Direct Smart Reefer Microprocessor Control System Revision 121 XX, 273 XX Software

TK 52573-EN-18-OD (Rev. 6, 10-08)

Direct Drive Truck Units (ESA)
B-100, V-100, V-200, V-300, V-400, V-500

Diagnostic Manual

Release History

(04-2005)	Original
(08-2006)	Add software revision 273 XX, V-400 MAX 30/50, V-500 MAX 20 1PH, V-500 MAX TC 10/20/30/50 1PH/3PH
(12-2006)	Add software revision 273 XX, B-100 10/20
(03-2007)	Add V-500 AC 10/20
(12-2007)	To replace CB1 by FP and F14 in B-100 units. To replace F20 (5A) by F20 (4A) in all the units "except B-100"
(04-2008)	To update electrical diagramsfor the V-100/200/300 MAX 10/20/30/50, V-400/500 MAX 20/50, V-500 MAX TC 20/50 and V-500 AC 10/20 units
(10-2008)	Add V-100/20 and V-100 MAX 20/50. To update electrical diagrams for V-100/200/300 MAX 10/20/30/50, V-400/500 MAX 10/20/30/50 and V-500 MAX TC 10/20/30/50 units. To update F21 and F14. To eliminate DAS connection.

ABOUT THIS MANUAL

Because not everyone is familiar with microprocessor-based control systems, please take a few minutes to read this page. It explains the content and structure of this manual. This will make it easier for you to find the information you need.

Section 1 - Safety Precautions

This section contains the safety precautions, safety decals and locations and microprocessor cautions. You should read this material carefully before working on the unit.

Section 2 - System Description

This section includes a complete system hardware description, including special features. It shows you how the system works in different modes and under various conditions.

Section 3 - Software Description

This section discusses the operation of the software, the programmable features, and the sequence of operation. Each programmable feature is discussed individually to show you how each works and how to change the settings.

Section 4 - Operation

This section shows you how to operate the Direct Smart Reefer Microprocessor Controller.

Section 5 - Diagnostics

This section shows you how to diagnosis problems. It includes both alarm code diagnostics and other symptom diagnostics.

Section 6 - Service Procedures

This section includes step by step procedures to repair and program the Direct Smart Reefer Microprocessor Controller. They are referenced by the Diagnostics section.

Section 7 - DSR µP Controller Information

This section offers information on the parts of the Direct Smart Reefer Microprocessor Controller, including identifying components.

Section 8 - Schematics and Wiring Diagrams

This section includes the control schematics and wiring diagrams.

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Section 1 - Safety Precautions

General Practices

1. Always wear goggles or safety glasses. Refrigerant and battery acid can permanently damage the eyes.

2. Keep hands, clothing and tools clear of fans and belts when the unit is running.

3. Be sure gauge manifold hoses are in good condition. Never let them come in contact with belts, fans, pulleys or hot surfaces.

4. Never apply heat to a sealed refrigeration system or container.

5. Refrigerants in the presence of an open flame produce toxic gases. These gases are severe respiratory irritants capable of causing death.

6. Be sure all mounting bolts are the correct length for the application and are securely tightened.

7. Use extreme caution when drilling holes in the unit. Holes may weaken structural components. Holes drilled in wiring can cause fire or explosion. Holes drilled into the refrigeration system will release refrigerant.

8. Use caution when working around exposed coil fins. The fins can cause painful lacerations.

9. Use caution when working with refrigerant in a closed or confined area with a limited air supply such as a trailer, container or hold of a ship. Refrigerant tends to displace air and can cause oxygen depletion which may result in unconsciousness or death due to suffocation.

10. If the air conditioning system is on, the **V-500 AC** unit continues running even though the in-cab control box is off.

Refrigerant

At Thermo King we recognize the need to preserve the environment and limit the potential harm to the ozone layer that can result from allowing refrigerant to escape into the atmosphere.

We strictly adhere to a policy that promotes the recovery and limits the loss of refrigerant into the atmosphere.

When working on transport refrigeration systems a recovery process that prevents or minimizes refrigerant loss to the atmosphere is required by law. In addition, service personnel must be aware of European Union, national, and local regulations governing the use of refrigerants and certification of technicians.

When refrigerants are exposed to the atmosphere in liquid form, they evaporate rapidly, freezing anything they contact. If they contact the skin severe frostbite can result. In the event of frostbite, the objectives of first aid are to protect the frozen area from additional injury and to warm it rapidly.

First Aid

1. Warm the frozen area by immersing it in luke-warm (not hot) water or by covering the area with warm blankets.

2. Obtain medical assistance as soon as possible.

3. If refrigerant contacts the eyes, flush them with water immediately and obtain medical assistance as soon as possible.

Section 1 - Safety Precautions

Refrigeration Oil

Avoid contact with the eyes. Avoid prolonged contact with the skin or clothing. Wash hands thoroughly after handling refrigeration oil to prevent skin irritation.

First Aid

In case of eye contact, flush immediately with water for at least 15 minutes. Obtain medical assistance as soon as possible.

Electrical

Microprocessor Service

Precautions must be taken to prevent electrostatic discharge when servicing the microprocessor and related components. A potential difference less than that required to produce a small spark between a finger and a doorknob can cause severe damage to solid state components. Refer to Service Procedure A12A, *ESD (Electrostatic Discharge) Procedure* in this manual and the Electrostatic Discharge Training Guide (TK 40282-1) for additional information.

Welding

Precautions must be taken before welding on the unit. Refer to Service Procedure A26A, *Welding on Units Equipped with Microprocessors* in this manual for additional information.

Batteries

When removing a battery from the unit, ALWAYS disconnect the negative battery terminal (-) first. Then remove the positive terminal (+). When RECONNECTING THE BATTERY TERMINALS, CONNECT THE POSITIVE TERMINAL (+) FIRST, AND CONNECT THE NEGATIVE (-) TERMINAL LAST.

Electrical Hazards

High Voltage

Units with optional Electric Standby utilize 115 or 230 volt, single-phase power or 230 to 440 volt three-phase AC power any time the unit is operating in Electric mode. This voltage potential is also present any time the unit is connected to standby power. Extreme care must be used when working on the unit, as these voltages are capable of causing serious injury or death.

1. When working on the high voltage circuits, do not make any rapid movements. Unplanned movements can cause contact with high voltage.

2. Use tools with insulated handles that are in good condition. Never hold metal tools in your hand if exposed high voltage conductors are within reach.

3. Treat all wires as high voltage wires.

4. Never work alone on high voltage circuits. Another person should be nearby in case of accident.

First Aid

Immediate action must be taken after a person has received an electrical shock. Medical attention should be summoned as soon as possible.

The source of electricity must be immediately removed, either by shutting down the power or removing the victim from the source.

If the victim must be removed from a live circuit, pull the victim off with a non-conductive material. Use the victim's clothing, a rope, wood or your belt. After separating the victim from the power source, immediately check for pulse and respiration. If a pulse is not present, start CPR (Cardio-PulmonaryResuscitation) immediately. If a pulse is present, respiration may be restored by mouth to mouth resuscitation. Obtain emergency medical assistance as soon as possible.

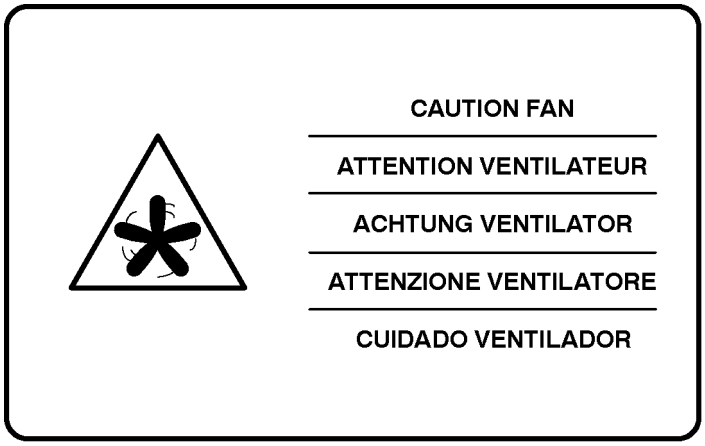
Low Voltage

Control circuits can be 12 volt DC or 24 volt DC. This voltage potential is not considered dangerous, but the large amount of current available can cause severe burns if shorted to ground.

Do not wear jewelry, watches or rings when working on the unit. If these items contact an electrical circuit severe burns may result.

Section 1 - Safety Precautions

Typical Safety Decals



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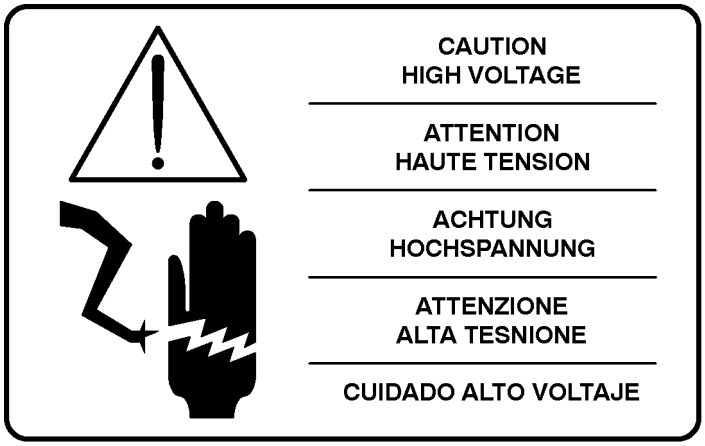

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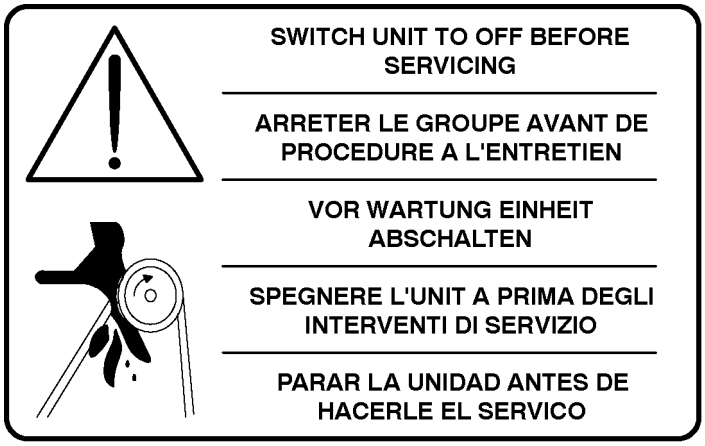

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Direct Smart Reefer Microprocessor Notes

The following procedures may not be readily apparent, but must be followed when working on units equipped with Direct Smart Reefer microprocessors.

- Never use testers consisting of a battery and a light bulb to test circuits on any microprocessor based system.
- Any time the software is changed, perform Service Procedure A02A, *Recording Existing Microprocessor Settings* and Service Procedure A04A, *Microprocessor Setup (Programming the DSR Microprocessor)*.
- Any time an Electronic Control Module printed circuit board is replaced, perform Service Procedure B02A, *Printed Circuit Board Removal and Replacement*.
- Any time welding is to be done on the unit or truck, perform Service Procedure A26A, *Welding on Units Equipped with Microprocessors*.

SEE SECTION 5 FOR ADDITIONAL DETAILS.

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Direct Smart Reefer Microprocessor Controller Block Diagram: for DSR μP Controllers with Platform 1

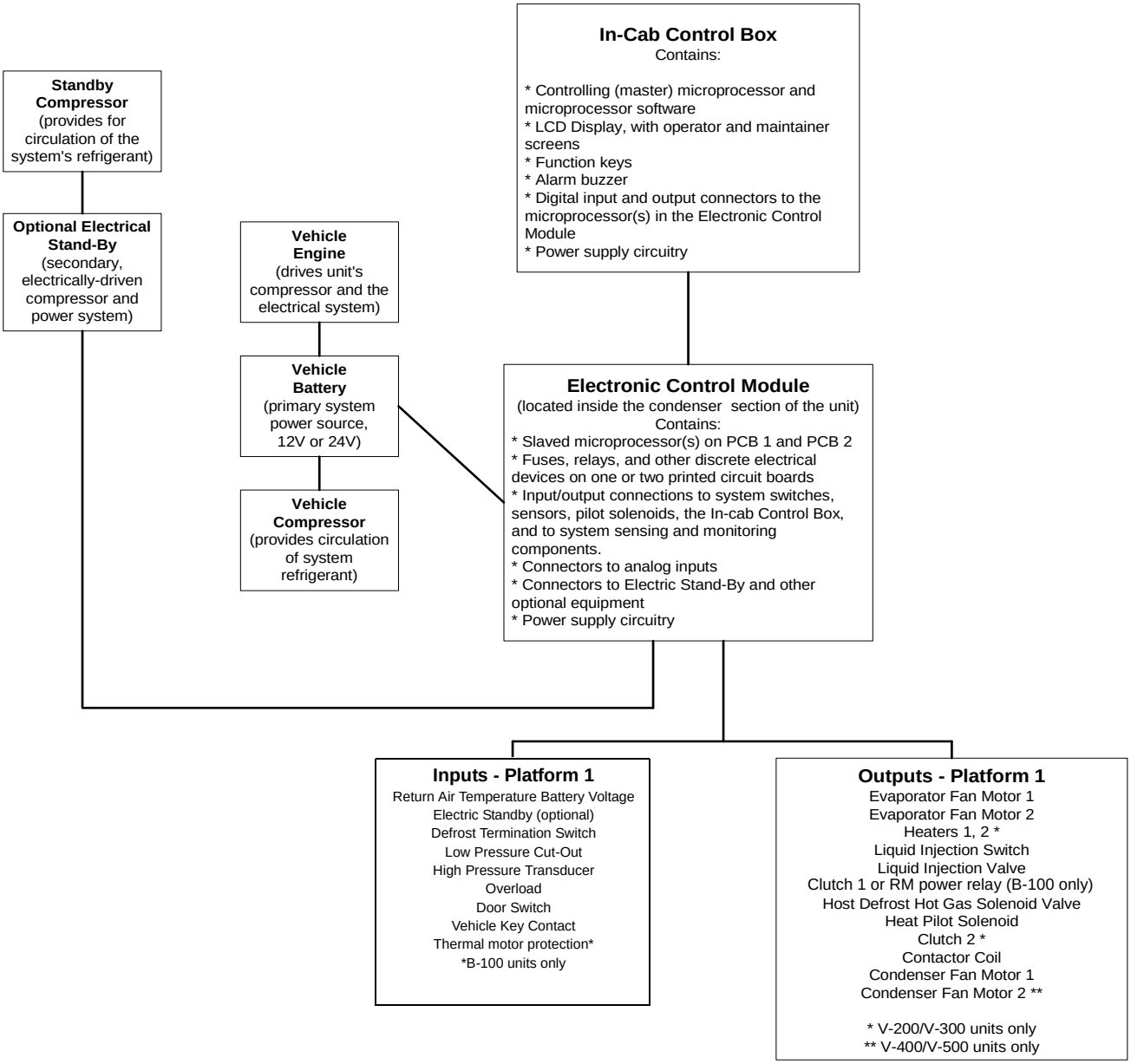

Figure 2-1 DSR Microprocessor Block Diagram: for Platform 1 Units

Section 2 - System Description

Direct Smart Reefer Microprocessor Controller Block Diagram: for DSR μP Controllers with Platform 1 and Platform 2

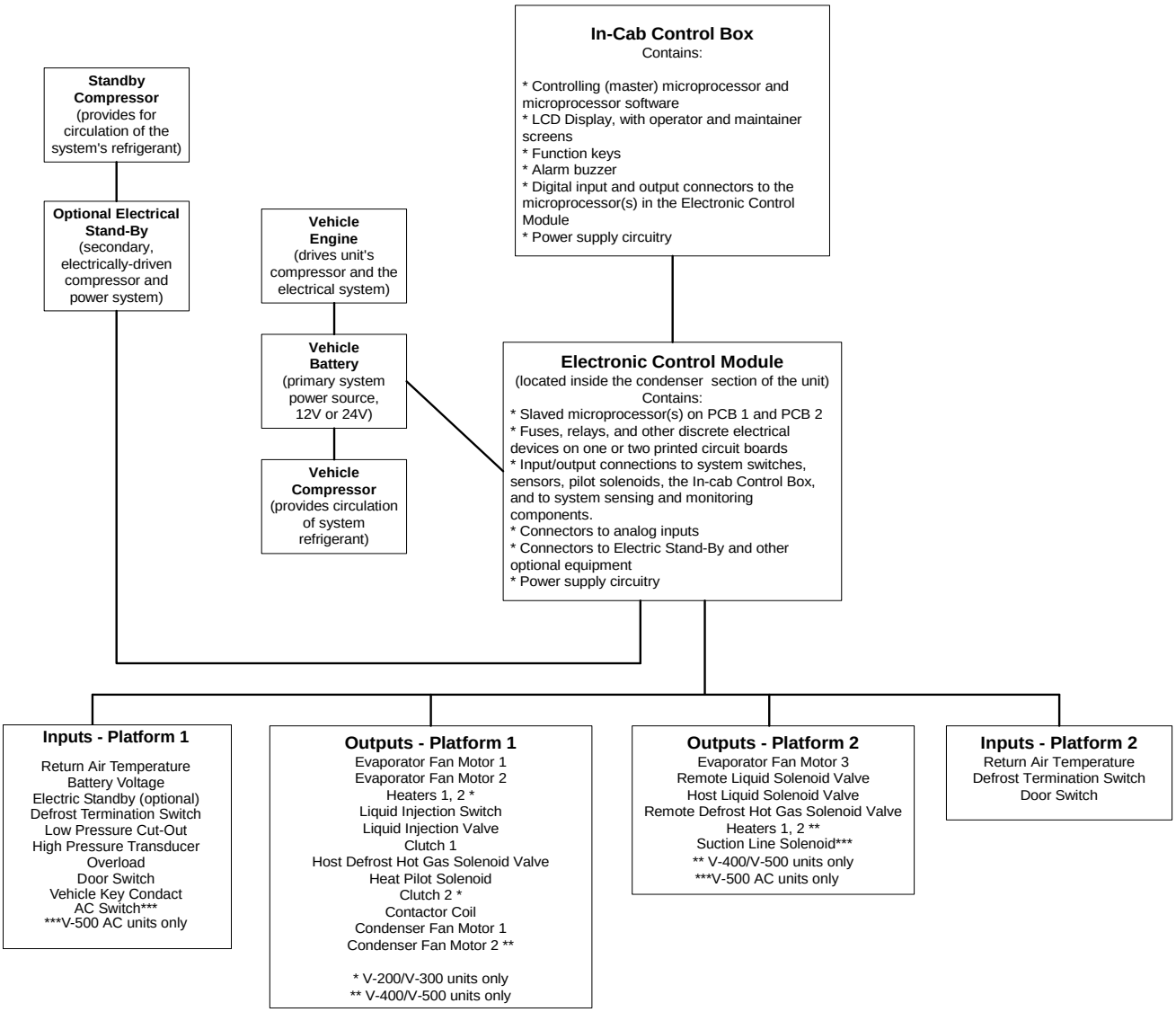

Figure 2-2 DSR Microprocessor Controller Block Diagram: for Platform 1 and 2 Units

General Description

Thermo King units that use the Direct Smart Reefer Microprocessor Control System (referred to, throughout the remainder of this manual, as a DSR µP Controller) are temperature-control units mounted on small- and medium-sized trucks. Units provide cooling and defrosting by means of the vehicle motor or DC motor (in models operating electrically, the second compressor is driven by a Electric Standby Motor).
Defrost is accomplished by hot gas. Heat is provided by the hot gas system and by the forced-convection air-flow created by the fans.

The DSR µP Controller consists of two main assemblies: an **In-Cab Control Box**, located near the vehicle driver, and an **Electronic Control Box (ECM)**, located in the condenser section of the unit. Both assemblies together are referred to as an Electronic Control System.

This section of the manual describes the Electronic Control System hardware in groups:

- In-Cab Control Box
- Electronic Control Module
- Microprocessor
- Printed Circuit Boards PCB 1 and PCB 2
- Input/Output Connectors
- Fuses
- Relays
- External Equipment

In-Cab Control Box

The In-cab Control Box contains the Electronic Control System's controlling (master) microprocessor, microprocessor software, LCD display screen, touch-sensitive function keys, and discrete electronic components. It is usually mounted on or above the truck instrument panel. The In-cab Control Box is connected to the ECM by a cable that contains communications, voltage, and chassis/ground wires.

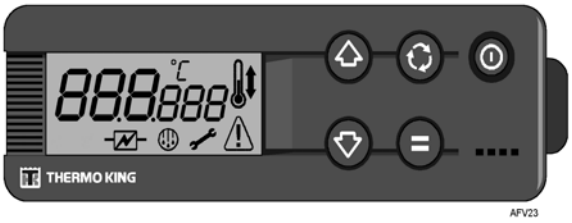

Figure 2-3 In-cab Control Box

The In-cab Control Box performs several major functions:

- It receives temperature-control and unit operating inputs from the microprocessor(s) in the ECM. The ECM can have one or two printed circuit boards (PCB 1, PCB2), each containing a microprocessor.
- The In-cab Control Box provides visual information to the user (vehicle driver or service personnel) about unit operating conditions, setpoints, and current load compartment temperatures.
- It allows the driver to select setpoint temperatures, review and respond to alarms, examine other unit operating conditions, and set the manual defrost. It allows service personnel to select operating parameters, hourmeters, and timers in the Information Menu and Installation Menu.

Section 2 - System Description

The unit can be operated by the ECM without an In-cab Control Box. However, operating conditions for the unit must be selected with the In-cab Control Box before it is disconnected from the ECM.

Electronic Control Module (ECM)

The ECM, located inside the unit's condenser, contains the system's secondary microprocessor(s), I/O connectors, output relays, fuses, LEDs, cooling fan, and discrete electronic components mounted on one or two printed circuit boards (platforms). The microprocessor(s) receives output signals from the load compartment return air sensor and electronic thermostat. These signals are sent to the microprocessor in the In-cab Control Box. Based on setpoint temperature and other parameters, the In-cab Control Box microprocessor determines when to adjust the temperature-control state in the main and/or remote load compartment to Cool, Heat, or Null mode, or to initiate a Defrost cycle.

The ECM microprocessor(s) also receives input signals from load compartment sensors and switches, the vehicle battery, engine, compressor clutches, an optional Electrical Standby, and solenoid valves. These inputs are sent to the In-cab Control Box microprocessor, where it determines if faulty or out-of-range conditions exist.

The ECM can be configured with a single, large printed circuit board (PCB 1) that is attached to the ECM enclosure. This configuration (PCB 1 only) is referred to as Platform 1.

The ECM can also be configured to contain a smaller, add-on printed circuit board (PCB 2) that is mounted above PCB 1. PCB 2 consists of a microprocessor, two I/O connectors, relays, fuses, and other discrete electronic components. This configuration (PCB 1 and PCB 2) is referred to as Platform 1 and 2.

See Figure 2-4 for a Platform 2 configuration, with the ECM cover removed and PCB 2 mounted above PCB 1. See Figure 2-5 and Figure 2-6 for typical PCB 1 and PCB 2 layouts.

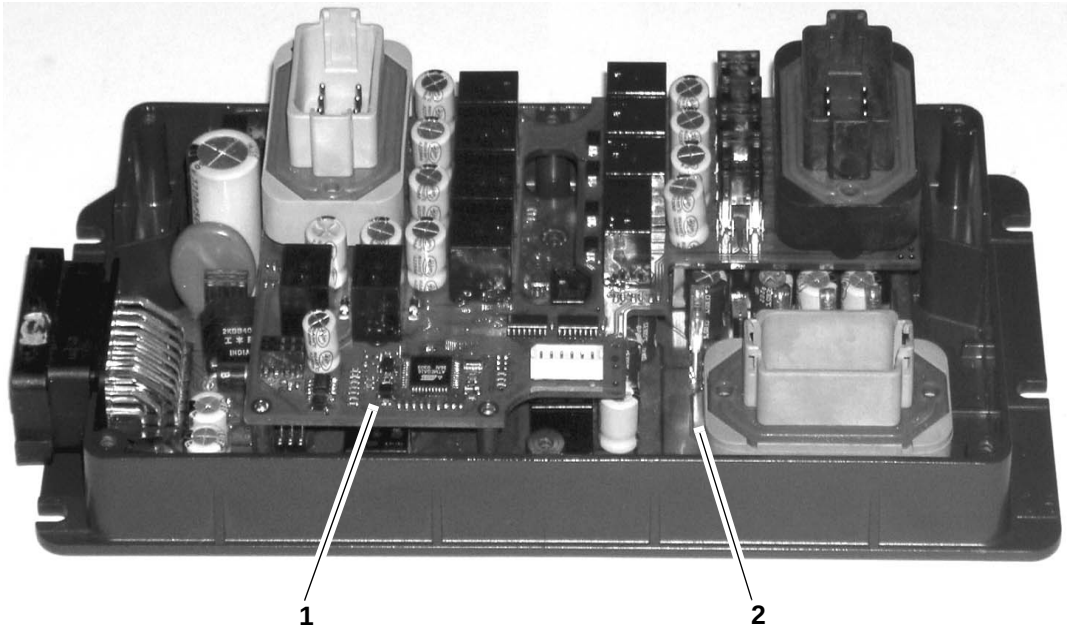

Figure 2-4 A Platform 2 ECM configuration, with PCB 2 mounted above PCB 1

Callout	Description
1	PCB 2
2	PCB 1

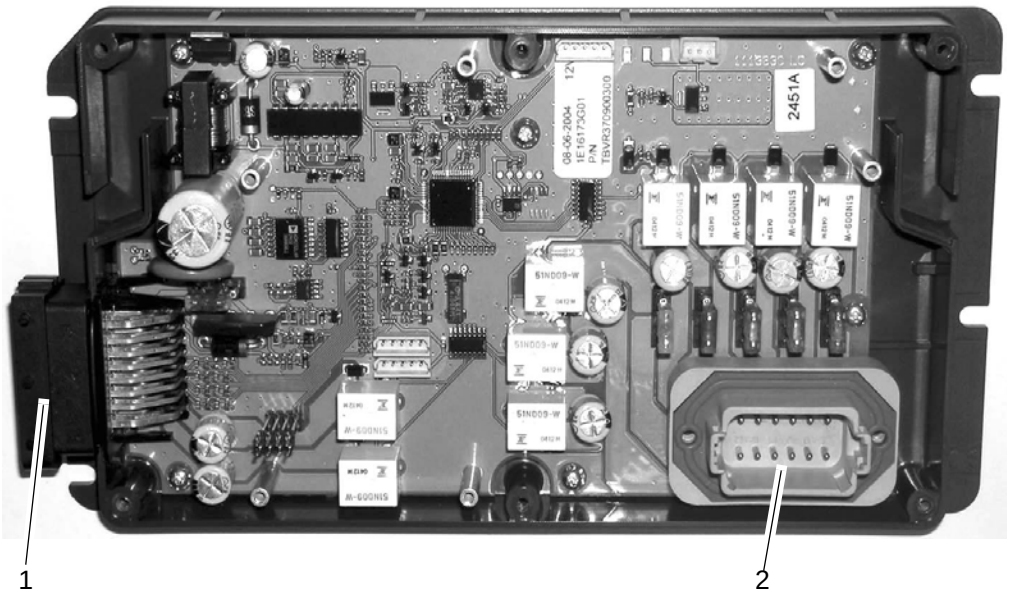

Figure 2-5 Internal Layout of a Platform 1 Electronic Control Module, showing PCB 1

Callout	Description
1	Connector C-1
2	Connector C-2

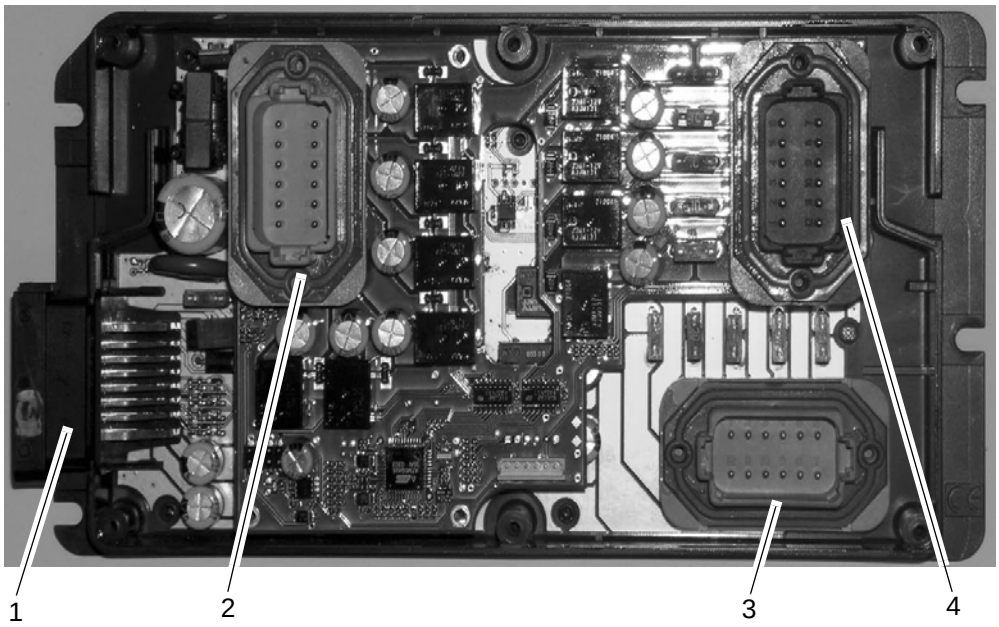

Figure 2-6 Internal Layout of a Platform 2 Electronic Control Module, showing PCB 1 and PCB 2

Callout	Description
1	Connector C-1, PCB 1
2	Connector C-1, PCB 2
3	Connector C-2, PCB 1
4	Connector C-2, PCB 2

Electronic Control System Components

The following sub-section describes the main components of the Electronic Control System:

- Microprocessors
- PCB 1 and PCB 2
- Printed Circuit Board I/O Connectors
- System Fuses
- Printed Circuit Board Relays
- DSR µP Controller Inputs
- DSR µP Controller Outputs

Microprocessors

The controlling microprocessor in the In-cab Control Box, and the slaved microprocessor(s) in the ECM, are the heart of the DSR µP Controller. The microprocessors accomplish the following:

- In general, they monitor and control the functioning of the refrigeration system sensors, valves, switches, and motors
- The microprocessor(s) on PCB 1 and PCB 2 in the ECM receive input signals from the controlling microprocessor in the In-cab Control Box, and from sensors and electrical components in the load compartment, and provide output power signals to system solenoid valves, motors, and heaters

- The microprocessor in the In-cab Control Box receives information signals from the ECM microprocessors regarding unit operations and power. The In-cab microprocessor send signals to the ECM microprocessors regarding setpoint and parameter settings, manual defrost, and the functioning of the evaporator, condenser, and other system components

- Changes made at the In-cab Control Box are processed by the In-cab microprocessor. Signals are routed to the microprocessor in PCB 1 and/or PCB 2, which analyzes and processes the commands. Signals are sent to the applicable relays on PCB 1 or PCB 2, which energize solenoid valves or activate system electrical devices, such as fan motors, clutches, heaters, etc.

PCB 1 and PCB 2

Printed Circuit Board 1 (PCB 1) and/or Printed Circuit Board 2 (PCB 2) are located in the ECM. Each printed circuit board is populated with a microprocessor and discrete electronic components, and connected by wires to analog and digital I/O devices. A PCB, in addition to physically connecting these components, is an interface between the microprocessor and the unit valves, evaporator and condenser fan motor contactors, heaters, the Data Acquisition System (which monitors and records the unit I/O's, alarms, and temperature-control device signals), and the In-cab Control Box.

Printed Circuit Board I/O Connectors

The pins for connectors C-1 (inputs) and C-2 (outputs) on PCB 1 and PCB 2 are different for each B-100 through V-500 direct-drive truck unit. These differences are noted in the following tables.

In the following tables, PCB 1 = Printed Circuit Board 1, PCB 2 = Printed Circuit Board 2.

C-1 Input Connector for the B-100 10 Single Temperature Units, 12 V and 24V (PCB 1)

Pin	Wire #	Description
A1	26A	Heat Pilot Solenoid
A2	LPCO	Low Pressure Cut-out Switch
A3	DSW1	Door Switch 1
A4	PNK	Thermostat Sensor
A5	DL2	DAS Comms 2 (RS-232)
A6	CHH	Chassis
A7	BAT	Battery Terminal
A8	03	Battery
B4	BLK	Thermostat Sensor
B5	DL1	DAS Comms 1 (RS-232)
B6	RXD	RX Comms Signal to the In-cab Control Box (RS-485)
B7	TXD	TX Comms Signal to the In-cab Control Box (RS-485)
C1	12	Defrost Temperature Switch
C2	DK3	DC motor thermal protection
C3	CHT	Chassis to THPCO
C4	HP	High Pressure to THPCO
C5	5V	5 Volt to THPCO
C6	CH, GND	Chassis and Ground to the In-cab Control Box
C7	9V	9-volts output voltage to the In-cab Control Box

C-2 Output Connector for the B-100 10 Single Temperature Units, 12V and 24V (PCB 1)

Pin	Wire #	Description
1	EF1-01	Terminal Board (EF1)
2	EF1	Evaporator Fan 1
5	CF1-01	Terminal Board (CF1)
6	CF1	Condenser Fan 1
8	26	Main Compartment Defrost Hot Gas Solenoid Valve
9	RM	Battery relay
10	PC	Terminal Board

C-1 Input Connector for the V-100, V-200, and V-300, 10/30 Single Temperature Units, 12 V and 24V (PCB 1)

Pin	Wire #	Description
A1	26A	Heat Pilot Solenoid
A2	LPCO	Low Pressure Cut-out Switch
A3	DSW1	Door Switch 1
A4	PNK	Thermostat Sensor
A6	CHH	Chassis
A7	BAT	Battery Terminal
A8	03	Battery
B4	BLK	Thermostat Sensor
B6	RXD	RX Comms Signal to the In-cab Control Box (RS-485)
B7	TXD	TX Comms Signal to the In-cab Control Box (RS-485)
C1	12	Defrost Temperature Switch
C3	CHT	Chassis to THPCO
C4	HP	High Pressure to THPCO
C5	5V	5 Volt to THPCO
C6	CH, GND	Chassis and Ground to the In-cab Control Box
C7	9V	9-volts output voltage to the In-cab Control Box

C-2 Output Connector for the V-100, V-200, and V-300 MAX, 10/30 Single Temperature Units, 12V and 24V (PCB 1)

Pin	Wire #	Description
1	EF1-01	Terminal Board (EF1)
2	EF1	Evaporator Fan 1
3	EF2-01	Terminal Board (EF2)
4	EF2	Evaporator Fan 2
5	CF1-01	Terminal Board (CF1)
6	CF1	Condenser Fan 1
8	26	Main Compartment Defrost Hot Gas Solenoid Valve
9	CLU1-01/ LIS	Liquid Injection Switch
9	CLU1-01/ CLU1	Compressor Clutch
10	PC	Terminal Board (Power Contactor)
11	27-01/ 27A	Heater 1
11	27-01/ 27	Heater 2
12	EXR1-01	Terminal Board

C-1 Input Connector for the V-400 and V-500 MAX, 10/30 Single Temperature Units, 12 V and 24V (PCB 1)

Pin	Wire #	Description
A1	26A	Heat Pilot Solenoid
A2	LPCO	Low Pressure Cut-out Switch
A3	DSW1	Door Switch 1
A4	PNK	Thermostat Sensor
A6	CHH	Chassis
A7	BAT	Battery Terminal
A8	03	Battery
B4	BLK	Thermostat Sensor
B6	RXD	RX Comms Signal to the In-cab Control Box (RS-485)
B7	TXD	TX Comms Signal to the In-cab Control Box (RS-485)
C1	12	Defrost Temperature Switch
C3	CHT	Chassis to THPCO

C-1 Input Connector for the V-400 and V-500 MAX, 10/30 Single Temperature Units, 12 V and 24V (PCB 1)

Pin	Wire #	Description
C4	HP	High Pressure to THPCO
C5	5V	5 Volt to THPCO
C6	CH, GND	Chassis and Ground to the In-cab Control Box
C7	9V	9-volts output voltage to the In-cab Control Box

C-2 Output Connector for the V-400 and V-500 MAX, 10/30 Single Temperature Units, 12 V and 24V (PCB 1)

Pin	Wire #	Description
1	EF1-01	Terminal Board (EF1)
2	EF1	Evaporator Fan Motor 1
3	EF2-01	Terminal Board (EF2)
4	EF2	Evaporator Fan Motor 2
5	CF1-02	Condenser Fan Motor 1
6	CHG	Chassis Ground
8	26	Main Compartment Defrost Hot Gas Solenoid Valve
9	CLU1-01/ LIS	Liquid Injection Switch
9	CLU1-01/ CLU1	Compressor Clutch
10	PC	Terminal Board
11	P2	Serial/Parallel
12	P1	Condenser Fan Motor 1

C-2 Output Connector for the V-400 and V-500 MAX, 10/30 Single Temperature Units, 12V and 24V (PCB 2)

Pin	Wire #	Description
3	EF3-01	Terminal Board (EF3)
4	EF3	Evaporator Fan Motor 3
5	CF2-01	Terminal Board
6	CF2-02	Condenser Fan Motor 2
11	27-01/27A	Heater 1
11	27-01/27	Heater 2
12	EXPR2-01	Terminal Board

C-1 Input Connector for the V-200 and V-300 MAX, Bi Temperature Units, 12V and 24V (PCB 2)

Pin	Wire #	Description
3	G	Sensor Thermostat
4	B	Sensor Thermostat
6	DSW2	Door Switch 2
11	PS3	Liquid Solenoid Valve
10	PS2	Remote Liquid Solenoid Valve
12	PS4	Remote Compartment Defrost Hot Gas Solenoid Valve

C-2 Input/Output Connector for the V-200 and V-300 MAX, Bi Temperature Units, 12V and 24V (PCB 2)

Pin	Wire #	Description
3	EF3-01	Terminal Board (EF3)
4	EF3	Evaporator Fan Motor 3
7	PC2	Terminal Board
8	DK2	Defrost Temperature Therm.

