The most common are copper plating, the formation of acid sludge, the ”freezing-up” of the metering devices by free water, the formation of acids resulting in metal corrosion.

3.7.2 Preparation

a. Evacuate and dehydrate the system after leak checking by a pressure leak test (See section 3.7)

b. The man tools to evacuate and dehydrate the system include an efficient vacuum pump (5 cfm = 8 m3/h volume displacement) and an efficient vacuum indicator, such as a thermocouple vacuum gauge.

NOTE

The use of a compound gauge is not recommended because of its inherent inaccuracy.

c. Keep the ambient temperature above 15.6°C (60°F) in order to accelerate the evaporation of moisture. If the ambient temperature is lower than 15.6°C (60°F), ice can form before moisture removal is complete. The use of heat lamps or other sources of heat enables the temperature of the system to be increased.

3.7.3 Evacuation and dehydration procedure

a. Remove the refrigerant using a refrigerant recovery system.

b. The recommended method for evacuating and dehydrating the system is to connect three evacuation hoses to the vacuum pump and to the refrigeration unit as indicated in Figure 3-10 (do not use standard hoses since these are not suitable for evacuation purposes). In addition, as indicated, connect an electronic micron-gauge with special evacuation hoses to the vacuum pump, to the electronic vacuum gauge and to the refrigerant recovery system.

c. Once the service valves are closed (backseated), and the valves of the vacuum pump and of the electronic vacuum gauge opened, start the pump and draw a high vacuum. Shut off the pump and check that the vacuum holds. This operation is designed to check the tightness of the evacuation system. Repair for tightness if necessary.

d. Midseat the service valves of the refrigerant system.

e. If the valves of the vacuum pump and of the electronic vacuum gauge are not opened, open them. Start the vacuum pump. Evacuate the unit until the electronic vacuum gauge indicates a pressure of 2000 microns. Close the valves of the vacuum pump and of the electronic vacuum gauge. Shut off the vacuum pump. Wait a few minutes in order to make sure the vacuum holds.

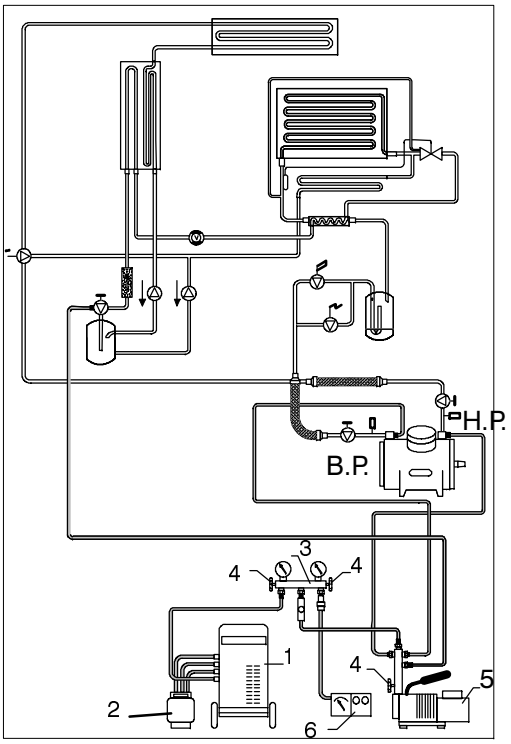
f. Break the vacuum using a clean, dry refrigerant. Use only the refrigerant corresponding to the unit. Raise pressure to approximately 0.13 kg/cm^2 (2 psi).

g. Remove the refrigerant using a refrigerant recovery system.

h. Repeat steps e/ to g/ above.

i. Evacuate the unit to a pressure of 500 microns. Close the valve of the vacuum pump and shut off the pump. Wait a few minutes in order to make sure the vacuum holds. This checks for residual moisture and leaks.

j. With a vacuum still in the unit, charge the system with refrigerant by drawing it from the refrigerant cylinder. Use scales to check the quantity of refrigerant charge. (See section 3.8.3)



1. Refrigerant recovery system
2. Refrigerant cylinder
3. Evacuation manifold
4. Valve
5. Vacuum pump
6. Electronic vacuum gauge

Figure 3-10 Refrigeration circuit maintenance

3.8 CHARGING THE REFRIGERATION SYSTEM

3.8.1 Installing a complete charge

WARNING

Never charge it with vapor but DRAW IN THE LIQUID REFRIGERANT from the receiver.

a. Dehydrate the refrigeration circuit and create a high vacuum. (See section 3.7.3)

b. Place the refrigerant cylinder on the scales and to connect the charging line from the cylinder to the king valve of the receiver outlet. Purge the charging line at the outlet valve.

c. Note the weight of the refrigerant cylinder.

d. Open the liquid valve of the refrigerant cylinder. Open the king valve half-way and allow the liquid refrigerant to flow into the unit until the correct weight of refrigerant has been added as indicated by the scales.

NOTE

It is possible that all the liquid may not be completely drawn into the receiver, as indicated in step d/ above. In this case, charge the remaining refrigerant in vapor form via the suction service valve. (See section 3.8.2)

e. When the weight indicated on the scales indicates that the correct charge has been added, close the liquid line valve on the refrigerant cylinder and backseat the service valve of the receiver.

3.8.2 Adding a partial charge

a. Place the refrigerant cylinder on scale and note weight. Backseat the suction service valve and connect charging line between suction service valve port and refrigerant cylinder. Open VAPOR valve on refrigerant cylinder and purge charging line.

b. Run the unit in high speed cool and backseat suction service valve.

c. If necessary partially block the air inlet to the condenser in order to raise the discharge pressure to 14.8 kg/cm2 (210 psi). The unit is correctly charged when the sight glass is full.

d. Backseat (open) suction service valve. Close VAPOR valve on refrigerant cylinder, noting weight.

e. Start unit and check for non-condensibles.

3.8.3 Checking the charge

a. Start unit in cooling mode. Let the unit run for approximately ten minutes. Partially block air flow to condenser coil so that discharge pressure rises to 14.8 kg/cm2 (210 psi).

The unit is correctly charged if the sight glass is full and no bubbles are present.

3.9 REPLACING THE COMPRESSOR

a. Removing

If compressor is inoperative and unit still has refrigerant pressure, frontseat suction and discharge services valves to trap most of the refrigerant in the unit

If compressor runs, pump down the unit.

1. Release compressor pressure by transferring refrigerant to a recovery system.
2. Remove bolts from suction and discharge service valve flanges.
3. Disconnect the high pressure switch (HP).
4. Release the belt tension pulleys and remove the belts.
5. Remove the four bolts holding the compressor to power tray. Remove the compressor from the chassis.
6. Remove the pulley from the compressor.
7. Drain oil from defective compressor before shipping

b. Installing

Observe the following torque values:

- Compressor flange: 55 N.m
- Clutch plate: 30 N.m

1. To install the compressor, reverse the procedure outlined below.

NOTE

The replacement compressor is sold without shutoff valves (but with valves pads). Check oil level in the replacement compressor. (See section 3.10)

2. Attach two lines (with hand valves near vacuum pump) to the suction and discharge valves. Dehydrate and evacuate compressor to 500 microns (29.90" Hg vacuum = 75.9 cm Hg vacuum). Turn off valves on both lines to vacuum pump.
3. Fully backseat (open) the suction and discharge valves.
4. Remove vacuum pump lines and install manifold gauges.

NOTE

It is important to check the new compressor oil level and fill if necessary.

5. Check refrigerant level. (Refer to section 3.8.3)
6. Check compressor oil level. (Refer to section 3.10). Add oil if necessary.
7. Check refrigerant cycles.