C-1 Input Connector for the B-100 20 Single Temperature Units, 1PH, 50Hz, 12 V and 24V (PCB 1)

Pin	Wire #	Description
A1	26A	Heat Pilot Solenoid

C-1 Input Connector for the B-100 20 Single Temperature Units, 1PH, 50Hz, 12 V and 24V (PCB 1)

Pin	Wire #	Description
A2	LPCO	Low Pressure Cut-out Switch
A3	DSW1	Door Switch 1
A4	PNK	Sensor Thermostat
A5	DL2	DAS Comms 2 (RS-232)
A6	CHH	Chassis
A7	BAT	Battery Terminal
A8	03	Battery
B1	CMC	Compressor Motor Contactor
B2	OL	Overload Relay
B4	BLK	Thermostat Sensor
B5	DL1	DAS Comms 1 (RS-232)
B6	RXD	RXD Comms Signal to the In-cab Control Box (RS-485)
B7	TXD	TXD Comms Signal to the In-cab Control Box (RS-485)
B8	X1	AC/DC power source
C1	12	Defrost Temperature Switch
C2	DK3	DC thermal motor protection
C3	CHT	Chassis to THPCO
C4	HP	High Pressure to THPCO
C5	5V	5 Volt to THPCO
C6	CH, GND	Chassis and Ground to the In-cab Control Box
C7	9V	9-volts output voltage to the In-cab Control Box
C8	X4	Transformer

C-2 Output Connector for the B-100 20 Single Temperature Units, 1 PH, 50Hz, 12 V and 24V (PCB 1)

1	EF1-01	Terminal Board
2	EF1	Evaporator Fan Motor 1
5	CF1-01	Terminal Board
6	CF1	Condenser Fan Motor 1
8	26	Main Compartment Defrost Hot Gas Solenoid Valve
9	RM	Battery relay
10	PC	Terminal Board

C-1 Input Connector for the V-100/V-200/V-300/MAX, 20/50 Single Temperature Units, 3PH/1PH, 50/60Hz, 12 V and 24V (PCB 1)

Pin	Wire #	Description
A1	26A	Heat Pilot Solenoid
A2	LPCO	Low Pressure Cut-out Switch
A3	DSW1	Door Switch 1
A4	PNK	Sensor Thermostat
A6	CHH	Chassis
A7	BAT	Battery Terminal
A8	03	Battery
B1	CMC	Compressor Motor Contactor (except V-100)
B2	OL	Overload Relay
B4	BLK	Thermostat Sensor
B6	RXD	RXD Comms Signal to the In-cab Control Box (RS-485)
B7	TXD	TXD Comms Signal to the In-cab Control Box (RS-485)
B8	X1	Transformer
C1	12	Defrost Temperature Switch
C3	CHT	Chassis to THPCO
C4	HP	High Pressure to THPCO
C5	5V	5 Volt to THPCO
C6	CH, GND	Chassis and Ground to the In-cab Control Box
C7	9V	9-volts output voltage to the In-cab Control Box
C8	X4	Transformer

C-2 Output Connector for the V-100/V-200/V-300/MAX, 20/50 Single Temperature Units, 3 PH/1PH, 50/60Hz, 12 V and 24V (PCB 1)

Pin	Wire #	Description
1	EF1-01	Terminal Board
2	EF1	Evaporator Fan Motor 1
3	EF2-01	Terminal Board (except V-100)
4	EF2	Evaporator Fan Motor 2 (except V-100)
5	CF1-01	Terminal Board

C-2 Output Connector for the V-100/V-200/V-300/MAX, 20/50 Single Temperature Units, 3 PH/1PH, 50/60Hz, 12 V and 24V (PCB 1)

Pin	Wire #	Description
6	CF1	Condenser Fan Motor 1
7	V-200/300 CLU2	Compressor Clutch 2
7	V-100: CMC	Compressor Motor Contactor
8	26	Main Compartment Defrost Hot Gas Solenoid Valve
9	CLU1-01/ CLU1	Compressor Clutch
9	CLU1-01/ LIS	Liquid Injection Switch
10	PC	Terminal Board
11	27-01/ 27A	Heater 1
11	27-01/ 27	Heater 2
12	EXR1-01	Terminal Board

C-1 Input Connector for the V-400 and V-500 MAX, 20/50 Single Temperature Units, 3 PH/1PH, 50/60Hz, 12 V and 24V (PCB 1)

Pin	Wire #	Description
A1	26A	Heat Pilot Solenoid
A2	LPCO	Low Pressure Cut-out Switch
A3	DSW1	Door Switch 1
A4	PNK	Sensor Thermostat
A6	CHH	Chassis
A7	BAT	Battery Terminal
A8	03	Battery
B1	CMC	Compressor Motor Contactor
B2	OL	Overload Relay
B4	BLK	Thermostat Sensor
B6	RXD	RXD Comms Signal to the In-cab Control Box (RS-485)
B7	TXD	TXD Comms Signal to the In-cab Control Box (RS-485)
B8	X1	Transformer
C1	12	Defrost Temperature Switch
C3	CHT	THPCO to Chassis

C-1 Input Connector for the V-400 and V-500 MAX, 20/50 Single Temperature Units, 3 PH/1PH, 50/60Hz, 12 V and 24V (PCB 1)

Pin	Wire #	Description
C4	HP	High Pressure to THPCO
C5	5V	5 Volt to THPCO
C6	CH, GND	Chassis and Ground to the In-cab Control Box
C7	9V	9-volts output voltage to the In-cab Control Box
C8	X4	Transformer

C-2 Output Connector for the V-400 and V-500 MAX, 20/50 Single Temperature Units, 3 PH/1PH, 50/60Hz, 12 V and 24V (PCB 1)

Pin	Wire #	Description
1	EF1-01	Terminal Board (EF1)
2	EF1	Evaporator Fan Motor 1
3	EF2-01	Terminal Board (EF2)
4	EF2	Evaporator Fan Motor 2
5	CF1-02	Terminal Board
6	CHG	Chassis Ground
8	26	Main Compartment Defrost Hot Gas Solenoid Valve
9	CLU1-01/ CLU1	Compressor Clutch
9	CLU1-01/ LIS	Liquid Injection Switch
10	PC	Terminal Board
11	P2	Serial/Parallel Condenser Fan Motor 2
12	P1	Serial/Parallel Condenser Fan Motor 1

C-2 Output Connector for the V-400 and V-500 MAX, 20/50 Single Temperature Units, 3 PH/1PH, 50Hz, 12 V and 24V (PCB 2)

Pin	Wire #	Description
3	EF3-01	Terminal Board (EF3)
4	EF3	Evaporator Fan Motor 3
5	CF2-01	Terminal Board
6	CF2-02	Condenser Fan Motor 2

C-2 Output Connector for the V-400 and V-500 MAX, 20/50 Single Temperature Units, 3 PH/1PH, 50Hz, 12 V and 24V (PCB 2)

Pin	Wire #	Description
11	27-01/27A	Heater 1
11	27-01/27	Heater 2
12	EXPR2-01	Terminal Board

C-1 Input Connector for the V-500 MAX 10/30, Bi Temperature Units, 12V and 24V (PCB 1)

Pin	Wire #	Description
A1	26A	Heat Pilot Solenoid
A2	LPCO	Low Pressure Cut-out Switch
A3	DSW1	Door Switch 1
A4	PNK	Thermostat Sensor
A6	CHH	Chassis
A7	BAT	Battery Terminal
A8	03	Battery
B4	BLK	Thermostat Sensor
B6	RXD	RX Comms Signal to the In-cab Control Box (RS-485)
B7	TXD	TX Comms Signal to the In-cab Control Box (RS-485)
C1	12	Defrost Temperature Switch
C3	CHT	Chassis to THPCO
C4	HP	High Pressure to THPCO
C5	5V	5 Volt to THPCO
C6	CH, GND	Chassis and Ground to the In-cab Control Box
C7	9V	9-volts output voltage to the In-cab Control Box

C-2 Output Connector for the V-500 MAX 10/30, Bi Temperature Units, 12V and 24V (PCB 1)

Pin	Wire #	Description
1	EF1-01	Terminal Board (EF1)
2	EF1	Evaporator Fan 1
3	EF2-01	Terminal Board (EF2)
4	EF2	Evaporator Fan 2
5	CF1-02	Condenser Fan Motor 1

C-2 Output Connector for the V-500 MAX 10/30, Bi Temperature Units, 12V and 24V (PCB 1)

Pin	Wire #	Description
6	CHG	Chassis Ground
8	26	Main Compartment Defrost Hot Gas Solenoid Valve
9	CLU1-01/ LIS	Liquid Injection Switch
9	CLU1-01/ CLU1	Compressor Clutch
10	PC	Terminal Board
11	P2	Serial/Parallel
12	P1	Condenser Fan Motor 1

C-1 Input Connector for the V-500 MAX 10/30, Bi Temperature Units, 12V and 24V (PCB 2)

Pin	Wire #	Description
3	G	Sensor Thermostat
4	B	Sensor Thermostat
6	DSW2	Door Switch 2
9	27-01/27 -27A	Heaters 1 and 2
11	PS3	Liquid Solenoid Valve
10	PS2	Remote Liquid Solenoid Valve
12	PS4	Remote Compartment Defrost Hot Gas Solenoid Valve

C-2 Input/Output Connector for the V-500 MAX 10/30, Bi Temperature Units, 12V and 24V (PCB 2)

Pin	Wire #	Description
1	EF4-01	Terminal Board (EF4)
2	EF4	Evaporator Fan Motor 4
3	EF3-01	Terminal Board (EF3)
4	EF3	Evaporator Fan Motor 3
5	CF2-01	Terminal Board
6	CF2-02	Condenser Fan Motor 2
7	PC2	Terminal Board

C-2 Input/Output Connector for the V-500 MAX 10/30, Bi Temperature Units, 12V and 24V (PCB 2)

Pin	Wire #	Description
8	DK2	Defrost Temperature Therm.
11	27-02/27 B-27C	Heaters 3 and 4
12	EXR2-01	Terminal Board

C-1 Input Connector for the V-500 MAX 20/50, Bi Temperature Units, 3 PH/1PH, 12 V and 24V (PCB 1)

Pin	Wire #	Description
A1	26A	Heat Pilot Solenoid
A2	LPCO	Low Pressure Cut-out Switch
A3	DSW1	Door Switch 1
A4	PNK	Sensor Thermostat
A6	CHH	Chassis
A7	BAT	Battery Terminal
A8	03	Battery
B1	CMC	Compressor Motor Contactor
B2	OL	Overload Relay
B4	BLK	Thermostat Sensor
B6	RXD	RXD Comms Signal to the In-cab Control Box (RS-485)
B7	TXD	TXD Comms Signal to the In-cab Control Box (RS-485)
B8	X1	Transformer
C1	12	Defrost Temperature Switch
C3	CHT	THPCO to Chassis
C4	HP	High Pressure to THPCO
C5	5V	5 Volt to THPCO
C6	CH, GND	Chassis and Ground to the In-cab Control Box
C7	9V	9-volts output voltage to the In-cab Control Box
C8	X4	Transformer

C-2 Output Connector for the V-500 MAX 20/50, Bi Temperature Units, 3 PH/1PH, 12 V and 24V (PCB 1)

Pin	Wire #	Description

C-2 Output Connector for the V-500 MAX 20/50, Bi Temperature Units, 3 PH/1PH, 12 V and 24V (PCB 1)

1	EF1-01	Terminal Board
2	EF1	Evaporator Fan Motor 1
3	EF2-01	Terminal Board
4	EF2	Evaporator Fan Motor 2
5	CF1-02	Condenser Fan Motor 1
6	CHG	Chassis Ground
8	26	Main Compartment Defrost Hot Gas Solenoid Valve
9	CLU1-01/ CLU1	Compressor Clutch
9	CLU1-01/ LIS	Liquid Injection Switch
10	PC	Terminal Board
Pin	**Wire #**	**Description**
11	P2	Serial/Parallel
12	P1	Condenser Fan Motor 1

C-1 Input Connector for the V-500 MAX 20/50, Bi Temperature Units, 12V and 24V (PCB 2)

Pin	Wire #	Description
3	G	Sensor Thermostat
4	B	Sensor Thermostat
6	DSW2	Door Switch 2
9	27-02/27 B-27C	Heaters 3 and 4
10	PS2	Remote Liquid Solenoid Valve
11	PS3	Liquid Solenoid Valve
12	PS4	Remote Compartment Defrost Hot Gas Solenoid Valve

C-2 Input/Output Connector for the V-500 MAX 20/50, Bi Temperature Units, 12V and 24V (PCB 2)

Pin	Wire #	Description
1	EF4-01	Terminal Board (EF4)
2	EF4	Evaporator Fan Motor 4

C-2 Input/Output Connector for the V-500 MAX 20/50, Bi Temperature Units, 12V and 24V (PCB 2)

Pin	Wire #	Description
3	EF3-01	Terminal Board (EF3)
4	EF3	Evaporator Fan Motor 3
5	CF2-01	Terminal Board
6	CF2-02	Condenser Fan Motor 2
7	PC2	Terminal Board
8	DK2	Defrost Temperature Therm.
11	27-01/27 -27A	Heaters 1 and 2
12	EXR2-01	Terminal Board

C-1 Input Connector for the V-500 AC 10 Units, 12 V and 24V (PCB 1)

Pin	Wire #	Description
A2	LPCO	Low Pressure Cut-out Switch
A3	DSW1	Door Switch 1
A4	PNK	Thermostat Sensor
A5	DL2	DAS Comms 2 (RS-232)
A6	CHH	Chassis
A7	BAT	Battery Terminal
A8	03	Battery
B3	AC_SW	AC Switch
B4	BLK	Thermostat Sensor
B5	DL1	DAS Comms 1 (RS-232)
B6	RXD	RX Comms Signal to the In-cab Control Box (RS-485)
B7	TXD	TX Comms Signal to the In-cab Control Box (RS-485)
C1	12	Defrost Temperature Switch
C3	CHT	Chassis to THPCO
C4	HP	High Pressure to THPCO
C5	5V	5 Volt to THPCO
C6	CH, GND	Chassis and Ground to the In-cab Control Box
C7	9V	9-volts output voltage to the In-cab Control Box

C-2 Output Connector for the V-500 AC, 10 Units, 12 V and 24V (PCB 1)

Pin	Wire #	Description
1	EF1-01	Terminal Board (EF1)
2	EF1	Evaporator Fan Motor 1
3	EF2-01	Terminal Board (EF2)
4	EF2	Evaporator Fan Motor 2
5	CF1-02	Condenser Fan Motor 1
6	CHG	Chassis Ground
8	26	Main Compartment Defrost Hot Gas Solenoid Valve
9	CLU1	Compressor Clutch
10	PC	Terminal Board
11	P2	Serial/Parallel
12	P1	Condenser Fan Motor 1

C-1 Input Connector for the V-500 AC 10, Units, 12V and 24V (PCB 2)

Pin	Wire #	Description
9	33A	PS6, Suction Line (bypass) Solenoid
10	33	PS2, AC Liquid Solenoid
11	B3	PS3 Liquid Solenoid Valve

C-2 Input/Output Connector for the V-500 AC 10, Units, 12V and 24V (PCB 2)

Pin	Wire #	Description
3	EF3-01	Terminal Board (EF3)
4	EF3	Evaporator Fan Motor 3
5	CF2-01	Terminal Board
6	CF2-02	Condenser Fan Motor 2
7	PC2	Terminal Board

C-1 Input Connector for the V-500 AC 20, Units, 3 PH/1PH, 12 V and 24V (PCB 1)

Pin	Wire #	Description
A2	LPCO	Low Pressure Cut-out Switch
A3	DSW1	Door Switch 1
A4	PNK	Sensor Thermostat
A5	DL2	DAS Comms 2 (RS-232)
A6	CHH	Chassis
A7	BAT	Battery Terminal

C-1 Input Connector for the V-500 AC 20, Units, 3 PH/1PH, 12 V and 24V (PCB 1)

Pin	Wire #	Description
A8	03	Battery
B1	CMC	Compressor Motor Contactor
B2	OL	Overload Relay
B3	AC_SW	AC switch
B4	BLK	Thermostat Sensor
B5	DL1	DAS Comms 1 (RS-232)
B6	RXD	RXD Comms Signal to the In-cab Control Box (RS-485)
B7	TXD	TXD Comms Signal to the In-cab Control Box (RS-485)
B8	X1	Transformer
C1	12	Defrost Temperature Switch
C3	CHT	THPCO to Chassis
C4	HP	High Pressure to THPCO
C5	5V	5 Volt to THPCO
C6	CH, GND	Chassis and Ground to the In-cab Control Box
C7	9V	9-volts output voltage to the In-cab Control Box
C8	X4	Transformer

C-2 Output Connector for the V-500 AC, 20 Units, 3 PH/1PH, 12 V and 24V (PCB 1)

Pin	Wire #	Description
1	EF1-01	Terminal Board
2	EF1	Evaporator Fan Motor 1
3	EF2-01	Terminal Board
4	EF2	Evaporator Fan Motor 2
5	CF1-02	Condenser Fan Motor 1
6	CHG	Chassis Ground
8	26	Main Compartment Defrost Hot Gas Solenoid Valve
9	CLU1	Compressor Clutch
10	PC	Terminal Board
11	P2	Serial/Parallel
12	P1	Condenser Fan Motor 1

C-1 Input Connector for the V-500 AC 20, Units, 3 PH/1PH, 12V and 24V (PCB 2)

Pin	Wire #	Description
9	33A	PS6, Suction Line (bypass) Solenoid
10	33	PS2, AC Liquid Solenoid
11	B3	PS3 Liquid Solenoid Valve

C-2 Input/Output Connector for the V-500 AC 20, Units, 3 PH/1PH, 12V and 24V (PCB 2)

Pin	Wire #	Description
3	EF3-01	Terminal Board (EF3)
4	EF3	Evaporator Fan Motor 3
5	CF2-01	Terminal Board
6	CF2-02	Condenser Fan Motor 2
7	PC2	Terminal Board

System Fuses

The following tables describe the fuses used to protect relays and other DSR μP Controller electrical components.

Fuse Sizes and Descriptions:
Located on Printed Circuit Board 1 (PCB 1) or Printed Circuit Board 2 (PCB 2)

Fuse #	Amps @ 12V	Amps @ 24V	Description
F1 (PCB 1)	5A	5A	Power supply circuit
F2 (PCB 1)	15A	10A	Condenser Fan 1 (CF1)
F3 (PCB 1)	15A	10A	Evaporator Fan 1 (EF1)
F4 (PCB 1)	15A	10A	Evaporator Fan 2 (EF2)
F5 (PCB 1)	20A	10A	Compressor clutch 1 (CCL1), liquid injection switch (LIS), liquid injection valve (LIV), host defrost hot solenoid valve (PS1), compressor motor contactor (CMC), heat pilot solenoid (PS5), compressor clutch 2 (CCL2), RM power relay****
F6 (PCB 1)	10A	7.5A	Condenser Fan 1, 2* (CF1, CF2) Heater 1, Heater 2** (HT1, HT2)
F7 (PCB 2)	15A	10A	Condenser Fan 2 (CF2)
F8 (PCB 2)	20A	10A	Remote liquid solenoid valve (PS2), host liquid solenoid valve (PS3), remote defrost hot gas solenoid valve (PS4) and AC system suction line solenoid valve (PS6) *****
F9 (PCB 2)	15A	10A	Evaporator Fan 3 (EF3)
F10 (PCB 2)	15A	10A	Evaporator Fan 4 (EF4)

Fuse Sizes and Descriptions:
Located on Printed Circuit Board 1 (PCB 1) or Printed Circuit Board 2 (PCB 2)

Fuse #	Amps @ 12V	Amps @ 24V	Description
F11 (PCB 2)	10A	7.5A	Heater 1, Heater 2*** (HT1, HT2)

* For V-400, V-500, V-500 MAX single-temperature.
** For V-100, V-200, V-300 MAX, 10/30, single-temperature, V-300 MAX 20/50 single temperature, and V-200/V-300 MAX, 10/30, 20/50, TC
*** For V-400, V-500 MAX, 10/30, 20/50 single-temperature.

**** For B-100 10/20 units.

***** For V-500 AC 10/20 units.

Fuse Sizes and Descriptions:
Located In the Direct-Drive Vehicle

Fuse	Amps @ 12V	Amps @ 24V	Description
F20 (except B-100)	5A	5A	Transformer
F21 (except B-100)	V-100: 30 A V-200: 40 A V-300: 40 A V-400: 50 A V-500: 50 A	V-100: 30 A V-200: 40 A V-300: 40 A V-400: 50 A V-500: 50 A	Battery Relay
FP (B-100 only)	100A	60A	DC power supply motor and electrical circuits.
F14	5A	5A	Wires 01 and BAT (B-100 only)

Section 2 - System Description

System Relays

Relay No.	Unit Type	Description
RY1	1, 3, 4, 5, 6, 7, 11	Compressor Clutch, Liquid Injection Switch, Liquid Injection Valve
RY1	8,9	RM power relay
RY2	5	Clutch 2
RY2	11	Compressor Motor Contactor (CMC)
RY3	4, 5, 7, 9	Compressor Motor Contactor (CMC)
RY4	1, 3, 4, 5, 6, 7, 8, 9, 11	Host Defrost Hot Gas Solenoid Valve (PS1)
RY5	1, 3, 4, 5, 6, 7, 8, 9, 11	Heat Pilot Sol. (PS 5)
RY6	1, 3, 4, 5, 6, 7, 8, 9, 11	Condenser Fan Motor 1 (CFM1)
RY7	1, 3, 4, 5, 6, 7, 8, 9, 11	Evaporator Fan Motor 1 (EFM1)
RY8	1, 3, 4, 5, 6, 7	Evaporator Fan Motor 2 (EFM2)
RY9	1, 5, 11	Heater 1, Heater 2
RY9	3, 4, 6, 7	Serial/Parallel CFM1, CFM2
RY10	3, 4, 6, 7	Condenser Fan Motor 2 (CFM2)
RY11	2, 6, 7	Remote Liquid Solenoid Valve (PS2)
RY12	2, 6, 7	Host Liquid Solenoid Valve (PS3)
RY13	2, 6, 7	Remote Defrost Hot Gas Sol. Valve (PS4)
RY14	6	Heater 1, heater 2
RY14	7	Heater 3, heater 4
RY 14	10	AC System Suction Line Solenoid (PS6)
RY17	2, 3, 4, 6, 7	Remote Evaporator Fan 3 (EF3)
RY18	6, 7	Remote Evaporator Fan 4 (EF4)
RY19	3, 4, 7	Heater 1, Heater 2
RY19	6	Heater 3, heater 4
BATR	1, 5, 6, 7, 11	Battery Relay
STDR	5, 7, 11	Stand-By Relay

Relay No.	Unit Type	Description
OLR	4, 5, 7, 9, 11	Overload Relay
C1R	5, 7, 11	Switching relay
ER1	8, 9	Switching relay
RM	8, 9	DC motor relay
SR	9, 11	Starter relay

Unit Type:

1 = V-100, V-200, V-300 MAX 10/30, Single Temp

2 = V-200 MAX, V-300 MAX, Bi-Temp

3 = V-400 MAX, V-500 MAX 10/30, Single Temp

4 = V-400 MAX, V-500 MAX 20/50, Single Temp

5 = V-200, V-300 MAX 20/50, Single Temp

6 = V-500 MAX 10/30 Bi-Temp

7 = V-500 MAX 20/50 Bi-Temp

8 = B-100 10

9 = B-100 20

10= V-500 AC 10/20

11= V-100/MAX/20/50

RY1 to RY9 = located on PCB 1
RY10 to RY19 = located on PCB 2
BATR = located in unit control box
STDR = located in unit control box
OLR = located in unit control box
C1R = located in unit control box
ER1 = located in unit control box
RM = located in condenser unit
SR = located in unit control box

System Inputs

Input	Description	Notes
Sensor 1 (Analog)	Return Air Sensor (main evaporator)	Platform 1, wires PNK, BLK
Sensor 2 (Analog)	Return Air Sensor (remote evaporator)	Platform 1, wires G, B
ACC (Digital)	On-the-road power to unit controls.	Platform 1, wire 03
BAT (Analog)	Battery Voltage Level	Platform 1, wire BAT
STD BY (Digital)	Electric Standby Option	Platform 1, wires X1, X4
DK1 (Digital)	Defrost Termination (main evaporator)	Platform 1, wire 12
DK2 (Digital)	Defrost Termination (remote evaporator)	Platform 2, wire 12A
LPCO (Digital)	Low Pressure Cut-Out	Platform 1, wire LPCO
HP	High Pressure Transducer	Platform 1, wires HP, 5V, CHT (analog)
OL (Digital)	Overload Electric Motor Protector (Electric Standby)	Platform 1, wire OL
DSW1 (Digital)	Door Switch 1	Platform 1, wire DSW1
DSW2 (Digital)	Door Switch 2	Platform 2, wire DSW2
EX1 (Digital)	Extra Relay 1 (for drain heater, main compart.)	Platform 1
EX2 (Digital)	Extra Relay 2 (for drain heater, remote compartment)	Platform 2
DK3	Thermal motor protection	Platform 1 (B-100 only)
AC_SW	AC Switch	Platform 1 (V-500 AC only)

NOTE: Inputs are applicable for vehicles with a single temperature/main load compartment, or with bi-temperature/main and remote load compartments.

System Outputs

Output	Description	Notes
CLU1	Vehicle Compressor Clutch	Platform 1
CLU2	Electric Standby Clutch	Platform 1
RM	Battery relay (B-100 only)	Platform 1
CMC	Compressor Motor Contactor	Platform 1, For Electric Standby option
PS1	Hot Gas Solenoid (defrost)	Platform 1, wire 26
PS2	Liquid Line Solenoid (on remote evaporator)	Platform 2, wire 33
PS3	Liquid Line Solenoid (on main evaporator)	Platform 2, wire B3
PS4	Hot Gas Solenoid (defrost, remote evaporator)	Platform 2, wire 28
PS5	Condenser Solenoid (heat)	Platform 1, wire 26A
PS6	Liquid Line Solenoid (AC system)	Platform 2
PS7	Pressure Regulating Line Bypass (on main evaporator suction line, MT units)	Platform 2
PS8	Pressure Regulating Line Bypass (on remote evaporator suction line, MT units)	Platform 2
CMCH	Compressor Motor Electric Heat Contactor (for Electric Standby)	Platform 1
CF1	Condenser Fan 1	Platform 1
CF2	Condenser Fan 2	Platform 2
EF1, EF2	Evaporator Fan 1, Fan 2 (main compartment)	Platform 1
DAS	Communications with DAS	Platform 1, wires DL1, DL2
EF3, EF4	Evaporator Fan 3, Fan 4 (remote compartment)	Platform 2
EXR1	Extra Relay 1 (used for Drain Heater)	Platform 1
EXR2	Extra Relay 2 (used for Drain Heater)	Platform 2

NOTE: Outputs are applicable for vehicles with a single temperature/main load compartment, or with bi-temperature/main and remote load compartments.

Unit Power

Unit power is supplied from the vehicle battery. Device power is supplied through the fuse F21 (FP in B-100 10/20 units) located near the vehicle battery. Power to the In-cab Control Box is supplied from the ECM.

An Electric Standby option supplies rectified DC power from the standby power pack, whenever a source of standby power is connected to the unit. Device power is supplied through the electric relay in the power pack. Power supply protection is achieved by means of a fuse located in the primary transformer (except B-100).

External Devices

External devices (such as the evaporator return air temperature sensors, coil temperature sensor, HP and LPCO switches) provide temperature-control data to the ECM microprocessor.

The microprocessor, in turn, energizes outputs to maintain the desired compartment temperature; displays information on the In-cab Control Box display; and protects the unit from excessive pressures and temperatures.

The operating characteristics of many of these devices is dependent on the type of refrigerant used* and other unit specific requirements. For the exact operating temperatures and pressures of these devices, consult the Maintenance Manual for the specific unit.

* Single temperature 10 and 20 model units use R-134a refrigerant; MAX, and MAX TC 10, 20, 30, and 50 model units use R-404A refrigerant.

Sensors

Return Air Temperature Sensor - senses the temperature of the air returning to the evaporator coil. For bi-temperature units, the temperature for both compartments is displayed on the In-cab Control Box.

Switches and Transducers

Low Pressure Cut-out (LPCO) Switch - opens when the refrigerant suction line pressure falls below a determined pressure and stops unit operation.

High Pressure Transducer - used to control the high-pressure circuit of the unit.

Liquid Injection Switch LIS (MAX units) - closes when the temperature of the refrigerant gas leaving the compressor exceeds a determined temperature. This information is used by the microprocessor to energize the liquid injection valve (LIV). The LIV allows liquid refrigerant to flow from the liquid line to the metering orifice that is attached to the suction line fitting on the compressor. As the refrigerant passes through the metering orifice, it expands and evaporates, and cools the suction gas entering the compressor. This cooling effect is transferred to the discharge gas leaving the compressor. When the discharge gas is cooled to a determined value, the LIS opens and refrigerant no longer flows through the liquid injection system.

Defrost Termination Switch (DK 1, DK2) - normally closed, DK1 or DK2 opens to stop the defrost operation in the load compartment (DK1 for the main load compartment, DK2 for a remote load compartment).

Door Switches (DSW1, DSW2) - used to stop unit operation except in defrost mode, when the load compartment doors are opened.

Overload Switch (OL) - used to protect the motor from an electrical overload. When this normally open switch closes, the unit shuts down.

Thermal protection switch (HTT1, HTT2) (B-100 only) - opens when engine temperature exceeds a determined value. This information is used by the microprocessor to energise the tEP alarm.

Valves

Hot Gas Solenoid Valve - during heat and defrost cycles, this valve energizes to route hot gas to the evaporator coil.

Liquid Injection Valve LIV (MAX units) - energizes to inject liquid refrigerant into the suction line near the compressor, in order to cool the compressor and the discharge gas that is leaving the compressor.

Liquid Solenoid Valve (MAX TC and V-500 AC units) - during a cool cycle, this valve energizes to inject liquid refrigerant into the evaporator coil.

Heating Pilot Solenoid Valve (30/50 units) - during the heating cycle, allows hot gas to flow to the evaporator coil.

Suction Line Solenoid (V-500 AC units). Cancels the Air Conditioning evaporator KVP valve function (bypass) to remove power limiting when the box refrigeration is not energised.

Expansion Valve - restricts (controls) the flow of high-pressure liquid coolant into the evaporator and thereby lowers coolant pressure. This also lowers coolant temperature and boiling point allowing for efficient cooling of the loadcompartment.

KVL suction pressure regulator valve (V-200/300 20/30/50 MAX, V-500 MAX single-phase and V-500 AC units) - protects compressor operation and start-up by impeding suction pressure from rising too high. The KVL is mounted in the suction line immediately upstream of the compressor. The KVL opens when suction pressure decreases. Normal pressure setting for this valve is 180 kPa (25 psi).

In the V-500 AC unit, it also limits the demand for power from the Air Conditioning evaporator to protect the refrigerated box charge. Normal pressure setting in this case is 37.7 psi (260 kPa).

KVP Evaporation Pressure Regulation Valve (MAX TC and V-500 AC units) - installed in the suction line behind the evaporator, it regulates evaporation pressure ininstallations with one or more evaporators and one compressor. IntheTC units running with different evaporation pressures, the KVP is installed behind the evaporator withhighest pressure.

Check valve (MAX TC, V-400 MAX/V-500/MAX20/50 and V-500 AC units) - guarantees proper air circulation in one direction only. Prevents migration and condensation from hot evaporator to cold evaporator in TC units.

Check valve (V-200/V300 20/50 units).
Isolates the compressor driven by the truck motor from the Electric Standby compressor and prevents compressor oil and refrigerant from flowing between the two compressors.

Relays

Control relays are energized by the microprocessor(s), depending on I/O requirements. In turn, the relay energizes its corresponding specified device, such as a motor, clutch, pilot solenoid, valve, fan, or heater. Each relay is fuse-protected.

Battery Relay BATR (except B-100) - when this relay is energized, the unit is powered from the vehicle battery.

Standby Relay STDR (except B-100) - when this relay is energized, the unit is powered from the electric power supply.

CR1 switching relay - when this relay is energized, power is disconnected from the battery relay. This prevents the two power sources for the unit (battery and electric power supply) from being connected at the same time.

Overload Relay OLR - protects the electric motor that drives the Electric Standby compressor. The overload relay opens the circuit to the microprocessor (which de-energizes the motor contactor and the electric motor) if the motor overloads for any reason (e.g., low line voltage or an improper power supply) during Electric Standby operation.

ER1 Electric Standby relay (B-100 units only) - when this relay is energised, power is disconnected from the battery relay. This prevents the two power sources for the unit (battery and electric power supply) from being connected at the same time.

RM battery relay (B-100 only) - when this relay is energised, the unit is powered by battery.

SR start relay (single-phase units only) -
when this relay is energised, the starter capacitor turns on the AC motor.

Motors and Motor Protectors

Evaporator Fan Motor (EFM1, EFM2, EFM3, EFM4) - draws air across the evaporator coil during cool or heat operation. The evaporator fan motor is turned off during defrost cycles.

Condenser Fan Motor (CFM1, CFM2) - turns on, as determined by the condenser fan pressure switch, to flow air across the condenser coil during cool and heat operation.

Clutches

Vehicle Compressor Clutch (CCL1) - energizes to activate the engine driven compressor when cooling, heating, or defrost operation is required.

Standby Compressor Clutch (CCL2) - energizes to activate the motor-driven compressor when cooling, heating, or defrost operation is required and the optional Electric Standby is active.

Contactors

Compressor Motor Contactor (CMC) - for units with an Electric Standby option, closes to provide electrical power to the Vac motor.

Power Sources

Electric Standby - substitutes the vehicle's engine-driven compressor with a second, electrically powered compressor and an external power source. **B-100 units** use one compressor only, driven by a DC motor when in battery mode or an AC motor when in Electric Standby mode. This ensures operational continuity when the vehicle is parked and the unit is on.

Battery – provides 12 Vdc or 24 Vdc power to the unit and the ECM. PCB 1 in the ECM provides between 7.5 and 9 Vdc power to the In-cab Control Box.

Heaters

Drain Heater - Consists of two resistors in parallel that are used to prevent ice build-up in the evaporator drain pipe. Extra relays EXR1 or EXR2 can be used to energize the drain heater when the unit is in Cool, Heat, or Defrost mode, and when Defrost Termination Switch DK1 or DK2 is closed (i.e., not activated).

Systems and Equipment Covered

The information contained in this manual applies to, but is not limited to, the following Direct-Drive Truck systems and their associated evaporators and condensers.

System	Description	Evaporator/ Condenser
900182	V-500 MAX TC 10	700239 / 700214 - 18 - 19 - 20 - 21 - 22
900045	V-500 MAX TC 20 3PH	700094 / 700214 - 18 - 19 - 20 - 21 - 22
900261	V-500 MAX TC 20 1PH	700094 / 700214 - 18 - 19 - 20 - 21 - 22
900488	V-500 AC 10	700925 / 720672
900489	V-500 AC 20 3PH	700926 / 720672
900490	V-500 AC 20 1PH	700927 / 720672
900498	B-100 10	700939 / 700941
900499	B-100 20 1PH	700940 / 700941
900874	V-100 20 1PH 12VDC	701519 / 701521
900875	V-100 20 1PH 24VDC	701520 / 701522
900876	V-100 MAX 20 1PH 12VDC	701529 / 701531
900877	V-100 MAX 20 1PH 24VDC	701530 / 701532
900878	V-100 MAX 50 1PH 12VDC	701543 / 701545
900879	V-100 MAX 50 1PH 24VDC	701544 / 701546
920238	V-200 20	720617 / 720629
920239	V-200 MAX 20	720618 / 720630
920240	V-300 20	720619 / 720631
920241	V-300 MAX 20	720620 / 720632
920242	V-200 10	720625 / 720629
920243	V-200 MAX 10	720626 / 720630
920244	V-300 10	720627 / 720631
920245	V-300 MAX 10	720628 / 720632
920248	V-100 10	720637 / 720639
920249	V-100 MAX 10	720621 / 720638
920271	V-500 10	720727 / 720672
920272	V-500 20 3 PH	720728 / 720672
920273	V-500 20 1PH	720729 / 720672
920274	V-500 MAX 10	720730 / 720670

System	Description	Evaporator/ Condenser
920275	V-500 MAX 20 3PH	720731 / 720670
920276	V-500 MAX 20 1H	720732 / 720670
920277	V-400 MAX 10	720733 / 720671
920278	V-400 MAX 20	720734 / 720671
920282	V-300 MAX TC 20	720673 / 720674
920290	V-200 MAX TC 20	720695 / 720693
920291	V-300 MAX TC 10	720689 / 720690
920292	V-200 MAX TC 10	720692 / 720693

Section 3
Software Description

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Section 3 - Software Description

Software Operation

The software that operates the microprocessor contains a complex set of instructions. The microprocessor examines the conditions of all the inputs and compares them to the instructions contained in the software. The outputs are then energized, as required, by the software instructions.

The operation mode is made by the microprocessor and software after analyzing all the input conditions and the setpoint temperature. For details, see the *Temperature vs. Operating Mode Chart* on page 3-3.

Software Revisions and Changes

- Parameters in the Installation (Guarded Access) Menu can be changed by using Service Procedure A04A.
- The current software revision can be checked by using the *Checking the Software Revision* procedure in Section 4, Operation.

Unit Operation

Unit operation is fully automatic. The compressor is turned on by the vehicle engine or the battery at start-up. Standard units operate in Cool mode or Null mode, as required, to maintain the load compartment temperature at the setpoint temperature. Defrost cycles occur manually or automatically, as required.

If power is shut off, the unit comes back in Null mode when the unit is restarted. There is a momentary delay at auto start-up for circuit protection. For units with Electric Standby, there are protective delays for the compressor clutch and electric compressor/electrical motor contactor.

Options

- The Heat option provides heating by hot gas.
- The Electric Standby option provides a second compressor driven by an electric motor (except B-100 units). *In B-100 units the same refrigeration compressor is driven by an AC motor.*
- The TC options provide temperature control for two-compartment systems.

Operation

The vehicle engine must be running and the unit must be turned on. On units with Electric Standby, connect the external power cord and the unit switches to Electric mode operation. Unit operation can be tailored, as required, using programmable settings that are shown later is this section.

Cool Mode Operation - Standard Units

When cooling is required (when there is a requirement to lower the evaporator return air temperature in the load compartment), the outputs of the microprocessor energize the compressor clutch and evaporator fans. *In **B-100** units the DC motor and evaporator fans are energised.* The condenser fan is also energized and turns on when the condenser fan pressure switch closes, and turns off when the condenser fan pressure switch opens. *In **TC** and **AC** units the liquid solenoid valve is enabled in the compartment requiring refrigeration to let the coolant go to the evaporator.*

The unit operates in Cool mode until the setpoint temperature is reached. The unit then enters Null mode. When the temperature rises to a pre-determined number of degrees, the unit restarts in Cool mode.

Section 3 - Software Description

V-500 units only have a triple-cooling capacity (TCC) feature that energizes condenser fans CF1 and CF2 at low, medium, and high refrigerant pressures. Controlled by the high pressure (HP) transducer, the applicable relays (RY6, RY9, RY10) remain closed or are opened, and operate the condenser fan speeds in the following manner:

- When HP pressure is less than 180 PSI (low pressure), RY6, RY9, and RY10 open. CF1 and CF2 receive no voltage and are in Null state.

- When the HP pressure is between 180 PSI and 300 PSI (medium pressure), RY9 closes. CF1 and CF2 become connected in series, receive low voltage, and operate at low speed

- When the HP pressure is greater than 300 PSI (high pressure), RY6 and RY10 close and RY9 opens. CF1 and CF2 become connected in parallel, receive high voltage, and operate at high speed.

Cool Mode Operation - Electric Standby Units

When cooling is required, the outputs of the microprocessor energize the electric motor contactor, standby compressor clutch, and evaporator fans. (For units with Electric Standby, compressor CLU2 and the Compressor Motor Contactor are energized when the standby input is high). *In **B-100** units the AC motor and evaporator fans are energised.*

The condenser fan is also energized. The fan turns on when the condenser fan pressure switch closes, and turns off when the condenser fan pressure switch opens. *In **TC** and **AC** units the liquid solenoid valve is enabled in the compartment requiring refrigeration to let the coolant go to the evaporator.*

The unit operates in Cool mode until the setpoint temperature is reached. The unit then enters Null mode. When the temperature rises a pre-determined number of degrees, the unit restarts in Cool mode.

Null Mode Operation - All Units

The unit operates in Null mode when the setpoint temperature is reached and cooling (or heating) is not required. All outputs are de-energized. If the temperature rises a pre-determined number of degrees, the unit restarts in Cool mode. If the temperature falls a pre-determined number of degrees, and a heat option is present, the unit restarts in Heat mode.

In addition, the evaporator fans (parameter EFc) operate during Null mode (except B-100).

Heat Mode

If the Heat mode option is present, the unit enters Heat mode when the temperature falls a pre-determined number of degrees below the setpoint temperature. When heat is required, the outputs of the microprocessor energize the evaporator fans. (For units with Electric Standby, compressor CLU2 and the Compressor Motor Contactor are energized when the standby input is high)

The unit operates in Heat mode until the setpoint temperature is reached. The unit then enters Null mode.

- If the temperature falls a pre-determined number of degrees, the unit restarts in Heat mode.

- If the temperature rises a pre-determined number of degrees, the unit restarts in Cool mode.

Defrost Mode Operation - All Units

Defrost is initiated automatically by the programmable defrost timer, or manually by means of the In-cab Control Box. If demand defrost is enabled, a demand defrost cycle occurs, based on the Defrost Initiation Timer (DIT) and the Defrost Termination Switch (DK1 or DK2) being closed. The evaporator coil temperature must be below 2°C (35°F) to allow defrost.

When defrost is required, the microprocessor output energizes the hot gas solenoid to supply hot refrigerant to the evaporator coil. The Defrost Initiation Timer (DIT) has counted-down its required time-setting, and the Defrost Termination Switch (DK1 or DK2) is closed.

The unit remains in Defrost mode until the Defrost Termination Switch setpoint is reached (that is, when the evaporator coil temperature rises to 14°C (58°F), or until the Defrost Termination Timer (DTT) count is completed). If the evaporator coil temperature does not rise above 14°C (58°F) within the defrost duration time limit, the microprocessor terminates the defrost operation.

The startup of the evaporator fans is delayed for several seconds after Defrost mode ends, to prevent water from the melting ice from being sprayed on the load.

For details of programmable defrost features, see the *Programmable Features* in this section.

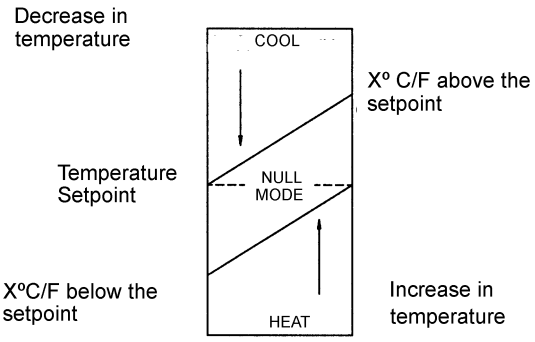

Figure 3-1 Temperature vs. Operating Mode Chart

Menu Screens

The function and data screens for the In-cab Control Box are divided into four groups or menus. These menus are:

- Main Menu
- Hourmeters Menu
- Information Menu
- Installation (Guarded Access) Menu

Within each menu, certain similar functions, such as changing hourmeter settings or parameters, can be accomplished by the driver or by maintenance personnel.

See Figure 3-2 for the overall DSR menu layout, *Direct Smart Reefer Microprocessor Controller Menus and Screens*. The illustration also shows the screens that appear within each menu, and how they are accessed and exited.

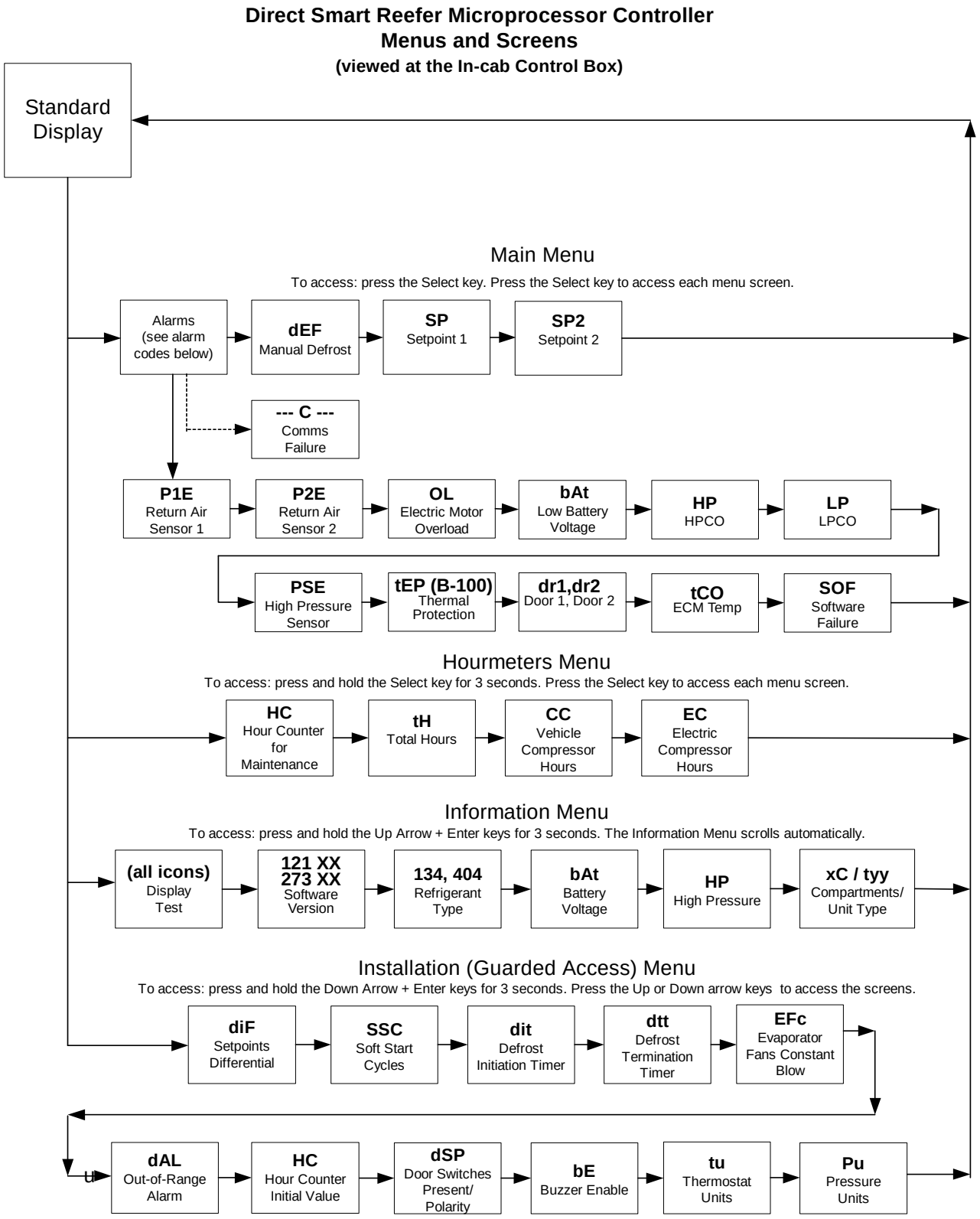

Figure 3-2 Direct Smart Reefer Microprocessor Controller Menus and Screens

Menu Flowcharts

The following pages include flowcharts of the four DSR μP Controller menus, as viewed at the In-cab Control Box. Examine the flowcharts and become familiar with the sequence of the screens, before reading detailed descriptions of the screens in the *Programmable Features* section.

The table below describes the four menus; the screens contained within each menu; and the keys that you must press to access each menu.

DSR μP Controller Menu Screens

Menu Type	From the Standard Display, do the following:
Main Menu Screens include: Alarm screens: **P1E** (Temp Probe 1 alarm) **P2E** (Temp Probe 2 alarm) **OL** (Overload alarm) **bAt** (Low Battery Voltage alarm) **HP** (HPCO alarm) **LP** (LPCO alarm) **PSE** (HPCO Pressure Sensor alarm) **tEP (B-100 only)** (Thermal protection alarm) **dr1** (Door Switch 1 alarm) **dr2** (Door Switch 2 alarm) **tCO** (ECM Temperature Control alarm) **SOF** (Software Failure alarm) **- C -** (Communications Failure alarm) **dEF** (Manual Defrost) **SP** (Setpoint 1) **SP 2** (Setpoint 2)	Press the Select key 
Hourmeters Menu Screens include: **HC** (Hour Counter for Maintenance) **tH** (Total Hours) **CC** (Vehicle Compressor Hours) **EC** (Electric Compressor Hours)	Press and hold the Select key for 3 seconds, then use the Select key to access a screen 
Information Menu Screens include: **(all icons)** (Display Test) **121 XX, 273 XX** (Software Version) **134, 404** (Refrigerant Type) **bAt** (Battery Voltage) **HP** (High Pressure) **xC / tyy** (Number of compartments / Unit type)	Press and hold the Enter and Up arrow keys for 3 seconds to enter the Information Menu, which scrolls automatically through the screens.  

Menu Type	From the Standard Display, do the following:
Installation (Guarded Access) Menu Screens include: **diF (**Setpoints Differential) **SSC** (Soft Start Cycles) **dit** (Defrost Initiation Timer) **dtt** (Defrost Termination Timer) **EFc** (Evaporator Fan Constant Blow) **dAL** (Out-of-Range Alarms) **HC** (Hour Counter Initial Value) **dSP** (Door Switches Present/Polarity) **bE** (Buzzer Enable) **tu** (Thermostat Units) **Pu** (Pressure Units)	Press and hold the Enter and Down Arrow keys for 3 seconds. To scroll through the menu press the UP or DOWN keys. 

Main Menu Screens

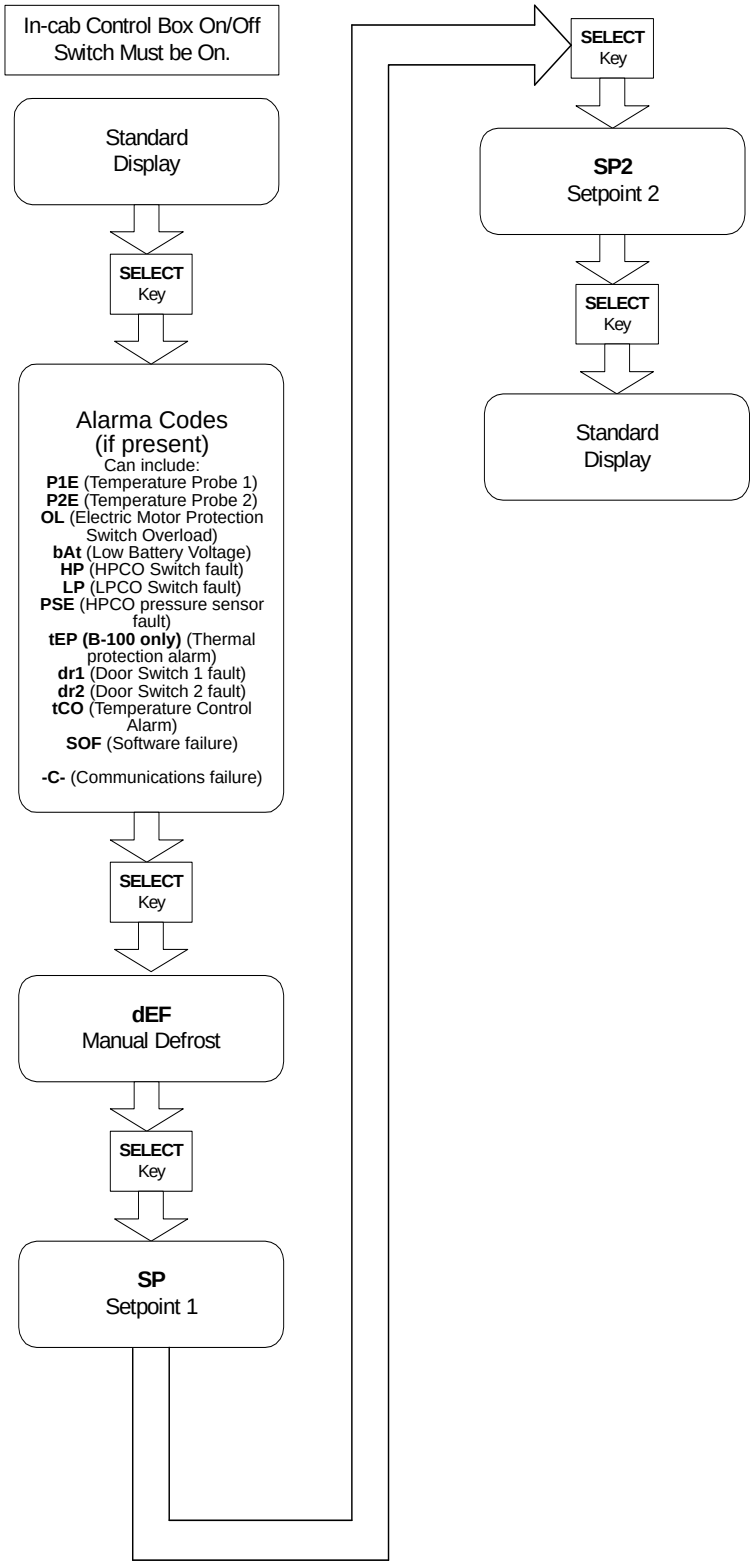

Figure 3-3 DSR Main Menu Screens

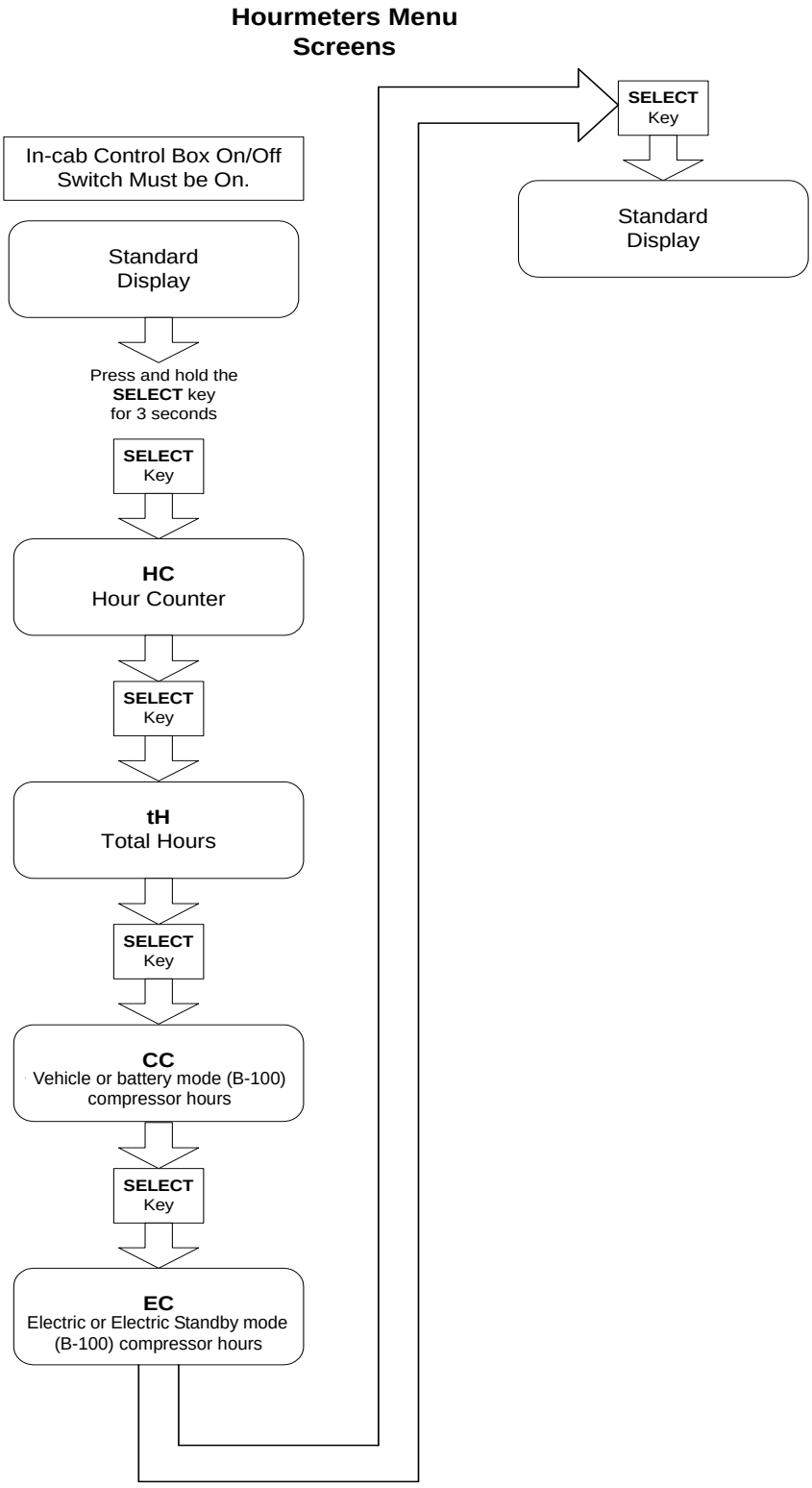

Figure 3-4 DSR Hourmeters Menu Screens

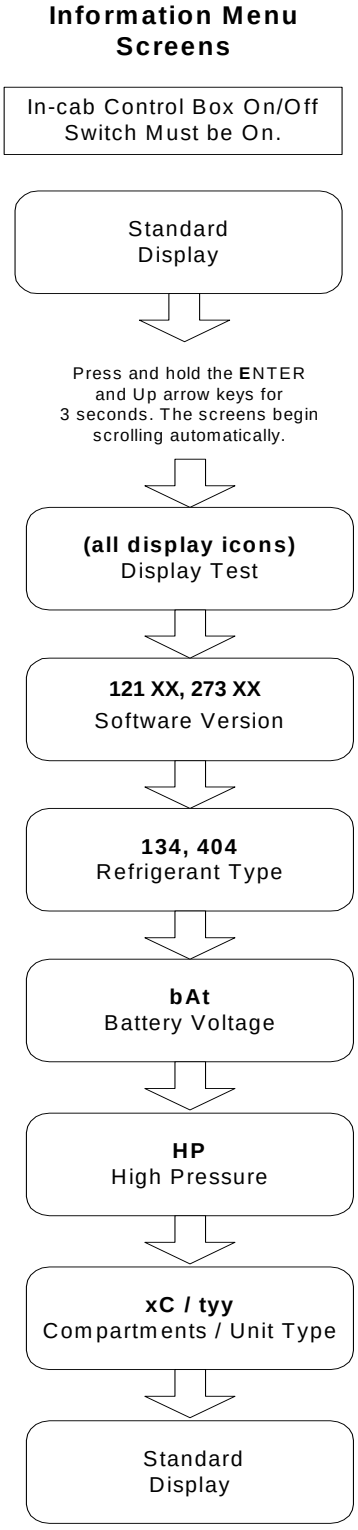

Figure 3-5 DSR Information Menu Screens

Installation (Guarded Access)
Menu Screens

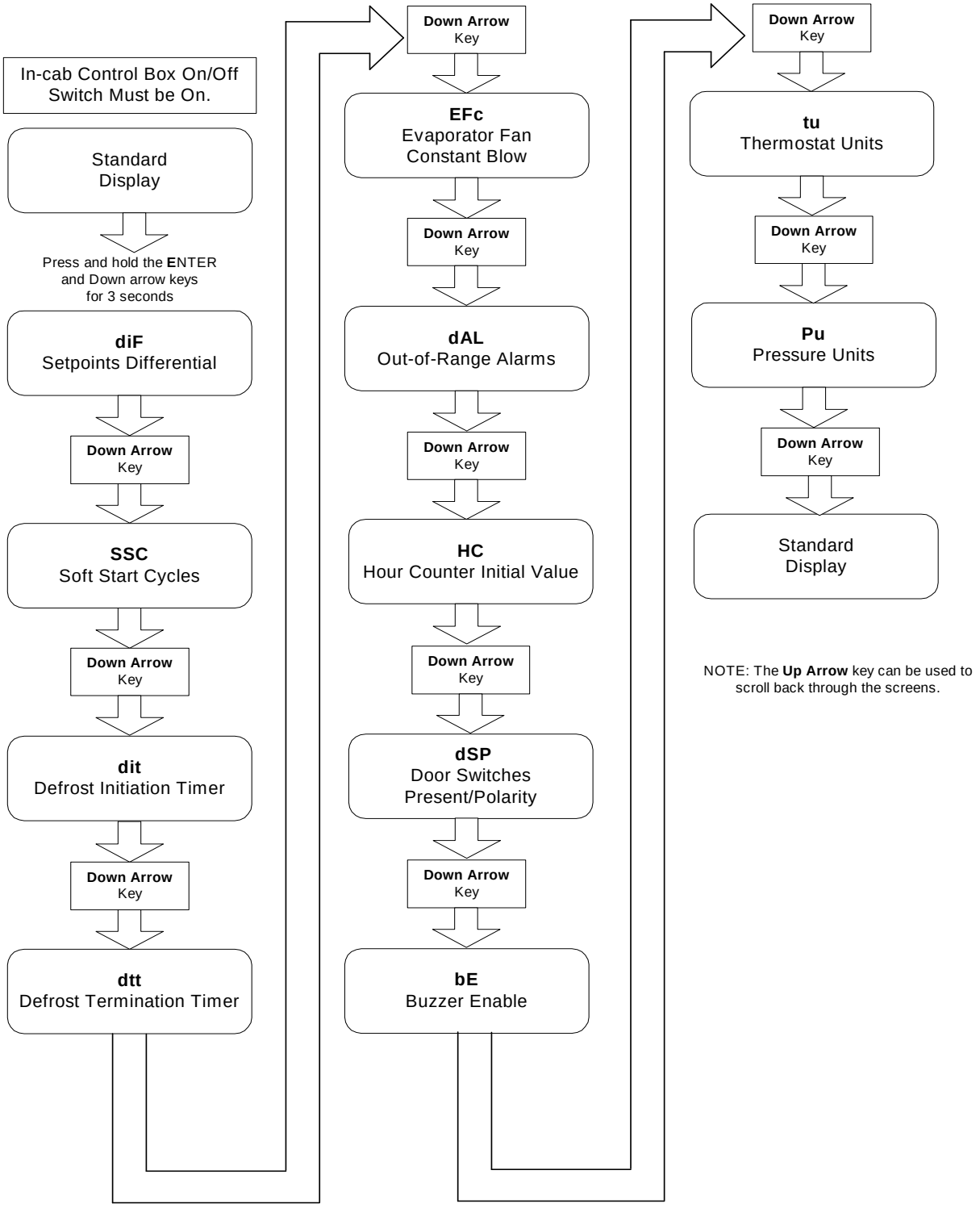

Figure 3-6 DSR Installation (Guarded Access) Menu Screens

Programmable Features

The DSR µP Controller contains a number of programmable features. These features allow users to configure their units to their own requirements, for improved performance and economy of operation.

When the unit is shipped from the factory, these features are set to the most commonly used (default) settings. However, they are easily changed to satisfy special requirements.

The following descriptions include all the programmable features available with the DSR µP Controller, as equipped with revisions 121 XX or 273 XX software. Features can be programmed from the following category of menus and their screens:

- Main Menu
- Hourmeters Menu
- Information Menu
- Installation (Guarded Access) Menu

The screens are presented in the order they appear in each menu category. The default factory setting for each feature is also shown. See the *Direct Smart Reefer Microprocessor Controller Menus and Screens* flowchart for reference.

Programming Aids

When programming many features at the same time, such as during the initial setup of the DSR µP Controller, it is wise to obtain and complete a copy of the Setup Sheet shown in Service Procedure A02A. Be certain that all customer specified settings are included when completing this setup sheet. The sheet is used to confirm each entry, to be certain that the correct settings are programmed.

Main Menu and Its Screens

Entering Main Menu

1. Press the In-cab Control Box On/Off switch on. For software version 121 21 and higher, the unit undergoes a 20-second system check. During this time, the Standard Display shows the word CHEck.

2. After the system check, the return air temperature setting is displayed at the Standard Display. For bi-temperature units, the return air temperature for both load compartments are displayed.

3. Press and release the Select key. If an alarm exists, its code appears in the display. See the following table for the alarm codes that can appear.

4. If there is more than one alarm, other alarm screens can be viewed, in sequence, by pressing the Select key and toggling through the alarms.

The following table, *Alarm Codes Displayed in the Main Menu*, describes the alarms that can exist with the DSR µP Controller. See *Section 5 - Diagnostics*, for a detailed explanation of an alarm, its possible causes, and the actions to take to diagnose the source(s) of the alarm.

Section 3 - Software Description

Alarm Codes Displayed in the Main Menu

Alarm Code	Alarm Description
P1E	Return Air Temperature Sensor in the main load compartment is faulty. The temperature reading on the In-cab Control Box displays [----] when the Return Air Temperature sensor reading is out of the readable range. This might be caused by a short circuit or an open circuit at the Return Air Temperature sensor.
P2E	For vehicles with a remote load compartment, this alarm indicates that the Return Air Temperature Sensor in the remote compartment is faulty. For details, see the description for alarm code P1E.
OL	For units with an Electric Standby option, this alarm indicates that there is an overload in the electric motor protector switch. The unit shuts down until the alarm condition is corrected. (The unit is shut down whether the unit is in Cool, Heat, or Defrost mode).
bAt	Low battery voltage. Battery voltage is below 10.5 Vdc on 12 V systems, or below 21 Vdc on 24 volt systems. The unit shuts down. The battery is possibly damaged, or a short circuits exists in battery wires 2 or BAT, or fuse 21.
HP	High Pressure Cut-Out Switch fault. The unit shuts down when there is excessively high pressure in the refrigerant circuit. The unit shuts down, but [HP] and the alarm icon are displayed on the In-cab Control Box. When the alarm condition is corrected, the unit returns to a Null state.
LP	Low Pressure Cut-Out Switch fault. The unit shuts down when there is excessively low pressure in the refrigerant circuit. The unit shuts down, but [LP] and the alarm icon are displayed on the In-cab Control Box. When the alarm condition is corrected, the unit returns to a Null state.

Alarm Code	Alarm Description
PSE	HPCO pressure sensor is faulty or disconnected. This indicates that the reading from the HP sensor is out of the readable range (<0.5 V or >4.5V). The unit remains in its existing mode (Cool, Heat, Null, Defrost) for a time determined by the factory-set Pressure Sensor Error Time Delay Time [PSt] parameter. If the alarm continues longer than the [PSt] time, the unit shuts down.
tEP	**(B-100 only)** Indicates that the thermal protection circuit has opened in one of the two electric standby motors (D.C. or A.C.) due to engine overheating or circuit failure.
dr1	Door 1 in Zone 1 is open or door switch DSW1 is faulty. The audible alarm buzzer is activated. ∗ If the unit is in Cool or Heat modes when the alarm occurs, the unit shuts down. When the door is closed, the unit starts in Null mode. ∗If the unit is in Defrost mode when the alarm occurs, it remains in Defrost mode.
dr2	Door 2 in Zone 2 is open or door switch DSW2 is faulty. The audible alarm buzzer is activated. ∗ If the unit is in Cool or Heat modes when the alarm occurs, the unit shuts down. When the door is closed, the unit starts in Null mode. ∗ If the unit is in Defrost mode when the alarm occurs, it remains in Defrost mode.
tCO	The Temperature Cut-Out value for the Electrical Control Module has been exceeded (>85°C [> 185°F]). The internal temperature of the ECM might exceed the temperature value because the internal ECM fan has failed, or the NTC sensor used to measure the module temperature is faulty. If the temperature is exceeded for more than 30 seconds, the unit shuts down.
SOF	Software failure. The software in the microprocessor is corrupted. The unit shuts down. The microprocessor must be reprogrammed. See Service Procedure A04A in Section 6.

Alarm Code	Alarm Description
- C -	Total communications failure between the microprocessor in the In-cab Control Box and the microprocessor(s) in the ECM. Unit is not able to turn on and operate. The [- C -] alarm code is not part of the Main Menu alarms. When a Main Menu alarm occurs, the In-cab Control Box can communicate with the ECM, and I/O and parameter statuses can be checked. When the [- C -] alarm code occurs, there are no communications between the In-cab Control Box and the ECM, and I/O and parameter statuses cannot be checked at the In-cab Control Box.

Accessing Additional Main Menu Screens

1. After all (if any) alarms are viewed, press the Select key, until a flashing [dEF] is viewed. This indicates the Manual Defrost function. To change the [deF] setting, press the Enter key, then use the Up Arrow or Down Arrow keys to change the defrost setting to ON or OFF.

2. Press the Select key. An [SP] appears, to indicate the setpoint temperature for the return air temperature in the single or primary load compartment of the vehicle.
   To change the [SP] setting, do the following:

- Press the Up Arrow key to increase the return air temperature by 1-degree increments.

- Press the Down Arrow key to decrease the return air temperature by 1-degree increments.

- Press and release the SELECT key to return to the Standard Display.

NOTE: If the Select key is not pressed within 20 seconds to select a new setpoint temperature, the unit continues to operate at the original setpoint temperature.

3. For vehicles with two compartments and bi-temperature functions, the screen displays [SP2]. This indicates the setpoint for the return air temperature in the second (remote) compartment.
   To change the [SP2] setting, do the following:

- Press the Up Arrow key to increase the return air temperature by 1-degree increments.

- Press the Down Arrow key to decrease the return air temperature by 1-degree increments.

4. Press and release the Select key to return to the Standard Display.

NOTE: If the Select key is not pressed within 20 seconds to select a new setpoint temperature, the unit continues to operate at the original setpoint temperature.

Leaving the Main Menu

Leaving the Main Menu can be accomplished in several ways.

- Press the Select key until you have toggled through all of the Main Menu screens.

- Turn the unit off and back on. The In-cab Control Box exits the Main Menu, at any point in the scrolling sequence, and returns to the Standard Display.

- Allow the display to time out. The In-cab Control Box automatically exits the Main Menu and return to the Standard Display, if no key is pressed for 20 seconds.

Section 3 - Software Description

Hourmeters Menu and Its Screens

The following paragraphs describe the hourmeters, their settings and parameters, and how to program certain hourmeter screens. See the *Direct Smart Reefer Microprocessor Controller Menus and Screens* flowchart for reference.

To access the Hourmeters Menu, do the following:

- From the Standard Display, press and hold the Select key for 3 seconds, then release it. The first Hourmeters Menu screen, [HC], appears.
- Press the Select key to access other Hourmeters Menu screens.

[HC] (Hours Counter for Maintenance)

Programming Choices - 1000 through 5000

Unit of Measurement - Tens of hours (e.g., 150 = 1500 hours)

Parameter Set By - Maintenance Personnel, in the Installation (Guarded Access) Menu

Factory setting - 150

This hourmeter counts-down the hours remaining until a maintenance procedure should occur. The hours remaining value starts from the value selected by the maintenance personnel. The [HC] value decreases whenever the unit is not shut down.

[tH] (Total Hours)

Programming Choices - n/a

Unit of Measurement - Tens of Hours

Parameter Set By: n/a

Factory setting - n/a

This hourmeter indicates the total number of hours that the unit has been in operation.

[CC] (Vehicle or *battery mode* compressor hours *in B-100 units*)

Programming Choices - n/a

Unit of Measurement - Tens of hours

Parameter Set By - n/a

Factory setting - n/a

This hourmeter indicates the total number of hours that the vehicle compressor has been operating while on-the-road. This parameter also indicates the total hours that clutch CLU1 has been engaged. *Indicates the total number of hours the compressor has been in battery mode operation in B-100 units.*

[EC] (Electric Standby compressor hours *or hours compressor has been operating in Electric Standby mode in B-100 units*)

Programming Choices - n/a

Unit of Measurement - Tens of hours

Parameter Set By - n/a

Factory setting - n/a

This hourmeter indicates the total number of hours that the Electric Standby compressor has been operating, if the unit is equipped with an Electric Standby option. This parameter also indicates the total hours that clutch CLU2 has been engaged while the electric motor is running. *Indicates the total number of hours the compressor has been in Electric Standby mode operation in B-100 units.*

Leaving the Hourmeters Menu

Leaving the Hourmeters Menu can be accomplished in several ways:

- Press the Select key until you have toggled through all of the Hourmeters screens.
- Turn the unit off and back on. The In-cab Control Box exits the Hourmeters Menu, at any point in the scrolling sequence, and returns to the Standard Display.
- Allow the display to time out. The In-cab Control Box automatically exits the Hourmeters Menu and return to the Standard Display, if no key is pressed for 20 seconds.

Information Menu and Its Screens

The following paragraphs describe the Information Menu screens that can we viewed. See the *Direct Smart Reefer Microprocessor Controller Menus and Screens* flowchart for reference.

To access the Information Menu, do the following:

- From the Standard Display, press and hold the Up Arrow key and Enter key for three seconds, then release them. The first Information Menu screen, [all icons], appears.
- The Information Menu screens scroll automatically from screen-to-screen. Each screen is displayed for 5 seconds before the next screen is displayed. After the last Information screen is shown, the In-cab Control Box returns to the Standard Display.

[all icons] Display Test

Programming Choices - none

Unit of Measurement - various temperature and operational measurements

Parameter Set By - n/a

Factory setting - n/a

This screen displays all of the In-cab Control Box icons, to indicate that they are functioning and visible.

[121 XX, 273 XX] Software Version

Programming Choices - current or future 121 XX, 273 XX revisions

Unit of Measurement - alphanumeric number

Parameter Set By - n/a

Factory setting - n/a

This screen displays the revision number of the software that is currently running the In-cab Control Box.

[134, 404] Refrigerant Type

Programming Choices - 134 or 404

Unit of Measurement - n/a

Parameter Set By - n/a

Factory setting - 134 or 404

B-100, V-100, V-200, V-300, V-400, and V-500 units are charged with R-134a refrigerant. R-404A refrigerant is available for use on MAX, and MAX TC.

[bAt] Battery Voltage

Programming Choices - n/a

Unit of Measurement - volts DC

Parameter Set By - n/a

Factory setting - n/a

This screen displays the current voltage of the vehicle battery.

- For vehicles with 12 Vdc batteries, if the voltage drops below 10.5 Vdc, the unit shuts down. A 12 Vdc unit functions within a voltage range of 10.5 Vdc to 18 Vdc.
- For vehicles with 24 Vdc batteries, if the voltage drops below 21 Vdc, the unit shuts down. A 24 Vdc unit functions with a voltage range over 21 Vdc.

[HP] High Pressure

Programming Choices - n/a

Unit of Measurement - PSIG or BAR, in decimals

Parameter Set By - n/a

Factory setting - P

This screen displays the current pressure setting, as detected by the HPCO pressure transducer. The pressure setting is influenced by the type of refrigerant.

- For units with R-134a: the HPCO opens at 300 PSIG and shuts down the unit. The HPCO closes when the pressure drops to 200 PSIG.
- For units with R-404A: the HPCO opens at 450 PSIG and shuts down the unit. The HPCO closes when the pressure drops to 375 PSIG.

[xC / tyy] Number of Compartments / Unit Type

Programming Choices - n/a

Unit of Measurement - numerals

Parameter Set By - n/a

Factory setting - depends on the unit

Displays the number of load compartments for the vehicle (xC, where x = 1 or 2 compartments), and the unit type (type = 10, 20, 30, or 50).

Leaving the Information Menu

The Information Menu screens are displayed automatically. When the sequence of screens is completed, the In-cab Control Box returns to the Standard Display.

Installation (Guarded Access) Menu and Its Screens

The following paragraphs describe the unit parameters that are set at the In-cab Control Box, their settings, and how to program certain parameter screens. See the *Direct Smart Reefer Microprocessor Controller Menus and Screens* flowchart for reference.

The Installation (Guarded Access) Menu contains screens that are changed by trained and authorized DSR μP Controller maintenance personnel. The parameters shown on these screens impact many of the primary operating settings for the unit. Only personnel who are familiar with the unit and DSR μP Controller functions are allowed to change the Installation (Guarded Access) Menu parameters.

To change or update the parameter settings in the Installation (Guarded Access) Menu, see Service Procedure A04A.

To access the Installation (Guarded Access) Menu, do the following:

- From the Standard Display, press and hold the Down Arrow and Enter key for three seconds, then release it. The first Installation (Guarded Access) Menu screen, [diF], appears.
- Use the Up Arrow or Down Arrow key to toggle through the other Installation (Guarded Access) Menu screens.

NOTE: Some versions of the Direct Smart Reefer display the Setpoint Temperature (SP) as the first Installation (Guarded Access) Menu screen.

[diF] Setpoint Temperature Differentials

Programming Choices - 1, 2, 3, 4, 5

Unit of Measurement - degrees Celsius or Fahrenheit

Parameter Set By - Maintenance Personnel

Factory setting - 3 degrees

This parameter means that when the setpoint temperature has been reached, and while the temperature remains between diF Celsius or Fahrenheit above or below the setpoint, there is no demand for heating or cooling and the unit remains in Null mode. This parameter is set in 1-degree increments.

[SSC] Soft Start Cycles

Programming Choices - Off, On

Unit of Measurement - n/a

Parameter Set By - Maintenance Personnel

Factory setting - Off

This parameter allows maintenance personnel to turn the vehicle compressor clutch CLU1 soft-start operation on or off, during initial startup of the vehicle engine. A soft start reduces wear & tear on the clutch. If “On” is selected, CLU1 is switched on for one-second every six seconds, for five cycles. After five cycles, the compressor clutch switches to continuous operation.

[dit] Defrost Initiation Timer

Programming Choices - 30 to 480, increments of 30 minutes

Unit of Measurement - minutes

Parameter Set By - Maintenance Personnel

Factory setting - 240 minutes

This parameter allows maintenance personnel to set the Defrost Initiation Timer which, when it times-out, switches the unit from Cool mode to Defrost mode. The timer counts all the time that the unit is in Cool mode. The count resets when Defrost mode starts.

If the timer is set at 0 (zero), this is a test position. Defrost mode starts in 15 seconds.

[dtt] Defrost Termination Timer

Programming Choices - 5 to 50, in increments of 5 minutes

Unit of Measurement - minutes

Parameter Set By - Maintenance Personnel

Factory settings - 45 minutes (except B-100) or 30 minutes (B-100 only)

This parameter allows maintenance personnel to set the Defrost Termination Timer, which begins counting from the initiation of a Defrost mode. When the timer times-out, the unit is switched from Defrost mode to Null mode. The timer resets at the end of a Defrost mode, or after the Defrost Termination Timer has timed-out.

If the timer is set at 0 (zero), this is a test position. Defrost mode stops in 15 seconds.

[EFc] Evaporator Fans Constant Blow

Programming Choices - On, Off

Unit of Measurement - n/a

Parameter Set By - Maintenance Personnel

Factory setting - Off

This parameter allows maintenance personnel to set whether the evaporator fans remain on during Null mode.

- On = the evaporator fans are on continuously during Null mode
- Off = the evaporator fans cycle on and off with the regulators

[dAL] Out-of-Range Alarm

Programming Choices - 0 (Off), 1 to 10

Unit of Measurement - degrees Celsius or Fahrenheit, in 1-degree increments

Parameter Set By - Maintenance Personnel

Factory setting - 0 degrees Celsius

This parameter allows maintenance personnel to set the number of degrees that the temperature can rise above the setpoint temperature before the temperature display flashes.

[HC] Hourmeter Initial Value

Programming Choices - Software version 121 15 to 121 19: 100 to 500. Software versions 121 19 and higher: 0 to 5000

Unit of Measurement - tens of hours; e.g., 150 = 1500 hours

Parameter Set By - Maintenance Personnel

Factory setting - 150 (1500 hours)

This parameter allows maintenance personnel to set the initial hourmeter value for maintenance hourmeters. The hours value can be viewed in the Hourmeters Menu, but can be changed only in Installation (Guarded Access) Menu.

- If the [HC] value had decreased to between 0 and 100 hours, the In-cab Control Box displays the value for 10 seconds, whenever the unit is manually turned-on.
- If the [HC] value has decreased to 0 hours, the In-cab Control Box displays a continuous maintenance icon, to alert the user that maintenance is required.

[dSP] Door Switches Present/Polarity

Programming Choices - 0 (normally closed), 1 (normally open), 2 (not present)

Unit of Measurement - n/a

Parameter Set By - Maintenance Personnel

Factory setting - 1 (normally open)

Door switches DSW1 and DSW2 (for two-compartment vehicles) are normally closed switches, and become active (open) when a door is opened. The unit shuts down when a door is opened and the unit is in Cool or Heat mode. The [dSP] parameter allows maintenance personnel to set the correct polarity, in accordance with the electrical characteristics of the door switches that are used on the vehicle.

0 = the door switch is a Normally Closed type; the switch opens when a door is opened

1 = the door switch is a Normally Open type; the switch closes when a door is opened

2 = door switch(es) is not present.

[bE] Buzzer Enable

Programming Choices -
0 = (not enabled)
1 = (enabled)
2 = (enabled, and also for when a key is pressed)
3 = (enabled only when a key is pressed)

Unit of Measurement - n/a

Parameter Set By - Maintenance Personnel

Factory setting - 2 (enabled, and also for when a key is pressed)

This parameter allows maintenance personnel to set the following conditions:

- **0** = disable the buzzer so that there is no audible sound when certain alarm condition exist
- **1** = enable the buzzer for normal functioning
- **2** = enable the buzzer to perform normal functioning, plus to be activated whenever an In-cab Control Box key is pressed
- **3** = enable the buzzer to become activated only when an In-cab Control Box key is pressed.

[tu] Temperature Units

Programming Choices - ^{0}C or ^{0}F

Unit of Measurement - tenths of a degree for degrees C; full degrees for degrees F

Parameter Set By - Maintenance Personnel

Factory setting - ^{0}C

This parameter allows maintenance personnel to set whether the temperature readout on the In-cab Control Box are displayed as ^{0}C or ^{0}F.

[Pu] Pressure Units

Programming Choices - b (BARS) or P (PSI)

Unit of Measurement - BARS or PSI

Parameter Set By - Maintenance Personnel

Factory setting - P

This parameter allows maintenance personnel to set whether the pressure readout on the In-cab Control Box is displayed in BARS or PSI.

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Operation

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Section 4 - Operation

In-cab Control Box Features

The In-cab Control Box contains the main (master) microprocessor, a driver/user LCD display, a keypad with function keys, integrated circuits, and discrete electrical components. It is typically located on or near the vehicle's instrument panel.

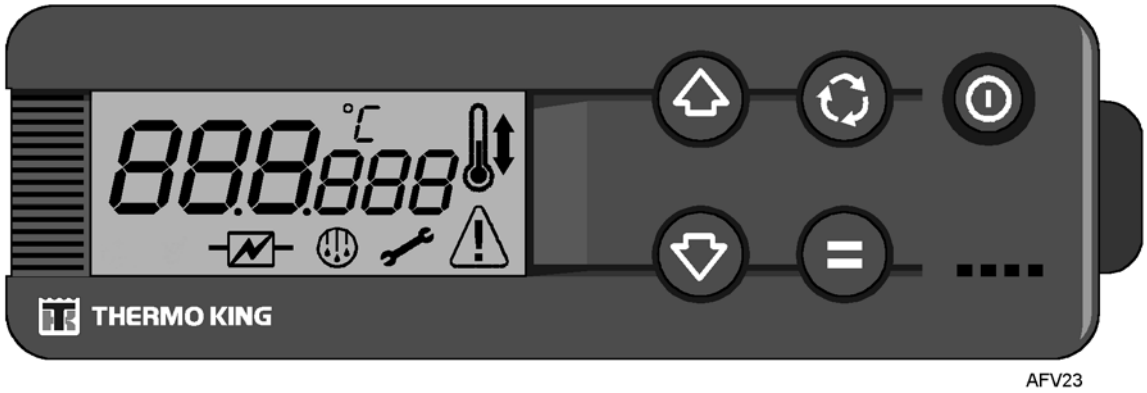

Figure 4-1 In-cab Control Box, with all icons illuminated in the Standard Display

Keypad

The five touch-sensitive keys are used to turn the unit "on" and "off," change the setpoint temperature, observe unit operating conditions and alarm codes, and control or change the unit's operating parameters.

Display

The display normally shows the Standard Display of return air temperature. The display shown here has all possible segments and icons lighted.

ATTENTION: If the air conditioning system is on, the V-500 AC unit continues running eventhough the in-cab control box is off.

Section 4 - Operation

Keypad Keys and Buzzer

The keys are illuminated any time the unit is turned on. This makes nighttime operation much easier.

On/Off Key	Turns the unit on and off. Always lit (except when the unit is disconnected). Provides a visual indication that the unit is powered-up.
Select Key	Scrolls through the menu screens.
Up Arrow Key	Chooses menu screen actions or increases the setpoint temperature or other settings.
Down Arrow Key	Chooses menu screen actions or decreases the setpoint temperature or other settings.
Enter Key	Executes menu screen actions or loads the setpoint temperature or other new settings.
Buzzer	Sounds an audible warning whenever these events occur: 1. When the vehicle battery and the optional Electric Standby power source are connected simultaneously 2. When the load compartment doors are opened while the unit is operating.

Understanding the Display

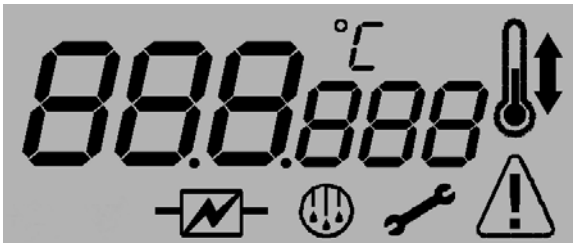

Figure 4-2 The Standard Display

The In-cab Control Box, at unit startup and during normal operation, shows the Standard Display and the return air temperature(s), as determined by the Return Air Temperature sensor(s) in the load compartment(s).

In addition, the icons located at the sides and bottom of the display indicate the operating mode of the unit, and indicate if any alarm codes are present. The display shown here has all possible display icons turned “on”.

Display Icons

	**Cool Icon**	Appears when the load compartment is cooling.
	**Heat Icon**	Appears when the load compartment is heating.
°C °F	**Degrees Icon**	Indicates whether the on-screen temperature reading is in degrees Celsius (°C) or degrees Fahrenheit (°F).
	**Maintenance Icon**	Appears when a user-defined maintenance event should occur.
	**Defrost Icon**	Appears when the evaporator coil is defrosting (the unit is in Defrost mode)
	**Alarm Icon**	Appears when an alarm condition has been detected by the microprocessor.
	**Electric Icon**	Appears when the unit is in Electric Standby mode.
SP	**Setpoint Icon**	Appears when the setpoint temperature is being shown in the display.

Reading a Typical Display

Figure 4-3 Typical Standard Display reading

Figure 4-3 shows the following information:

- The unit is “on” and is cooling
- The load compartment temperature is 20 degrees Celsius
- No alarm conditions exist.

Section 4 - Operation

The Standard Display

The Standard Display appears when the unit is turned on and no other functions have been selected. The return air temperature appears in the display. In Figure 4-4, the display shows a load compartment temperature of 3 degrees C, and that the unit is cooling the load compartment.

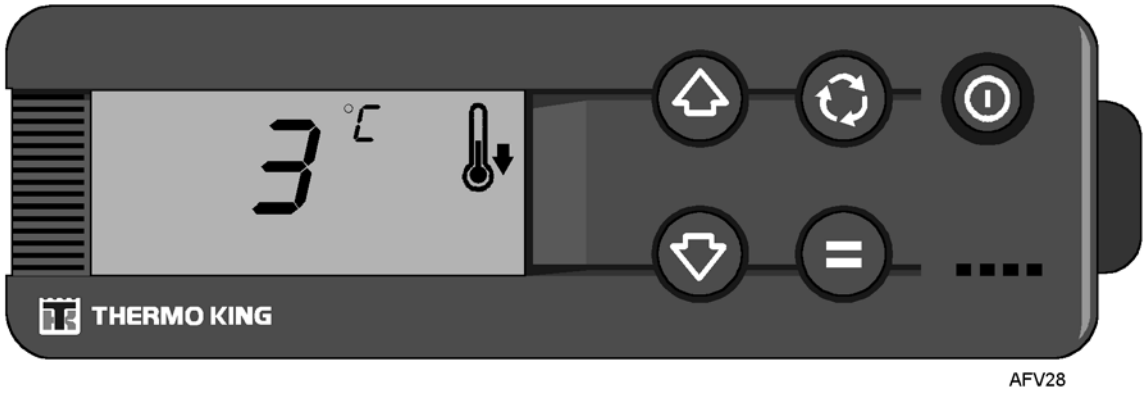

Figure 4-4 The Standard Display, with a load compartment temperature of 3°C

NOTE: For software version 121 21 and higher, the unit undergoes a 20-second system check when the On/Off switch is turned On. During this time, the Standard Display shows the word CHEck.

Manual Start After an Alarm

When an alarm stops unit operation, the Alarm icon appears on the Standard Display. After the condition that caused the alarm is corrected, the On/Off key on the In-cab Control Box must be pressed, in order to start unit operations. See Figure 4-5.

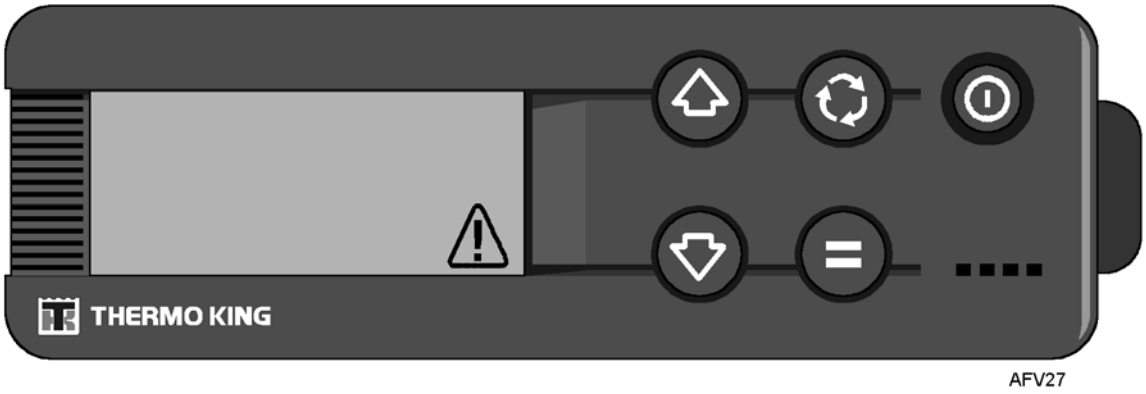

Figure 4-5 The Standard Display, with an alarm icon

NOTE: This information applies only to the OL (Electric Standby overload) alarm and bAt (low battery voltage) alarm.

Auto Start After an Alarm

When an alarm stops unit operation, the Alarm icon appears on the Standard Display. After the condition that caused the alarm is corrected, the unit starts automatically.

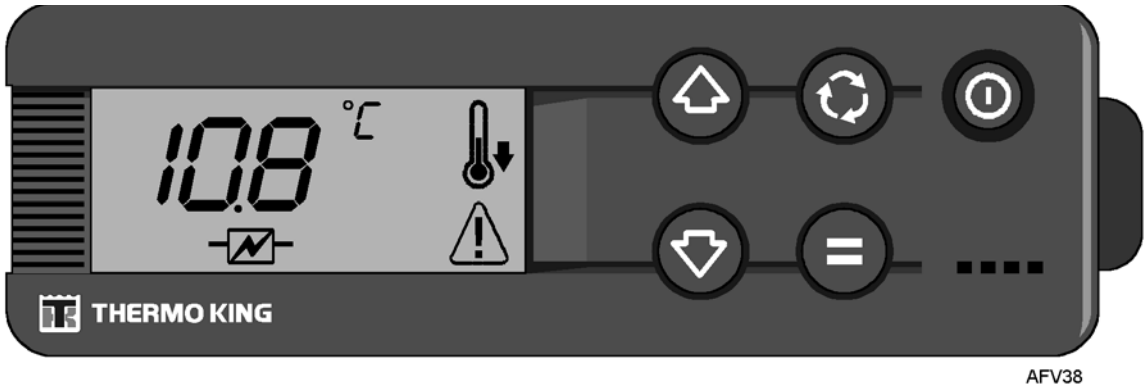

Figure 4-6 The Standard Display, with a setpoint of 10.8 and a declining compartment temperature

For single-temperature units, when a Return Air Sensor alarm [P1E] occurs in the load compartment, the return air temperature reading on the Standard Display is replaced by the - - - icon. The Alarm icon also appears. See Figure 4-7.

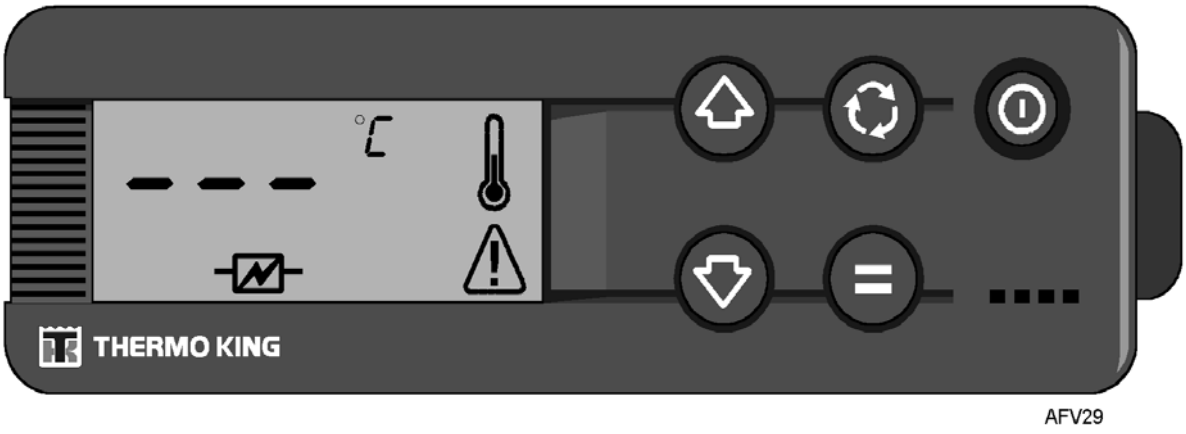

Figure 4-7 The Standard Display, with a Return Air Alarm and alarm icon

For bi-temperature units, when a Return Air Sensor alarm [P2E] occurs in the remote compartment, the return air temperature reading for the remote compartment is replaced by the - - - icon. The temperature reading for the main compartment continues to be displayed. The Alarm icon also appears.

In Figure 4-8, the temperature reading for the main compartment is -10°C. The temperature reading for the remote compartment has been replaced by - - -. The Alarm icon appears.