3.10 CHECKING THE COMPRESSOR OIL LEVEL

3.10.1 05K compressor

a. To check the oil level in the compressor

1. Operate the unit in high speed cooling for at least 20 minutes.
2. Check the oil sight glass on the compressor to ensure that no foaming is present after 20 minutes of operation. If the oil is foaming excessively after 20 minutes of operation, check the refrigerant system for flood-back of liquid refrigerant. If necessary, correct the situation before performing step 3.
3. Check the oil level in the sight glass with the compressor operating,. The correct oil level should be between bottom and 1/4 of the sight glass. If the level is above 1/4, oil must be removed from the compressor. To remove oil from the compressor, follow step d. If the level is below the sight glass, add oil to the compressor following step c.

b. Adding oil with compressor in system

Two methods for adding oil are the oil pump method and closed system method.

1. Oil pump method

The compressor oil pump adapts to a one U.S. gallon (3.785 liters) metal refrigeration oil container and pumps 0.0725 liter per stroke when connected to the suction service valve port. Also, there is no need to remove pump from the container after each use.

When the compressor is in operation, the pump check valve prevents the loss of refrigerant while allowing servicemen to develop sufficient pressure to add oil as necessary.

Backseat suction service valve and connect the oil charging hose to port. Slightly open the suction service valve and purge the oil hose at oil pump. Add oil as necessary.

2. Closed system method

In an emergency where an oil pump is not available, oil may be drawn into the compressor by the suction service valve.

CAUTION

Extreme care must be taken to ensure the manifold common connection remains immersed in oil at all times. Otherwise air and moisture will be drawn into the compressor.

Connect the suction connection of the gauge manifold to the compressor suction service valve port, and immerse the common connection of the gauge manifold in an open container of refrigeration oil. Slightly open the suction valve and gauge valve to vent a small amount of refrigerant through the common connection and the oil to purge the lines of air. Close the gauge manifold valve.

With the unit running, frontseat the suction service valve and pull a vacuum in the compressor crankcase. SLOWLY crack open the suction gauge manifold valve and oil will flow into the compressor. Add oil as necessary.

c. Adding oil to replacement compressor

The replacement compressor may be shipped without oil.

In such cases :

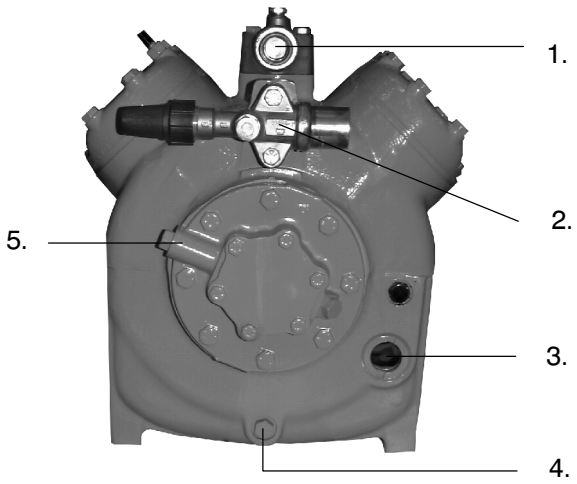
Add correct oil charge (Refer to section 1.4) by removing the oil fill plug.

d. Checking compressor oil – level

1. Close suction valve (frontseat) and pump unit down to 0.1 to 0.3 kg/cm2 (2 to 4 psig). Frontseat the discharge service valve and slowly bleed remaining refrigerant.

2. Open service valves and run the unit to check oil level; repeat as required to ensure proper oil level.

3. Remove the oil drain plug from the compressor and drain the proper amount of oil from the compressor. Replace the plug securely back into the compressor.



1. Suction service valve
2. Discharge service valve
3. Oil level sight glass
4. Oil drain plug
5. Oil fill plug

Figure 3-11 05K Compressor

3.11 CHECKING AND REPLACING THE FILTER-DRIER

To check the filter – drier :

Check for a restricted or plugged filter-drier by feeling the liquid line inlet and outlet connections of the drier cartridge. If the outlet side feels cooler than the inlet side, then filter-drier should be changed.

To replace filter – drier :

Drain the unit as indicated in Section 3.7. Remove bracket, then replace the filter-drier.

Slowly close the compressor suction service valve to a suction pressure of 0 psi. Stop the compressor and frontseat the suction and discharge service valves. Check refrigerant level. (Refer to Section 3.8.3)

3.12 CHECKING AND REPLACING THE HIGH PRESSURE SWITCH

3.12.1 Replacing the high pressure switch

a. Pump down the unit according to Section 3.5. Frontseat both suction and discharge service valves to isolate compressor.

b. Disconnect wiring from the pressure switch. The high pressure switch is located above the compressor.

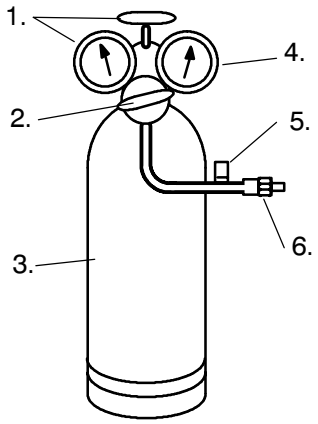
c. Install the new pressure switch after verifying switch settings. (Refer to Section1.5.4)

d. Evacuate and dehydrate the compressor. (Refer to section 3.7.3)

3.12.2 Checking the high pressure switch

WARNING

Never use a nitrogen cylinder without a pressure regulator. Cylinder pressure is approximately 165 bars (2350 psig). Never use oxygen in or near a refrigerant system as an explosion may occur.



1. Cylinder valve and gauge
2. Pressure regulator
3. Nitrogen cylinder
4. Pressure gauge (0 to 400 psig = 0 to 25 bars)
5. Bleed-off valve
6. 1/4 inch connection

Figure 3-12 Typical setup for testing the high pressure switch

a. Remove the pressure switch as outlined in section 3.12.

b. Connect ohmmeter or continuity light across pressure switch terminals. The ohmmeter will indicate resistance and the continuity light will be lighted On if the switch closed after pressure was relieved.

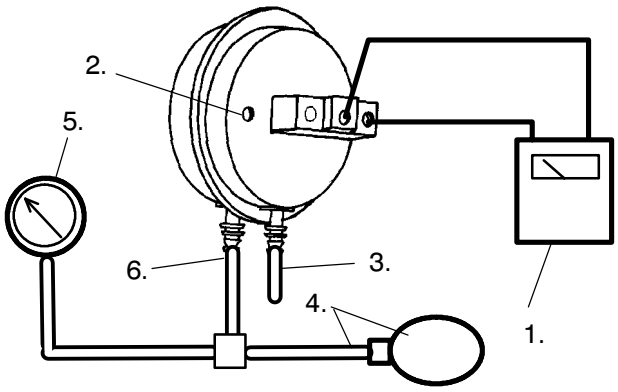
c. Connect the pressure switch to a cylinder of dry nitrogen. (See Figure 3-12)

d. Set the nitrogen pressure regulator higher than the cutout point on switch being tested. Pressure switch cutout and cut-in points are given in Section 1.5.4.

e. Close valve on cylinder and open the bleed-off valve.

f. Open cylinder valve. Slowly close bleed-off valve and increase pressure until the pressure switch opens. If a continuity light is used, light will go out and if an ohmmeter is used, the meter will indicate open. Open pressure on gauge. Slowly open the bleed-off valve (to decrease pressure) until the switch closes (the continuity light will light On or the ohmmeter will move).

3.13 CHECKING CALIBRATION OF THE DEFROST PRESSURE SWITCH



1. Ohmmeter or continuity light
2. Adjustment screw (0.050 socket head size)
3. Low side connection
4. Pressure line or aspirator bulb
5. Pressure gauge
6. High side connection

Figure 3-13 Defrost pressure switch test setup

a. Make sure the pressure gauge is in proper calibration.