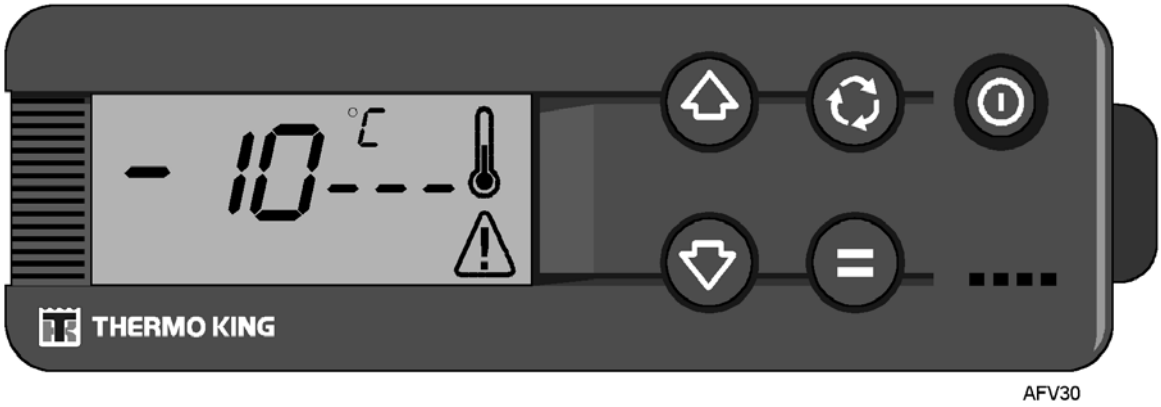

Figure 4-8 The Standard Display, with main and remote compartment temperature readings

Buzzers

The buzzers are energized when the vehicle battery and the electrical supply are connected simultaneously (the unit continues running in Standby mode). The buzzers are also energized when the doors are opened, if this option has been selected.

Changing the Setpoint

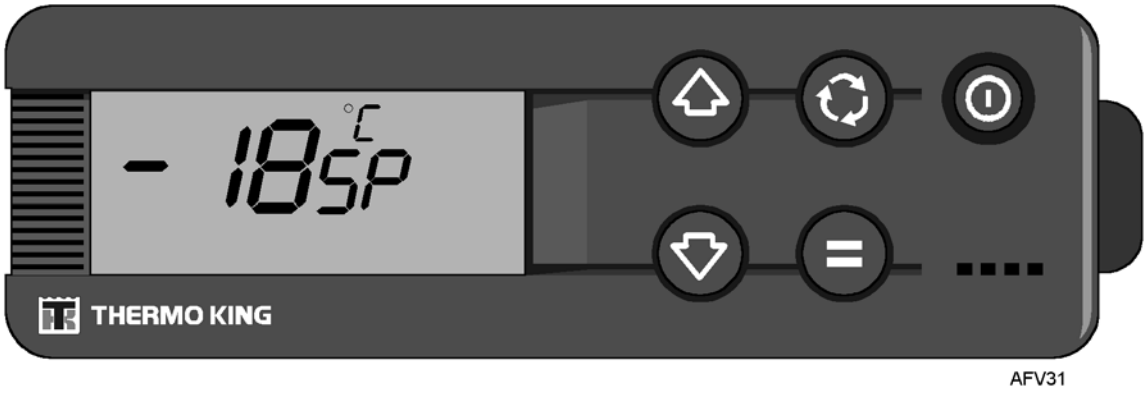

Figure 4-9 The Standard Display, with a setpoint of -18°C

NOTE: The V-500 AC series works in the same way as single-temperature units.

For Single-Temperament Units

1. Press the On/Off key to turn the unit on.

2. Press the Select key twice to choose the setpoint display. The Setpoint icon *SP* and the current setpoint temperature appear. See Figure 4-9.

3. Press the Up Arrow key or Down Arrow key to select a higher or lower setpoint. Each time an arrow key is pressed, the temperature changes by 1 degree.

NOTE: If the Select key is not pressed within 20 seconds to select a new setpoint temperature, the unit continues to operate at the original Setpoint temperature.

4. Press and release the Select key. The Standard Display appears on the screen.

Section 4 - Operation

For Bi-Temperament Units (with Main and Remote Compartments)

Figure 4-10 The Standard Display, with a setpoint of 5ºC for the remote compartment

For the Main Load Compartment of a Bi-Temperature Unit

1. Press the On/Off key to turn the unit on.

2. Press the Select key twice to choose the setpoint display. The setpoint icon *SP* and the current setpoint temperature appear. See Figure 4-9.

3. Press the Up Arrow key or Down Arrow key to select a higher or lower setpoint. Each time an arrow key is pressed, the temperature changes by 1 degree.

NOTE: If the Select key is not pressed within 20 seconds to select a new setpoint temperature, the unit continues to operate at the original Setpoint temperature.

For The Remote Load Compartment of a Bi-Temperature Unit

1. Press and release the Select key. The remote compartment setpoint temperature setting screen appears.

2. The current setpoint temperature for the remote compartment and the letters *SP2* appear on the display. See Figure 4-10.

3. Press the Up Arrow key or Down Arrow key to select a higher or lower setpoint. Each time an arrow key is pressed, the temperature changes by 1 degree.

4. Press and release the Select key. The Standard Display appears on the screen.

NOTE: If the Select key is not pressed within 20 seconds to select a new setpoint temperature, the unit continues to operate at the original Setpoint temperature.

Initiating a Manual Defrost Cycle

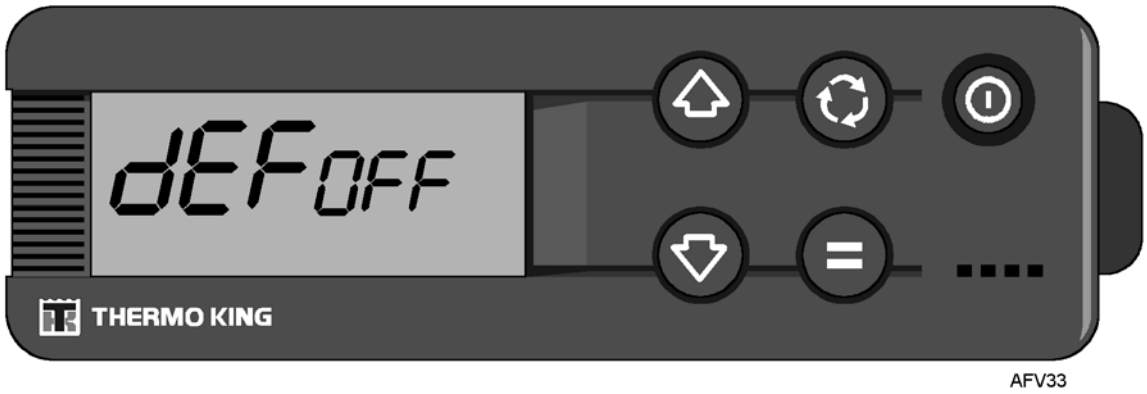

Figure 4-11 The Standard Display, showing defrost off

CAUTION: Before initiating a manual defrost, make sure that the unit is not already in manual defrost. Check to see if the defrost icon appears on the Standard Display.

NOTE: If the unit is not running, or if the coil temperature is not below 2°C, the request for a manual defrost is ignored.

1. The unit must be running and the evaporator coil temperature must be below 2°C. Press and release the Select key once. [dEF] appears (flashing) on the screen, with the letters *OFF*. See Figure 4-11.

2. Press the Enter key and either the Up Arrow or Down Arrow key. The letters *On* appears on the screen. This means that the manual defrost is activated. See Figure 4-12.

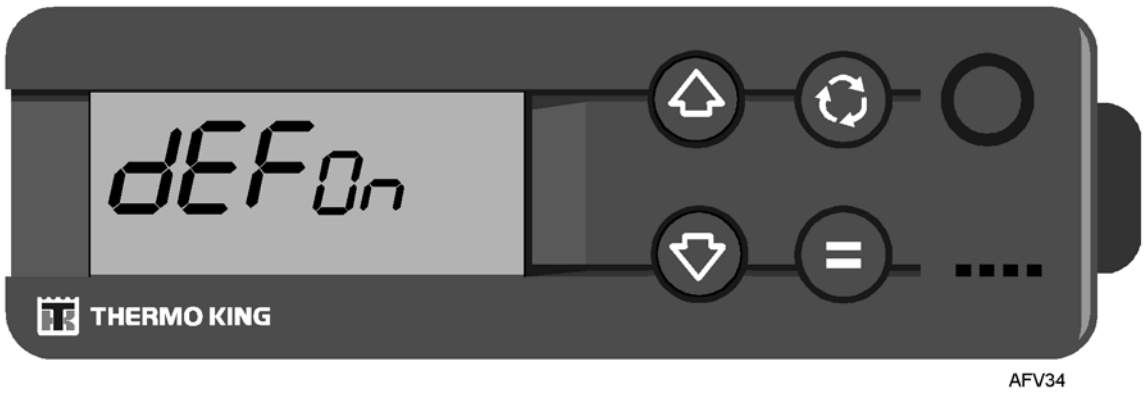

Figure 4-12 The Standard Display, showing defrost on

3. Press the Select key two times, to return to the Standard Display. (Press the Select key three times for bi-temperature units). The round defrost icon appears when the defrost cycle begins. See Figure 4-13.

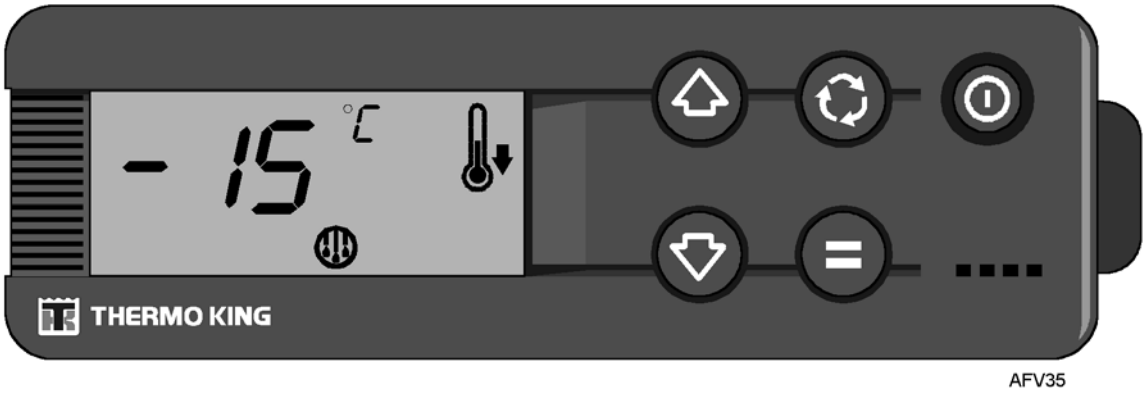

Figure 4-13 The Standard Display, with a setpoint of -15°C and the defrost icon

4. A defrost cycle terminates automatically, in accordance with the [dtt] time set at the Parameters screen. See Section 3 for a description of the [dtt] parameter.

Checking the Software Revision

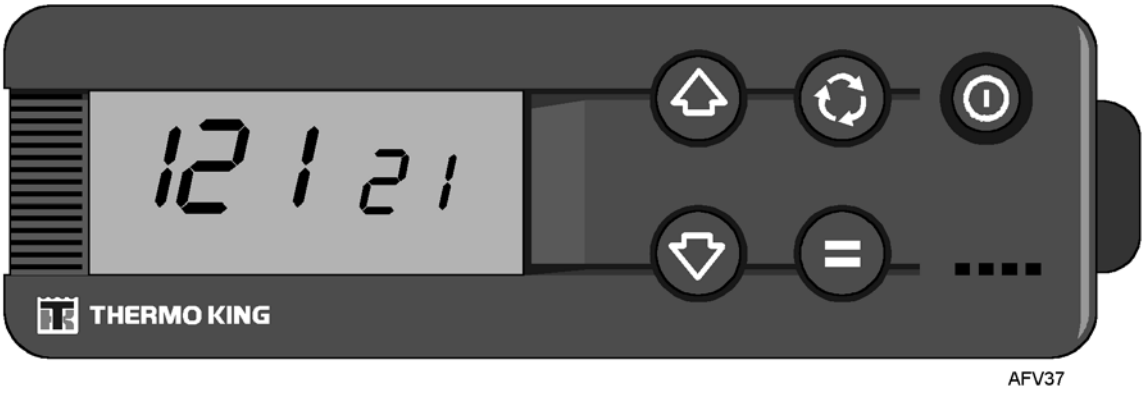

Figure 4-14 The Standard Display, showing the software revision at the Information Menu

1. Make sure that the unit is on and the Standard Display is showing.

2. Press and hold both the Up Arrow and Enter keys for three seconds. The first Information Menu screen, [all icons], appears. See Figure 4-14.

3. The Information Menu scrolls automatically. The second screen to appears indicates the software version. The numbers 121 XX or 273 XX are shown, where “XX” indicates software version 121 15 (273 02) or higher for the DSR µP Controller microprocessor.

Viewing and Clearing Alarm Codes

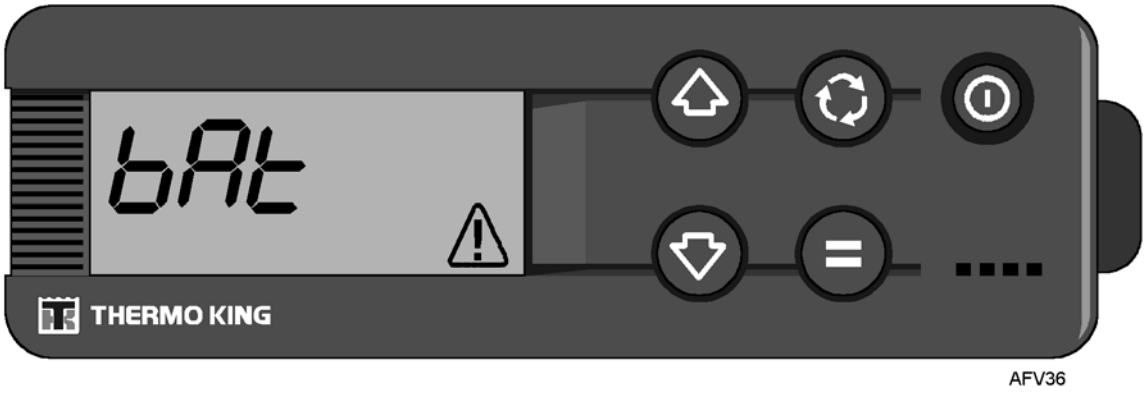

Figure 4-15 The Standard Display, showing the bAt (Low Battery Voltage) alarm

If the Alarm icon is present, one or more alarms have been detected.

To View Alarm Codes

NOTE: See the table on the following page for a list of DSR μP Controller alarm codes. In Section 3, see the table named Alarm Codes Displayed in the Main Menu for detailed descriptions of DSR μP Controller alarm codes.

If the Alarm icon is present, press the Select key once to show the Alarm screen. The most recent alarm code is shown on the display.

- If no alarm conditions have occurred, the Alarm icon does not appear. (If the Select key is pressed, the Alarm screen does not appear).
- If more than one alarm code exists, each is displayed for several seconds.

The alarm code shown in Figure 4-15 is for alarm code bAt (Low Battery Voltage).

To Clear Alarm Codes

- Correct the cause of the alarm code.
- Press the Select key to remove the alarm code.

If more than one alarm code is present, press the Select key to clear each alarm code individually.

Section 4 - Operation

DSR μP Controller Alarm Codes

The following table indicates the alarm codes that the DSR μP Controller can experience. All of the alarm codes can appear on the display of the In-cab Control Box. In Section 3, see the table entitled *Alarm Codes Displayed in the Main Menu* for a description of each alarm code.

Alarm Code	Auto or Manual Restart After Alarm is Cleared	Description
P1E	Auto	When [----] appears: indicates that the return air temperature in the main load compartment is outside of the readable range.
P2E	Auto	When [----] appears: indicates that the return air temperature in the remote load compartment is outside of the readable range.
OL	Manual	Electric Standby electric motor protector overload.
bAt	Manual	Low battery voltage.
HP	Auto	High Pressure in refrigeration system failure (HPCO fault).
LP	Auto	Low Pressure in refrigeration system failure (LPCO fault).
PSE	Auto	High Pressure sensor fault.
tEP	Auto	Thermal protection alarm (B-100 only)
dr1	Auto	Door open or Door Switch 1 faulty.
dr2	Auto	Door open or Door Switch 2 faulty.
tCO	Auto	Electronic Control Module internal temperature exceeds specified limit.
SOF	Auto	Microprocessor software failure.
- C -	-------	Communications failure between the In-Cab Control Box and the ECM.

Section 5
Diagnostics

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DSR μP Controller Notes

The following procedures might not be not readily apparent, but must be followed when working on units equipped with DSR μP Controller microprocessors.

- Turn off the unit before connecting or disconnecting the vehicle battery
- Never use testers, consisting of a battery and a light bulb, to test circuits on any microprocessor-based equipment
- Any time the microprocessor is replaced, use these Service Procedures:
  - A02A - *Recording Existing Microprocessor Settings*
  - A04A - *Microprocessor Setup (Programming the DSR Microprocessor)*
  - A12A - *ESD (Electrostatic Discharge) Procedure*
  - A26A - *Welding on Units Equipped with Microprocessors*
  - A28A - *Setting Unit Running Time Hourmeters*

Electrostatic Discharge

The DSR μP Controller printed circuit board(s) and In-cab Control Box can be damaged by electrostatic discharge. Any time that work is performed directly on the printed circuit boards, do the following:

- Use an ESD wrist strap, as shown in Service Procedure A12A, *ESD (Electrostatic Discharge) Procedure*.
- Keep all printed circuit boards in anti-static bags at all times.
- Protect all defective printed circuit boards and In-cab Control Boxes from physical damage by placing them in the shipping carton supplied with the replacement. They will be returned for failure analysis and possible re-manufacture.

Section 5 - Diagnostics

DSR μP Controller Diagnostic Hints

Section 5 is devoted to diagnostic routines designed to help the technician quickly identify the cause of a problem and repair it, using the correct tools, information, and procedures. It is important that the required procedures be followed exactly. Failure to do so might result in an incomplete repair.

The remaining material is divided into two parts. The first part suggests corrective actions as a result of alarm codes. The second part suggests corrective actions as a result of other symptoms.

In order to properly service the DSR μP Controller, the cautions listed at the front of this section must be followed carefully.

The following hints might prove helpful when working on the PCBs.

- Record all alarm codes for reference.
- Clear all alarm codes before testing the unit.
- Be certain all printed circuit board and wire harness connectors are securely in place.
- Be certain all programmable features are restored to the customers specifications, as shown in the procedures.

Part 1 - Corrective Actions as a Result of Alarm Codes

In Section 3, see the table entitled *Alarm Codes Displayed in the Main Menu* for a description of the DSR μP Controller alarm codes. In Section 4, see the sub-section entitled *DSR μP Controller Alarm Codes* for a description of the types of alarm codes that the DSR μP Controller can experience.

ALARM CODES, THEIR CAUSES AND CORRECTIVE ACTIONS

<table>
<tr><th>Code</th><th>Cause or Explanation</th><th>Corrective Action (check in order shown)</th></tr>
<tr><td>P1E, P2E</td><td>Return Air Temperature Sensor Fault
(P1E = Main Load Compartment)
(P2E = Remote Load Compartment, if applicable)

A problem exists with the Return Air Temperature sensor (temperature probe) or its wiring. The sensor is a thermistor-type sensor and can be checked with an ohmmeter. The sensor is located in the return air stream before the evaporator coil. The wiring is part of the sensor harness.</td><td>1. Check the Return Air Temperature sensor by checking the Standard Display.
- If the Standard Display shows [----], the return air temperature is outside of the readable range. The Return Air Temperature sensor might be defective, or the circuit is open or has shorted.
2. Check the sensor connector at the sensor for damage or a broken wire.
3. With the Return Air Temperature sensor disconnected, check the sensor with an ohmmeter. Sensor resistance should be about as shown below for each temperature:

<table>
<tr><th>Temp (deg. C)</th><th>Resistance (kOhms)</th><th>Temp (deg. C)</th><th>Resistance (kOhms)</th></tr>
<tr><td>-25</td><td>86.43</td><td>45</td><td>4.911</td></tr>
<tr><td>-20</td><td>67.77</td><td>50</td><td>4.160</td></tr>
<tr><td>-15</td><td>53.41</td><td>55</td><td>3.536</td></tr>
<tr><td>-10</td><td>42.47</td><td>60</td><td>3.020</td></tr>
<tr><td>-5</td><td>33.90</td><td>65</td><td>2.588</td></tr>
<tr><td>0</td><td>27.28</td><td>70</td><td>2.228</td></tr>
<tr><td>5</td><td>22.05</td><td>75</td><td>1.924</td></tr>
<tr><td>10</td><td>17.96</td><td>80</td><td>1.668</td></tr>
<tr><td>15</td><td>14.69</td><td>85</td><td>1.451</td></tr>
<tr><td>20</td><td>12.09</td><td>90</td><td>1.266</td></tr>
<tr><td>25</td><td>10.00</td><td>95</td><td>1.108</td></tr>
<tr><td>30</td><td>8.313</td><td>100</td><td>0.9731</td></tr>
<tr><td>35</td><td>6.940</td><td>105</td><td>0.8572</td></tr>
<tr><td>40</td><td>5.827</td><td>110</td><td>0.7576</td></tr>
</table>
Reconnect the sensor to the wiring harness.
4. Remove connector C-1 from PCB 1, and remove the cable from the connector. Check pins A4 and B4 for a pushed pin, loose pin crimp, or broken wire. As needed, squeeze the pins together for better contact.
5. With the sensor connected and using a voltmeter, check the voltage of the harness wires at pins A4 (PNK) and B4 (BLK) of C-1 connector on PCB 1. The voltage should be +5 Vdc. If +5 Vdc is not present, the microprocessor might be malfunctioning.
6. If the microprocessor is assumed to be functioning, disconnect the C-1 connector from PCB 1 and disconnect the suspected bad sensor. Using a Fluke meter set for ohms, check for shorts to chassis ground at the PNK and BLK wires of the suspected sensor. If a short exists, examine the wiring harness for splits, cut wiring, or corrosion. Repair or replace the wire.
7. Disconnect the sensor and temporarily connect a new sensor. Run the unit in Cool and Heat modes. If the new sensor displays correctly on the In-cab Control Box, the removed sensor is malfunctioning.</td></tr>
</table>

ALARM CODES, THEIR CAUSES AND CORRECTIVE ACTIONS (continued)

Code	Cause or Explanation	Corrective Action (check in order shown)
P1E, P2E (continued)		8. If the resistance of the sensor and harness is correct, replace the microprocessor. If the problem persists, replace PCB 1 and re-install the original microprocessor. 9. Check the sensor, using *Service Procedure D01A*.
OL	**Electric Standby Overload** ***DANGER: High voltage is present any time the unit is connected to Electric Standby power. Death or serious injury could result from unsafe or improper handling of the Electric Standby equipment.*** The optional Electric Standby electric motor protector has tripped on single-phase units, or the overload relay has tripped on three-phase units. This alarm is cleared automatically whenever the unit is turned off and back on, using the In-cab Control Box On/Off key or when the Electric Standby power source is turned off and on.	1. Allow the motor protector or overload relay several minutes to cool. Turn the unit off and back on to clear the alarm. 2. Check the voltage on all phases of the motor, to be sure it is within specification. 3. Check for excessive drive motor current. Check the nameplate on the motor for the full-load amperage rating. Correct any condition contributing to excessive motor load. 4. Check the refrigeration system for any problems that might cause an overload condition. 5. Check the setting of Electric Standby relay STDR. It should be 10% greater than the full load amperage rating of the motor. 6. Check the continuity of the wire between overload relay OL and pin B2, connector C-1 on PCB 1. See *Service Procedure H04A*. 7. Check for continuity between overload relay terminals 97 and 98. The contacts should be Normally Closed. See *Service Procedure H04A*. 8. Check the CHX circuit for continuity to chassis ground.
bAt	**Low Battery Voltage (alarm does not occur if the unit is in Electric Standby mode)** ***NOTE: This alarm code can occur if the unit is rapidly switched on and off. Wait 5-10 seconds after switching the unit off before turning it back on.***	1. Check that the cables to the battery (BAT and CHA) are tightly attached to the battery terminals. 2. Check the battery terminals for corrosion. The vehicle battery might be discharged or its electrolytic cells might be damaged or leaking. 3. Check the operation of the truck alternator. Make sure that the belt is properly adjusted. 4. At the battery, use a voltmeter or multi-meter to check the voltage. - For 12V units, the voltage must be between 10.5 Vdc and 15.0 Vdc. - For 24V units, the voltage must be between 21 Vdc and 30 Vdc. 5. At connector C-1 on PCB 1, check pins A6 (CHH) and A7 (BAT) for a pushed pin.

ALARM CODES, THEIR CAUSES AND CORRECTIVE ACTIONS (continued)

Code	Cause or Explanation	Corrective Action (check in order shown)
HP	**High Discharge Pressure**	1. This alarm indicates that the refrigerant discharge pressure, as sensed by the transducer, is excessively high. When the discharge pressure rises above the specified value, the transducer opens the circuit to the compressor clutch and stops compressor (and unit) operations. The transducer is connected to PCB 1 at connector C-1, pin C4 (high pressure), and C-1, pin C5 (5V power). Check for a pushed pin, loose pin crimp, or broken wire. 2. Check for obstructions, debris, or dirt on the condenser coil and condenser fans. (Obstructions can increase the discharge pressure). 3. Check for a slipping or broken condenser fan belt. (A malfunctioning condenser fan contributes to increased discharge pressure). 4. Check the AMP connector on the transducer for a pushed pin or missing pin wedge, loose pin crimp, or broken wire. See *Service Procedure H02A*. 5. Check for a defective transducer. The switch is a Normally Closed component (it opens when there is excessive discharge pressure). 6. Check the refrigeration system for high discharge pressure and correct the condition, as required. 7. Connect a pressure gauge to the high-pressure side of the unit, with the unit operating. Check the high pressure reading at the gauge. At the Information Menu screen of the In-cab Control Box, check the high-pressure reading. Verify that the high-pressure reading at the Information Menu screen is the same as the high-pressure reading at the pressure gauge. If not: • Determine if the voltage between 5V-CHT is approximately 5V. If the voltage is higher, check point 4. • If point 4 is OK, connect directly from transducer to ECM with external wires. • Determine that ground bolts are correctly fitted and there is continuity between them and wire CHH. Check that frame surface for ground bolts is clean of painting and check that a special star washer is installed. 8. If a problem persists, replace the DSR μP controller

ALARM CODES, THEIR CAUSES AND CORRECTIVE ACTIONS (continued)

<table>
<tr><th>Code</th><th>Cause or Explanation</th><th>Corrective Action (check in order shown)</th></tr>
<tr><td>LP</td><td>Low Suction Pressure</td><td>1. This alarm indicates that the suction pressure, as sensed by the Low Pressure Cut-Out (LPCO) switch, is excessively low. When the suction pressure falls below the specified value, the LPCO opens the circuit to the compressor clutch and stops compressor (and unit) operations.
The LPCO is connected to PCB 1 at connector C-1, pin A2. Check for a pushed pin, loose pin crimp, or broken wire.
2. Check compressor and unit operation for cause of the low suction pressure. Check for possible obstruction in the suction line or a lack of heat exchange in the evaporator.
3. Inspect for blocked or dirty evaporator coil (causing reduced volume of refrigerant reaching the evaporator and contributing to reduced suction).
4. Determine if there is increased amperage draw at the LPCO, for indication of a defective LPCO switch.
5. Check ground bolts and continuity between the grounds and CHH (pin A6, connect C-1)</td></tr>
<tr><td>PSE</td><td>High Pressure Sensor Fault</td><td>1. This alarm code indicates that the signal from the HP sensor is outside of the readable range (<0.5 Vdc [at 0 psi] or >4.5 Vdc [at 500 psi]), and that a fault exists with the high discharge pressure sensor.
2. Inspect for a blocked or dirty condenser coil.
3. Inspect for a faulty High Pressure transducer.
4. Check that pin C4 at connector C-1 on PCB 1 is connected (check for a pushed pin or loose pin crimp), not corroded, and is not obstructed by dirt.
5. Observe the continuity between CHT (pin C2, connector C-1) and the ground bolts.
6. Make sure that the voltage between pins C3 and C4 on connector C-1 corresponds to the table below.

Pressure (PSI) — Output Voltage (HP-CHT) (V)
130 — 1.4
180 — 1.8
200 — 1.9
300 — 2.7
450 — 3.9

7. Check for +5 volts at pin C5, connector C-1 on PCB 1.
8. If the problem persists, replace the terminals in the connectors of the ECM and the transducer.
9. Outside the main harness, connect the transducer directly to the ECM.</td></tr>
</table>

ALARM CODES, THEIR CAUSES AND CORRECTIVE ACTIONS (continued)

Code	Cause or Explanation	Corrective Action (check in order shown)
tEP (B-100 only)	**Thermal protection alarm**	1. This alarm code indicates that the thermal protection circuit has opened in one of the two Electric Standby motors (D.C. or A.C.) due to engine overheating or circuit failure. 2. If alarm persists, use a multimeter to check voltage between the R1K resistance posts (located in aerial connector next to the ECM). • If 12 or 24 VDC, check the voltage at PCB 1 between connector C-1, pin C2 (DK3), and connector C-1, pin C6 (CH). If 0 VDC, test for continuity between R1K resistance and pin C2. If 12 or 24 VDC, replace PCB1, using *Service Procedure B02A.* Perform complete microprocessor setup using *Service Procedure A04A*. • If 0 VDC, go to Item 3. 3. Determine which motor matches the open thermal protection circuit. In B-100 10 units this will be possible only in the D.C. motor. 4. If circuit is open, disconnect C-40 connector in DC motor and measure thermal switch continuity: • Test brushes, pulley and correct belt alignment. • Check refrigeration system for any problems that might cause DC motor overheating. • If problem persists, replace DC motor using procedure shown in *Direct Drive Units (DSR) Service Manual TK 52979-18-BD. Chapter B-100 10/20.* 5. Disconnect C-2 connector in AC motor and measure thermal switch continuity, if circuit is open. • Test pulley and correct belt alignment. • Check refrigeration system for any problems that might cause AC motor overheating. • If problem persists, replace AC motor using procedure shown in *Direct Drive Units (DSR) Maintenance Manual TK 52979-18-BD. Chapter B-100 10/20.*

ALARM CODES, THEIR CAUSES AND CORRECTIVE ACTIONS (continued)

Code	Cause or Explanation	Corrective Action (check in order shown)
dr1, dr2	**Door Open/Door Switch Failure**	1. This alarm indicates one or more of the following: - A door is open. Check if the door is open and close it. - Wire DSW1 between door switch 1 and PCB 1, or wire DSW2 between door switch 2 and PCB 2, is defective. Remove the applicable door switch and check the wire to the switch for voltage of +5 Vdc. - There is a short to chassis ground at CHW (PCB 1), or at CH (PCB 2). - Voltage at A3 of connector C-1 on PCB 1, or pin 6 of connector C-1 on PCB 2, is faulty. 2. Confirm that the load compartment doors are closed. Check the In-cab Control Box screen. If the [dr1**]** or [dr2] alarm codes still appear, check the DSW1 and DSW2 door switches for damage, cut or broken wires, corrosion, or misalignment. 3. Check the polarity setting at the Installation (Guarded Access) Menu. Make sure that the polarity for a Normally Closed door switch is 0, and that the polarity for a Normally Open door switch is 1.
tCO	**Electronic Control Module Internal Temperature Exceeds Limit**	1. This alarm indicates that the microprocessor has detected an excessively high (>85°C) temperature inside the ECM enclosure. The built-in fan might be malfunctioning or not functioning. 2. Check the cable between the fan and PCB 1. Look for cuts, abrasion, and other damage. Check for a secure connection to C6-1 on PCB 1 and at the fan motor. 3. Check the fan for a broken blade. Check for a “burned” smell, indicating that the fan motor has burned out. Remove and replace the fan and/or filter, using *Service Procedure UH09A*.
SOF	**Microprocessor Software Failure**	1. This alarm code indicates the In-cab Control Box microprocessor has become defective, or that the software has become corrupted. 2. If the software is corrupt, the microprocessor must be reprogrammed. Complete the microprocessor setup using *Service Procedure A04A*. 3. If the ECM microprocessor is corrupted or damaged, replace the microprocessor by replacing PCB1 and/or PCB 2, using *Service Procedure B02A*. Complete the microprocessor setup, using *Service Procedure A04A*.

ALARM CODES, THEIR CAUSES AND CORRECTIVE ACTIONS (continued)

Code	Cause or Explanation	Corrective Action (check in order shown)
- C -	**Communications Failure, Microprocessor to In-cab Control Box.**	1. Check the cable between PCB 1 and the In-cab Control Box. Look for a loose connector or damage to the cable. Look for disconnected wires or damaged pins on the cable, at connector C-1 on PCB 1, or at the connector on the In-can Control Box. Look for dirt or debris at all connectors. 2. Using a multimeter, check the voltage at PCB 1 between connector C-1, pin C7 (9V), and connector C-1, pin C6 (CH). Minimum voltage = 7.5 Vdc. Maximum voltage = 9 Vdc. 3. Check the continuity of all wires from PCB 1 to the In-cab Control Box: black wire at connector C-1, pin B6 (RDX, comms); blue wire at connector C-1, pin B7 (TXD, comms); yellow/green wire at connector C-1, pin C6 (CH, ground); red wire at connector C-1, pin C7 (9V, In-cab power supply); and shield wire at connector C-1, pin C6 (GND, shield). See *Service Procedure H04A*. 4. Remove and replace the In-cab Control Box. If the replacement does not function, replace PCB 1.

Part 2 - Corrective Actions as a Result of Other Symptoms

A problem with the unit might exist without generating an alarm code. The following pages are suggested corrective actions to be taken when dealing with these symptoms. They have been broken into sections for ease in locating specific symptoms.

Important Diagnostic Considerations

- In some cases, replacement of PCB 1 and/or PCB 2 is suggested. If replacing the printed circuit board corrects the problem, recheck the new printed circuit board and the original printed circuit board, as the original printed circuit board might not have been defective.
- When performing diagnostics, consider if the problem is caused by the refrigeration system rather than the controls.

UNIT WILL NOT OPERATE - VEHICLE POWER

Symptom	Cause	Corrective Action
Unit will not operate on vehicle power and the In-cab Control Box display remains blank.	Vehicle ignition switch is not on	Turn the vehicle ignition switch on.
	Blown ignition power fuse F 21.	Check 40-amp ignition power fuse F21, located near the vehicle battery.
	Dead or disconnected vehicle battery.	Service the vehicle battery.
	Defective or disconnected In-Cab Control Box.	Verify that cable is connected between PCB 1 in the ECM and the In-Cab Control Box.
	No voltage in BAT (pin A7, connector C-1) and/or 03 (pinA8, connector C-1) in the ECM, even with the ignition on.	Check the continuity between the ECM side and the battery side. If no continuity, repair the wiring.
	Loose or disconnected printed circuit board connector.	Check PCB 1 and/or PCB 2 connectors C1 and C2, to be sure they are attached securely.
	Defective microprocessor or printed circuit board.	Replace the In-cab Control Box. Setup the replacement In-cab Control Box in accordance with *Service Procedure A04A*.
Unit will not operate on vehicle power, but the In-Cab Control Box display turns on.	Blown unit power fuse F21	Check 40-amp unit power fuse F21, located near the vehicle battery.
	Loose or disconnected printed circuit board connector.	Check PCB1 and/or PCB 2 connectors C1 and C2, to be sure they are attached securely.
	No voltage in wire 2A	Check 40-amp unit power fuse F21 and BATR relay. Replace, if necessary.
	Defective microprocessor or printed circuit board.	Replace In-cab Control Box or PCB 1 and/or PCB 2. Setup the replacement printed circuit board in accordance with *Service Procedure A04A*.

UNIT NOT COOLING - VEHICLE POWER

Symptom	Cause	Corrective Action
Vehicle compressor clutch does not engage.	Vehicle not running or unit not turned on.	Start vehicle and turn unit on. Be sure that the setpoint and the load compartment temperature requires a Cool or Heat mode.
	Blown unit power fuse F21.	Check 40-amp unit power fuse F21 located near the vehicle battery.
	Discharge pressure is above HPCO value or the Low Pressure Cut-Out switch is open.	Verify that the discharge pressure is under the HPCO value, and that the Low Pressure Cut-Out switch is closed.
	Defective wiring harness or loose connector for CLU1-01 and CLU2 circuit.	Check wiring and connections for CLU1-01 and CLU2 circuit. Using the schematic diagram, check splice 2.
	Defective microprocessor or printed circuit board.	Replace PCB 1. Setup the replacement printed circuit board in accordance with *Service Procedure A04A*.
	Blown vehicle compressor clutch fuse F5.	Check power fuse F5 (20A for 12V units; 10A for 24V units) located on PCB 1. Check vehicle compressor clutch for shorted coil.
	Loose or defective CLU1-01 and CLU2 circuit to compressor clutch.	Check the CLU1-01 and CLU2 circuit to vehicle compressor clutch.
	Open vehicle compressor clutch coil or defective clutch.	Check continuity of vehicle compressor clutch coil. See *Service Procedure H04A*.
Vehicle compressor clutch is engaged, but unit is not cooling.	Refrigerant system problem.	Check refrigerant system. Check for level refrigerant level
	Defective compressor	Determine if the compressor is defective. Replace it, if necessary.

UNIT NOT HEATING - VEHICLE POWER

Symptom	Cause	Corrective Action
Vehicle compressor clutch does not engage.	Vehicle not running or unit not turned on.	Start vehicle and turn unit on. Be sure that the setpoint and the load compartment temperature requires a Cool or Heat mode.
	Blown unit power fuse F21.	Check 40-amp unit power fuse F21 located near the vehicle battery.
	Discharge pressure is above HPCO value or the Low Pressure Cut-Out switch is open.	Verify that the discharge pressure is under the HPCO value, and that the Low Pressure Cut-Out switch is closed.
	Defective wiring harness or loose connector for CLU1-01 and CLU2 circuit.	Check wiring and connections for CLU1-01 and CLU2 circuit. Using the schematic diagram, check splice 2.
	Defective microprocessor or printed circuit board.	Replace PCB 1. Setup the replacement printed circuit board in accordance with *Service Procedure A04A*.
	Blown vehicle compressor clutch fuse F5.	Check power fuse F5 (20A for 12V units; 10A for 24V units) located on PCB 1. Check vehicle compressor clutch for shorted coil.
	Loose or defective CLU1-01 and CLU2 circuit to compressor clutch.	Check the CLU1-01 and CLU2 circuit to vehicle compressor clutch.
	Open vehicle compressor clutch coil or defective clutch.	Check continuity of vehicle compressor clutch coil. See *Service Procedure H04A*.
Vehicle compressor clutch is engaged but vehicle is not heating.	Refrigerant system problem.	Check refrigerant system. Check for level refrigerant level
	Defective compressor	Determine if the compressor is defective. Replace it, if necessary.

UNIT WILL NOT DEFROST - VEHICLE POWER

Symptom	Cause	Corrective Action
Unit does not defrost.	Vehicle not running or unit not turned on.	Start vehicle and turn unit on.
	Initiate a manual defrost cycle using the Main Menu.	Press the Select key until the display briefly shows [dEF]. The defrost icon should appear. As desired, press the Enter key, then the Up or Down arrow key, to change the defrost setting in 1-degree Celsius increments.
	Defrost Initiation Time [dit] is not set or set to an incorrect time.	In the Installation (Guarded Access) Menu, scroll to the [dit] parameter screen. Check if the time (factory default = 240 minutes) is too short or too long between defrost initiation cycles. Change the time setting, as required.
	For units with older versions of software revision 121 21: The unit has been switched off using the vehicle key.	Switch off the unit with the Direct Smart Reefer, before switching off the vehicle.
	Vehicle compressor clutch must be energized and compressor must be operating.	If compressor clutch is not energized troubleshoot as shown under *UNIT NOT COOLING - VEHICLE POWER*.
	Defrost klixon (DK) wire 12 not connected in the ECM (at pin C1, connector C-1)	Inspect the wiring and connector and make sure that DK wire 12 is securely connected.
	Defrost klixon (DK) is defective	Inspect the klixon for defects. Replace the klixon, as required.
Compressor is running, hot gas solenoid is not energized. ***NOTE: If the unit is equipped with option defrost drain heaters they turn on and off with the hot gas solenoid.***	Blown hot gas solenoid fuse F5.	Check hot gas solenoid fuse F5 (20A for 12V units, 10A for 24V units), located on PCB 1. Check hot gas solenoid coil for short to ground. If present, check defrost drain heaters for short to ground.

UNIT WILL NOT DEFROST - VEHICLE POWER (continued)

Symptom	Cause	Corrective Action
Compressor is running, hot gas solenoid is not energized (continued). ***NOTE: If the unit is equipped with option defrost drain heaters they turn on and off with the hot gas solenoid.***	Loose or defective wire 26 to hot gas solenoid.	Check wire 26 to the hot gas solenoid, PS1. Check the pin connections at PCB 1 connector C-2, pin 8 for crimps or loose connections.
	Defective hot gas solenoid, PS1.	Check hot gas solenoid PS1 for proper operation.
	Open hot gas solenoid	Check the continuity of the hot gas solenoid coil. See *Service Procedure H04A*.
	Not output voltage to the hot gas solenoid (wire 26)	Check wire 26. Replace PCB 1, as required.
Compressor is running, hot gas valve is energized, but unit is not defrosting.	Refrigerant system problem.	Check refrigerant system.
	Evaporator fan(s) stuck on.	Check operation of evaporator fans EF1 and EF2. Check the [EFc] Evaporator Fans Constant Blow parameter at the Installation (Guarded Access) Menu. Change the parameter setting from On to Off (changing to Off causes the evaporator fans to cycle on/off with Cool, Heat, and Null mode changes)

EVAPORATOR FANS DO NOT OPERATE - VEHICLE POWER

The unit is equipped with 1, 2, or 3 evaporator fans. These fans operate in Cool, Heat and Null (if the Evaporator Fan Constant Blow [EFc] feature is set to [on].

Symptom	Cause	Corrective Action
Evaporator fans should be running, but are not.	Vehicle not running or unit not turned on.	Start vehicle and turn unit on. Be sure conditions require evaporator fans to be operating.
	Blown unit power fuse F21.	Check 40-amp unit power fuse F21 located near the vehicle battery.
	Defective wiring harness or loose connector for EF1 and EF2 circuits.	Check wiring and connections for EF1 and EF2 circuits.
	Defective evaporator fan relays on PCB 1.	Replace PCB 1.
	Blown evaporator fan fuse F3 and F4 on PCB1. (Fuse F9 on PCB2 is for units with evaporator fan EF3)	Check 15A/12V or 10A/24V evaporator fan fuses F3 and F4 (and F9), located on the printed circuit board. Check evaporator fan motors EFM1 and EFM2 for short to ground. For units with EF3, check evaporator fan motor EFM3 for short to ground.
	Open evaporator fan motors.	Check the continuity of the evaporator fan motors. See *Service Procedure H04A*.
	Loose or defective EF1, EF2, or EF3 circuit to the evaporator fan motors.	Check the EF1, EF2, or EF3 circuit to the evaporator fan motors.
	Defective microprocessor.	Replace PCB 1 and/or PCB 2.
In vehicles with 2 zones (compartments), or vehicles with V-400/V-500 units, not all of the evaporator fans are operating.	The microprocessor has been programmed for the wrong unit.	Check the DSR microprocessor parameters.

CONDENSER FANS DO NOT OPERATE - VEHICLE POWER

The unit is equipped with 1 or 2 condenser fans. These fans operate in Cool mode when the condenser fan pressure switch is closed.

Symptom	Cause	Corrective Action
Condenser fans should be running but are not.	Vehicle not running or unit not turned on.	Start vehicle and turn unit on. Be sure conditions require condenser fans to be operating.
	Blown unit power fuse F21.	Check 40-amp unit power fuse F21 located near the vehicle battery.
	Defective wiring harness or loose connector for CF1-01 circuit (for units with CFM1) or CF1-02 (for units with CFM2) circuits.	Check wiring and connections for the CF1-01 or CF1-02 circuits.
	Discharge pressure is greater than CFP (180 psi) but fan is not energised.	Enter cab control information Menu and display HP value; test that pressure reading is correct, using gauge. Check refrigeration system and replace high pressure transducer, if applicable.
	Defective condenser fan relay RY6 on PCB 1, or RY10 on PCB 2. (See the unit's wiring diagram for the correct relay number, or see the table in Section 2 entitled *System Relays*.	Replace PCB 1 or PCB 2.
	Defective microprocessor.	Replace PCB 1 and/or PCB 2.
For V-400/V-500 units only: only one condenser fan is operating.	The microprocessor has been programmed for the wrong unit.	Check the DSR microprocessor parameters. As necessary, reprogram the microprocessor, using *Service Procedure A04A*.
Condenser fans should be running but are not.	Blown condenser fan fuse F2 on PCB 1, and/or F7 on PCB 2. See the applicable electric schematic for the unit, or the table in Section 2 entitled *Fuse Sizes and Descriptions: Located on Printed Circuit Board 1 (PCB 1) or Printed Circuit Board 2 (PCB 2)*	Check the 15A/12V and 10A/24V condenser fan fuses F2 and F6 on PCB 1, and/or F7 on PCB 2. Check condenser fan motors for short to ground.

CONDENSER FANS DO NOT OPERATE - VEHICLE POWER (continued)

The unit is equipped with 1 or 2 condenser fans. These fans operate in Cool mode when the condenser fan pressure switch is closed.

Symptom	Cause	Corrective Action
Condenser fans should be running but are not (continued).	Open condenser fan motor circuits.	Check continuity of condenser fan motors CFM1 and CFM2. See *Service Procedure H04A*.
	Loose or defective CF1-02 and CF2-02 circuits to the condenser fan motors.	Check the CF1-02 circuit to CFM1, and the CF2-02 circuit to CFM2.

UNIT WILL NOT OPERATE - BATTERY DRIVEN (B-100)

Symptom	Cause	Corrective Action
Unit does not operate and the In-cab Control Box screen remains blank.	Vehicle ignition switch is not on	Turn vehicle ignition switch on.
	Blown FP power ignition fuse.	Check FP power ignition fuse (100A in 12V units; 60A in 24V units), located near vehicle battery. Replace, if necessary.
	Dead or disconnected vehicle battery.	Service vehicle battery.
	Defective or disconnected In-cab Control Box	Verify that cable is connected between PCB 1 in the ECM and the In-cab Control Box.
	No voltage in BAT (pin A7, connector C-1) and/or 03 (pinA8, connector C-1) in the ECM, even with the ignition on.	Check continuity between ECM side and battery side. If no continuity, repair wiring.
	Loose or disconnected printed circuit board connector.	Check connectors C1 and C2 on PCB 1 to ensure they are securely attached
	Defective microprocessor or printed circuit board.	Replace In-cab Control Box. Setup replacement In-cab Control Box in accordance with *Service Procedure A04A.*

UNIT WILL NOT OPERATE - BATTERY DRIVEN (B-100) (continued)

Symptom	Cause	Corrective Action
Unit does not operate but In-cab Control Box screen remains lit.	Blown FP power ignition fuse.	Check FP power ignition fuse (100A in 12V units; 60A in 24V units), located near vehicle battery. Replace, if necessary.
	Loose or disconnected printed circuit board connector.	Check connectors C1 and C2 on PCB 1 to ensure they are securely attached.
	No voltage in RM relay connector 30.	Check FP power ignition fuse (100A in 12V units; 60A in 24V units) and RM relay. Replace, if necessary.
	Defective microprocessor or printed circuit board.	Replace in-Cab Control Box or PCB 1. Setup replacement printed circuit board in accordance with *Service Procedure A04A.*

UNIT NOT COOLING - BATTERY DRIVEN (B-100)

Symptom	Cause	Corrective Action
Compressor does not operate.	Vehicle not operating or unit not turned on.	Start vehicle and turn unit on. Make sure setpoint and load compartment temperature requires a Cool or Heat mode.
	Blown FP power ignition fuse.	Check FP power ignition fuse (100A in 12V units; 60A in 24V units), located near vehicle battery. Replace, if necessary.
	Discharge pressure is above HPCO value or the Low Pressure Cut-Out switch is open.	Verify that the discharge pressure is under the HPCO value, and that the Low Pressure Cut-Out switch is closed.
	Defective wiring harness or a loose connector for RM circuit.	Check RM circuit wiring and connections.
	Defective microprocessor or printed circuit board.	Replace PCB 1. Setup replacement printed circuit board in accordance with *Service Procedure A04A.*
	Blown F5 fuse.	Check power F5 fuse (20A for 12V units; 10A for 24V units) located on PCB 1.

UNIT NOT COOLING - BATTERY DRIVEN (B-100) (continued)

Symptom	Cause	Corrective Action
Compressor does not operate (continued).	Refrigeration system problem	Check refrigeration system. Check refrigerant level
	Faulty compressor.	Determine if the compressor is defective. Replace, if necessary. Use procedure shown in *Direct Drive Units (DSR) Maintenance Manual TK 52979-18-BD. Chapter B-100 10/20*
	Defective DC power supply.	Check brushes and replace, as applicable. Determine if DC power supply is defective and replace, if necessary. Use procedure shown in *Direct Drive Units (DSR) Maintenance Manual TK 52979-18-BD. Chapter B-100 10/20*
	DC power belt incorrectly mounted or defective.	Test DC motor belt and replace, if necessary. Use procedure shown in *Direct Drive Units (DSR) Maintenance Manual TK 52979-18-BD. Chapter B-100 10/20*

UNIT WILL NOT DEFROST - BATTERY DRIVEN (B-100)

Symptom	Cause	Corrective Action
Unit does not defrost.	Vehicle not running or unit not turned on.	Start vehicle and turn unit on.
	Initiate a manual defrost cycle using the Main Menu.	Press the Select key until [dEF] is briefly displayed on screen. The defrost icon should appear. Accordingly, press the Enter key, then the Up or Down arrow key, to change settings. This will change the defrost setting in 1-degree Celsius increments.
	Defrost Initiation Time [dit] is not set or set incorrectly.	In the Installation (Guarded Access) Menu, scroll to the [dit] parameter screen. Check if setting (factory default = 240 minutes) is too short or too long between defrost initiation cycles. Change time settings, as required.
	Defrost klixon (DK) wire 12 not connected to the ECM (at pin C1, connector C-1).	Check wiring and connector and make sure that DK wire 12 is securely connected.
	Defrost klixon (DK) is defective	Check klixon for defects. Replace klixon, as required.

UNIT WILL NOT DEFROST - BATTERY DRIVEN (B-100) (continued)

Symptom	Cause	Corrective Action
Compressor is running; hot gas solenoid is not energised.	Hot gas solenoid F5 fuse blown.	Check hot gas solenoid F5 fuse (20A for 12V units, 10A for 24V units), located on PCB 1. Check hot gas solenoid coil for short circuit to ground.
	Loose or defective wire 26 to hot gas solenoid.	Check wire 26 to the hot gas solenoid, PS1. Check pin connections at PCB 1 connector C-2, pin 8 for crimps or loose connections.
	Defective hot gas solenoid, PS1.	Check hot gas solenoid PS1 for proper operation.
	Open hot gas solenoid	Test hot gas solenoid coil continuity. See *Service Procedure H04A.*
	No output voltage to hot gas solenoid (wire 26)	Check wire 26. Replace PCB 1, as required.
Compressor is running, hot gas valve is energised, but unit is not defrosting.	Refrigeration system problem.	Check refrigeration system.
	Evaporator fan is locked in ON position.	Check EFM evaporator fan operating hours. Check [EFc] evaporator fan constant blow parameter in Installation (Guarded Access) Menu. Change the parameter setting On to Off, which causes the evaporator fan to alternate between On and Off positions with Cool, Heat, and Null mode changes.

EVAPORATOR FAN WILL NOT OPERATE - BATTERY DRIVEN (B-100)

The unit is equipped with 1 evaporator fan. This fan operates in Cool, Heat and Null modes (if evaporator fan constant blow [EFc] function is set to [on].

Symptom	Cause	Corrective Action
Evaporator fan should be running but is not.	Vehicle not running or unit not turned on.	Start vehicle and turn unit on. Make sure conditions require evaporator fans to be operating.
	Blown FP power ignition fuse.	Check FP power ignition fuse (100A in 12V units; 60A in 24V units), located near vehicle battery. Replace, if necessary.
	Defective wiring harness or a loose connector for EFM circuit.	Check EFM circuit wiring and connections
	Defective evaporator fan relay on PCB 1.	Replace PCB 1.
	Evaporator fan F3 fuse blown on PCB1.	Check 15A/12V or 10A/24V evaporator fan F3 fuse, located on the printed circuit board. Check EFM evaporator fan Electric Standby motor for short circuit to ground.
	Electric Standby evaporator fan motor open.	Check Electric Standby evaporator fan motor continuity. See *Service Procedure H04A.*
	Loose or defective EFM circuit to Electric Standby evaporator fan motor.	Check Electric Standby evaporator fan motor EFM circuit.
	Defective microprocessor.	Replace PCB 1.

CONDENSER FAN WILL NOT OPERATE - BATTERY DRIVEN (B-100)

The unit is equipped with 1 condenser fan. This fan operates in Cool mode when the condenser fan pressure switch is closed.

Symptom	Cause	Corrective Action
Condenser fan should be running but is not.	Vehicle not running or unit not turned on.	Start vehicle and turn unit on. Make sure conditions require condenser fans to be operating.
	Blown FP power ignition fuse.	Check FP power ignition fuse (100A in 12V units; 60A in 24V units), located near vehicle battery. Replace, if necessary.
	Defective wiring harness or loose connectors for CF1 circuit.	Check CF1 circuit wiring and connections

CONDENSER FAN WILL NOT OPERATE - BATTERY DRIVEN (B-100) (continued)

Symptom	Cause	Corrective Action
Condenser fan should be running but is not (continued).	Discharge pressure is greater than CFP (180 psi) but fan is not energised.	Enter cab control information Menu and display HP value; test that pressure reading is correct, using gauge. Check refrigeration system and replace high pressure transducer, if applicable.
	Defective RY6 condenser fan relay on PCB 1. (See unit wiring diagram for the correct relay number or see *System Relays* table in Section 2.)	Replace PCB 1.
	Defective microprocessor.	Replace PCB 1.
	Condenser fan F2 fuse blown on PCB1. See electric schematic for the unit or *Sizes and description of fuses located on printed circuit board 1 (PCB1) or printed circuit board 2 (PDB 2)* table in Section 2.	Check PCB 1 15A/12V or 10A/24V condenser fan F2 fuse, respectively. Test Electric Standby condenser fan motor for short circuit to ground.
	Condenser fan motor capacitor circuit open.	Check Electric Standby CFM condenser fan motor continuity. See *Service Procedure H04A.*
	Defective wiring harness or loose connectors for CF1 circuit.	Check CF1 circuit wiring and connections

UNIT WILL NOT OPERATE - ELECTRIC STANDBY POWER (except B-100 20)

Symptom	Cause	Corrective Action
Unit will not operate on Electric Standby power and the In-cab Control Box display remains blank.	Unit not connected to Standby power or Standby power is turned off.	Connect power cord. Verify that the Electric Standby power is turned on and is the correct voltage.
	Blown transformer primary fuse F20.	Check transformer primary fuse F20 (5A for 12V and 24V units).

UNIT WILL NOT OPERATE - ELECTRIC STANDBY POWER (except B-100 20) (continued)

Symptom	Cause	Corrective Action
Unit will not operate on Electric Standby power and the In-cab Control Box display remains blank. (continued).	Defective bridge rectifier.	Check the bridge rectifier, using a digital multimeter. See the schematic diagram for the voltage requirements at the 12V or 24V bridge connections.
	Defective step-down transformer.	Check transformer continuity. See *Service Procedure H04A*.
	Defective voltage in the X1 and X4 wires (pins B8 and C8, connector C-1)	Determine if the voltage at X1 and X4 is 12 Vac or 24 Vac.
	Pins X1 and X4 are misaligned or fit incorrectly on connector C-1	Examine the terminals. Bend the pins into alignment or replace the connector, as necessary.
	Defective or disconnected In-cab Control Box	Verify cable is connected at the ECM and the In-cab Control Box.
	Loose or disconnected PCB 1 and/or PCB 2 connector.	Check connectors C-1 and C-2 on PCB 1 and/or PCB 2 to be sure they are attached securely.
	Defective ECM	Replace the ECM.
Unit will not operate on Electric Standby power but In-cab Control Box turns on.	Defective Electric Standby power pack or circuitry	Check Electric Standby relay STDR for functioning. Check the connection of wire 2RA between STDR and battery terminal board TB.
	Defective In-cab Control Box microprocessor, or PCB 1 and/or PCB 2.	Check the C1R relay. Replace the In-cab Control Box or PCB 1 and/or PCB 2.

UNIT NOT COOLING - ELECTRIC STANDBY POWER (except B-100 20)

Symptom	Cause	Corrective Action
Electric Standby motor is not running, compressor clutch does not engage.	Power cord not plugged in or unit not turned on.	Connect the power cord and turn the unit on. Make sure that the setpoint and load compartment temperature requires Cool mode.
	Defective bridge rectifier.	Check the bridge rectifier, using a digital multimeter.

UNIT NOT COOLING - ELECTRIC STANDBY POWER (except B-100 20) (continued)

Symptom	Cause	Corrective Action
Electric Standby motor is not running, compressor clutch does not engage (continued).	Defective step-down transformer	Check the continuity of the transformer. See Service Procedure H04A, *Checking Harness Continuity*.
	Blown transformer fuse	Check transformer fuse F20.
	Defective electric relay STDR	Check electric relay STDR, located in the Electric Standby power pack.
	Discharge pressure above the HPCO value, or Low Pressure Cut-Out switch is open	Verify that the discharge pressure is below the HPCO value and that the LPCO is closed.
	Defective wiring harness or loose connector for the CLU2 circuit.	Check wiring and connections for the CLU2 circuit.
	Defective wiring harness or a loose connector for the CMC circuit	Inspect the wiring and connections for the CMC circuit.
	Defective microprocessor or printed circuit board(s).	Replace the PCB 1 and/or PCB 2. Setup the replacement printed circuit board in accordance with *Service Procedure A04A*.
Electric Standby motor is running, compressor clutch does not engage. ***NOTE: It can take 15 seconds or more after the Electric Standby motor starts for the Electric Standby clutch to become energized.***	Open Electric Standby compressor clutch coil or defective clutch.	Check the continuity of the Electric Standby compressor clutch coil. See *Service Procedure H04A*.
	Defective wiring harness or loose connector for CLU2 circuit	Inspect the wiring and connector for the CLU2 circuit.

UNIT NOT COOLING - ELECTRIC STANDBY POWER (except B-100 20) (continued)

Symptom	Cause	Corrective Action
Electric Standby motor is running, compressor clutch does not engage (continued). ***NOTE: It can take 15 seconds or more after the Electric Standby motor starts for the Electric Standby clutch to become energized.***	Loose or defective 2RA circuit to the Electric Standby motor contactor.	Check the 2RA circuit to the Electric Standby motor contactor.
Electric Standby motor is not running, and the compressor clutch does engage.	Open Compressor Motor Contactor (CMC).	Check continuity on the CMC at wires L1/T1A and L2/T2A for single-phase units, and at wires L1/T1B, L2/T2B, and L3/T3B for 3-phase units. See *Service Procedure H04A*.
	Open or defective L1, L2, and/or L3 wire to the CMC.	Check that wiring is connected. Check wires L1, L2, and/or L3 for shorts, abrasions, or damage.
	Defective CMC wire connection from the ECM (pin B1, connector C-1)	Inspect pin B1 at connector C-1 on the ECM. Check for bent or missing pin. Replace connector C-1, as necessary.
	Electric Standby motor overload relay OLR has tripped.	Turn unit off, allow overload relay to cool and turn the unit back on to reset the overload relay. Check motor operation to determine cause for overload relay tripping.
Electric Standby compressor clutch is engaged, but the unit is not cooling.	There is a problem with the refrigeration system.	Check the Return Air Temperature sensors and setpoint, check the refrigerant level, check the evaporator and condenser for obstructions or not-functioning valves.

UNIT NOT HEATING - ELECTRIC STANDBY POWER

Symptom	Cause	Corrective Action
Electric Standby motor is not running, compressor clutch does not engage.	Power cord not plugged in or unit not turned on.	Connect the power cord and turn the unit on. Make sure that the setpoint and load compartment temperature requires Heat mode.

UNIT NOT HEATING - ELECTRIC STANDBY POWER (continued)

Symptom	Cause	Corrective Action
Electric Standby motor is not running, compressor clutch does not engage (continued).	Defective bridge rectifier.	Check the bridge rectifier, using a digital multimeter.
	Defective step-down transformer	Check the continuity of the transformer. See *Service Procedure H04A*.
	Blown transformer fuse	Check transformer fuse F20.
	Defective electric relay STDR	Check electric relay STDR, located in the Electric Standby power pack.
	Discharge pressure above the HPCO value, or Low Pressure Cut-Out switch is open	Verify that the discharge pressure is below the HPCO value and that the LPCO is closed.
	Defective wiring harness or loose connector for the CLU2 circuit.	Check wiring and connections for the CLU2 circuit.
	Defective wiring harness or a loose connector for the CMC circuit	Inspect the wiring and connections for the CMC circuit.
	Defective microprocessor or printed circuit board(s).	Replace the PCB 1 and/or PCB 2. Setup the replacement printed circuit board in accordance with *Service Procedure A04A*.
Electric Standby motor is running, compressor clutch does not engage. ***NOTE: It can take 15 seconds or more after the Electric Standby motor starts for the Electric Standby clutch to become energized.***	Open Electric Standby compressor clutch coil or defective clutch.	Check the continuity of the Electric Standby compressor clutch coil. See *Service Procedure H04A*.

UNIT NOT HEATING - ELECTRIC STANDBY POWER (continued)

Symptom	Cause	Corrective Action
Electric Standby motor is running, compressor clutch does not engage (continued). ***NOTE: It can take 15 seconds or more after the Electric Standby motor starts for the Electric Standby clutch to become energized.***	Defective wiring harness or loose connector for CLU2 circuit	Inspect the wiring and connector for the CLU2 circuit.
	Loose or defective 2RA circuit to the Electric Standby motor contactor.	Check the 2RA circuit to the Electric Standby motor contactor.
Electric Standby motor is not running, and the compressor clutch does engage.	Open Compressor Motor Contactor (CMC).	Check continuity on the CMC at wires L1/T1A and L2/T2A for single-phase units, and at wires L1/T1B, L2/T2B, and L3/T3B for 3-phase units. See *Service Procedure H04A*.
	Open or defective L1, L2, and/or L3 wire to the CMC.	Check that wiring is connected. Check wires L1, L2, and/or L3 for shorts, abrasions, or damage.
	Defective CMC wire connection from the ECM (pin B1, connector C-1)	Inspect pin B1 at connector C-1 on the ECM. Check for bent or missing pin. Replace connector C-1, as necessary.
	Electric Standby motor overload relay OLR has tripped.	Turn unit off, allow overload relay to cool and turn the unit back on to reset the overload relay. Check motor operation to determine cause for overload relay tripping.
Electric Standby compressor clutch is engaged, but the unit is not heating.	There is a problem with the refrigeration system.	Check the Return Air Temperature sensors and setpoint, check the refrigerant level, check the evaporator and condenser for obstructions or not-functioning valves.
	Check the parameters map	Download the suitable parameters map

UNIT WILL NOT DEFROST - ELECTRIC STANDBY POWER (except B-100 20)

Symptom	Cause	Corrective Action
Unit does not defrost.	Power cord not plugged in or unit not turned on.	Connect power cord and turn unit on.
	Initiate a manual defrost cycle using the Select and Enter Keys.	Press the Select key until the display briefly shows [dEF]. The defrost icon should appear. As desired, press the Enter key, then the Up or Down arrow key, to change the defrost setting in 1-degree Celsius increments.
	Defrost Initiation Time [dit] is not set or set to an incorrect time.	In the Installation (Guarded Access) Menu, scroll to the [dit] parameter screen. Check if the time (factory default = 240 minutes) is too short or too long between defrost initiation cycles. Change the time setting, as required.
	For units with older versions of software revision 121 21: The unit has been switched off using the vehicle key.	Switch off the unit with the Direct Smart Reefer, before switching off the vehicle.
	Electric standby compressor clutch must be energized and compressor must be operating.	If electric standby compressor clutch is not energized, troubleshoot as shown in the diagnostics section entitled *UNIT NOT COOLING - ELECTRIC STANDBY POWER (except B-100 20).*
	Defrost klixon (DK) wire 12 is not connected to the ECM (pin C1, connector C-1)	Inspect the wiring and the terminals. Make sure that DK wire 12 is securely connected.
	Klixon DK is defective	Replace klixon DK.
Compressor is running, hot gas solenoid is not energized.	Defective step-down transformer.	Check transformer continuity. See *Service Procedure H04A*.
	Defective wiring harness or loose connector for 26 circuit.	Check wiring and connections for the 26 circuit.
	Defective microprocessor at PCB 1 and/or PCB 2.	Replace PCB 1 and/or PCB 2.

UNIT WILL NOT DEFROST - ELECTRIC STANDBY POWER (except B-100 20) (continued)

Symptom	Cause	Corrective Action
Compressor is running, hot gas solenoid is not energized (continued).	Blown host hot gas solenoid fuse F5 or remote hot gas solenoid fuse F8.	Check host hot gas solenoid fuse F5 on PCB 1, and/or remote hot gas solenoid fuse F8 on PCB 2. Check hot gas solenoid coil for short to ground. If present, check defrost drain heaters for short to ground.
	Open hot gas solenoid coil.	Check continuity of hot gas solenoid coil. See *Service Procedure H04A*.
	Defective hot gas solenoid.	Check hot gas solenoid PS1 (host) or PS4 (remote) for proper operation.
	Loose or defective 26 circuit to hot gas solenoid.	Check the 26 circuit to hot gas solenoid PS1 (on PCB 1), or the 28 circuit to hot gas solenoid PS4 (on PCB 2).
Compressor is running, hot gas valve is energized but unit is not defrosting.	Refrigerant system problem.	Check refrigerant system.
	Evaporator fan(s) stuck on.	Check operation of evaporator fans EF1 and EF2. Check the [EFc] Evaporator Fans Constant Blow parameter at the Super Guarded Access Menu. Change the parameter setting from On to Off (changing to Off causes the evaporator fans to cycle on/off with Cool, Heat, and Null mode changes)

CONDENSER FANS DO NOT OPERATE - ELECTRIC STANDBY POWER (except B-100 20)

The unit is equipped with 1 or 2 condenser fans. These fans operate in cool mode when the condenser fan pressure switch is closed

Symptom	Cause	Corrective Action
Condenser fans should be running but are not.	Power cord not plugged in or unit not turned on.	Connect power cord and turn unit on. Be sure conditions require condenser fans to be operating.
	Blown transformer primary fuse F20.	Check 5A transformer primary fuse, located at wire H1B to the transformer.
	Defective bridge rectifier.	Check bridge rectifier, using a digital multimeter. See the schematic diagram for the voltage requirements at the 12V or 24V bridge connections.
	Defective step-down transformer.	Check the continuity of the transformer. See *Service Procedure H04A*.
	Discharge pressure is greater than CFP (180 psi) but fan is not energised.	Enter cab control information Menu and display HP value; test that pressure reading is correct, using gauge. Check refrigeration system and replace high pressure transducer, if applicable.
	Defective condenser fan relay RY6 or RY9 on PCB 1, or RY10 on PCB 2. (See the unit's wiring diagram for the correct relay number, or see the table in Section 2 entitled *System Relays*.	Replace PCB1 or PCB 2.
	Defective microprocessor.	Replace PCB1 and/or PCB2
	Blown condenser fan fuses F2 or F6 on PCB1, and/or F7 on PCB 2. (See the applicable electric schematic for the unit, or the table in Section 2 entitled *Fuse Sizes and Descriptions: Located on Printed Circuit Board 1 (PCB 1) or Printed Circuit Board 2 (PCB 2)*	Check the 15A/12V or 10A/24V condenser fan fuses F2 and F6 on PCB 1, and/or F7 on PCB 2. Check the condenser fan motors for short to ground.

CONDENSER FANS DO NOT OPERATE - ELECTRIC STANDBY POWER (except B-100 20) (continued)

The unit is equipped with 1 or 2 condenser fans. These fans operate in cool mode when the condenser fan pressure switch is closed

Symptom	Cause	Corrective Action
Condenser fans should be running but are not (continued).	Open condenser fan motors.	Check continuity of condenser fan motors. See *Service Procedure H04A*.
	Loose or defective CF1-02 and CF2-02 circuits to condenser fan motors.	Check the CF1-02 circuit (for units with a single condenser fan) and the CF2-02 circuit (for units with two condense fans) to condenser fan motors CFM1 and/or CFM2.
For V-400/V-500 units only: only one condenser fan is operating.	The microprocessor has been programmed for the wrong unit.	Check the DSR microprocessor parameters. As necessary, reprogram the microprocessor, using *Service Procedure A04A*.

EVAPORATOR FANS DO NOT OPERATE - ELECTRIC STANDBY POWER (except B-100 20)

Symptom	Cause	Corrective Action
Evaporator fans should be running but are not.	Power cord not plugged in or unit not turned on.	Connect power cord and turn unit on. Be sure conditions require condenser fans to be operating.
	Blown transformer primary fuse F20.	Check 5A transformer primary fuse, located at wire H1B to the transformer.
	Defective bridge rectifier	Check bridge rectifier, using a digital multimeter. See the schematic diagram for the voltage requirements at the 12V or 24V bridge connections.
	Defective step-down transformer.	Check the continuity of the transformer. See *Service Procedure H04A*.
	Defective wiring harness or loose connector for EF1 or EF 2 circuits	Check wiring and connections for EF1 and EF2 circuits.
	Defective evaporator fan relays on PCB 1	Replace PCB 1.
	Blown evaporator fan fuse F3 and F4 on PCB1 (fuse F9 on PCB 2 is for units with evaporator fan EF3)	Check 15A/12V or 10A/24V evaporator fan fuses F3 and F4 (and F9), located on the printed circuit board. Check evaporator fan motors EFM1 and EFM2 for short to ground. For units with EF3, check evaporator fan motor EFM3 for short to ground.

EVAPORATOR FANS DO NOT OPERATE - ELECTRIC STANDBY POWER (except B-100 20) (continued)

Symptom	Cause	Corrective Action
Evaporator fans should be running but are not (continued).	Open evaporator fan motors	Check the continuity of the evaporator fan motors. *Service Procedure H04A*.
	Loose or defective EF1, EF2, or EF 3 circuit to the evaporator fan motors	Check the EF1, EF2, or EF3 circuit to the evaporator fan motors.
	Defective microprocessor	Replace PCB 1 and/or PCB 2.
In vehicles with 2 zones (compartments), or vehicles with V-400/V-500 units, not all of the evaporator fans are operating.	The microprocessor has been programmed for the wrong unit.	Check the DSR microprocessor parameters.

UNIT WILL NOT OPERATE - ELECTRIC STANDBY POWER (B-100 20 only)

Symptom	Cause	Corrective Action
Unit will not operate on Electric Standby power and In-cab Control Box display remains blank.	Unit not connected to Standby power or Standby power is turned off.	Connect power cord. Verify that the Electric Standby power is turned on and is at correct voltage.
	AC/DC SMPS power supply does not operate.	Check voltage between AC/DC SMPS power supply V+ and V- posts (12 VDC for 12V units, 24 VDC for 24V units). Replace power supply, if necessary. Check for short circuit between X1, X4, 2RB wires and chassis. AC/DC SMPS power supply has an auto-protection mechanism that turns off supply in case of short circuit or overload.
	Defective voltage in the X1 and X4 wires (pins B8 and C8, connector C-1)	Determine if the voltage at X1 and X4 is 12 VDC or 24 VDC.
	X1 and X4 pins are misaligned or incorrectly fitted on connector C-1	Examine the terminals. Bend pins into alignment or replace the connector, if necessary.
	Defective or disconnected In-cab Control Box	Verify cable is connected at the ECM and the In-cab Control Box.

UNIT WILL NOT OPERATE - ELECTRIC STANDBY POWER (B-100 20 only) (continued)

Symptom	Cause	Corrective Action
Unit will not operate on Electric Standby power and In-cab Control Box display remains blank (continued).	Loose or disconnected PCB1 connector	Check connectors C-1 and C-2 on PCB1 to ensure they are securely attached
	Defective ECM	Replace ECM.
Unit will not operate on Electric Standby power but In-cab Control Box turns on.	Defective Electric Standby power pack or circuitry	Check Electric ER1 Standby relay is operating. Check 2RB wire connection between ER1 and SMPS AC/DC power supply.
	Defective In-cab Control Box microprocessor or PCB 1.	Check PC connection between ER1 and PCB1. Replace In-cab Control Box or PCB 1.

UNIT NOT COOLING - ELECTRIC STANDBY POWER (B-100 20 only)

Symptom	Cause	Corrective Action
AC motor fails to run.	Power cord not plugged in or unit not turned on.	Connect the power cord and turn the unit on. Make sure that the setpoint and load compartment temperature requires Cool mode.
	AC/DC SMPS power supply does not operate.	Check voltage between AC/DC SMPS power supply V+ and V- posts (12 VDC for 12V units, 24 VDC for 24V units). Replace power supply, if necessary. Check for short circuit between X1, X4, 2RB wires and chassis. AC/DC SMPS power supply has an auto-protection mechanism that turns off supply in case of short circuit or overload.
	Defective electric ER1 relay.	Check electric ER1 relay, located in the Electric Standby power pack.
	Defective Starter Assembly.	Check SR relay starter as well as CR and CS condensers.
	Discharge pressure is above HPCO value or the Low Pressure Cut-Out switch is open.	Verify that the discharge pressure is below the HPCO value and that the LPCO is closed.

UNIT NOT COOLING - ELECTRIC STANDBY POWER (B-100 20 only) (continued)

Symptom	Cause	Corrective Action
AC motor fails to run. (continued).	Defective CMC Compressor Motor Contactor.	Check CMC circuit wiring and connections, replace contactor, if necessary.
	Defective microprocessor or printed circuit board(s).	Replace PCB. Setup replacement printed circuit board in accordance with Service Procedure A04A.
	Defective AC motor.	Determine if AC motor is defective and replace, if necessary. Use procedure shown in *Direct Drive Units (DSR) Maintenance Manual TK 52979-18-BD. Chapter B-100 10/20*
	Electric Standby motor overload relay OLR has tripped.	Turn unit off, allow overload relay to cool and turn unit back on to reset overload relay. Check Electric Standby motor operation to determine cause for overload relay tripping.
AC motor runs, but unit fails to refrigerate.	Refrigeration system problem.	Check return air temperature sensors and setpoint, refrigerant level, evaporator and condenser for obstructions or non-operating valves.
	Faulty compressor.	Determine if compressor is defective. Replace, if necessary. Use procedure shown in the *Direct Drive Units (DSR) Maintenance Manual TK 52979-18-BD. Chapter B-100 10/20*
	Defective DC power supply.	Check brushes and replace, if applicable. Determine if DC power supply is defective and replace, if necessary. Use procedure shown in *Direct Drive Units (DSR) Maintenance Manual TK 52979-18-BD. Chapter B-100 10/20*
	DC power belt incorrectly mounted or defective.	Test DC power supply belt and replace, if necessary. Use procedure shown in *Direct Drive Units (DSR) Maintenance Manual TK 52979-18-BD. Chapter B-100 10/20*

UNIT WILL NOT DEFROST - ELECTRIC STANDBY POWER (B-100 20 only)

Symptom	Cause	Corrective Action
Unit does not defrost.	Power cord not plugged in or unit not turned on.	Connect the power cord and turn the unit on.

UNIT WILL NOT DEFROST - ELECTRIC STANDBY POWER (B-100 20 only) (continued)

Symptom	Cause	Corrective Action
Unit does not defrost (continued).	Initiate a manual defrost cycle using the Select and Enter Keys.	Press the Select key until [dEF] is briefly displayed on screen. The defrost icon should appear. Accordingly, press the Enter key, then the Up or Down arrow key, to change settings. This will change the defrost setting in 1-degree Celsius increments.
	Defrost Initiation Time [dit] is not set or set incorrectly.	In the Installation (Guarded Access) Menu, scroll to the [dit] parameter screen. Check if setting (factory default = 240 minutes) is too short or too long between defrost initiation cycles. Change the time setting, as required.
	Defrost klixon (DK) wire 12 is not connected to ECM (pin C1, connector C-1)	Check wiring and terminals. Make sure the DK cable 12 is securely connected.
	Klixon DK is defective	Replace klixon DK.
Compressor is running; hot gas solenoid is not energised.	AC/DC SMPS power supply does not operate.	Check voltage between AC/DC SMPS power supply V+ and V- posts (12 VDC for 12V units, 24 VDC for 24V units). Replace power supply, if necessary. Check for short circuit between X1, X4, 2RB wires and chassis. AC/DC SMPS power supply has an auto-protection mechanism that turns off supply in case of short circuit or overload.
	Defective microprocessor in PBC 1.	Replace PCB 1.
	Hot gas solenoid F5 fuse blown.	Check host hot gas solenoid F5 fuse on PCB 1. Check hot gas solenoid coil for short circuit to ground.
	Open hot gas solenoid coil.	Check gas solenoid coil continuity. See *Service Procedure H04A.*
	Defective hot gas solenoid.	Check hot gas solenoid PS1 (host) for proper operation.

UNIT WILL NOT DEFROST - ELECTRIC STANDBY POWER (B-100 20 only) (continued)

Symptom	Cause	Corrective Action
Compressor is running; hot gas solenoid is not energised (continued).	Loose or defective 26 circuit to hot gas solenoid.	Check circuit 26 to the hot gas solenoid, PS1 (on PCB 1).
Compressor is running, hot gas valve is energised, but unit is not defrosting.	Refrigerant system problem.	Check refrigerant system.
	Evaporator fan is locked in ON position.	Check EFM evaporator fan operating hours. Check [EFc] evaporator fan constant blow parameter at the Installation (Guarded Access) Menu. Change the parameter setting On to Off, which causes the evaporator fan to change the operation of Cool, Heat, and Null modes.

CONDENSER FAN WILL NOT OPERATE - ELECTRIC STANDBY POWER (B-100 20 only)

The unit is equipped with 1 condenser fan. The fan runs in cooling mode when the condenser fan pressure switch is closed.

Symptom	Cause	Corrective Action
Condenser fan should be running but is not.	Power cord not plugged in or unit not turned on.	Connect the power cord and turn the unit on. Make sure conditions require condenser fans to be operating.
	Discharge pressure is greater than CFP (180 psi) but fan is not energised.	Enter cab control information Menu and display HP value; test that pressure reading is correct, using gauge. Check refrigeration system and replace high pressure transducer, if applicable.
	AC/DC SMPS power supply does not operate.	Check voltage between AC/DC SMPS power supply V+ and V- posts (12 VDC for 12V units, 24 VDC for 24V units). Replace power supply, if necessary. Check for short circuit between X1, X4, 2RB wires and chassis. AC/DC SMPS power supply has an auto-protection mechanism that turns off supply in case of short circuit or overload.

CONDENSER FAN WILL NOT OPERATE - ELECTRIC STANDBY POWER (B-100 20 only) (continued)

The unit is equipped with 1 condenser fan. The fan runs in cooling mode when the condenser fan pressure switch is closed.

Symptom	Cause	Corrective Action
Condenser fan should be running but is not (continued).	Defective RY6 condenser fan relay on PCB 1. (See unit wiring diagram for the correct relay number or see *System Relays table in Section 2.)*	Replace PCB 1.
	Defective microprocessor.	Replace PCB 1.
	Condenser fan F2 fuse blown on PCB1. See electric schematic for the unit or *Sizes and description of fuses located on printed circuit board 1 (PCB1) or printed circuit board 2 (PDB 2)* table in Section 2.	Check PCB 1 15A/12V or 10A/24V condenser fan F2 fuse, respectively. Test Electric Standby condenser fan motor for short circuit to ground.
	Condenser fan motor capacitor circuit open.	Check continuity of condenser fan Electric Standby motors. See *Service Procedure H04A.*
	Defective wiring harness or loose CF1 circuit connectors.	Check CF1 circuit wiring and connections.
	Defective DC power supply.	Check brushes and replace, if applicable. Determine if DC power supply is defective and replace, if necessary. Use procedure shown in *Direct Drive Units (DSR) Maintenance Manual TK 52979-18-BD. Chapter B-100 10/20*
	DC power belt incorrectly mounted or defective.	Test DC power supply belt and replace, if necessary. Use procedure shown in *Direct Drive Units (DSR) Maintenance Manual TK 52979-18-BD. Chapter B-100 10/20*

EVAPORATOR FAN WILL NOT OPERATE - ELECTRIC STANDBY POWER (B-100 20 only)

Symptom	Cause	Corrective Action
Evaporator fan should be running but is not.	Power cord not plugged in or unit not turned on.	Connect the power cord and turn the unit on. Make sure conditions require condenser fans to be operating.

EVAPORATOR FAN WILL NOT OPERATE - ELECTRIC STANDBY POWER (B-100 20 only) (continued)

Symptom	Cause	Corrective Action
Evaporator fan should be running but is not (continued).	AC/DC SMPS power supply does not operate.	Check voltage between AC/DC SMPS power supply V+ and V- posts (12 VDC for 12V units, 24 VDC for 24V units). Replace power supply, if necessary. Check for short circuit between X1, X4, 2RB wires and chassis. AC/DC SMPS power supply has an auto-protection mechanism that turns off supply in case of short circuit or overload.
	Defective wiring harness or a loose EFM circuit connector	Check EFM circuit wiring and connections
	Defective evaporator fan relay on PCB 1.	Replace PCB 1.
	Evaporator fan F3 fuse blown on PCB1.	Check 15A/12V or 10A/24V evaporator fan F3 fuse, located on the printed circuit board. Check EFM evaporator fan Electric Standby motor for short circuit to ground.
	Electric Standby evaporator fan motor open.	Check Electric Standby evaporator fan motor continuity. See *Service Procedure H04A.*
	Loose or defective EFM circuit to Electric Standby evaporator fan motor.	Check evaporator fan Electric Standby EFM circuit.
	Defective microprocessor.	Replace PCB 1.
	Defective DC power supply.	Check brushes and replace, if applicable. Determine if DC power supply is defective and replace, if necessary. Use procedure shown in *Direct Drive Units (DSR) Maintenance Manual TK 52979-18-BD. Chapter B-100 10/20*
	DC power belt incorrectly mounted or defective.	Test DC power supply belt and replace, if necessary. Use procedure shown in *Direct Drive Units (DSR) Maintenance Manual TK 52979-18-BD. Chapter B-100 10/20*

IN-CAB AIR CONDITIONING DOES NOT WORK (V-500 AC only)

Symptom	Cause	Corrective Action
In-cab air conditioning does not cool.	Vehicle not running or unit not turned on.	Start vehicle and turn unit on.
	Unit is working in electric mode.	AC option is only operational in highway mode.
	In-cab air conditioning fan speed not selected.	Select a fan speed using the truck selector.
	AC system liquid solenoid valve not enabled.	Check the F8 fuse located in PCB2. Check the wiring (33A) between the PCB2 board (C-1,9) and the PS6 solenoid valve.
	The PCB1 board receives no signal through the AC-SW wire.	Check the wiring and that the DSR microprocessor is properly connected to the truck's AC module.
	The microprocessor has been programmed for the wrong unit.	Check the DSR microprocessor parameters. As necessary, reprogram the microprocessor by using *Maintenance Procedure A04A.*
	Regulation of the AC system KVP and KVL valves is incorrect.	Regulate the valves as described in Installation *Manual TK 60084-ML-18-IM and in the Maintenance Chapter of the V-500 AC 10/20.*
	Vehicle's AC module is defective.	Have an official brand dealer check the vehicle.

ERRATIC OPERATION

Symptom	Cause	Corrective Action
Intermittent or erratic operation of the microprocessor.	Loose printed circuit board connectors C-1 and/or C-2.	Check the C-1 and/or C-2 connectors on PCB 1 an/or PCB 2 to be sure that they are attached securely.
	Defective wiring harness.	Check wiring harness for damage. Verify all connections are secure.

ERRATIC OPERATION (continued)

Symptom	Cause	Corrective Action
Intermittent or erratic operation of the microprocessor (continued).	Loose or broken ground wires or connections.	Check all ground wires and connections. A common ground point is located next to the ECM.
	Defective microprocessor or printed circuit board(s)	Replace the In-cab Control Box or PCB1 and/or PCB 2.

Section 6
Service Procedures

MICROPROCESSOR PROCEDURES

Number	Procedure Title
A02A	Recording Existing Microprocessor Settings
A04A	Microprocessor Setup
A12A	ESD (Electrostatic Discharge) Procedures
A26A	Welding on Units Equipped with Microprocessors
A28A	Setting Unit Running Time Hourmeters

PRINTED CIRCUIT BOARD PROCEDURES

Number	Procedure Title
B02A	Printed Circuit Board Removal and Replacement

MISCELLANEOUS PROCEDURES

Number	Procedure Title
D01A	Return Air Temperature Sensor Test
F06A	3 Wire Magnetic Door Switch
H02A	Deutsch Connector Repair using Pigtail
H04A	Checking Harness Continuity
UH09A	Removal and Replacement of the Filter or Fan in an Electronic Control Module

Recording Existing Microprocessor Settings

Where Used

All units equipped with DSR μP Controller microprocessors and Revision 121 21 and 273 XX software.

Purpose

This procedure should be used to retrieve and record the current settings of a microprocessor. These settings will then be duplicated in the replacement microprocessor. This must be done prior to replacement of a microprocessor.

STEP	ACTION	RESULTS	COMMENTS
1			**NOTE:** It may not be possible to accomplish part or all of this process with a defective microprocessor. If not, the information must be obtained from customer records.
2	Obtain a copy of the Setup Sheet at the end of this procedure.		This copy will be used to record the information as it is retrieved.
3	Turn the unit on.	The Standard Display appears on the In-cab Control Box.	
4	Press the Select key once.	The Manual Defrost [dEF] screen appears.	Record the Manual Defrost setting on the Setup Sheet.
5	Press the Select key.	The Setpoint 1 [SP] screen appears.	Record the Setpoint 1 setting on the Setup Sheet.
6	Press the Select key.	The Setpoint 2 [SP2] screen appears.	Record the Setpoint 2 setting on the Setup Sheet.
7	Press the Select key.	The display returns to the Standard Display.	
8	Press and hold the Select key for 3 seconds.	The first Hourmeters Menu screen, Remaining Hours [HC] appears.	Record the [HC] setting on the Setup Sheet.
9	Press the Select key.	The Total Hours [tH] screen appears.	Record the [tH] setting on the Setup Sheet.
10	Press the Select key.	Vehicle compressor hours or in battery mode for B-100 unit [CC] display appears.	Record the [CC] setting on the Setup Sheet.
11	Press the Select key.	Electric Standby compressor hours or in Electric Standby mode for B-100 20 unit [EC] display appears.	Record the [EC] setting on the Setup Sheet.
12	Press the Select key.	The display returns to the Standard Display.	
13	Press and hold the Up Arrow and Enter keys for 3 seconds.	The Display Test (all icons) screen of the Information Menu appears.	
14		The Software Revision screen [121 XX or 273 XX] appears.	Record the [121 XX or 273 XX] setting on the Setup Sheet.

STEP	ACTION	RESULTS	COMMENTS
15		The Refrigerant Type [134] or [404] screen appears.	Record the [134] or [404] setting on the Setup Sheet.
16		The Battery Voltage [bAt] screen appears.	Record the [bAt] setting on the Setup Sheet.
17		The High Pressure [HP] screen appears.	Record the [HP] setting on the Setup Sheet.
18		The Compartments / Unit Type [xC/ tyy] screen appears.	Record the [xC / tyy] setting on the Setup Sheet.
19		The display returns to the Standard Display.	
20	Press and hold the Down Arrow and Enter keys for 3 seconds. NOTE: In some software versions, the setpoint temperature [SP] appears first.	The Setpoints Differential [diF] parameter screen of the Installation (Guarded Access) Menu appears.	Record the [diF] setting on the Setup Sheet.
21	Press the Down key.	The Soft Start Cycles [SSC] parameter screen appears.	Record the [SSC] setting on the Setup Sheet.
22	Press the Down key.	The Defrost Initiation Timer [dit] parameter screen appears.	Record the [dit] setting on the Setup Sheet.
23	Press the Down key.	The Defrost Termination Timer [dtt] parameter screen appears.	Record the [dtt] setting on the Setup Sheet.
24	Press the Down key.	The Evaporator Fans Constant Blow [EFc] parameter screen appears.	Record the [EFc] setting on the Setup Sheet.
25	Press the Down key.	The Out-of-Range Alarm [dAL] parameter screen appears.	Record the [dAL] setting on the Setup Sheet.
26	Press the Down key.	The Hour Counter Initial Value [HC] parameter screen appears.	Record the [HC] setting on the Setup Sheet.
27	Press the Down key.	The Door Switches Present/Polarity [dSP] parameter screen appears.	Record the [dSP] setting on the Setup Sheet.
28	Press the Down key.	The Buzzer Enable [bE] parameter screen appears.	Record the [bE] setting on the Setup Sheet.
29	Press the Down key.	The Thermostat Units [bu] parameter screen appears.	Record the [bu] setting on the Setup Sheet.
30	Press the Down key.	The Pressure Units [Pu] parameter screen appears.	Record the [Pu] setting on the Setup Sheet.
31	Press the Down key.	The display returns to the Standard Display.	All current microprocessor settings have been retrieved and recorded.