NOTE

The pressure gauge may be used in any position, but must be re-zeroed if position of gauge is changed from vertical to horizontal position or vice-versa. USE ONLY IN POSITION FOR WHICH IT IS CALIBRATED.

b. With the defrost pressure switch in the vertical position, connect the high pressure side of the pressure gauge to the high side connection of the defrost pressure switch.

c. Install a Tee in the pressure line to the high side connection. The tee should be approximately halfway between the pressure gauge and the defrost pressure switch, or an improper reading may result.

d. Attach an ohmmeter to the defrost pressure switch contacts to check the action of the switch.

NOTE

Use a hand aspirator, since blowing into the tube by mouth may cause an incorrect reading.

e. With the pressure gauge reading at zero, very slowly apply air pressure to the defrost pressure switch. The ohmmeter will indicate continuity when the pressure switch is activated.

f. See section 1.5.2 for pressure switch settings. If the pressure switch fails to actuate at the correct gauge reading, turn the adjusting screw clockwise to increase the setting, and anti-clockwise to decrease it.

g. Repeat the test procedure until the pressure switch actuates at the correct setting.

h. Once the pressure switch has been set, place a small amount of paint or glycerol on the adjusting screw: this prevents any movement of the screw as a result of unit vibration.

3.14 CLEANING THE EVAPORATOR

The use of the recycled cardboard cartons is increasing. Recycled cardboard creates more fiber dust during transport than new cardboard. The fiber dust and particles are drawn into the evaporator and trapped between the evaporator fins. If the coil is not cleaned regularly after each trip, the accumulation of dirt can be sufficient to reduce air flow, causing coil icing, repeated defrosts and loss of refrigeration capacity. Because of the "washing" action of a defrost cycle, fiber dust and particles may be invisible on the surface of the coil but may accumulate inside.

It is recommended to clean the evaporator on a regular basis, not only to remove cardboard dust, but also to remove any grease or the oil film which sometimes coats the fins and prevents water from draining into the defrost pan.

After being wet and dried several times, cardboard fiber particles are very difficult to eliminate. Several washings are sometimes necessary.

a. Spray on the coil with a mild detergent solution such as any good commercial dishwasher detergent, and let the solution stand for a few minutes. Then reverse flush (opposite normal air flow) with clean water at mild pressure. A garden hose with a spray nozzle is usually sufficient. Make sure the drain lines are clean.

b. Start the unit. Initiate a defrost cycle, in order to check the water is correctly drained from the defrost pan.

3.15 HOT GAS VALVE (THREE-WAY)

3.15.1 Replacing the solenoid coil

It is not necessary to pump the unit down in order to replace the coil.

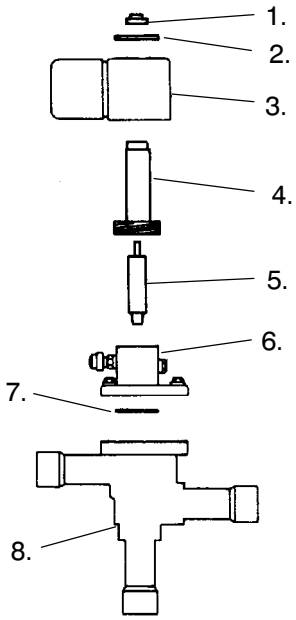
a. Remove the coil snap cap, the voltage plate and the coil assembly. Disconnect the leads and, if necessary, remove the junction box.

b. Check the type of the coil and voltage. The information is indicated on the voltage plate and on the coil housing.

c. Place the new coil on the enclosing tube, install the voltage plate and the snap cap.

WARNING

Do not damage or overtighten the enclosing tube assembly. Also make sure that all the parts are placed on the enclosing tube in the correct order to avoid premature burn-out of the coil.



1. Snap cap
2. Voltage plate
3. Coil assembly
4. Enclosing tube
5. Plunger assembly
6. Body head
7. Gasket
8. Valve body assembly

Figure 3-14 Hot gas valve (Three-way)

3.15.2 Replacing Solenoid valve internal parts

If the hot gas valve has to be replaced, or if a service operation is scheduled on the internal components of the valve, the refrigerant must be evacuated.

a. Remove and store the refrigerant in an empty container. (See section 3.5).

b. Remove the snap cap, the voltage plate and the coil assembly. Remove the head of the valve body.

c. Check for all foreign material in the valve body.

d. Check for any damage to the plunger and the O-ring. If an O-ring has to be replaced, lubricate it with refrigeration oil before installing it.

e. Tighten the enclosing tube assembly. If the valve has been removed from the circuit, check for leaks.

f. Install the coil assembly, the voltage plate and the snap cap.

g. Evacuate and dehydrate the circuit.

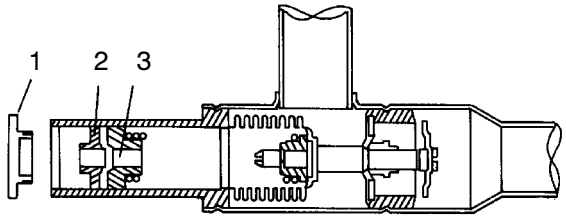
h. Install a complete refrigerant charge.

i. Start the unit and check operation.

3.16 ADJUSTING THE COMPRESSOR PRESSURE REGULATING VALVE (CPR)

The compressor pressure regulating (CPR) valve is factory pre-set; in principle it needs no further adjustment. If necessary, proceed as follows :

When adjusting the CPR valve, the unit must be in high speed heating or defrost cycle mode. This ensures a suction pressure above the normal CPR pressure.



1- Cap
2- Jam-nut
3- Setting screw

Figure 3-15 Compressor pressure regulating valve

To adjust the compressor pressure regulating valve, proceed as follows :

a. Install a low-pressure pressure gauge.

b. Unscrew the cap (item 1) from the CPR valve.

c. With an 8 mm Allen key, loosen the jam nut (Figure 4-14, item 2).

d. Using the Allen key, adjust the setting screw. To raise the suction pressure, turn the setting screw (item 3) clockwise; to decrease the suction pressure, turn the setting screw anti-clockwise. See section 1.5.6 for CPR valve settings.

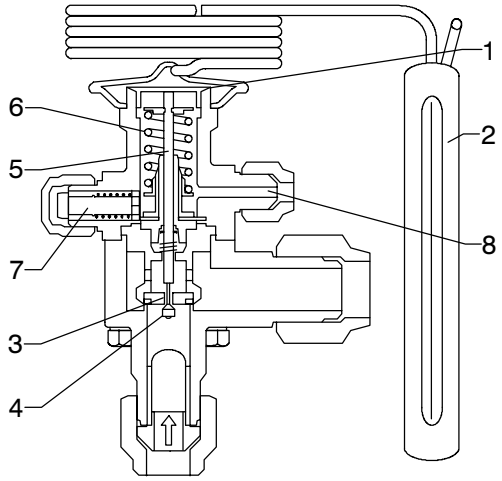
e. When the setting has been adjusted, tighten the jam nut securely against the setting screw (item 3). This prevents any movement of the setting screw caused by unit vibration. Replace the cap.

3.17 THERMOSTATIC EXPANSION VALVE

The thermostatic expansion valve controls the automatic admission of refrigerant gas to the evaporator in order to ensure it is filled to the maximum in relation to heat supplied from outside the evaporator.

It also enables expansion of the refrigerant as it enters the evaporator, which transforms the refrigerant into a liquid-vapor mixture and lowers its temperature and pressure.

Unless the expansion valve is defective, it needs no maintenance.