SETUP SHEET

SOFTWARE REVISION

ACCESS KEY	FUNCTION	STANDARD SETTING	RECORDED SETTING
Press "Up Arrow" + "Enter" and hold for 3 seconds.	Display Check	---	---
Software Revision appears automatically when Display Check is finished	[121 xx, 273 xx]	Software Revision	

HOURMETERS ACCESS

ACCESS KEY	FUNCTION	STANDARD SETTING	RECORDED SETTING
Press and hold "Select" key for 3 seconds	Hourmeters Menu		
"Select"	[HC]	accumulated hours	
"Select"	[tH]	accumulated hours	
"Select"	[CC]	accumulated hours	
"Select"	[EC]	accumulated hours	

INFORMATION MENU

ACCESS KEY	FUNCTION	STANDARD SETTING	RECORDED SETTING
Press "Up Arrow + "Enter" and hold for 3 seconds	Information Menu		
	[all icons]	---	
	[121 xx, 273 xx]	---	
	[134] or [404]	134 (for R-134a) or 404 (for R-404A)	
	[bAt]	Measured voltage (0-30V)	
	[HP]	Measured pressure (0 to 500 PSIG)	
	[xC / tyy]	x for the number of compartments; yy for unit type	

INSTALLATION (GUARDED ACCESS) MENU

ACCESS KEY	FUNCTION	STANDARD SETTING	RECORDED SETTING
Press and hold "Down Arrow" + "Enter" for 3 seconds	Installation Menu		
"Down"	[diF]	3 Celsius	
"Down"	[SSC]	Off	
"Down"	[dit]	240	
"Down"	[dtt]	45 (30 in B-100 only)	
"Down"	[EFc]	Off	
"Down"	[dAL]	0	

INSTALLATION (GUARDED ACCESS) MENU

ACCESS KEY	FUNCTION	STANDARD SETTING	RECORDED SETTING
"Down"	[dSP]	1 (normally open)	
"Down"	[HC]	150 [= 1500 hours]	
"Down"	[bE]	2 (enabled and when pressed)	
"Down"	[tu]	C (Celsius)	
"Down"	[Pu]	P (PSI)	

Microprocessor Setup (Programming the DSR Microprocessor)

Where

All units equipped with a DSR µP Controller microprocessor and revision 121 21 and 273 XX software.

Purpose

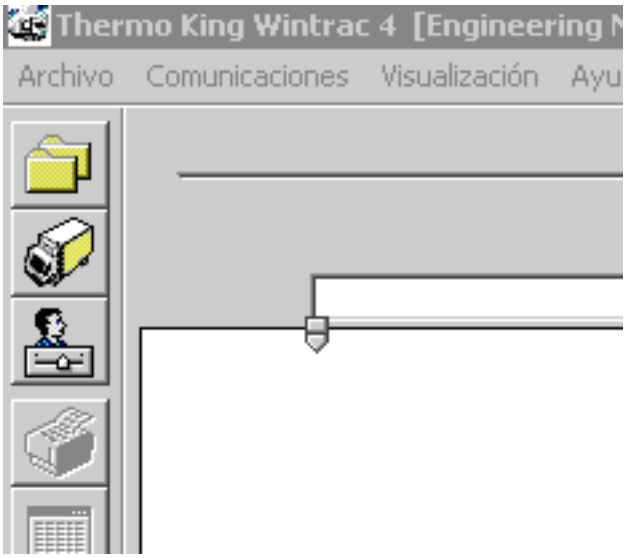
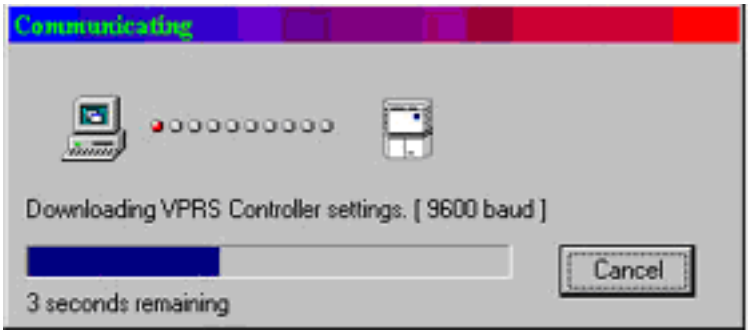
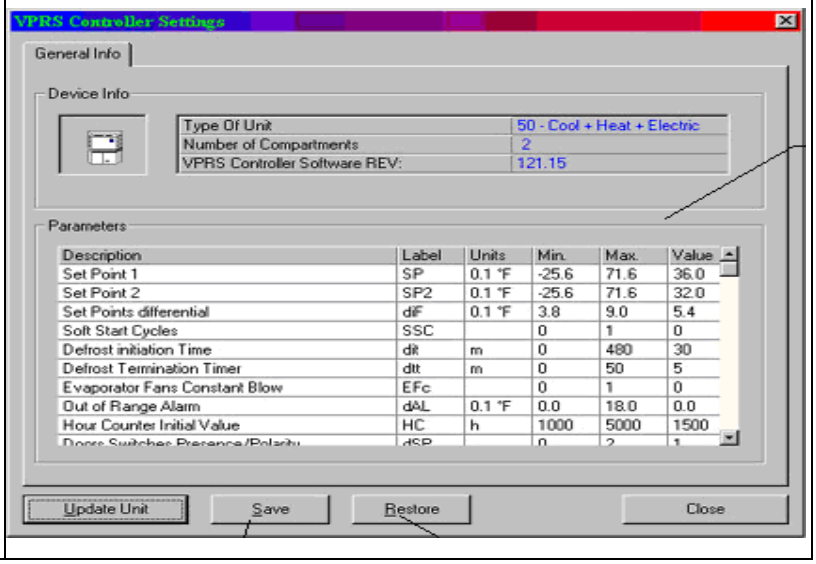
This procedure is used to program a DSR microprocessor.

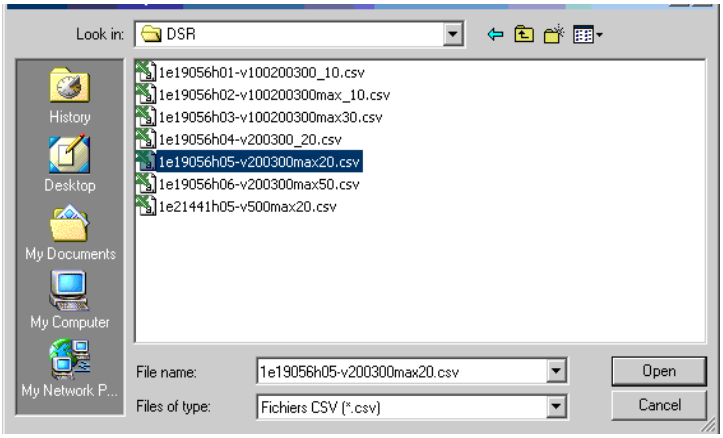
Required Tools

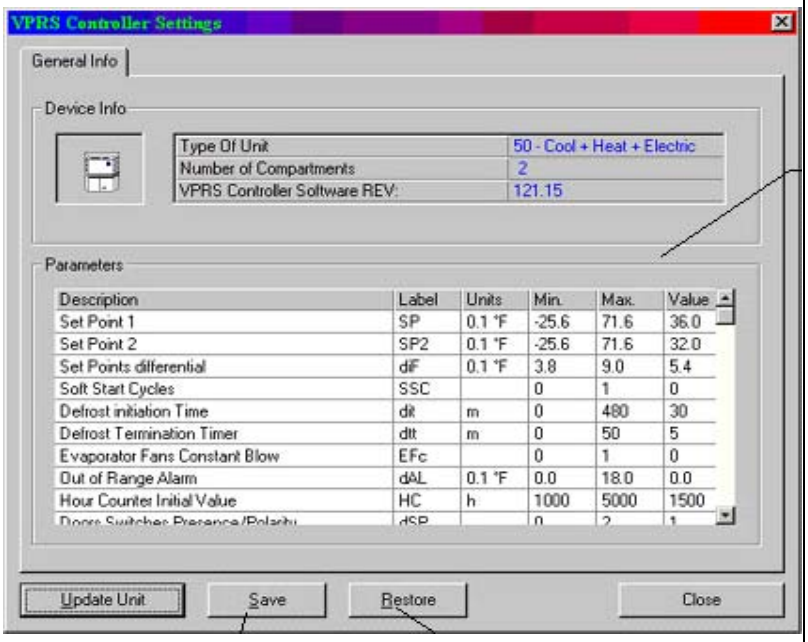
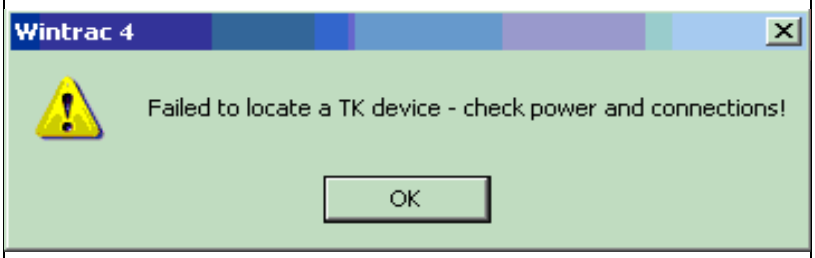
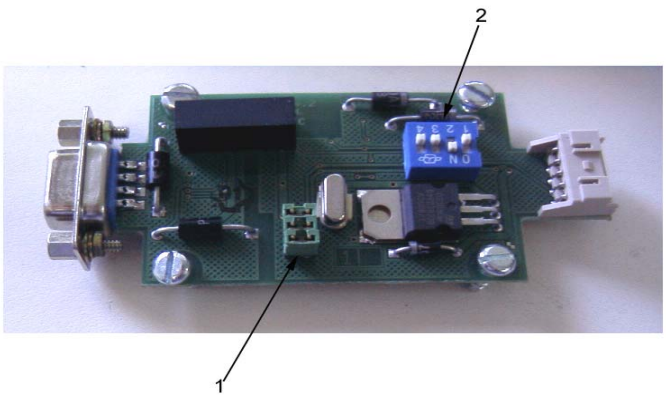
- A PC computer loaded with Wintrac 4.xx software
- Configuration files (downloaded from the Thermo King Information Central Intranet site)
- DSR interface cable, P/N 204-1126

For complete details of programmable features, see Section 3 of this manual.

STEP	ACTION	RESULTS	COMMENTS
Uploading the DSR Controller Software Files			
1	Obtain a completed copy of the Setup Sheet created with Service Procedure A02A.		This information on this Setup Sheet will be used to set up the DSR microprocessor.
2	At the PC computer, make sure that decimal point is set correctly for the "Regional Settings" of Windows.		Refer to the computer's system operators manual for guidance.
3	Access the Thermo King Information Central Intranet site by accessing <www.thermoking.com\iService>		
4	At infoCentral, access the Wintrac files by accessing the following path: European Served Area>TK Products>Direct Drive Units>Wintrac files for Direct Smart Reefer		
5	At the DSR, disconnect the In-cab Control Box from its cable connector.		
6	Connect cable 204-1126 to the In-cab Control Box and to the computer serial port: • Connect the small connector on cable 204-1126 to the computer serial port. • Connect the large connector on cable 204-1126 to the In-cab cable connector.		

STEP	ACTION	RESULTS	COMMENTS
7	Power-up the truck ignition key or connect the DSR unit to a standby power source. (The DSR controller must have a source of electrical power, in order to be programmed).		
8	Run the Wintrac software program		
9	At the Wintrac screen, click on the Seek Device icon (the truck graphic)		
10	The Communicating screen appears.		
11	Within a few seconds, the VPRS Controller Settings screen appears. It displays a table of the microprocessor configuration parameters. See the adjacent illustration.		

STEP	ACTION	RESULTS	COMMENTS
12	Click the restore button at the bottom of the screen.	A Windows browser appears to choose the unit file.	
13	Select the correct file for the unit and click Open.		
14	Click "Yes" when the confirmation window appears.	The parameters in the DSR controller are updated.	
15	Close Wintrac.		
16	Switch the truck ignition key to Off or turn off power to the standby electric power source		
17	Turn the unit On/Off switch to On. Go to the Information Menu and check if the microprocessor controller has been correctly modified.		

STEP	ACTION	RESULTS	COMMENTS
	Saving Parameter Files		
	To save a file and its parameter settings, in order to upload it to other units with the identical configuration, perform the following:		
1	Set the parameter as required. See the adjacent illustration.		
2	Click the Save button.		To upload the file, follow steps 11 through 17 in Uploading the DSR Controller Software Files.
3	The adjacent error message might appear.		
4	If the error message appears, check the following: • Check that the DSR controller is receiving electrical power • Check that jumpers 1 and 2, inside the converter, are set as shown in the adjacent illustration (see Service Bulletin 739-G-04 for additional information).		

ESD (Electrostatic Discharge) Procedure

Where Used:

All solid state applications.

Purpose:

To prevent ESD (electrostatic discharge) damage while working on a microprocessor. ESD (electrostatic discharge) is an invisible enemy which can only be counteracted by using good procedures. Failure to follow stated procedures may result in electronic component failure. Additional information may be found in the ELECTRO STATIC DISCHARGE (ESD) TRAINING GUIDE TK40282.

STEP	ACTION	RESULTS	COMMENTS
1	Obtain and use a wrist strap when handling a microprocessor that is not connected to the unit via the plugs or is not in an anti-static bag.		Service Part 204-622. Refer to ESD Training Guide TK 40282.
2	Store and ship microprocessors in the anti-static bags and protective packaging.		
3	Assume that if these steps are not followed that damage will be done to the microprocessor.		

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Welding on Units Equipped with Microprocessors

Where Used

All units equipped with DSR μP Controller microprocessors.

Purpose

To prevent damage to the microprocessor during welding operations. Electric welding generates extremely high amperage currents which can damage electrical and electronic components. In order to minimize the possibility of damage the following procedures must be followed.

STEP	ACTION	RESULTS	COMMENTS
	Before Welding		
1	Turn the unit off.		
2	Disconnect Electric Standby power, if connected.		
3	Remove the negative battery cable.		
4	Connect the welder ground cable as close as possible to the area where the welding is to be performed. Move the welder ground cable, as required.		
	After Welding is Completed		
1	Reconnect the battery cable.		
2	Connect standby power, if necessary.		
3	Turn the unit on.	The Standard Display should appear.	

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Setting Unit Running Time Hourmeters

Where used

All new replacement DSR μP Controller microprocessors only.

Purpose

This procedure should be followed to set the unit running time hourmeters for [HC] (Remaining Hours Counter).

Setting Hourmeters

STEP	ACTION	RESULTS	COMMENTS
1	Obtain a completed copy of the Setup Sheet, shown in Service Procedure A02A, *Recording Existing Microprocessor Settings*.		This information on this copy will be used to set up the hourmeters.
2	Turn the unit on.	The Standard Display appears.	
3	At the Standard Display, press and hold the Select key for 3 seconds. The first Hourmeters Menu screen, [HC], appears.		
4	Press the Enter key to select the hourmeter. The two left digits are displayed and the digit on the far left flashes.	If necessary, change the flashing digit to 0 through 5000, using the Up or Down arrow keys.	To reset [HC] and remove the service symbol, repeat steps 1 to 3 above.
5	Press the Enter key to load the new value. If no number is shown on the Setup Sheet, consult the customer for a record of hours that are desired or recommended before a maintenance procedure (inspection, part replacement, test, etc.) is performed.	The display briefly shows [Lod] and then the new setting appears.	

NOTE: To reset the HC symbol from the display, follow steps 3 to 5 only.

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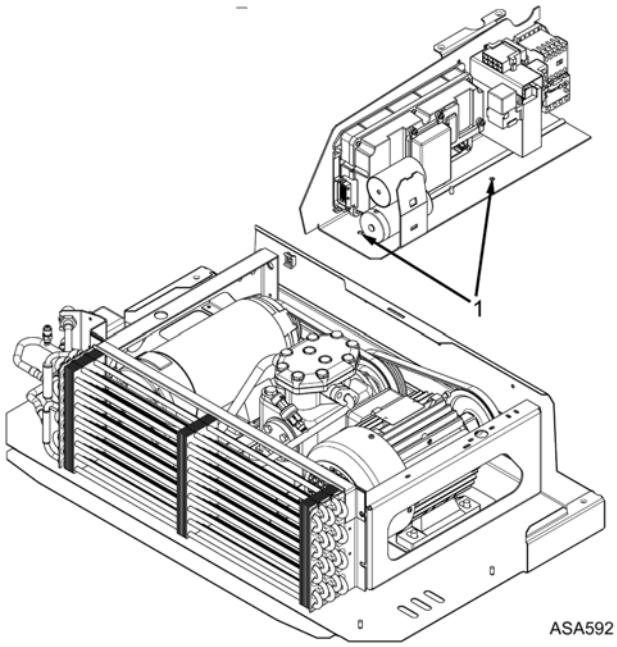
Printed Circuit Board Removal and Replacement

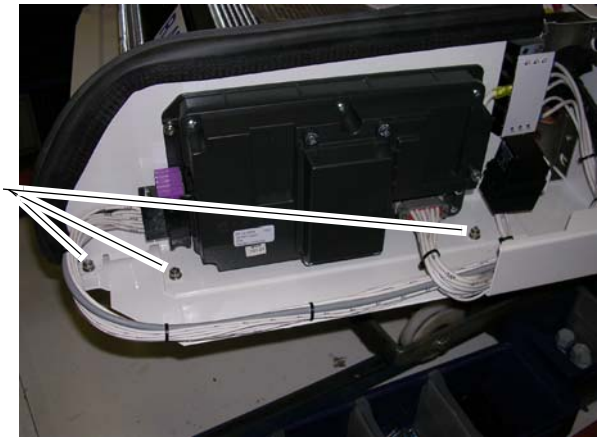
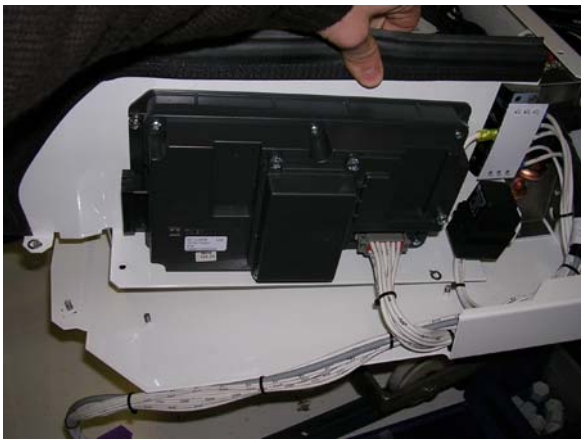
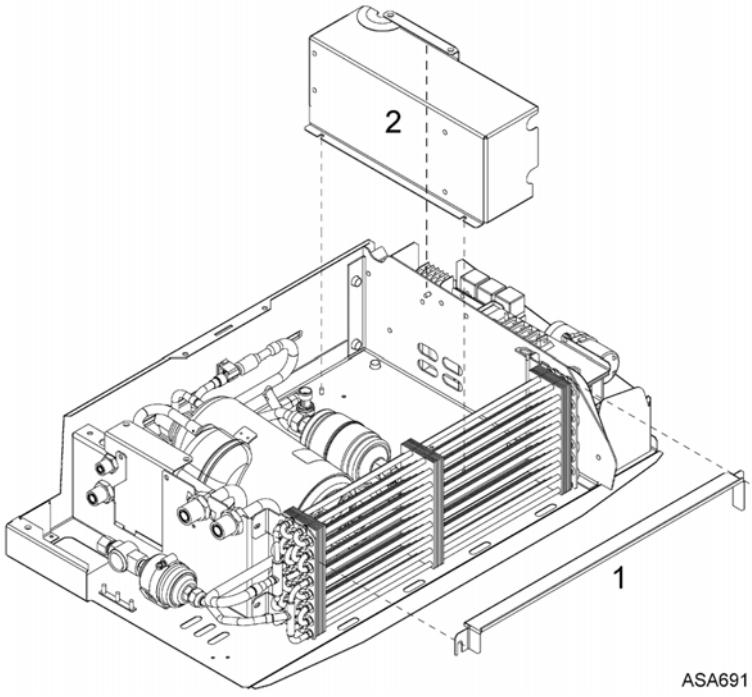
Where Used

All units equipped with DSR μP Controller microprocessors.

Purpose

This procedure should be followed when replacing PCB 1 and /or PCB 2.

STEP	ACTION	RESULTS	COMMENTS
		PCB Removal	
1	Turn the vehicle ignition off.		
2	Disconnect standby power, if connected.		
3	Wear an ESD wrist strap. Connect the lead from the wrist strap to the unit chassis ground.		Proper Electro Static Discharge procedures must be followed. See Service Procedure A12A, *ESD (Electrostatic Discharge) Procedure*.
4	Remove the wiring harness receptacles from connector C-1 and C-2 on the printed circuit board(s).		
5	B-100 units: Remove the two screws **1** that secure the ECM enclosure to the unit. Remove ECM from the unit.		

STEP	ACTION	RESULTS	COMMENTS
6	For V-100 10/30, V-200 and V-300 units: Remove the three screws that secure the ECM enclosure to the unit. Remove the ECM from the unit.	 	
7	For V-100 20/50: Remove the routing guide support plate **(1)** from the unit by removing the two bolts that secure the plate to the unit chassis. Remove the electric box support plate **(2)** from the unit by removing the three nuts that secure the plate to the unit chassis. Remove the ECM from the unit.		

STEP	ACTION	RESULTS	COMMENTS
8	For V-400/V-500 units: Remove the three screws that secure the ECM enclosure to the unit. Remove the ECM from the unit.	 	
9	Remove the six screws and the cover from the ECM enclosure.	Printed circuit board PCB1 On Platform 1), or PCB 1 and PCB2 (for Platform 2), are exposed.	
10	For a Platform 2, remove the four screws that secure PCB 2 to the standoffs attached to PCB 1.		
11	Remove PCB 2 from the ECM.		
12	Remove the six screws that secure PCB 1 to the ECM enclosure.		
13	Remove PCB 1 from the ECM enclosure.		
		PCB Replacement	
1	Position the replacement PCB 1 in the enclosure.		
2	Install the six screws that secure PCB 1 to the ECM enclosure.		
3	For a Platform 2, install the four screws that secure PCB 2 to the standoffs attached to PCB 1.		

STEP	ACTION	RESULTS	COMMENTS
4	Connect the cable that connects the fan to PCB1.		
5	Position the cover of the ECM over the printed circuit board(s). Insert the six screws and tighten.		
6	Connect the power wire to the screw terminal of PCB 1.		
7	Connect the wire harness receptacles to connectors C-1 and C-2 of PCB 1 and/or PCB 2.		
8	Place the ECM in the unit. Install the three screws that secure the ECM enclosure to the unit.		
9	Remove the ESD wrist strap.		
10	Reconnect the Electric Standby power, if needed.		
11	Start the unit.	The Standard Display should appear.	
12	Operate the unit, as required, to confirm proper operation.		
13	Replace the cover on the ECM enclosure. Be sure and route the power wire and In-cab Control Box cable through the provisions on the cover.		Be sure no wires or cables are pinched in the cover.
14	Route harnesses, as required, and replace any tie bands that were removed.		

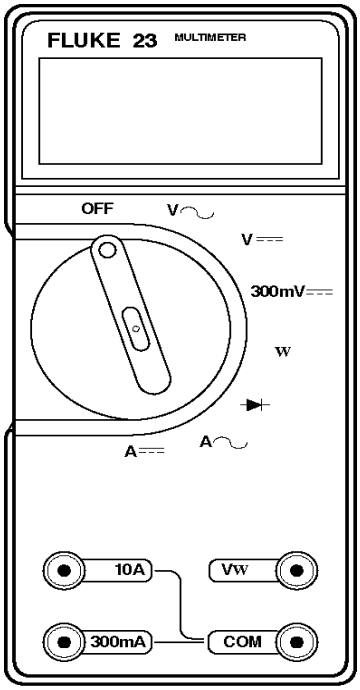
Return Air Temperature Sensor Test

Where Used

All DSR μP Controller microprocessors and other solid state controller applications.

Purpose

This procedure is used to confirm the proper operation of Return Air Temperature sensor 1 (Sensor 1), located in the single or main load compartment, and Return Air Temperature sensor 2 (Sensor 2), located in the remote load compartment of multi-temp vehicles.



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STEP	ACTION	RESULTS	COMMENTS
NOTE: Polarity must be considered when temperature sensors are connected. If the sensors are connected backwards, the In-cab Control Box display shows [----]. Consult the schematic diagram or wiring diagram for the unit for the correct connections.			
1	Use the On/Off button on the In-cab Control Box to turn the unit off.		
2	Disconnect the applicable Return Air Temperature sensor at the plug next to the sensor.		
3	Use the On/Off button on the In-cab Control Box to turn the unit on.		

STEP	ACTION	RESULTS	COMMENTS
4	Check the Standard Display for the temperature in the main or remote load compartment.	The display should show [----], meaning that the applicable Return Air Temperature sensor (Sensor 1 in the main load compartment, or Sensor 2 in the remote load compartment) is disconnected.	
5	Using a high quality digital multimeter, check the voltage at the sensor plug, on the sensor half of the wire that is still connected to the printed circuit board.	The voltage must be between 4.90 Vdc and 5.10 Vdc.	If the voltage is correct, replace the sensor.
6	If the voltage measured in Step 5 is incorrect, check the voltage at the sensor connector at the ECM, at the following connector locations: Sensor 1 = Printed Circuit Board 1 at connector C-1, pin A4, and C-1, pin B4. Sensor 2 = Printed Circuit Board 2 at connector C-1, pin 3, and C-1, pin 4.	The voltage must be between 4.90 Vdc and 5.10 Vdc.	If the voltage is correct at Step 6, but incorrect at Step 5, the problem is in the wiring. If the voltage is incorrect at Step 5 and Step 6, the problem is in the microprocessor.
7	Completely disconnect the return air temperature sensor from the ECM. Check the resistance between wires PNK and BLK.	Depending on the ambient temperature, the resistance should be what is indicated in the *Temperature vs. Operating Mode Chart* in Section 3, Software Description.	• If the resistance is OK, and step 6 is OK, the problem is in the wiring. • If the wiring is OK, replace the return air temperature sensor.

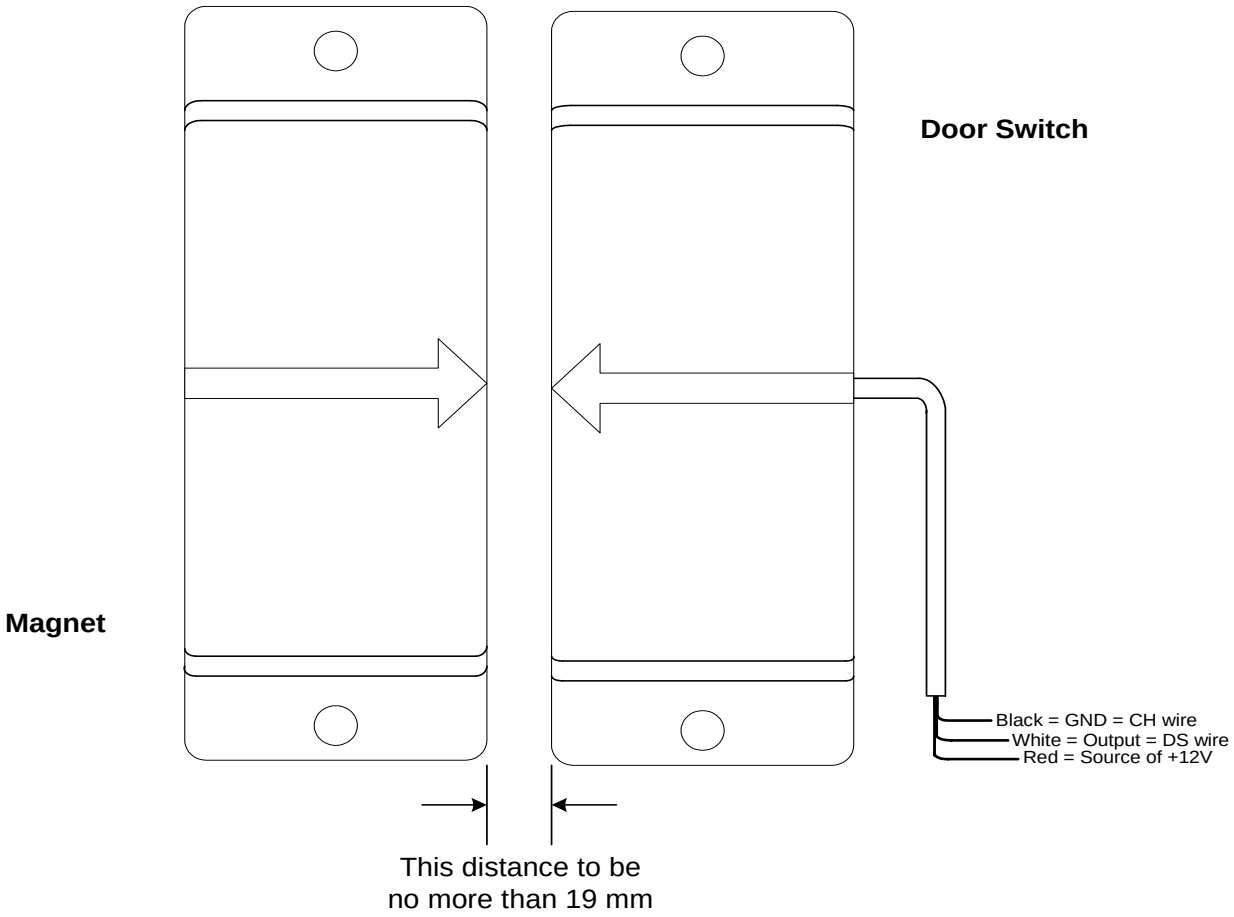
3 Wire Magnetic Door Switch

Where Used

All 3-wire magnetic door switch applications

Purpose

This information is used to install and wire the 3-wire magnetic door switch.



IMPORTANT INFORMATION: +12 volts is connected to the red wire, and chassis ground is connected to the black wire, to energize the door switch. When the door is closed no voltage is present on the white DS wire to the microprocessor. When the door is open +12 volts is present on the white DS wire to inform the microprocessor that the door is open. The magnet should be no more than 19 mm from the door switch when the door switch is closed.

Service Procedure F06A

Document Control

REVISIONS

Any changes must be verified with all WHERE USED documents to insure correctness.

Date	By	Changes
12/12/96	CA	Original
17/04/05	PAF	English measurements deleted; metric only used for DSR μP Controller microprocessor application

Deutsch Connector Repair Using Pigtail

Where Used

All units equipped with DSR μP Controller microprocessors.

Purpose

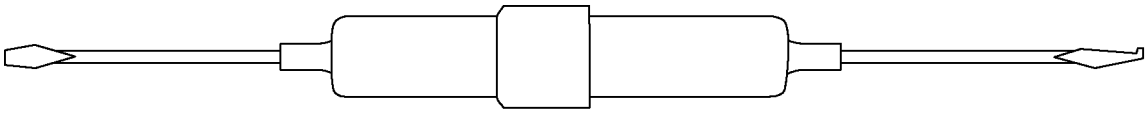
This procedure should be used to repair a broken pin in any of the Deutsch connectors used on the unit. The service part numbers are shown below.

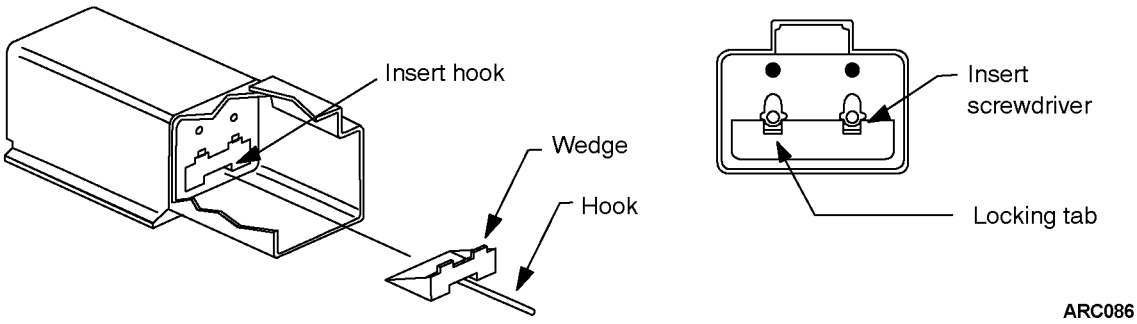
Deutsch Connectors

Male DEUTSCH pin with pigtail 44-9701

Female DEUTSCH pin with pigtail 44-9700

Repairing Deutsch Connectors





STEP	ACTION	RESULTS	COMMENTS
1	Identify the defective pin and determine if it is male or female.		
2	Obtain the required replacement pin.		
3	Using a Deutsch Tool (Service Part Number 204-799), remove the orange locking wedge from the front of the connector shell.		
4	Using the Deutsch Tool release the locking tab in the shell of the connector and remove the pin.		
5	Cut the wire leading to the defective pin as close to the pin as possible.		

STEP	ACTION	RESULTS	COMMENTS
6	Insert the replacement pin with short lead into the connector from the back of the shell.		
7	Check to be sure the pin is fully seated and locked in the shell.		
8	Re-install the orange locking wedge from the front side of the connector shell.		
9	Insert the shrink tubing over the harness wire and position it far enough away from the joint that it does not shrink prematurely when soldering.		See Figure 1.
10	Carefully strip 13 mm of insulation from the end of the pin wire and the matching harness wire.		Trim wire lengths, as required, to properly fit harness. See Figure 2.
11	Twist the ends of the wire together to create a compact, mechanically strong connection.		See Figure 3.
12	Using a small soldering iron, solder the connection using rosin core solder.		See Figure 4.
13	Position the shrink tubing over the connection.		See Figure 5.
14	Shrink the tubing in place using the small soldering iron.		The connection may be additionally insulated with electrical tape, if necessary.
15	Reinstall the connector on the mating connector.		
16	Carefully position the harness and replace any cable ties removed or missing.		

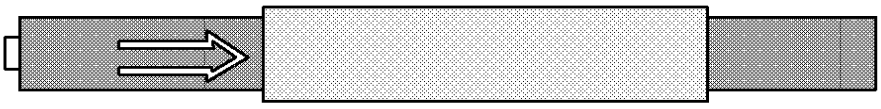


Figure 1: Cut and slide shrink tubing on wire.

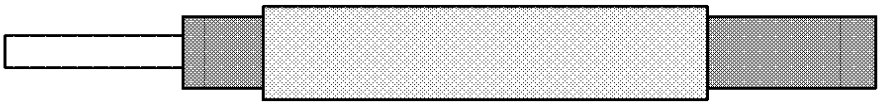


Figure 2: Strip wire insulation back 13 mm.

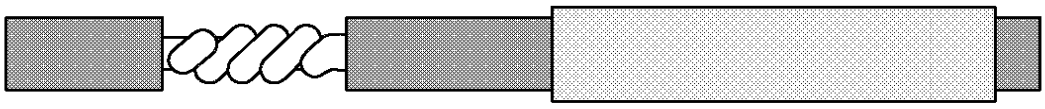


Figure 3: Twist wires together as shown.

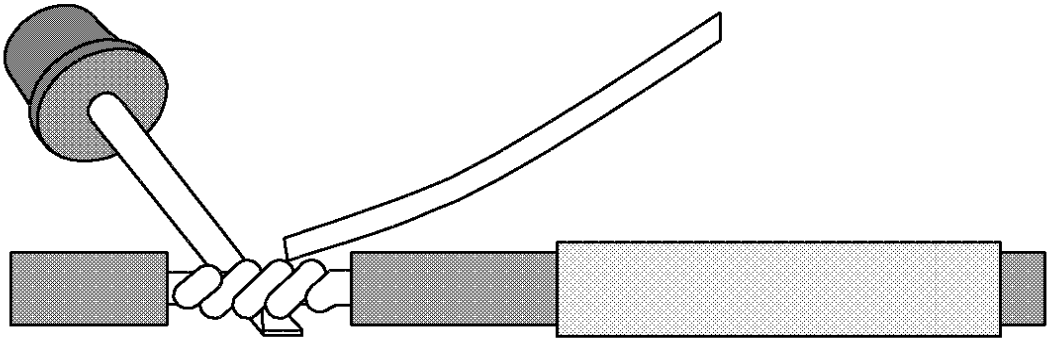


Figure 4: Apply solder to twisted wire.

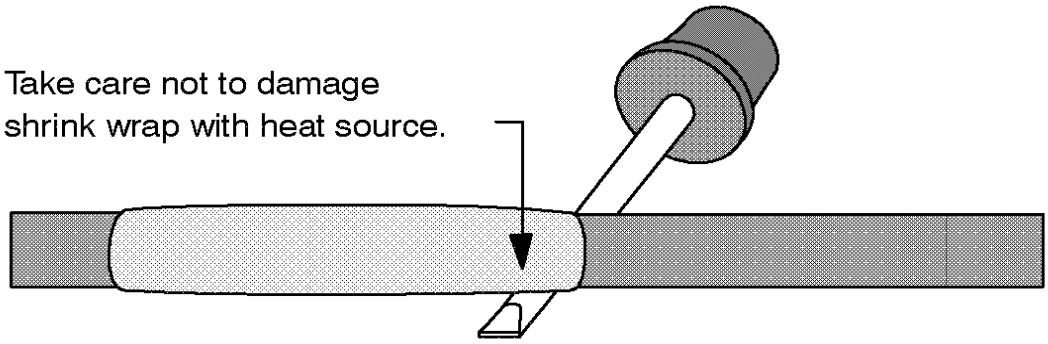


Figure 5: Slide shrink tubing over solder joint. Apply heat near shrink tube.
DO NOT place direct heat to shrink tube as it will become damaged.

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Splicing Connector and Harness Wires

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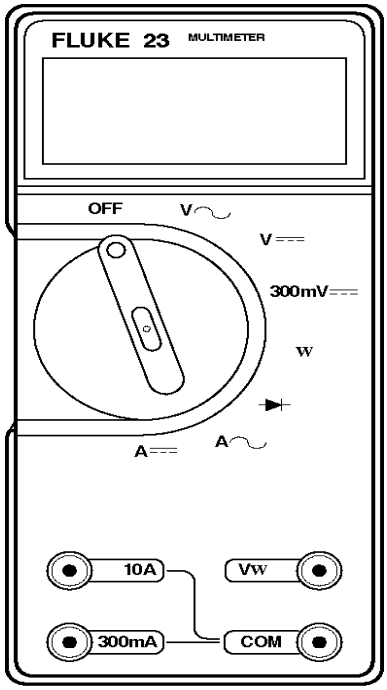
Checking Harness Continuity

Where Used

All DSR μP Controller microprocessors and other solid state controller applications.

Purpose

To illustrate the correct procedures for checking harness continuity on equipment utilizing solid state devices.



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STEP	ACTION	RESULTS	COMMENTS
CAUTION STATEMENTS			
1	Do not use battery and light combinations to check continuity.		Using such devices might present excessive voltage or current to solid state devices. In most cases the device will be damaged or destroyed.
2	Use a high quality digital multimeter such as that illustrated or an analog meter with high input impedance.		Older analog (needle type meter movement) meters and some inexpensive “mechanic tool box” meters present a large load to the circuit being tested. This can significantly alter the meter reading, especially when measuring small voltages or currents.
3	Do not test a circuit to see if it is energized by tapping the circuit wire to ground and watching for a spark.		This will damage solid state components or blow a fuse.

STEP	ACTION	RESULTS	COMMENTS
4	Always wear a grounded wrist strap when working on exposed solid state circuits (such as changing a software IC).		Failure to use a grounded wrist strap and/or failure to observe other ESD (Electrostatic Discharge) procedures can result in damage to solid state components. This damage might not be immediately noticeable. See Service Procedure A12A *ESD (Electrostatic Discharge) Procedure* for additional information on ESD procedures.
GENERAL PROCEDURES			
1	Locate the suspect circuit on the appropriate wiring diagram.		
2	Isolate both ends of the circuit using the following methods, as required. • Disconnect the appropriate connector at the interface module. • Disconnect the device connector at the device. • Remove the wire from the device terminal.		Harness connections might be determined by consulting the wiring diagrams. **CAUTION:** Failure to isolate both ends might cause misleading results.
3	Using jumpers as required, connect each end of the circuit to a high quality multimeter.	The meter must show a very low resistance (less than 1.0 ohm), indicating circuit continuity. If not, the circuit is open or has excessive resistance. Troubleshoot the circuit to determine the cause using the wiring diagrams.	Be certain the ohmmeter battery is good and the meter zeros with the leads held together.
4	After determining that the circuit passes a continuity test, remove one lead and connect it to chassis ground to check for a short to ground.	The meter should indicate an open circuit. If continuity is indicated, the circuit is shorted to ground. Troubleshoot the circuit to determine the cause of the short using the wiring diagrams.	

Removal and Replacement of the Filter or Fan in an Electronic Control Module

Where Used

All units equipped with a DSR μP Controller Electronic Control Module (ECM).

Purpose

1. To replace a filter on the ECM enclosure.

2. To replace the ECM fan.

Equipment and Parts Required

- Fan, 40x40x10, DC Co-Axial, TK service code 415480
- Filter, Fan, 40x40, TK service code 923472
- Electrostatic discharge (ESD) strap
- Screwdriver with a plastic handle

Procedure - Removing and Replacing the Filter

STEP	ACTION	RESULTS	COMMENTS
	Removal		
1	Press the On/Off button the In-cab Control Box to off.		
2	Disconnect Electric Standby power, if connected.		
3	Open the unit and locate the ECM.		
4	Remove the six screws that attach the fuse access cover to the front cover.		
5	Lift the fuse access cover and set it aside.		
6	Remove the four screws that attach the filter to the fan housing.		
7	Remove the filter and discard it.		
	Replacement		
1	Position the replacement filter over the fan housing.		
2	Position the fuse access cover over the filter and the front cover.		
3	Install the four screws that attach the fuse access cover to the front cover.		
4	Close the unit.		
5	Turn Elecric Standby power on, if applicable.		
6	Turn the On/Off button the In-cab Control Box to On.		

Procedure - Removing and Replacing the Fan

STEP	ACTION	RESULTS	COMMENTS
	Removal		
1	Turn the On/Off button the In-cab Control Box to off.		
2	Disconnect Electric Standby power, if connected.		
3	Open the unit and locate the ECM.		
4	Remove the six screws that attach the fuse access cover to the front cover.		
5	Remove the fuse access cover and set it aside.		
6	Remove the four screws that attach the filter to the fan housing.		
7	Remove the filter and set it aside.		
8	Place an ESD strap on your wrist.		Make sure that the ESD strap is connected to an ESD mat or to ground.
9	Disconnect the fan cable receptacle from connector CN6-1 on PCB 1 (Platform 1).		
10	Remove the fan and its cable from the ECM enclosure.		
	Replacement		
1	Position the replacement fan assembly over the ECM. Route the fan cable through the opening in the front cover.		
2	Make sure the fan screw holes are aligned with the ECM front cover.		
3	While wearing an ESD strap, connect the fan cable receptacle to connector CN6-1 on PCB 1.		
4	Position the filter over the fan.		Make sure the screw holes are aligned.
5	Install the four screws through the screw holes in the filter and the fan.		Make sure the screws are tightened.
6	Install the fuse access cover over the filter/fan assembly and the front cover.		
7	Install the six screws and tighten.		
8	Close the unit cover.		
9	Connect Electric Standby power, if applicable.		
10	At the In-cab Control Box, press the On/Off button to on.		

Section 7
DSR μP Controller Information

DSR μP Controller Software Features and Interchange..... 7 - 1

DSR μP Controller Software Features and Interchange

To identify the software version used with your DSR μP Controller, see *Checking the Software Revision*, in Section 4, *Operation*.

CAUTION: The software of a replacement microprocessor should always be checked, to be certain that it is the current software revision level.