1. Diaphragm
2. Bulb
3. Valve seat
4. Valve
5. Linkage rod
6. Adjustable spring
7. Setting screw
8. Pressure equalization port

Figure 3-16 Thermostatic expansion valve

a. Replacing the expansion valve

1. If necessary, pump down the unit and place the charge in the receiver by running the unit (the receiver valve must be closed).
2. Shut down the unit when the pressure of the LP pressure gauge indicates 0.2 bar.
3. Completely close the compressor HP valve in order to isolate the HP circuit from the LP circuit.
4. Remove the black insulation around the expansion valve bulb and loosen the 2 clamps which hold it into place.
5. Free the bulb from its clamps.

6. **PRECAUTIONARY MEASURE :**

   - **Wrap the expansion valve in a damp cloth**
   - **Flush the circuit with nitrogen**

Loosen the expansion valve inlet then unsolder the external pressure equalizer and the expansion valve outlet.

7. Plug all the refrigeration lines and change the expansion valve.
8. Unplug the lines and reconnect the new expansion valve.
9. After reconnecting the expansion valve, put the expansion valve bulb back in the same place it was in before. Clean pipe for good contact.
10. Tighten the bulb correctly and insulate it to prevent it from being affected by the peripheral temperature.
11. Check for leaks after the charging the expansion valve by pressurizing the circuit.
12. If refrigerant gas has been evacuated from the unit, flush the refrigeration circuit properly with nitrogen and pump the unit down. Charge the unit with refrigerant and check unit operates correctly.

If the refrigerant has been stored in the receiver, pump out the LP part of the circuit, then open the service valves in order to fill the circuit with refrigerant.

WARNING

In all service operations on the refrigeration circuit, change the filter-drier before restarting the unit.

b. Checking superheat

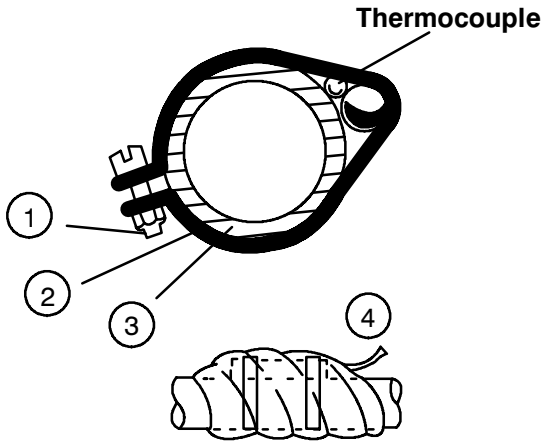
NOTE

It is not recommended to adjust expansion valves unless absolutely necessary.

If the factory pre-setting of the expansion valve is correct, any later change in the setting is due to a mechanical malfunction which cannot be corrected by adjusting superheat.

c. Measuring superheat

1. Remove insulation from the expansion valve and of the suction line.
2. Place a thermocouple near the bulb and isolate probe and bulb.
3. Connect an accurate pressure gauge to the 1/4" port on the suction line near the bulb.
4. Let the unit run until the rotation speed has stabilized.
5. Read off the temperature of the thermostatic bulb.



1. Locking screw
2. Clamp
3. Suction line
4. Thermostatic expansion valve bulb
5. Thermocouple

Figure 3-17 Thermostatic expansion valve bulb and thermocouple

6. Subtract the saturation temperature from the average temperature (at the level of the thermostatic bulb). The difference is equal to the superheat of the suction gas.

d. Adjusting superheat

1. Remove the protective cap and turn the setting screw in order to raise or lower superheat.
2. Let the unit run for 20 minutes. Check the superheat setting once again.

If the setting is correct, remove the pressure gauge and the thermocouple and then put back the protective cap.

3.18 MICROPROCESSOR CONFIGURATION

Table 4-1 Microprocessor configuration		
Configuration		**Description**
CNF1	**TV**	Unit with “trivortex” motor and quick preheating glow plugs.
	DI	Unit with “trivortex” motor and slow preheating glow plugs or motor direct or indirect injection.
CNF2	ON	With CDT sensor
	OFF	Without CDT sensor
CNF3	ON	With electronic starting valve
	OFF	Without electronic starting valve
CNF4	ON	Cool / Heat regulation for the setpoint < -12°C
	OFF	Cool mode regulation for the setpoint < -12°C
CNF5	ON	With “varipower”
	OFF	Without “varipower”
CNF6	ON	-
	OFF	All
CNF7	ON	Starting on low speed
	OFF	Starting on high speed
CNF8	ON	Electrical fans
	OFF	Mechanical fans
CNF9	ON	Temperature alarm after 45 mn out-of-range with unit shut down
	OFF	Temperature alarm after 15 mn out-of-range without unit shut down
CNF10	ON	NOT USED
	OFF	
CNF11	ON	Function change locked
	OFF	Function change activated
CNF12	Modification ot the low pressure values to energize the varipower	
	ON	Application for extreme conditions (MOP+)
	OFF	Application for standart conditions (MOP std)
CNF13	ON	NOT USED
	OFF	
CNF14	ON	For multitemperature units
	OFF	For standard and bitemperature unit
CNF15	ON	NOT USED
	OFF	
CNF16	**ON**	Unit stops when there is an alternator fault.
	OFF	Unit doesn't stop when there is an alternator fault.
CNF17	ON	Enable Ultra Fresh 1
	OFF	Disable Ultra Fresh 1
CNF18	**ON**	Enable low refrigerant test
	OFF	Disable low refrigerant test
CNF19	ON	NOT USED
	OFF	
CNF20	**ON**	Unit selection is locked
	OFF	Metric unit or English metric is not locked
CNF21	ON	Active
	OFF	Frozen priority not active
CNF22	ON	NOT USED
	OFF	
CNF23	ON	NOT USED
	OFF	
CNF24	ON	NOT USED
	OFF	
CNF25	ON	NOT USED
	OFF	
CNF26	ON	NOT USED
	OFF	
CNF27	ON	NOT USED
	OFF	
CNF28	ON	NOT USED
	OFF	
CNF29	ON	NOT USED
	OFF	
CNF30	ON	NOT USED
	OFF	
CNF31	ON	NOT USED
	OFF	
CNF32	ON	NOT USED
	OFF	
Setting in BOLD are factory settings.		

3.19 CONTROLLER SENSOR CHECKOUT

An accurate ohmmeter must be used to check the resistance values indicated in Table 4-2.

Because of the variations and inaccuracies in ohmmeters, thermometers and other test equipment, a reading within 2 % of the chart value indicates the sensor is operating correctly. If a sensor is defective, the resistance value can be considerably higher or lower than those indicated in Table 4-2.

At least one lead from the sensor must be disconnected from the unit electrical system before any reading is taken, or else it will be false. Two methods are recommended for determining the actual test temperature of the sensor: an ice bath at 0°C (32°F), or the use of a calibrated temperature tester.

Table 4-2 Sensor resistance (RAS & SAS)

Temperature		RAS & SAS Resistance in Ohms
°C	°F	
-28,9	-20	165 300
-23,3	-10	117 800
-17,8	0	85 500
-12,2	10	62 400
-6,7	20	46 300
-1,1	30	34 500
0	32	32 700
4,4	40	26 200
10,0	50	19 900
15,6	60	15 300
21,1	70	11 900
25	77	10 000
26,7	80	9 300
32,2	90	7 300
37,8	100	5 800
43,3	110	4 700
48,9	120	3 800
90	194	915
100	212	680
130	266	301
150	302	186

Table 4-3 R404A – Pressure – Temperature

TEMPERATURE		PRESSURE			TEMPERATURE		PRESSURE		
°C	°F	Psi	Kg/cm^2	Bar	°C	°F	Psi	Kg/cm^2	Bar
-40	-40	4.5	0.32	0.31	0	32	72.5	5.10	5.00
-37	-35	7.1	0.50	0.49	1	34	75.6	5.32	5.21
-34	-30	9.9	0.70	0.68	2	36	78.8	5.54	5.43
-32	-25	12.9	0.91	0.89	3	38	82.1	5.77	5.66
-29	-20	16.3	1.15	1.12	4	40	85.5	6.01	5.90
-28	-18	17.7	1.24	1.22	6	42	89.0	6.26	6.14
-27	-16	19.2	1.35	1.32	7	44	92.5	6.50	6.38
-26	-14	20.7	1.46	1.43	8	46	96.2	6.76	6.63
-24	-12	22.3	1.57	1.54	9	48	99.9	7.02	6.89
-23	-10	23.9	1.68	1.65	10	50	103.7	7.29	7.15
-22	-8	25.6	1.80	1.77	13	55	115.4	8.11	7.96
-21	-6	27.3	1.92	1.88	16	60	126.1	8.87	8.69
-20	-4	29.1	2.05	2.01	18	65	137.4	9.66	9.47
-19	-2	30.9	2.17	2.13	21	70	149.4	10.50	10.30
-18	0	32.8	2.31	2.26	24	75	162.1	11.40	11.18
-17	2	34.8	2.45	2.40	27	80	175.5	12.34	12.10
-16	4	36.8	2.59	2.54	29	85	189.6	13.33	13.07
-14	6	38.9	2.73	2.68	32	90	204.5	14.38	14.10
-13	8	41.1	2.89	2.83	35	95	220.2	15.48	15.18
-12	10	43.3	3.04	2.99	38	100	236.8	16.65	16.33
-11	12	45.6	3.21	3.14	41	105	254.2	17.87	17.53
-10	14	48.0	3.37	3.31	43	110	272.4	19.15	18.78
-9	16	50.4	3.54	3.47	46	115	291.6	20.50	20.11
-8	18	52.9	3.72	3.65	49	120	311.8	21.92	21.50
-7	20	55.5	3.90	3.83	52	125	332.9	23.41	22.95
-6	22	58.1	4.08	4.01	54	130	355.0	24.96	24.48
-4	24	60.9	4.28	4.20	57	135	378.1	26.58	26.07
-3	26	63.7	4.48	4.39	60	140	402.3	28.28	27.74
-2	28	66.5	4.68	4.59	63	145	427.6	30.06	29.48
-1	30	69.5	4.89	4.79	66	150	454.0	31.92	31.30

SECTION 4

TROUBLE-SHOOTING

PROBLEM	POSSIBLE CAUSES	REFERENCE SECTION
4.1 Diesel engine		
4.1.1 Engine will not start		
Starter motor will not crank or low cranking speed	Battery insufficiently charged	Check
	Battery terminal post dirty or defective	Check
	Bad electrical connections	Check
	Starter motor malfunction	4.1.3
	Starter motor solenoid defective	Engine Manual
	Open starting circuit	4.1.4
	Incorrect grade of lubricating oil	1.2
Starter motor cranks but engine fails to start	No fuel in tank	Check
	Air in fuel system	Check
	Water in fuel system	Drain crankcase
	Plugged fuel filters	Replace
	Plugged fuel lines to injectors	Check
	Glow plug(s) defective	3.2.8
	Run solenoid defective	3.2.3
	Fuel pump defective (FP)	3.2.7
The starter cranks, but stops	Engine lube oil too heavy	1.2
	Voltage drop in starter cable(s)	Check
4.1.2 Engine starts then stops		
Engine stops after several rotations	Fuel supply restricted	Check
	Fuel pressure low	Check
	Leak in fuel system	Check
	Fuel filter restricted	Replace
	Injector nozzles defective	Engine manual
	Injection pump defective	Engine manual
	Air cleaner or hose restricted	3.2.4
	Safety device open	Check
	Open wiring circuit to run solenoid	Check
	Fuel pump malfunction (FP)	3.2.7
4.1.3 Starter motor malfunction		
Starter motor will not crank or turns slowly	Battery insufficiently charged	Check
	Battery cable connections loose or oxidized	Check
	Battery cables defective	Replace
	Starters brushes shorted out	Engine manual
	Brushes worn	Engine manual
	Starter solenoid damaged	Engine manual
	Run-Stop or Start-Run-Stop switch defective	Replace
	Engine lube oil too heavy	1.2

PROBLEM	POSSIBLE CAUSES	REFERENCE SECTION
4.1.3 Starter motor malfunction (Cont'd)		
Starter motor turns but pinion does not engage	Pinion or ring gear obstructed or worn	Clean, remove burrs or replace,apply grease
Starter motor does not disengage after switch was depressed	Run-Stop or Start-Run-Stop switch defective Starter motor solenoid defective	Replace Engine Manual
The pinion does not disengage after engine is running	Starter defective	Engine Manual
4.1.4 Malfunction in the engine starting circuit		
No power to starter motor solenoid	Battery defective Loose electrical connections	Check Tighten
Run solenoid is not energized or does not remain energized	Battery defective Loose electrical connections Oil pressure safety switch defective (OP) Run relay (RR) defective Water temperature safety switch open Water temperature sensor (WTS) defective Run solenoid defective Run-Stop or Start-Run-Stop switch defective	Check Tighten Replace Replace Replace 1.3.1 / 1.7 Replace
4.2 Alternator (Automotive type)		
Alternator fails to charge	Battery condition Alternator belt loose or broken oose, dirty, corroded terminals or broken cables Worn or broken brushes Regulator defective Open diode Open rotor (grounded coil) Poor ground on brush pack to alternator case	Check 3.4.1 Check/Repl. Check Check Check Check Replace Clean
Low or unsteady charging rate	Alternator belt loose, dirty, corroded terminals, or broken leads Worn or broken brushes Defective regulator Grounded or shorted turns in rotor Open, shorted or grounded turns in stator	3.4.1 Chech/Repl. Check Check Check Replace
Excessive charging rate (as evidenced by battery requiring too frequent refilling) or charge indicator shows constant charge with engine idling	Regulator leads loose, dirty, corroded terminals, or broken wires Regulator defective	Check/Repl. Check
Noisy alternator	Defective or worn belt Worn bearing(s) Misaligned belt or pulley Loose pulley	3.4.1 Replace 3.4.1 Tighten

PROBLEM	POSSIBLE CAUSES	REFERENCE SECTION
4.3 Refrigeration		
4.3.1 Unit will not cool		
Diesel engine	Malfunction(s)	4.1
Compressor malfunction	Compressor drive defective	3.4.3
	Compressor defective	3.9
Refrigeration system	Defrost cycle did not terminate	4.3.5
	Abnormal pressure	4.3.6
	Hot gas (three-way) valve malfunction	4.3.11
4.3.2 Unit runs but has insufficient cooling		
Compressor	Compressor Valves defective	3.9
Refrigeration system	Abnormal pressure	4.3.6
	Expansion valve malfunction	4.3.10
	No or restricted evaporator airflow	4.3.9
Engine does not develop full rpm	Engine speed control linkage	3.2.3
	Engine malfunction	4.1
4.3.3 Unit operates long or continuously in cooling		
Trailer	Hot load	Pulldown time insufficient
	Defective box insulation or air leak	Correct
Refrigeration system	Abnormal pressure	4.3.6
Compressor	Compressor defective	3.9
4.3.4 Unit does not heat or has insufficient heating		
Refrigeration	Abnormal pressure	4.3.6
	Hot gas (three-way) valve malfunction	4.3.11
Compressor	Compressor drive defective	3.4.3
	Compressor defective	3.9
Engine does not develop full rpm	Engine speed control linkage	3.2.3
	Engine malfunction	4.1