DSR μP Controller Software

Software Revision Number	Features	Interchange With:
121 15	Field test units	
121 19	Production until August 2004	Interchange with 121 15
121 21	Production from September 2004	Interchange with 121 15 and 121 19
273 02	Production from September 2004	Interchange with 121 15, 121 19 and 121 21
273 03	Production from March 2007	Interchange with 121 15, 121 19, 121 21 and 273 02

Section 7 - DSR μP Controller Information

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Section 8
Schematics and Wiring Diagrams

Number	Description
1E26983, Rev. B	B-100 10/20 DSR μP Controller Schematic Diagram
1E26984, Rev. C	B-100 10/20 DSR μP Controller Wiring Diagram
1E23072, Rev. B	V-100, V-200, V-300 MAX 10/30 DSR μP Controller Schematic Diagram
1E23071, Rev. B	V-100, V-200, V-300 MAX 10/30 DSR μP Controller Wiring Diagram
1E50773, Rev. A	V-100 MAX 20/50 DSR μP Controller Schematic Diagram
1E50774, Rev. A	V-100 MAX 20/50 DSR μP Controller Wiring Diagram
1E47098, Rev. B	V-200, V-300 MAX 20/50 DSR μP Controller Schematic Diagram
1E47097, Rev. B	V-200, V-300 MAX 20/50 DSR μP Controller Wiring Diagram
1E17674, Rev. A	V-200, V-300 MAX Multi-Temp DSR μP Controller Schematic Diagram
1E17673, Rev. A	V-200, V-300 MAX Multi-Temp DSR μP Controller Wiring Diagram
1E19988, Rev. B	V-400, V-500 MAX 10/30 DSR μP Controller Schematic Diagram
1E19987, Rev. B	V-400, V-500 MAX 10/30 DSR μP Controller Wiring Diagram
1E47148, Rev. B	V-400, V-500 MAX 20/50 DSR μP Controller Schematic Diagram
1E47147, Rev. B	V-400, V-500 MAX 20/50 DSR μP Controller Wiring Diagram
1E29761, Rev. C	V-500 MAX TC 10/30 DSR μP Controller Schematic Diagram
1E29760, Rev. C	V-500 MAX TC 10/30 DSR μP Controller Wiring Diagram
1E47150, Rev. B	V-500 MAX TC 20/50 DSR μP Controller Schematic Diagram
1E47149, Rev. B	V-500 MAX TC 20/50 DSR μP Controller Wiring Diagram
1E47152, Rev. A	V-500 AC 10/20 DSR μP Controller Schematic Diagram
1E47151, Rev. A	V-500 AC 10/20 DSR μP Controller Wiring Diagram

Section 8 - Schematics and Wiring Diagrams

The following schematic diagrams and wiring diagrams are for B-100, V-100, V-200, V-300, V-400, and V-500 units that use the DSR μP Controller.

Diagram, Schematic

TK Part Number	Description
1E26983, Rev. B	B-100 10/20, Single Temp, 1PH, 50Hz, 12V/24V
1E23702, Rev. B	V-100/V-200/V-300 MAX, 10/30, Single Temp, 12V/24V
1E50773, Rev. A	V-100 MAX, 20/50, Single Temp, 1PH, 50Hz, 12V/24V
1E47098, Rev. B	V-200/V-300 MAX, 20/50, Single Temp, 12V/24V
1E17674, Rev. A	V-200/V-300 MAX, Bi-Temp, 12V/24V
1E19988, Rev. B	V-400/V-500 MAX, 10/30, Single Temp, 12V/24V
1E47148, Rev. B	V-400/V-500 MAX, 20/50, Single Temp, 3PH, 50Hz, 12V/24V
1E29761, Rev. C	V-500 MAX 10/30, Bi-Temp, 12V/24V
1E47150, Rev. B	V-500 MAX 20/50, Bi-Temp, 1PH/3PH, 50Hz, 12V/24V
1E47152, Rev. A	V-500 AC 10/20, 1PH/3PH, 50Hz, 12V/24V

Diagram, Wiring

TK Part Number	Description
1E26984, Rev. C	B-100 10/20, Single Temp, 1PH, 50Hz, 12V/24V
1E23071, Rev. B	V-100/V-200/V-300 MAX, 10/30, Single Temp, 12V/24V
1E50774, Rev. A	V-100 MAX, 20/50, Single Temp, 1PH, 50Hz, 12V/24V
1E47097, Rev. B	V-200/V-300 MAX, 20/50, Single Temp, 12V/24V
1E17673, Rev. A	V-200/V-300 MAX, Multi-Temp, 12V/24V
1E19987, Rev. B	V-400/V-500 MAX, 10/30, Single Temp, 12V/24V
1E47147, Rev. B	V-400/V-500 MAX, 20/50, Single Temp, 3PH, 50Hz, 12V/24V
1E29760, Rev. C	V-500 MAX 10/30, Bi-Temp, 12V/24V
1E47149, Rev. B	V-500 MAX 20/50, Bi-Temp, 1PH/3PH, 50Hz, 12V/24V
1E47151, Rev. A	V-500 AC 10/20, 1PH/3PH, 50Hz, 12V/24V

Section 8 - Schematics and Wiring Diagrams

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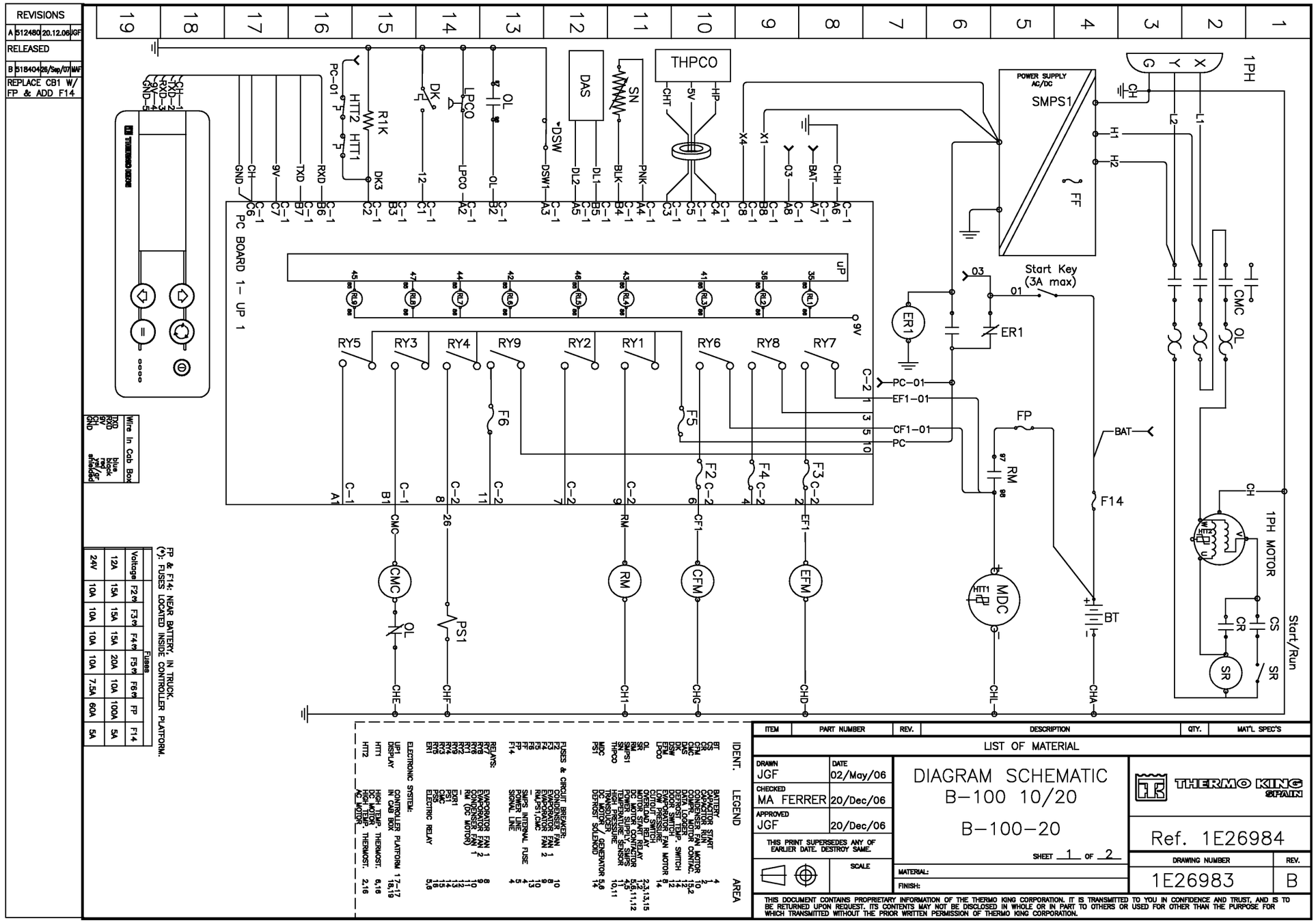
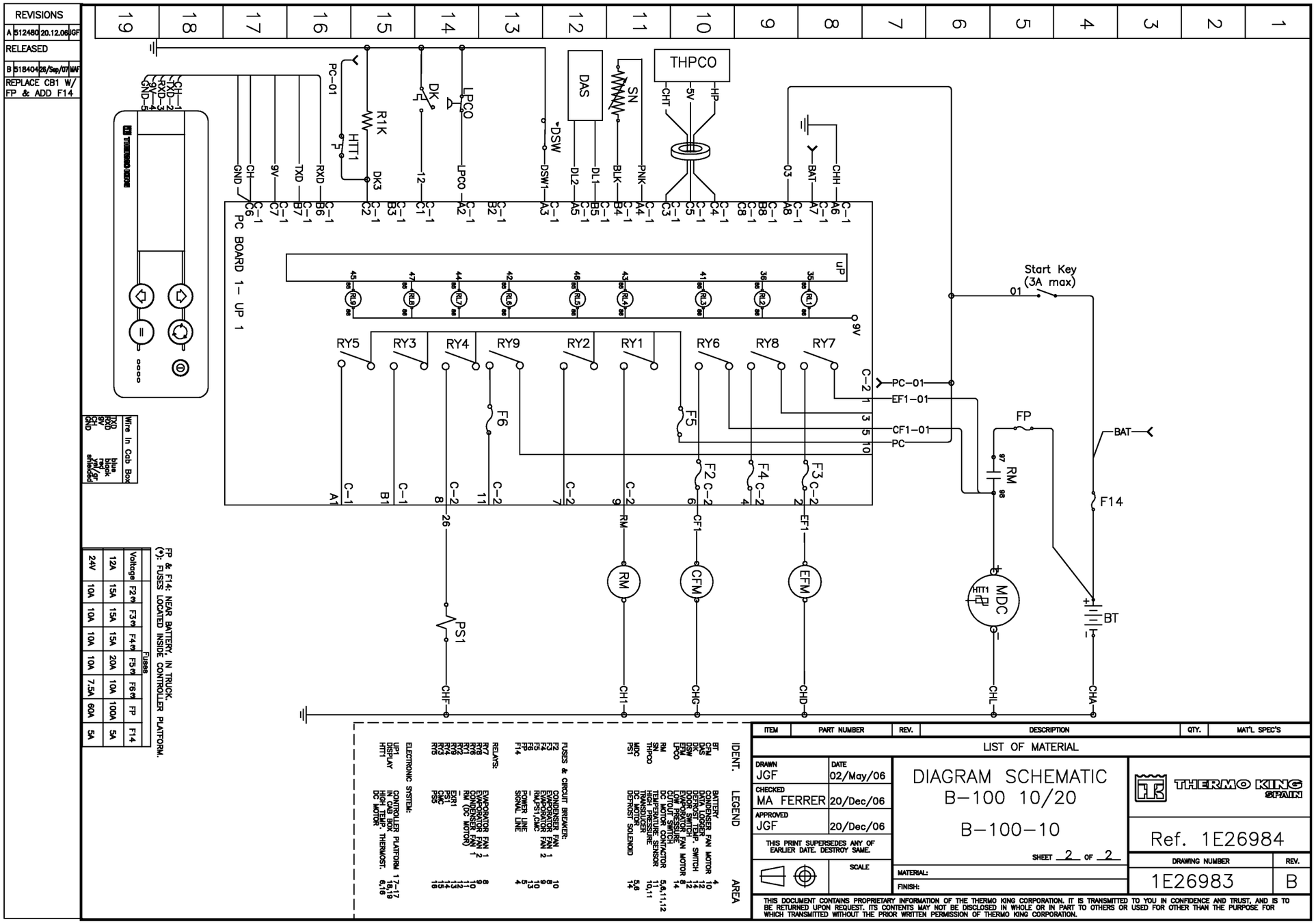
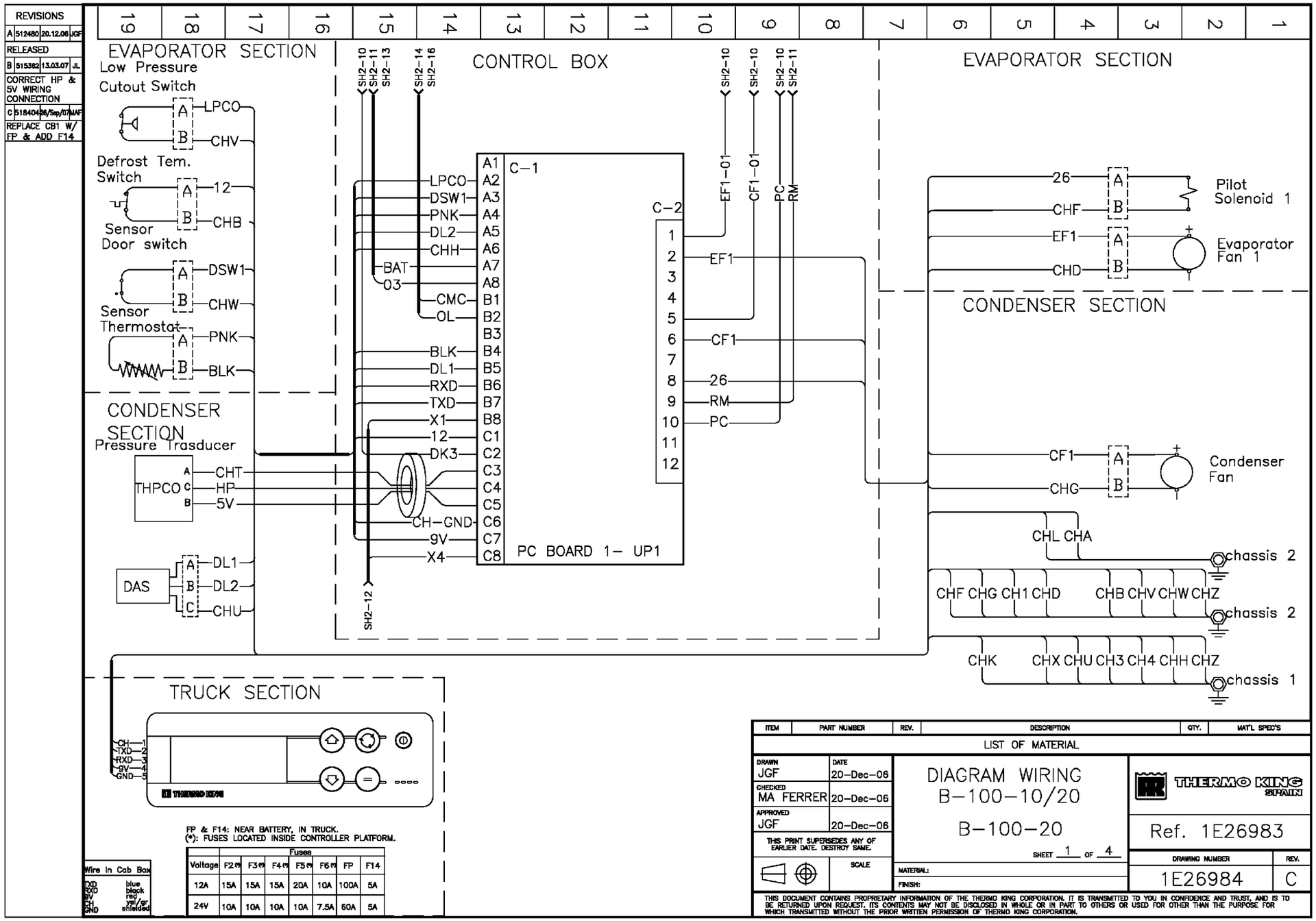
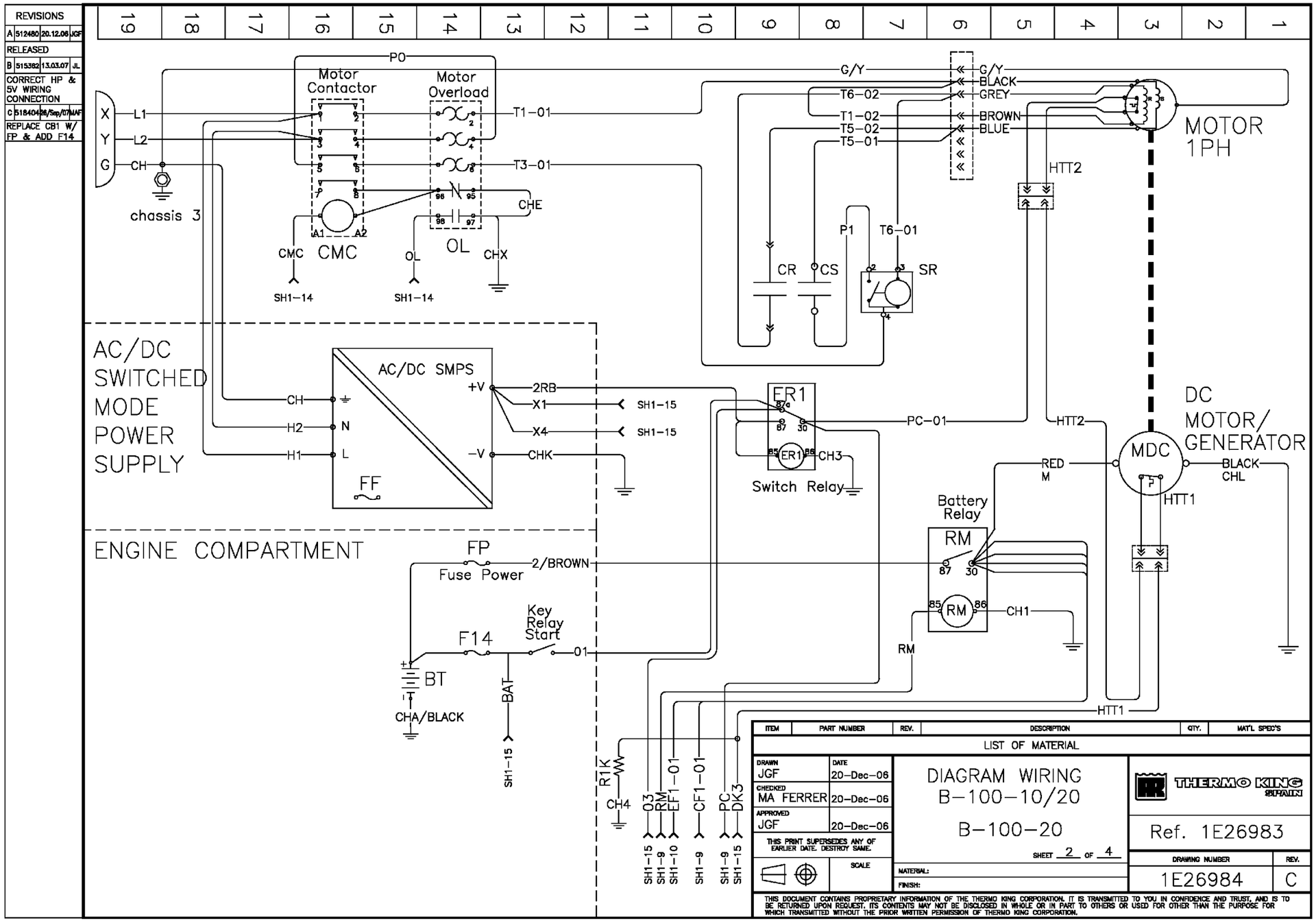
1E26983 DSR MICROPROCESSOR CONTROLLER SCHEMATIC DIAGRAM, B-100, 10/20 - Page 1 of 2




REVISIONS
A 512480 20.12.06 JGF
RELEASED
B 518404 26/Sep/07 MAF
REPLACE CB1 W/ FP & ADD F14
THPCO
DAS
SN
DSW
LPCO
DK
R1K
HTT1
PC-01
PC BOARD 1- UP 1
uP
RY5
RY3
RY4
RY9
RY2
RY1
RY6
RY8
RY7
F6
F5
F2
F4
F3
RM
CFM
EFM
PS1
MDC
BT
Start Key (3A max)
FP
F14
BAT
PC-01
EF1-01
CF1-01
PC
9V
Wire In Cab Box
blue
black
red
white
green
Voltage
12A
24V
10A
7.5A
60A
5A
Fuses
F2(*)
F3(*)
F4(*)
F5(*)
F6(*)
FP
F14
15A
20A
100A
FP & F14: NEAR BATTERY, IN TRUCK.
(*): FUSES LOCATED INSIDE CONTROLLER PLATFORM.
IDENT.
LEGEND
AREA
BT. BATTERY 4,10
CDR DATA LOGGER FAN MOTOR 12
DK DEFROST TEMP. SWITCH 12,14
EFM EVAPORATOR FAN MOTOR 2,14
LPCO LOW PRESSURE CUTOUT SWITCH 2,14
RM CONDENSER FAN MOTOR 5,6,11,12
SN THPCO DC MOTOR CONTACTOR 11
TEMPERATURE SENSOR 10,11
HIGH PRESSURE CUTOUT SWITCH 5,6
MDC DC MOTOR 14
PST DEFROST SOLENOID 5,6
FUSES & CIRCUIT BREAKER:
F2 EVAPORATOR FAN 1 10
F3 EVAPORATOR FAN 2 8
F4 CONDENSER FAN 9
FP MAIN POWER 13
F6 SIGNAL LINE 15
F14 4
RELAYS:
RY7 EVAPORATOR FAN 1 8
RY8 EVAPORATOR FAN 2 10
RY1 CONDENSER FAN 7 11
RM (DC MOTOR) 13
EXR1 14
PST 15
CFM 16
ELECTRONIC SYSTEM:
UP1 CONTROLLER PLATFORM 17-17
DISPLAY IN CAB BOX 18,19
HTT1 HIGH TEMP. THERMOST. 6,18
ITEM
PART NUMBER
REV.
DESCRIPTION
QTY.
MAT'L SPEC'S
LIST OF MATERIAL
DRAWN JGF
DATE 02/May/06
CHECKED MA FERRER
20/Dec/06
APPROVED JGF
20/Dec/06
THIS PRINT SUPERSEDES ANY OF EARLIER DATE. DESTROY SAME.
SCALE
DIAGRAM SCHEMATIC
B-100 10/20
B-100-10
SHEET 2 OF 2
MATERIAL:
FINISH:
THERMO KING SPAIN
Ref. 1E26984
DRAWING NUMBER
1E26983
REV.
B
THIS DOCUMENT CONTAINS PROPRIETARY INFORMATION OF THE THERMO KING CORPORATION. IT IS TRANSMITTED TO YOU IN CONFIDENCE AND TRUST, AND IS TO BE RETURNED UPON REQUEST. ITS CONTENTS MAY NOT BE DISCLOSED IN WHOLE OR IN PART TO OTHERS OR USED FOR OTHER THAN THE PURPOSE FOR WHICH TRANSMITTED WITHOUT THE PRIOR WRITTEN PERMISSION OF THERMO KING CORPORATION.


REVISIONS
A 512480 20.12.06 JGF RELEASED
B 515382 13.03.07 JL CORRECT HP & 5V WIRING CONNECTION
C 518404 28/Sep/07 NAF REPLACE CB1 W/ FP & ADD F14
EVAPORATOR SECTION
Low Pressure Cutout Switch
LPCO
CHV
Defrost Tem. Switch
12
CHB
Sensor Door switch
DSW1
CHW
Sensor Thermostat
PNK
BLK
CONDENSER SECTION
Pressure Trasducer
THPCO
CHT
HP
5V
DAS
DL1
DL2
CHU
CONTROL BOX
C-1
C-2
PC BOARD 1- UP1
LPCO
DSW1
PNK
DL2
CHH
BAT
03
CMC
OL
BLK
DL1
RXD
TXD
X1
12
DK3
CH-GND
9V
X4
EF1-01
CF1-01
PC
RM
EF1
CF1
26
RM
PC
SH2-10
SH2-11
SH2-13
SH2-14
SH2-16
SH2-12
EVAPORATOR SECTION
26
CHF
EF1
CHD
Pilot Solenoid 1
Evaporator Fan 1
CONDENSER SECTION
CF1
CHG
Condenser Fan
CHL CHA
chassis 2
CHF CHG CH1 CHD
CHB CHV CHW CHZ
chassis 2
CHK
CHX CHU CH3 CH4 CHH CHZ
chassis 1
TRUCK SECTION
CH
TXD
RXD
9V
GND
FP & F14: NEAR BATTERY, IN TRUCK.
(*): FUSES LOCATED INSIDE CONTROLLER PLATFORM.
Fuses
Voltage F2(*) F3(*) F4(*) F5(*) F6(*) FP F14
12A 15A 15A 15A 20A 10A 100A 5A
24V 10A 10A 10A 10A 7.5A 60A 5A
Wire In Cab Box
TXD blue
RXD black
9V red
CH yel/gr
GND shielded
ITEM PART NUMBER REV. DESCRIPTION QTY. MAT'L SPEC'S
LIST OF MATERIAL
DRAWN JGF 20-Dec-06
CHECKED MA FERRER 20-Dec-06
APPROVED JGF 20-Dec-06
THIS PRINT SUPERSEDES ANY OF EARLIER DATE. DESTROY SAME.
SCALE
DIAGRAM WIRING B-100-10/20
B-100-20
SHEET 1 OF 4
MATERIAL:
FINISH:
THERMO KING SPAIN
Ref. 1E26983
DRAWING NUMBER 1E26984
REV. C
THIS DOCUMENT CONTAINS PROPRIETARY INFORMATION OF THE THERMO KING CORPORATION. IT IS TRANSMITTED TO YOU IN CONFIDENCE AND TRUST, AND IS TO BE RETURNED UPON REQUEST. ITS CONTENTS MAY NOT BE DISCLOSED IN WHOLE OR IN PART TO OTHERS OR USED FOR OTHER THAN THE PURPOSE FOR WHICH TRANSMITTED WITHOUT THE PRIOR WRITTEN PERMISSION OF THERMO KING CORPORATION.


REVISIONS
A 512480 20.12.06 JGF RELEASED
B 515382 13.03.07 JL CORRECT HP & 5V WIRING CONNECTION
C 518404 28/Sep/07 NAF REPLACE CB1 W/ FP & ADD F14
19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1
P0
Motor Contactor
Motor Overload
X L1
Y L2
G CH
chassis 3
T1-01
T3-01
CHE
A1 A2
CMC
OL
CHX
SH1-14
SH1-14
G/Y
T6-02
T1-02
T5-02
T5-01
G/Y
BLACK
GREY
BROWN
BLUE
MOTOR 1PH
HTT2
P1
T6-01
CR
CS
SR
AC/DC SWITCHED MODE POWER SUPPLY
AC/DC SMPS
CH
H2
H1
N
L
+V
-V
2RB
X1
X4
CHK
SH1-15
SH1-15
FF
ER1
PC-01
Switch Relay
CH3
HTT2
DC MOTOR/ GENERATOR
MDC
RED M
BLACK CHL
HTT1
Battery Relay
RM
87 30
85 86
CH1
RM
ENGINE COMPARTMENT
FP
Fuse Power
2/BROWN
Key Relay Start
F14
01
BT
CHA/BLACK
BAT
SH1-15
R1K
CH4
03
RM
EF1-01
CF1-01
PC
DK3
SH1-15
SH1-9
SH1-10
SH1-9
SH1-9
SH1-15
HTT1
ITEM PART NUMBER REV. DESCRIPTION QTY. MAT'L SPEC'S
LIST OF MATERIAL
DRAWN JGF 20-Dec-06
CHECKED MA FERRER 20-Dec-06
APPROVED JGF 20-Dec-06
THIS PRINT SUPERSEDES ANY OF EARLIER DATE. DESTROY SAME.
SCALE
DIAGRAM WIRING B-100-10/20
B-100-20
SHEET 2 OF 4
MATERIAL:
FINISH:
THERMO KING SPAIN
Ref. 1E26983
DRAWING NUMBER 1E26984
REV. C
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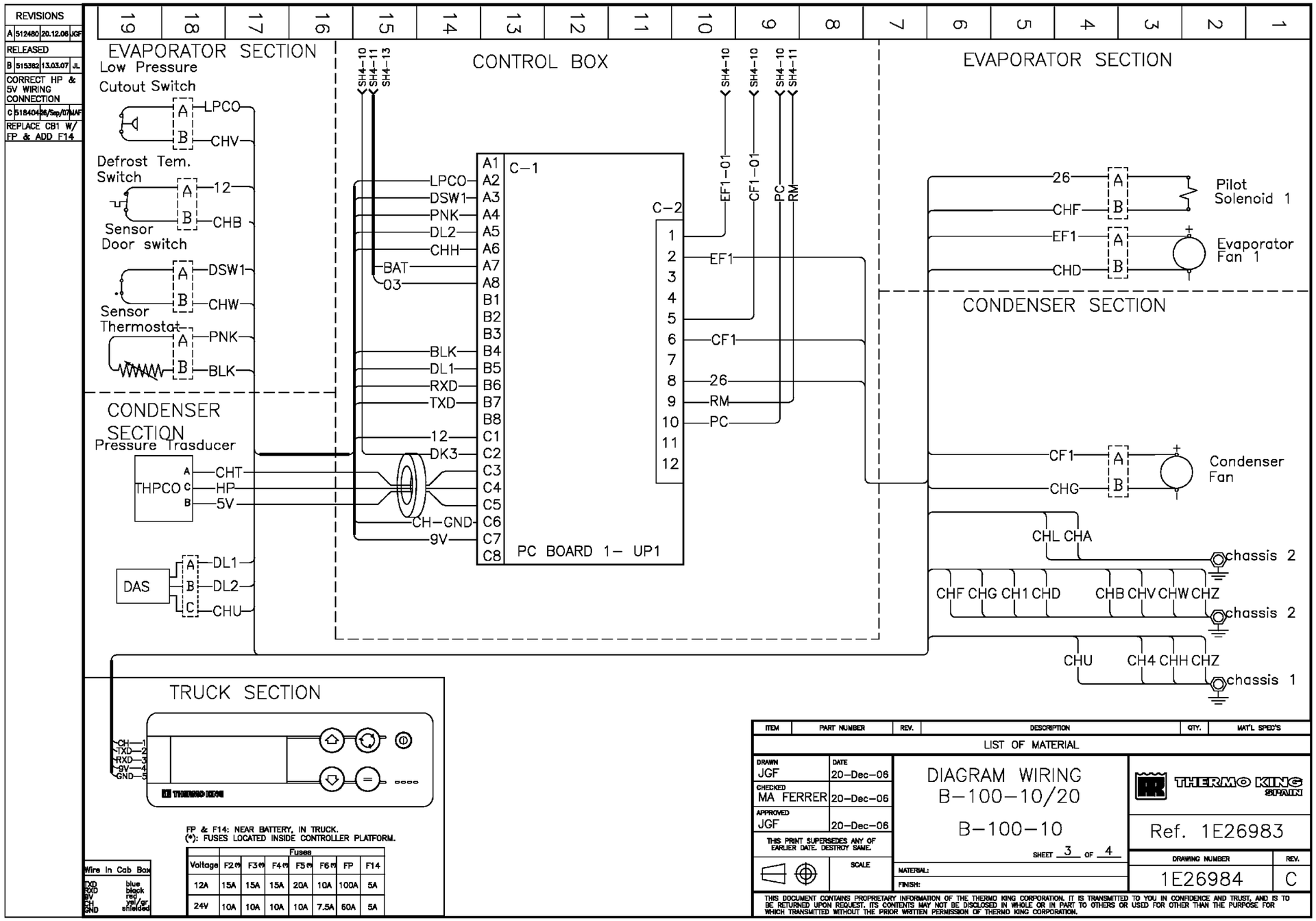
REVISIONS
A 512480 20.12.06 JGF RELEASED
B 515382 13.03.07 JL CORRECT HP & 5V WIRING CONNECTION
C 518404 28/Sep/07 NAF REPLACE CB1 W/ FP & ADD F14
EVAPORATOR SECTION
Low Pressure Cutout Switch
LPCO
CHV
Defrost Tem. Switch
12
CHB
Sensor Door switch
DSW1
CHW
Sensor Thermostat
PNK
BLK
CONDENSER SECTION
Pressure Trasducer
THPCO
CHT
HP
5V
DAS
DL1
DL2
CHU
CONTROL BOX
SH4-10
SH4-11
SH4-13
C-1
C-2
LPCO
DSW1
PNK
DL2
CHH
BAT
03
BLK
DL1
RXD
TXD
12
DK3
CH-GND
9V
EF1-01
CF1-01
PC
RM
EF1
CF1
26
PC BOARD 1- UP1
EVAPORATOR SECTION
Pilot Solenoid 1
Evaporator Fan 1
CONDENSER SECTION
Condenser Fan
CHL CHA
chassis 2
CHF CHG CH1 CHD CHB CHV CHW CHZ
chassis 2
CHU CH4 CHH CHZ
chassis 1
TRUCK SECTION
CH
TXD
RXD
9V
GND
FP & F14: NEAR BATTERY, IN TRUCK.
(*): FUSES LOCATED INSIDE CONTROLLER PLATFORM.
Fuses
Voltage F2(*) F3(*) F4(*) F5(*) F6(*) FP F14
12A 15A 15A 15A 20A 10A 100A 5A
24V 10A 10A 10A 10A 7.5A 60A 5A
Wire In Cab Box
TXD blue
RXD black
9V red
CH yel/gr
GND shielded
ITEM PART NUMBER REV. DESCRIPTION QTY. MAT'L SPEC'S
LIST OF MATERIAL
DRAWN JGF 20-Dec-06
CHECKED MA FERRER 20-Dec-06
APPROVED JGF 20-Dec-06
THIS PRINT SUPERSEDES ANY OF EARLIER DATE. DESTROY SAME.
SCALE
DIAGRAM WIRING B-100-10/20
B-100-10
SHEET 3 OF 4
MATERIAL:
FINISH:
THERMO KING SPAIN
Ref. 1E26983
DRAWING NUMBER 1E26984
REV. C
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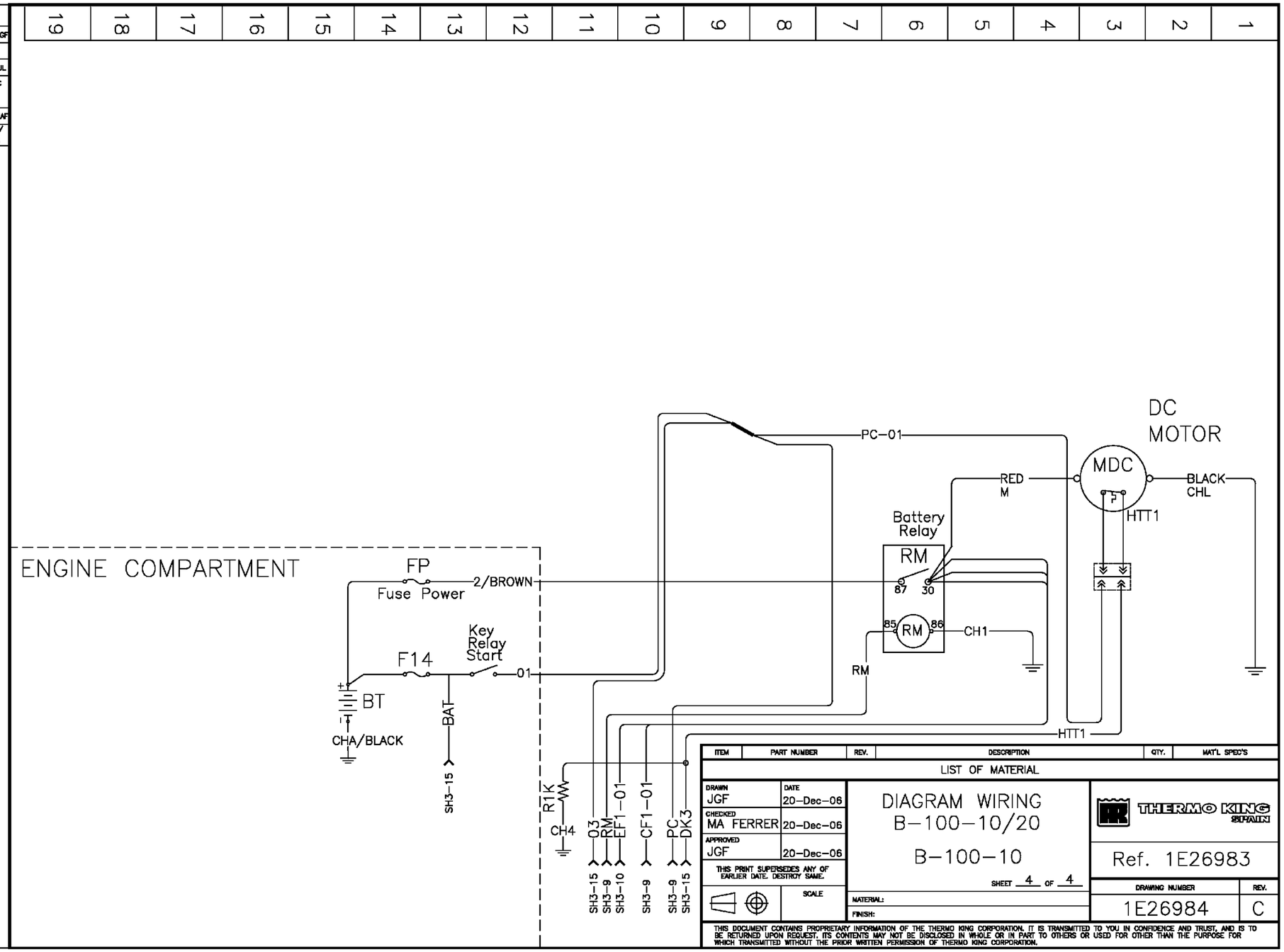
REVISIONS			
A	512480	20.12.06	JGF
RELEASED			
B	515382	13.03.07	JL
CORRECT HP & 5V WIRING CONNECTION			
C	518404	26/Sep/07	MAF
REPLACE CB1 W/ FP & ADD F14			



ITEM	PART NUMBER	REV.	DESCRIPTION	QTY.	MAT'L SPEC'S

LIST OF MATERIAL

DRAWN JGF	DATE 20–Dec–06
CHECKED MA FERRER	20–Dec–06
APPROVED JGF	20–Dec–06

THIS PRINT SUPERSEDES ANY OF EARLIER DATE. DESTROY SAME.