PROBLEM	POSSIBLE CAUSES	REFERENCE SECTION
4.3.5 Defrost cycle malfunction		
Will not initiate defrost automatically	Defrost pressure switch (DA) out of calibration	1.5.2 / 3.13
	Defrost termination thermostats (DTT) open or defective	Replace
	Defrost pressure switch (DA) defective	3.13
	Loose terminal connections	Tighten
	Air sensors defective or disconnected	Check/Replace
Will not initiate defrost manually	Loose terminal connections	Replace
	Defrost termination thermostats (DTT) open or defective	Tighten
	Pre-heating/Defrost switch defective	Replace
Initiates but does not defrost	Hot gas (three-way) valve malfunction	4.3.11
	Defrost relay (DR) defective	Replace
	Evaporator clutch defective	Replace
Frequent defrost	Defrost pressure switch (DA) out of adjustment	1.5.2 / 3.13
	Wet load	Normal
Does not terminate or cycle on defrost	Defrost termination thermostats (DTT) shorted closed	Replace
	Defrost timer defective	Replace
	Glow/Defrost switch defective	Replace
	Defrost pressure switch (DA) out of adjustment	1.5.2 / 3.13
4.3.6 Abnormal pressure		
4.3.6.1 Cooling		
High discharge pressure	Condenser coil dirty	Replace
	V-belt broken or loose	3.4
	Discharge check valve restricted	1.5.4
	Non-condensibles or refrigerant overcharge	Replace
		Check
Low discharge pressure	Compressor valve(s) worn or broken	3.9
	Hot gas (three-way) valve malfunction	4.3.11
	Low refrigerant charge	
High suction pressure	Compressor valve(s) worn or broken	3.9
	Gaskets compressor defective	3.9
	Hot gas (three-way) valve malfunction	4.3.11
	CPR non adjusted	
Low suction pressure	Suction service valve partially closed	Open
	Receiver service valve partially closed	Open
	Filter-drier partially plugged	3.11
	Low refrigerant charge	3.8
	Expansion valve malfunction	4.3.10
	No evaporator air flow or restricted air flow	4.3.9
	Excessive frost on coil	Check
Suction and discharge pressures tend to equalize when unit is operating	Compressor Valves plates defective	3.9
	Hot gas (three-way) valve malfunction	4.3.11

PROBLEM	POSSIBLE CAUSES	REFERENCE SECTION
4.3.6.2 Heating		
High discharge pressure	Overcharged system	1.5.2 / 3.5
	Non-condensibles in system	3.5 / 3.14 Check
Low discharge pressure	Hot gas (three-way) valve malfunction	4.3.11 / 3.15
Low suction pressure	Refrigerant shortage	3.10
	Compressor pressure regulating valve malfunction	3.15
	Suction valve partially closed	Open
4.3.7 Abnormal noise		
Compressor	Loose mounting bolts	Tighten
	Worn bearings	3.9
	Worn or broken valves plates	3.9
	Liquid slugging	4.3.10
	Insufficient oil level	3.10
Condenser or evaporator fan	Defective bearings	Check
	Bent shaft	Check
V-belts	Cracked or worn	3.4
4.3.8 Control system malfunction		
Will not control	Sensor defective	3.19
	Relay defective	Check
	Solid state controller malfunction	Check
4.3.9 No evaporator air flow or restricted air flow		
Coil blocked	Frost on coil	Check
	Dirty coil	3.14
No or partial air flow	V-belts broken or loose	3.4
	Clutch defective	Replace
	Evaporator fan loose or defective	Check
	Evaporator fan rotating backwards	Check
	Evaporator air flow blocked in trailer box	Check
	Fan motor malfunction	

PROBLEM	POSSIBLE CAUSES	REFERENCE SECTION
4.3.10 Expansion valve malfunction		
Low suction pressure with high superheat	Low refrigerant charge	1.5.2 / 3.8
	External equalizer line restricted	Clean
	Ice formation at valve seat	3.17
	Oil or dirt plugging valve or orifice	3.17
	Broken capillary	3.17
	Power assembly complete or partial failure	Replace
	Loss of element/bulb charge	Replace
	Superheat setting too high	1.5.7 / 3.17
Low superheat and liquid slugging in compressor	Superheat setting too low	1.5.7 / 3.17
	External equalizer line restricted	Open
	Ice holding three-way valve open	3.15
	Foreign material in three-way valve	Clean
	Pin and seat of expansion valve eroded or held open by foreign material	3.15
Fluctuating suction pressure	Improper bulb location or installation	3.17
	Low superheat setting	1.5.7 / 3.17
High superheat	Broken capillary	3.17
4.3.11 Hot gas (three-way) valve malfunction		
Valve does not function properly	No power to valve	Check
	Improper wiring or loose connections	Check
	Coil defective	3.15.1
	Valve improperly assembled	3.15.2
	Coil improperly assembled	3.15.1
	Temperature controller malfunction	Replace
	Movement of the plunger restricted due to :	
	a. Corroded or worn parts	
	b. Foreign material lodged in valve	3.15.2
	c. Bent or dented enclosing tube	
Valve shifts but refrigerant continues to flow	Foreign material lodged under seat	3.15.2
	Seat defective	3.15.2
4.4 Standby motor malfunction		
Standby motor fails to start	Motor contactor (MC) defective	Replace
	Overload relay (OL) open	Check/ Repl. motor
	Improper power supply	1.6
	Oil pressure switch (OPS) open	Check
	Selector switch (SSW) defective	Replace
Standby motor starts then stops	Overload relay (OL) open	1.6
	High amperage draw	Check

SECTION 5

ELECTRICAL SCHEMATIC WIRING DIAGRAM

This section contains Electrical Schematic Wiring Diagram covering the Models listed in Table 1-1. The following general safety notices supplement the specific warnings and cautions appearing elsewhere in this manual. They are recommended precautions that must be understood and applied during operation and maintenance of the equipment covered herein.

Model	Drawing #
Maxima 1000 & 1200	62-60935
Maxima 1200 Mt°	62-61327

WARNING

Beware of unannounced starting of the fans and V-belts caused by the thermostat and the start/stop cycling of the unit.

WARNING

Under no circumstances should ether or any other starting aids be used to start engine.

CAUTION

Under no circumstances should anyone attempt to repair the Logic or Display Boards! Should a problem develop with these components, contact your nearest Carrier Transicold dealer for replacement.

CAUTION

Observe proper polarity when installing battery, negative battery terminal must be grounded. Reverse polarity will destroy the rectifier diodes in alternator. As a precautionary measure, disconnect positive battery terminal when charging battery in unit. Connecting charger in reverse will destroy the rectifier diodes in alternator.

CAUTION

Under no circumstances should a technician electrically probe the processor at any point, other than the connector terminals where the harness attaches. Microprocessor components operate at different voltage levels and at extremely low current levels. Improper use of voltmeters, jumper wires, continuity testers, etc. could permanently damage the processor.

CAUTION

Most electronic components are susceptible to damage caused by electrical static discharge (ESD). In certain cases, the human body can have enough static electricity to cause resultant damage to the components by touch. This is especially true of the integrated circuits found on the truck/trailer microprocessor.

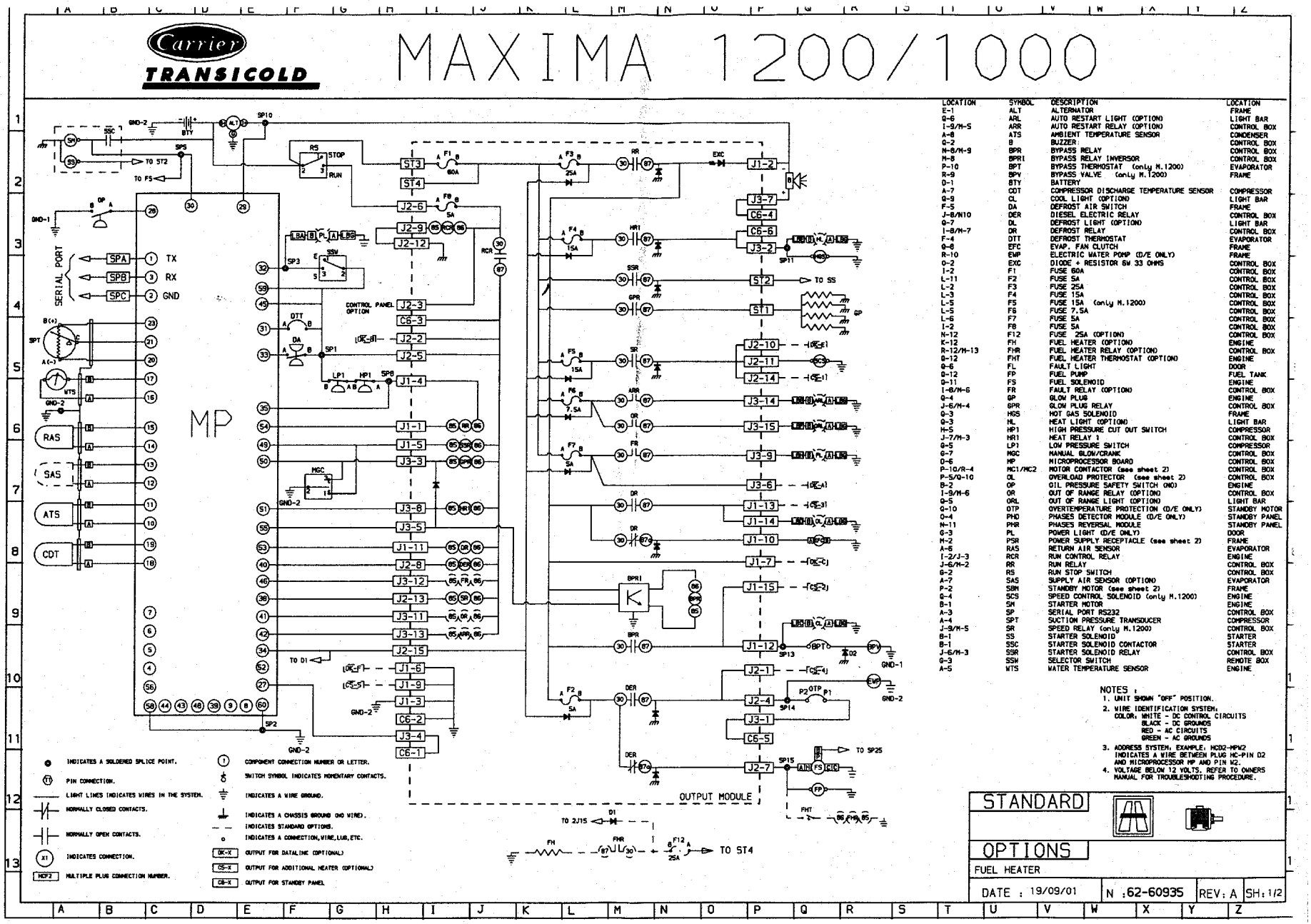


Figure 5-1 - Electrical schematic diagram - MAXIMA 1000 & 1200 (1/2)

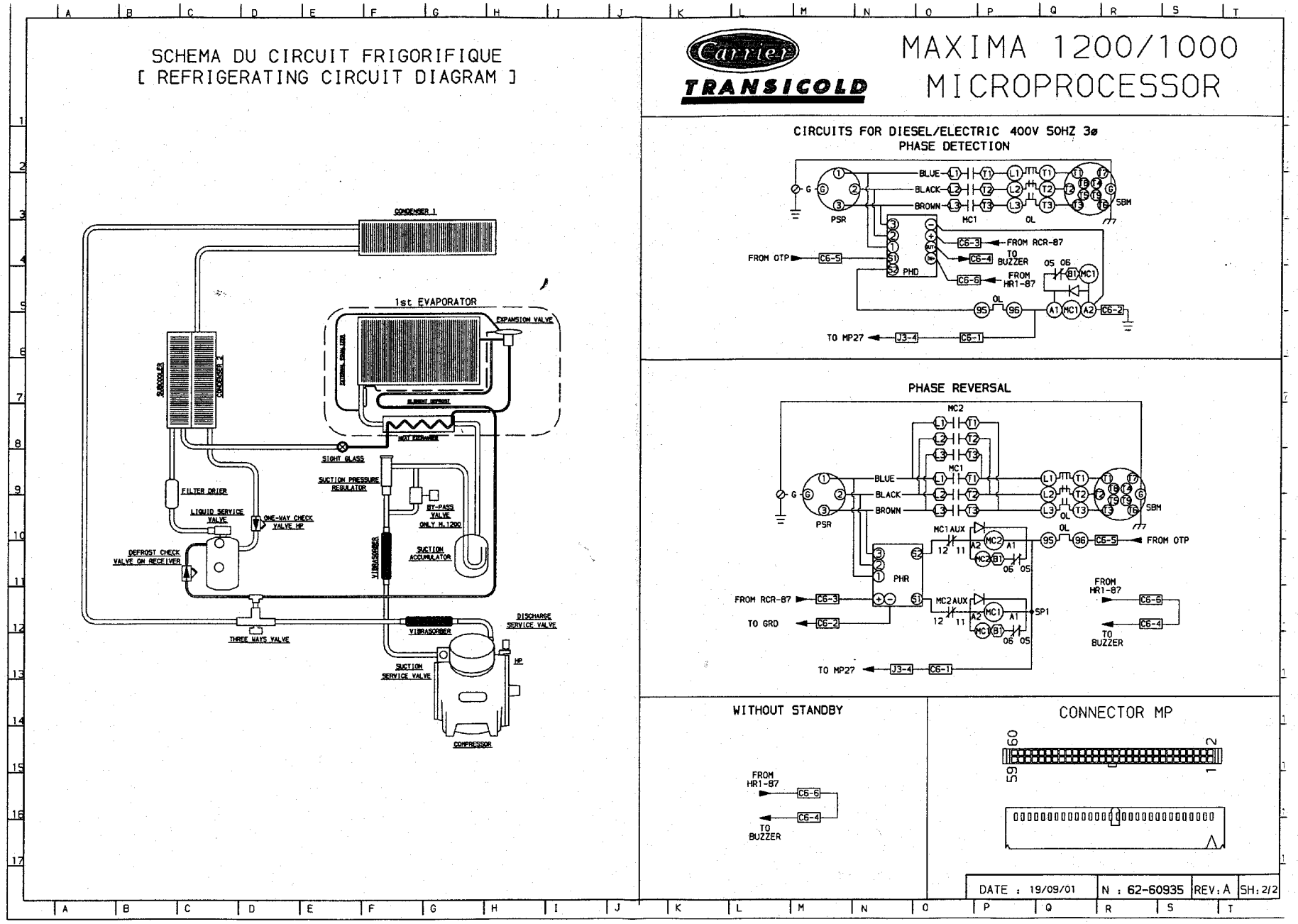


Figure 5-1 - Electrical schematic diagram - MAXIMA 1000 & 1200 (2/2)

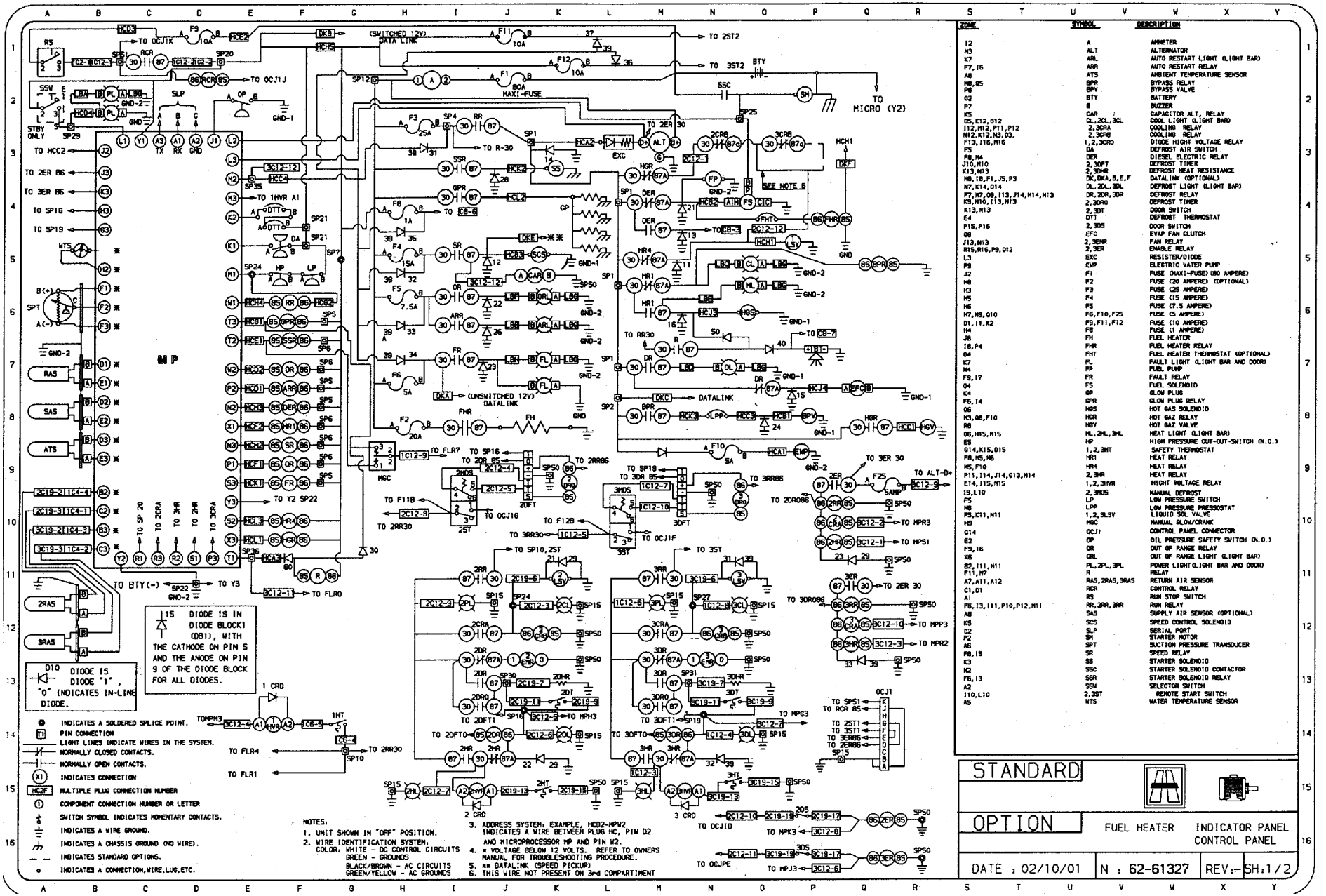


Figure 5-2 - Electrical schematic diagram - MAXIMA 1200 Mt° (1/2)

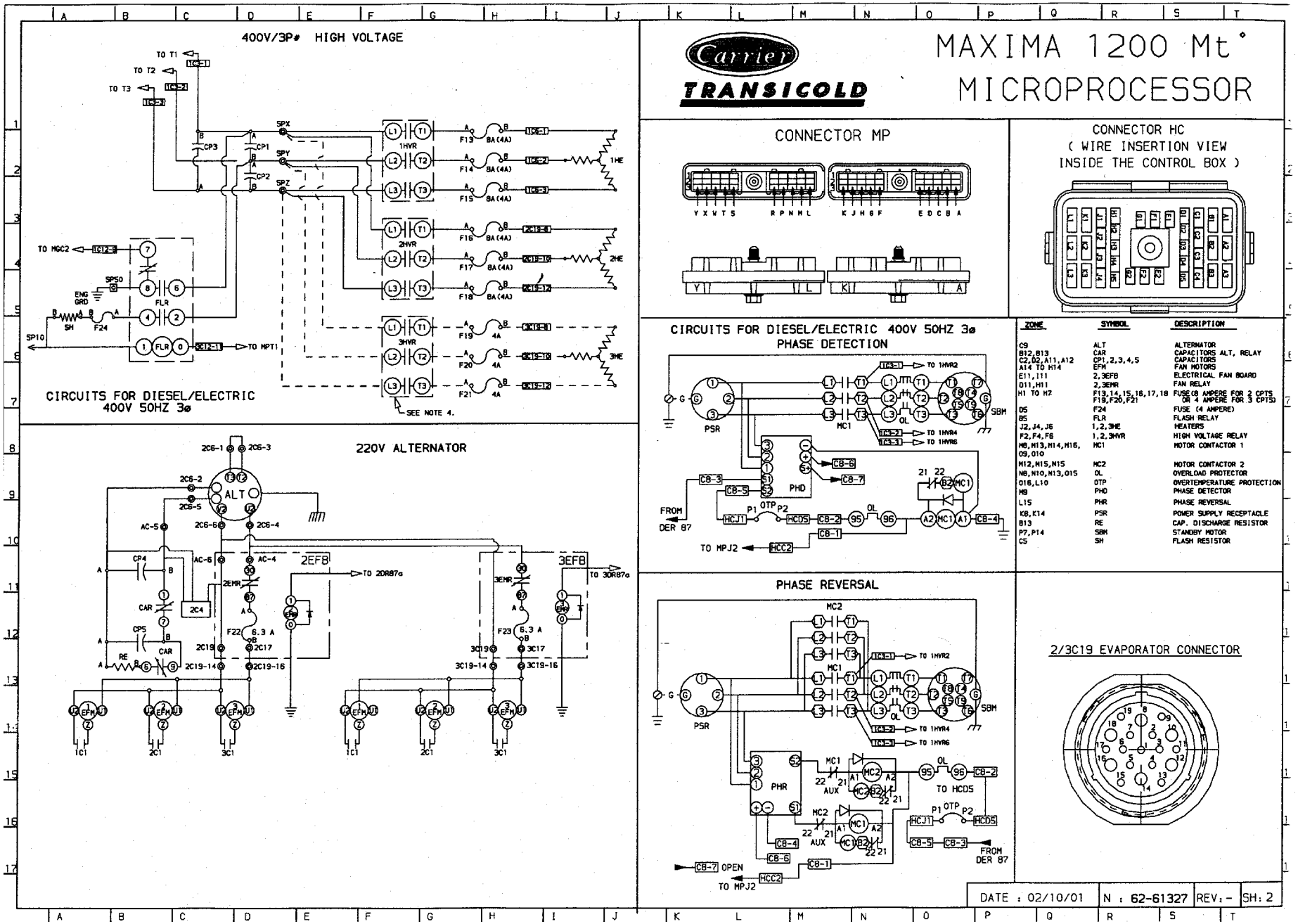


Figure 5-2 - Electrical schematic diagram - MAXIMA 1200 Mt° (2/2)