SCALE

DIAGRAM WIRING
B–100–10/20

B–100–10

SHEET 4 OF 4

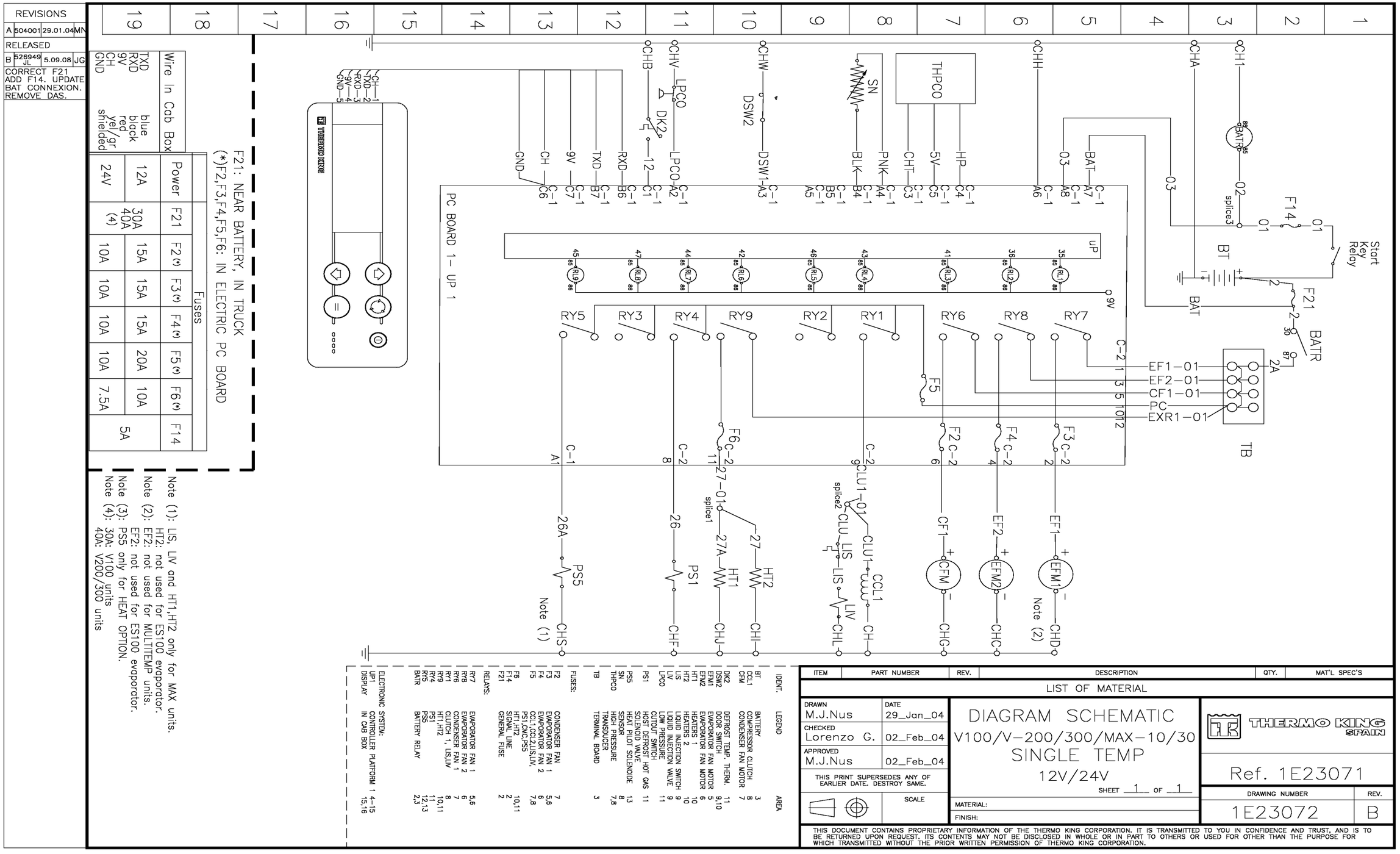
MATERIAL:

FINISH:

THERMO KING SPAIN

Ref. 1E26983

DRAWING NUMBER	REV.
1E26984	C


REVISIONS
A 504001 29.01.04 MN
RELEASED
B 526949 JL 5.09.08 JG
CORRECT F21
ADD F14. UPDATE
BAT CONNEXION.
REMOVE DAS.
Wire In Cab Box
TXD blue
RXD black
9V red
CH yel/gr
GND shielded
F21: NEAR BATTERY, IN TRUCK
(*)F2,F3,F4,F5,F6: IN ELECTRIC PC BOARD
Fuses
Power F21
24V 12A
30A 40A (4) F2 (*)
10A 15A F3 (*)
10A 15A F4 (*)
10A 15A 20A F5 (*)
10A 10A F6 (*)
7.5A 5A F14
PC BOARD 1– UP 1
uP
RY5 RY3 RY4 RY9 RY2 RY1 RY6 RY8 RY7
F5 F6 F2 F4 F3
EF1–01 EF2–01 CF1–01 PC EXR1–01
TB
Start Key Relay
BT
BATR
BAT
F14
F21
splice1 splice2 splice3
DSW2 DK2 LPCO SN THPCO
CHA CHB CHC CHD CHE CHF CHG CHH CHI CHJ CHL CHS
CCL1 CLU1 LIS LIV
CFM EFM1 EFM2
HT1 HT2
PS1 PS5
Note (1)
Note (2)
26 26A 27 27A
TXD RXD 9V CH GND
THERMO KING
Note (1): LIS, LIV and HT1,HT2 only for MAX units.
Note (2): HT2: not used for ES100 evaporator.
EF2: not used for MULTITEMP units.
EF2: not used for ES100 evaporator.
Note (3): PS5 only for HEAT OPTION.
Note (4): 30A: V100 units
40A: V200/300 units
IDENT. LEGEND AREA
BT BATTERY 3
CCL1 COMPRESSOR CLUTCH 8
CFM CONDENSER FAN MOTOR 7
DK2 DEFROST TEMP. THERM. 11
DSW2 DOOR SWITCH 9,10
EFM1 EVAPORATOR FAN MOTOR 5
EFM2 EVAPORATOR FAN MOTOR 6
HT1 HEATERS 1 10
HT2 HEATERS 2 10
LIS LIQUID INJECTION SWITCH 9
LIV LIQUID INJECTION VALVE 9
LPCO LOW PRESSURE CUTOUT SWITCH 11
PS1 HOST DEFROST HOT GAS SOLENOID VALVE 11
PS5 HEAT PILOT SOLENOID 13
SN SENSOR 8
THPCO HIGH PRESSURE TRANSDUCER 7,8
TB TERMINAL BOARD 3
FUSES:
F2 CONDENSER FAN 7
F3 EVAPORATOR FAN 1 5,6
F4 EVAPORATOR FAN 2 6
F5 CONDENSER FAN 1 7
F6 CLUTCH 1, LIS,LIV PS1,CHG,PS5 7,8
HT1,HT2 10,11
F14 SIGNAL LINE 2
F21 GENERAL FUSE 2
RELAYS:
RY7 EVAPORATOR FAN 1 5,6
RY8 EVAPORATOR FAN 2 6
RY6 CONDENSER FAN 7
RY1 CLUTCH 1, LIS,LIV 8
RY9 HT1,HT2 10,11
RY4 PS1 11
RY5 PS5 12,13
RY3 BATTER RELAY 2,3
ELECTRONIC SYSTEM:
UP1 CONTROLLER PLATFORM 1 4–15
DISPLAY IN CAB BOX 15,16
ITEM PART NUMBER REV. DESCRIPTION QTY. MAT'L SPEC'S
LIST OF MATERIAL
DRAWN M.J.Nus DATE 29_Jan_04
CHECKED Lorenzo G. 02_Feb_04
APPROVED M.J.Nus 02_Feb_04
THIS PRINT SUPERSEDES ANY OF EARLIER DATE. DESTROY SAME.
SCALE
DIAGRAM SCHEMATIC
V100/V–200/300/MAX–10/30
SINGLE TEMP
12V/24V
SHEET 1 OF 1
MATERIAL:
FINISH:
THERMO KING SPAIN
Ref. 1E23071
DRAWING NUMBER 1E23072
REV. B
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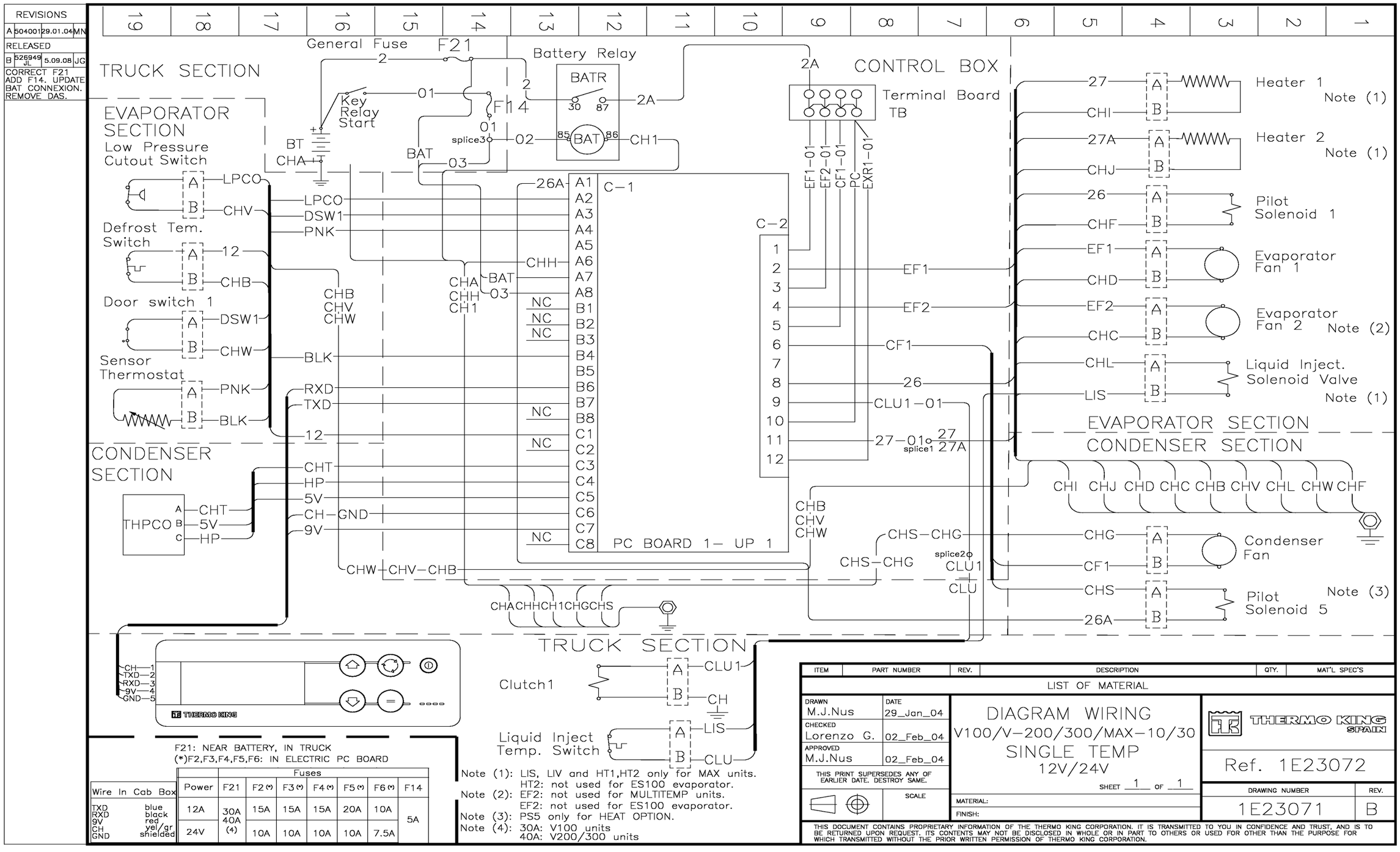
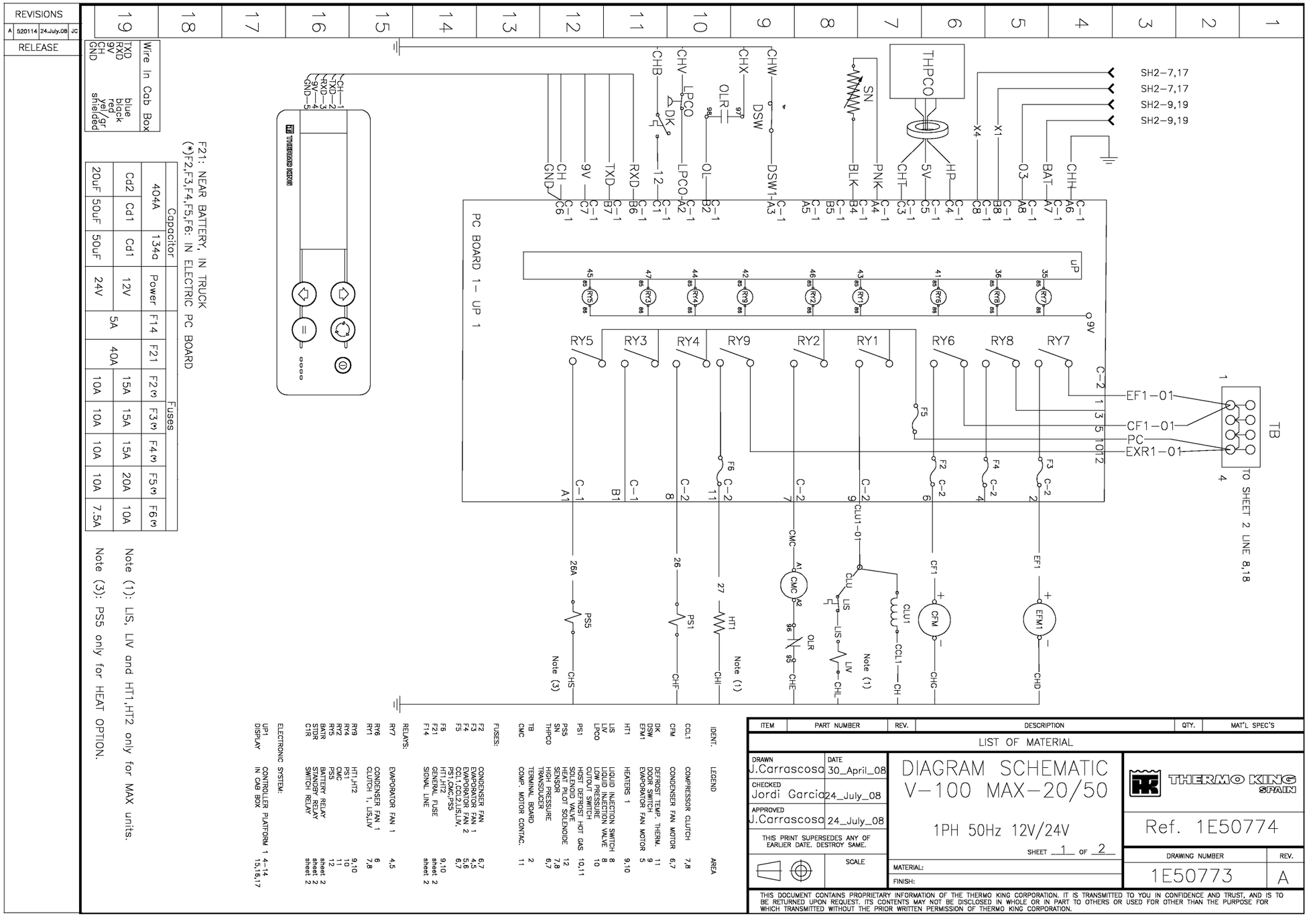
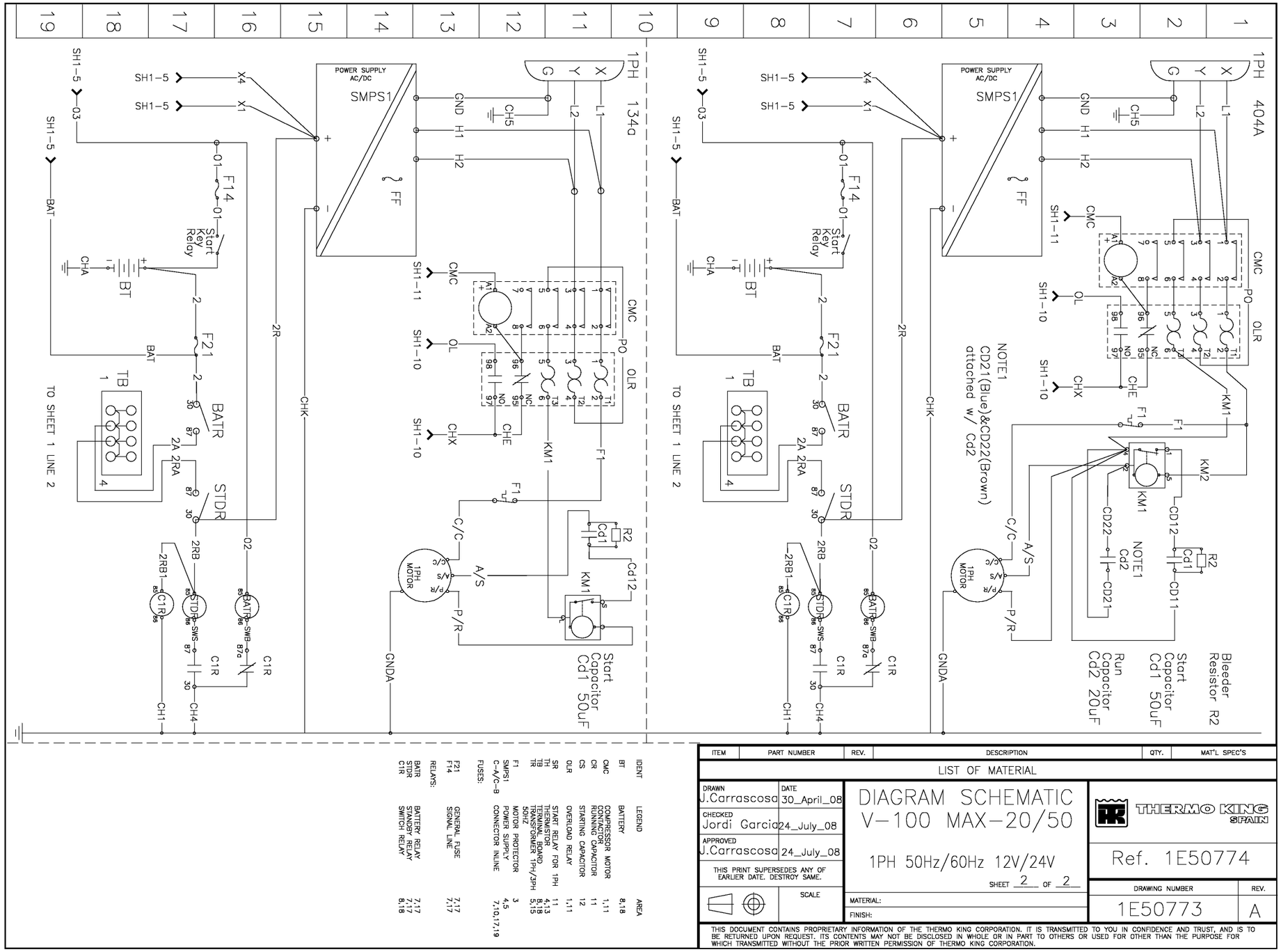


Wire In Cab Box		Fuses							
		Power	F21	F2 (*)	F3 (*)	F4 (*)	F5 (*)	F6 (*)	F14
TXD	blue	12A	30A 40A (4)	15A	15A	15A	20A	10A	5A
RXD	black								
9V	red								
CH	yel/gr	24V		10A	10A	10A	10A	7.5A	
GND	shielded								

1E50773 DSR MICROPROCESSOR CONTROLLER SCHEMATIC DIAGRAM, V-100 MAX, 20/50 - PAGE 1 OF 2





IDENT	LEGEND	AREA
BT	BATTERY	8,18
CMC	COMPRESSOR MOTOR CONTACTOR	1,11
CR	RUNNING CAPACITOR	11
CS	STARTING CAPACITOR	12
OLR	OVERLOAD RELAY	1,11
SR	START RELAY FOR 1PH	11
TH	THERMISTOR	4,13
TR	TRANSFORMER 1PH/3PH 50HZ	5,18
F1	MOTOR PROTECTOR	3
SMPS1	POWER SUPPLY	4,5
C--A/C--B	CONNECTOR INLINE	7,10,17,19
FUSES:		
F21	GENERAL FUSE	7,17
F14	SIGNAL LINE	7,17
RELAYS:		
BATR	BATTERY RELAY	7,17
STDR	STANDBY RELAY	7,17
C1R	SWITCH RELAY	8,18

ITEM	PART NUMBER	REV.	DESCRIPTION	QTY.	MAT'L SPEC'S

LIST OF MATERIAL

DRAWN J.Carrascosa	DATE 30_April_08
CHECKED Jordi Garcia	24_July_08
APPROVED J.Carrascosa	24_July_08

THIS PRINT SUPERSEDES ANY OF EARLIER DATE. DESTROY SAME.

SCALE

DIAGRAM SCHEMATIC
V-100 MAX-20/50

1PH 50Hz/60Hz 12V/24V

SHEET 2 OF 2

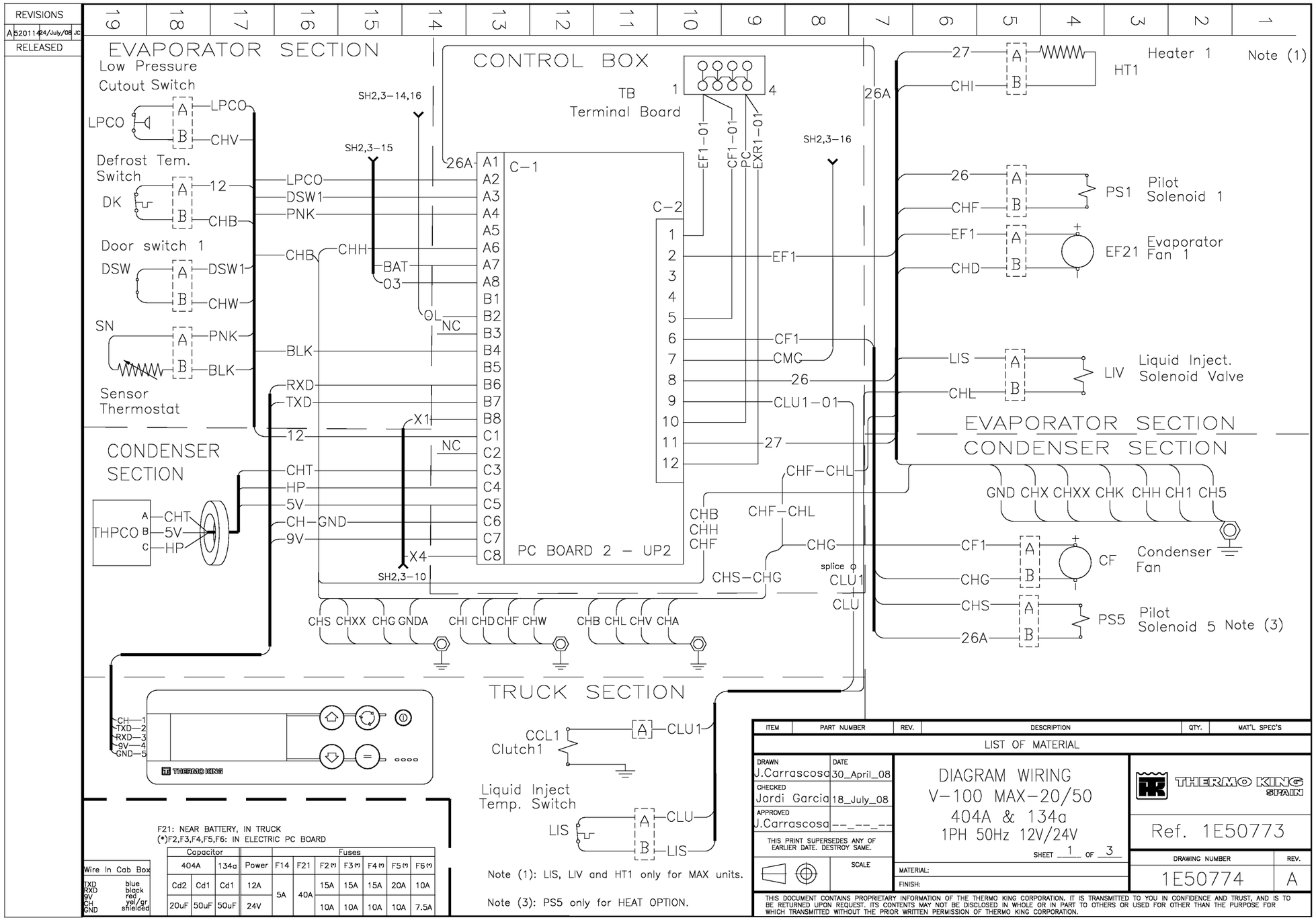
MATERIAL:

FINISH:

THERMO KING SPAIN

Ref. 1E50774

DRAWING NUMBER	REV.
1E50773	A


REVISIONS
A 52011 24/July/08 JC
RELEASED
EVAPORATOR SECTION
Low Pressure Cutout Switch
LPCO
CHV
Defrost Tem. Switch
DK
12
CHB
Door switch 1
DSW
DSW1
CHW
SN
PNK
BLK
Sensor Thermostat
CONDENSER SECTION
THPCO
CHT
5V
HP
CONTROL BOX
TB Terminal Board
SH2,3-14,16
SH2,3-15
SH2,3-16
SH2,3-10
C-1
C-2
PC BOARD 2 - UP2
26A
EF1-01
CF1-01
PC
EXR1-01
EF1
CF1
CMC
CLU1-01
27
CHF-CHL
CHG
CHS-CHG
CLU1
CLU
CHB
CHH
CHF
LPCO
DSW1
PNK
BLK
CHH
BAT
03
OL
NC
RXD
TXD
X1
X4
CHT
HP
5V
GND
9V
CHS CHXX CHG GNDA
CHI CHD CHF CHW
CHB CHL CHV CHA
Heater 1
HT1
Note (1)
CHI
PS1
Pilot Solenoid 1
CHF
EF1
EF21
Evaporator Fan 1
CHD
LIS
LIV
Liquid Inject. Solenoid Valve
CHL
EVAPORATOR SECTION
CONDENSER SECTION
GND CHX CHXX CHK CHH CH1 CH5
CF1
CF
Condenser Fan
CHG
CHS
PS5
Pilot Solenoid 5 Note (3)
26A
splice
CLU1
CLU
TRUCK SECTION
CH
TXD
RXD
9V
GND
THERMO KING
CCL1
Clutch1
CLU1
Liquid Inject Temp. Switch
LIS
CLU
Note (1): LIS, LIV and HT1 only for MAX units.
Note (3): PS5 only for HEAT OPTION.
F21: NEAR BATTERY, IN TRUCK
(*)F2,F3,F4,F5,F6: IN ELECTRIC PC BOARD
Wire In Cab Box
TXD blue
RXD black
9V red
CH yel/gr
GND shielded
Capacitor
404A 134a
Cd2 Cd1 Cd1
20uF 50uF 50uF
Power
12A
24V
Fuses
F14 F21 F2(*) F3(*) F4(*) F5(*) F6(*)
5A 40A
15A 15A 15A 20A 10A
10A 10A 10A 10A 7.5A
ITEM PART NUMBER REV. DESCRIPTION QTY. MAT'L SPEC'S
LIST OF MATERIAL
DRAWN J.Carrascosa DATE 30_April_08
CHECKED Jordi Garcia 18_July_08
APPROVED J.Carrascosa
THIS PRINT SUPERSEDES ANY OF EARLIER DATE. DESTROY SAME.
SCALE
DIAGRAM WIRING
V-100 MAX-20/50
404A & 134a
1PH 50Hz 12V/24V
SHEET 1 OF 3
MATERIAL:
FINISH:
THERMO KING SPAIN
Ref. 1E50773
DRAWING NUMBER 1E50774
REV. A
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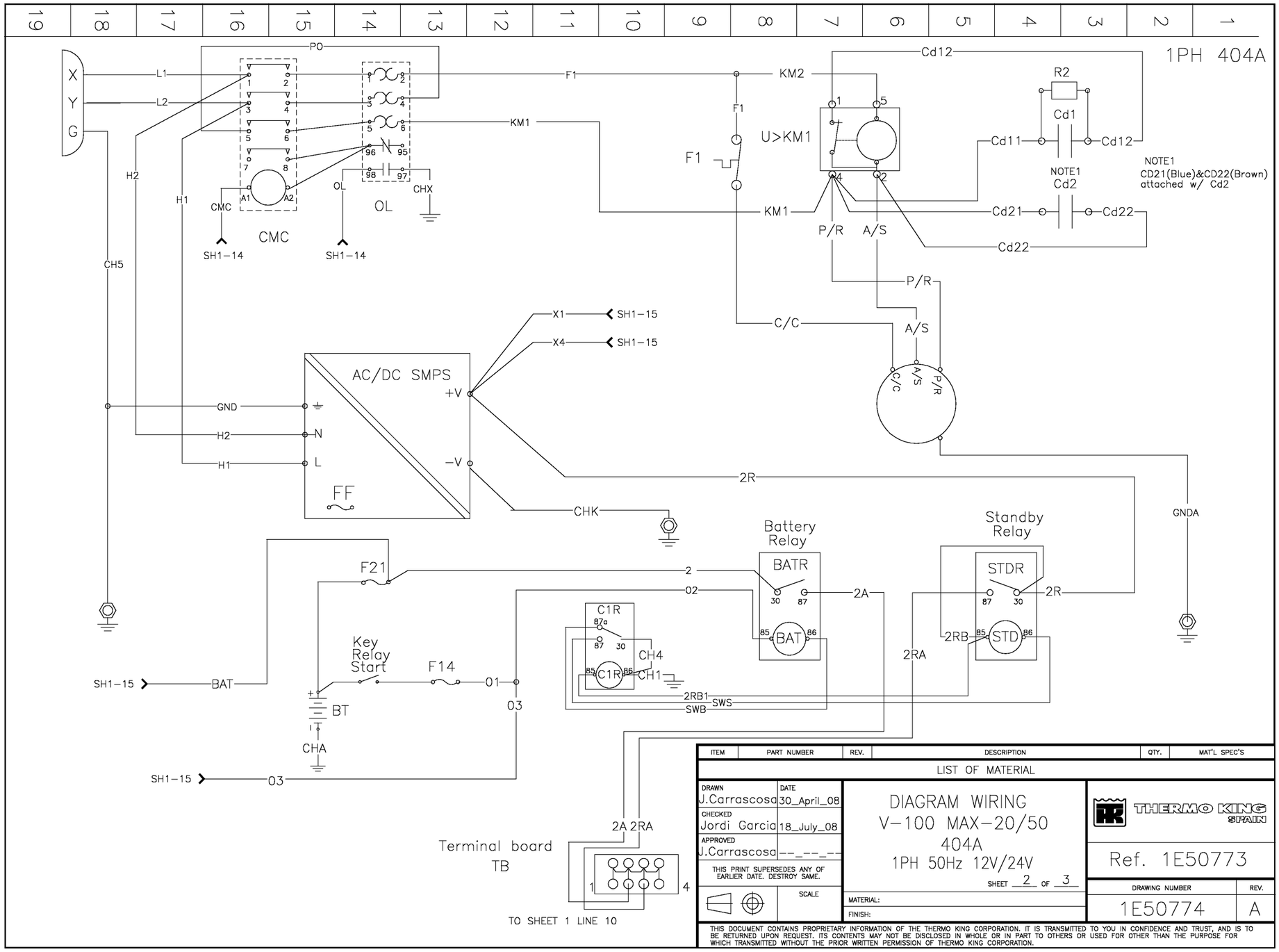
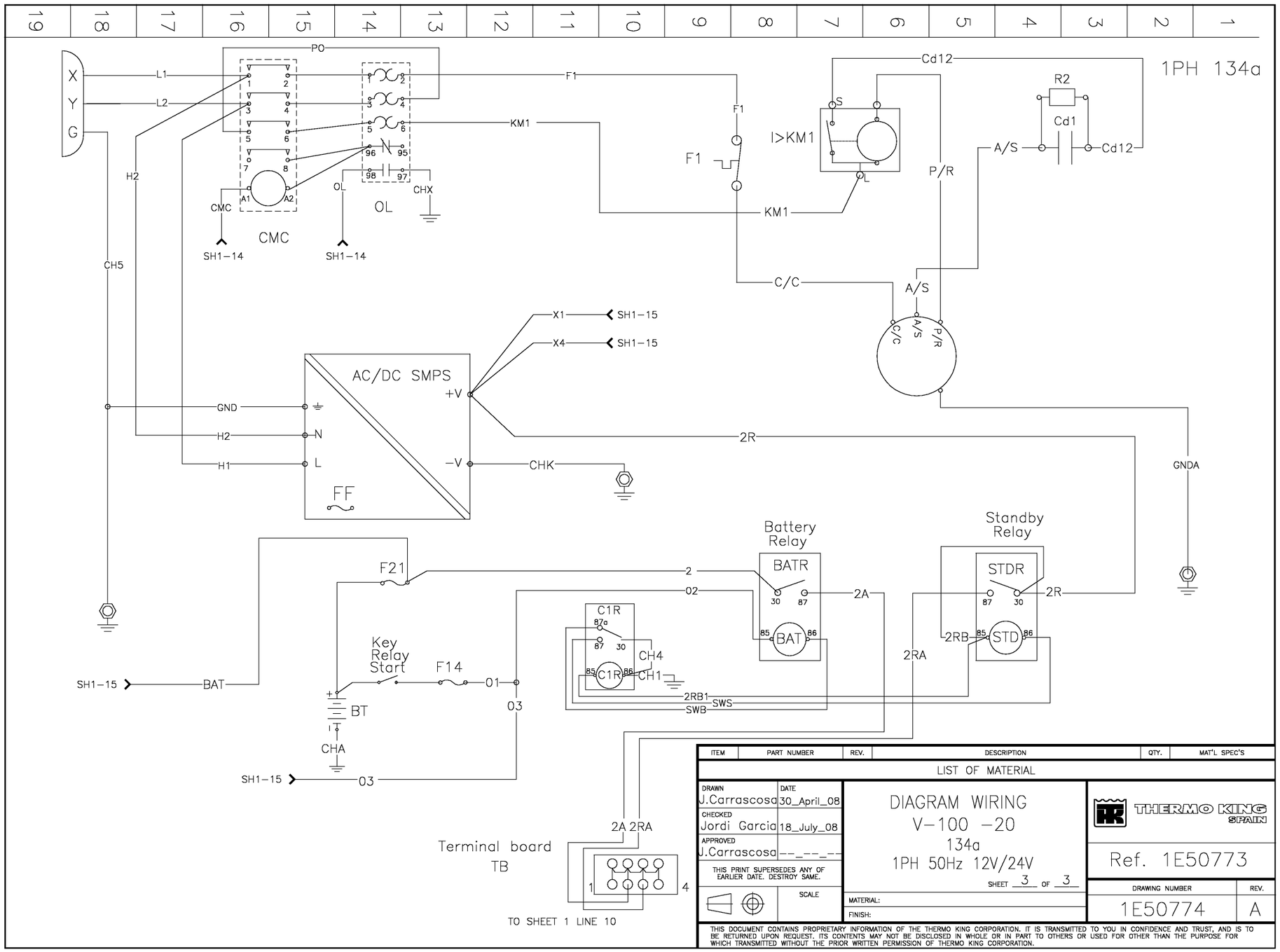
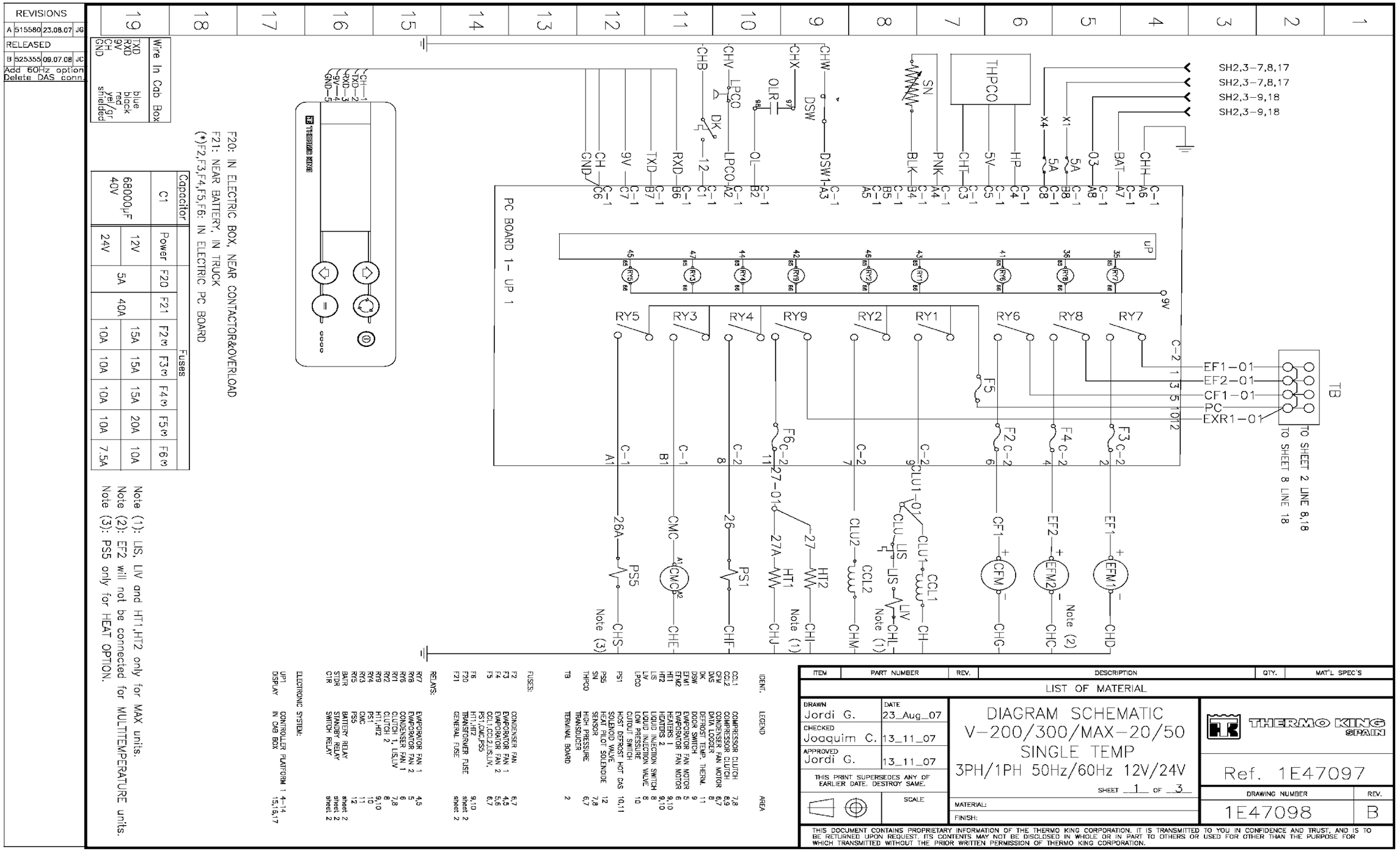
1E50774 DSR MICROPROCESSOR CONTROLLER WIRING DIAGRAM, V-100 MAX, 20/50 - PAGE 2 OF 3



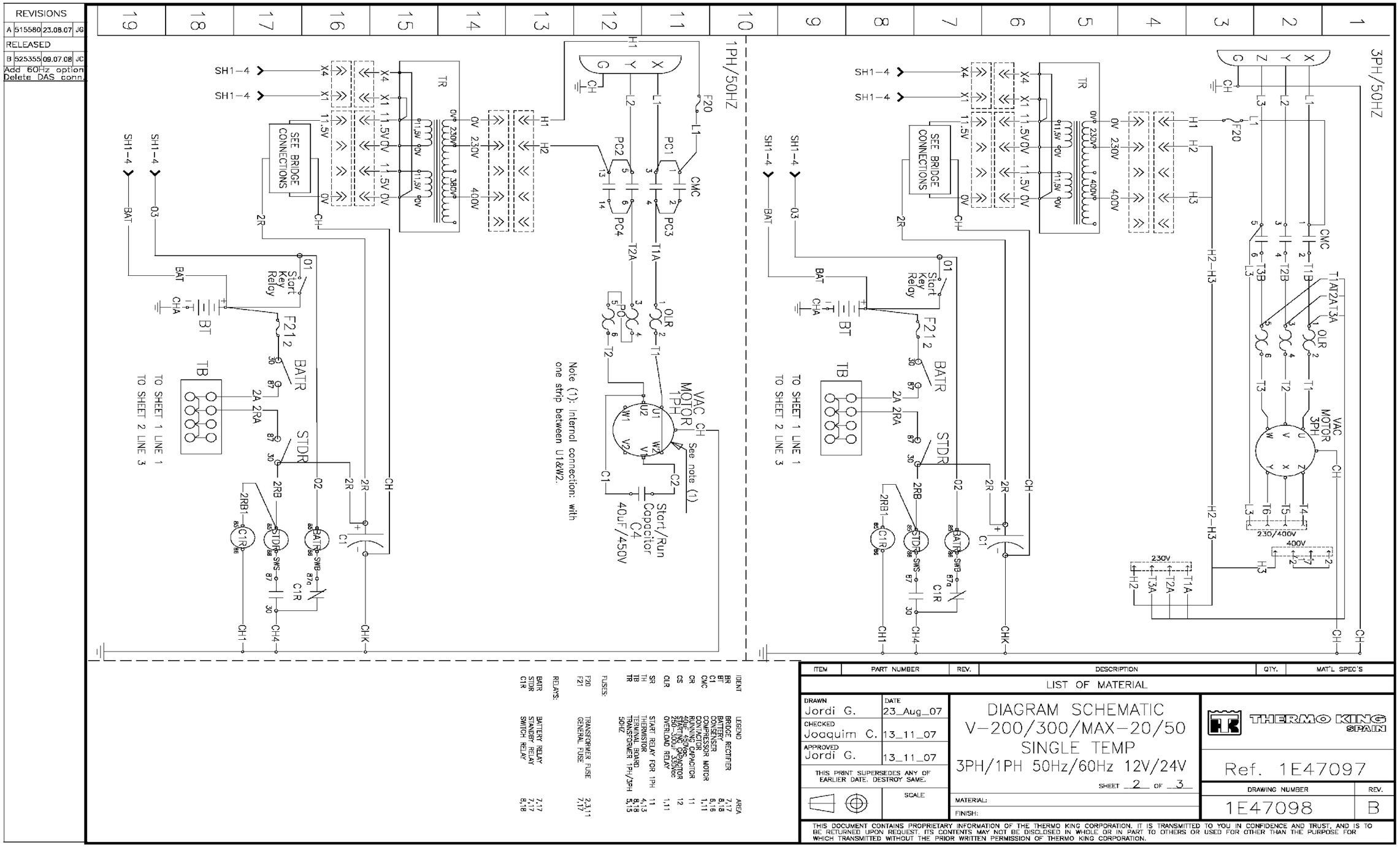
1E50774 DSR MICROPROCESSOR CONTROLLER WIRING DIAGRAM, V-100 MAX, 20/50 - PAGE 3 OF 3



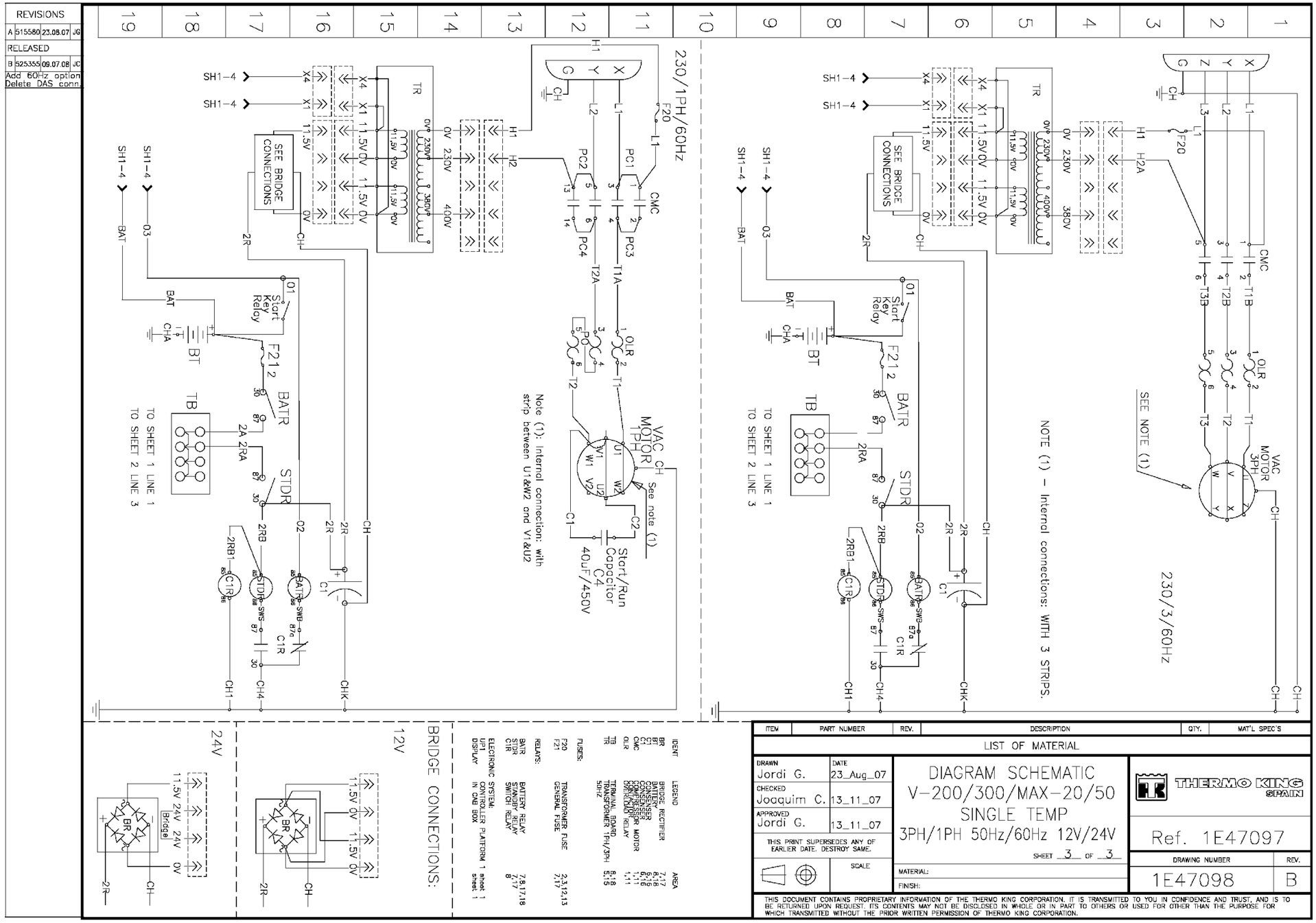
1E47098 DSR MICROPROCESSOR CONTROLLER SCHEMATIC DIAGRAM, V-200, V-300 MAX, 20/50 - PAGE 1 OF 3

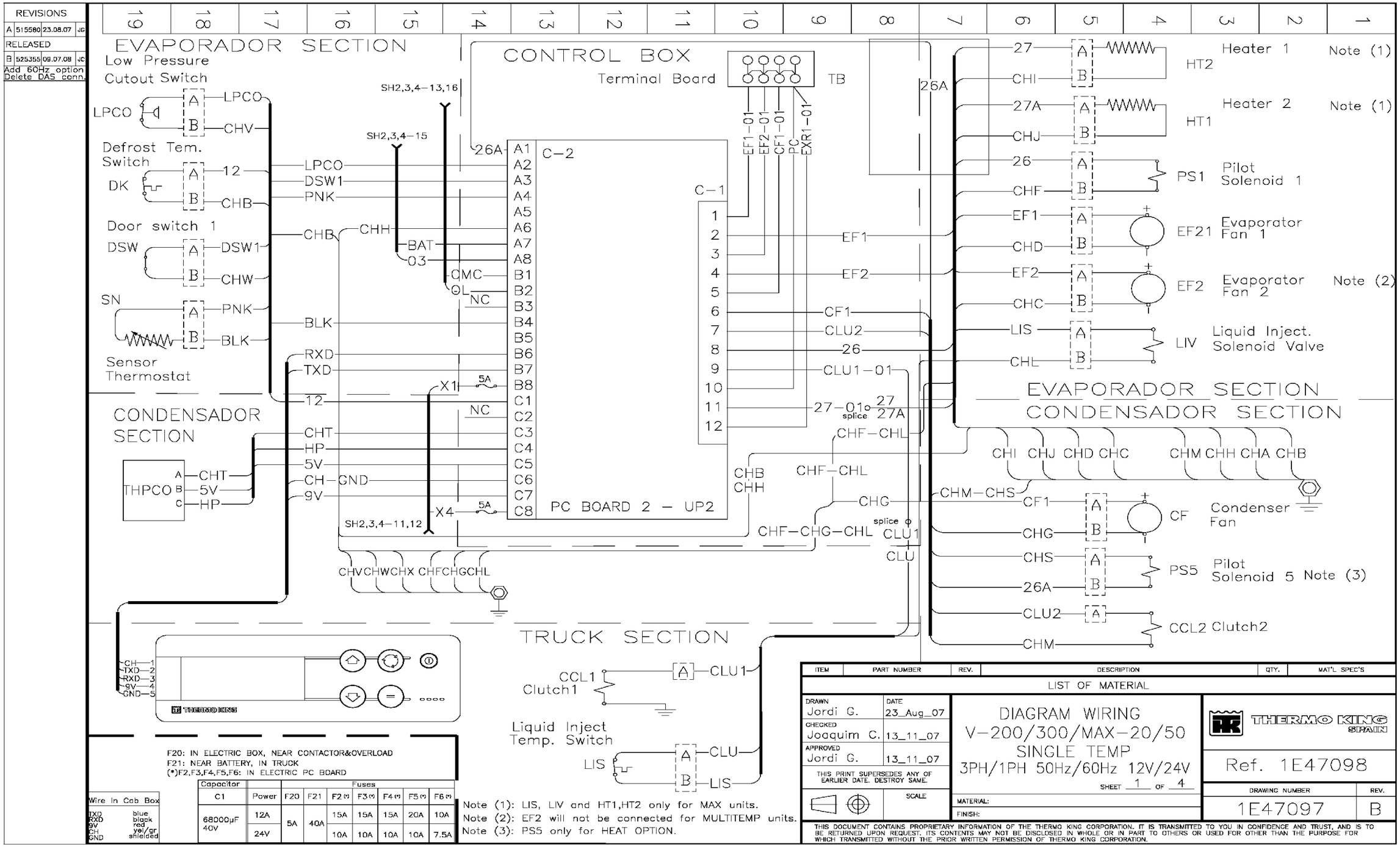


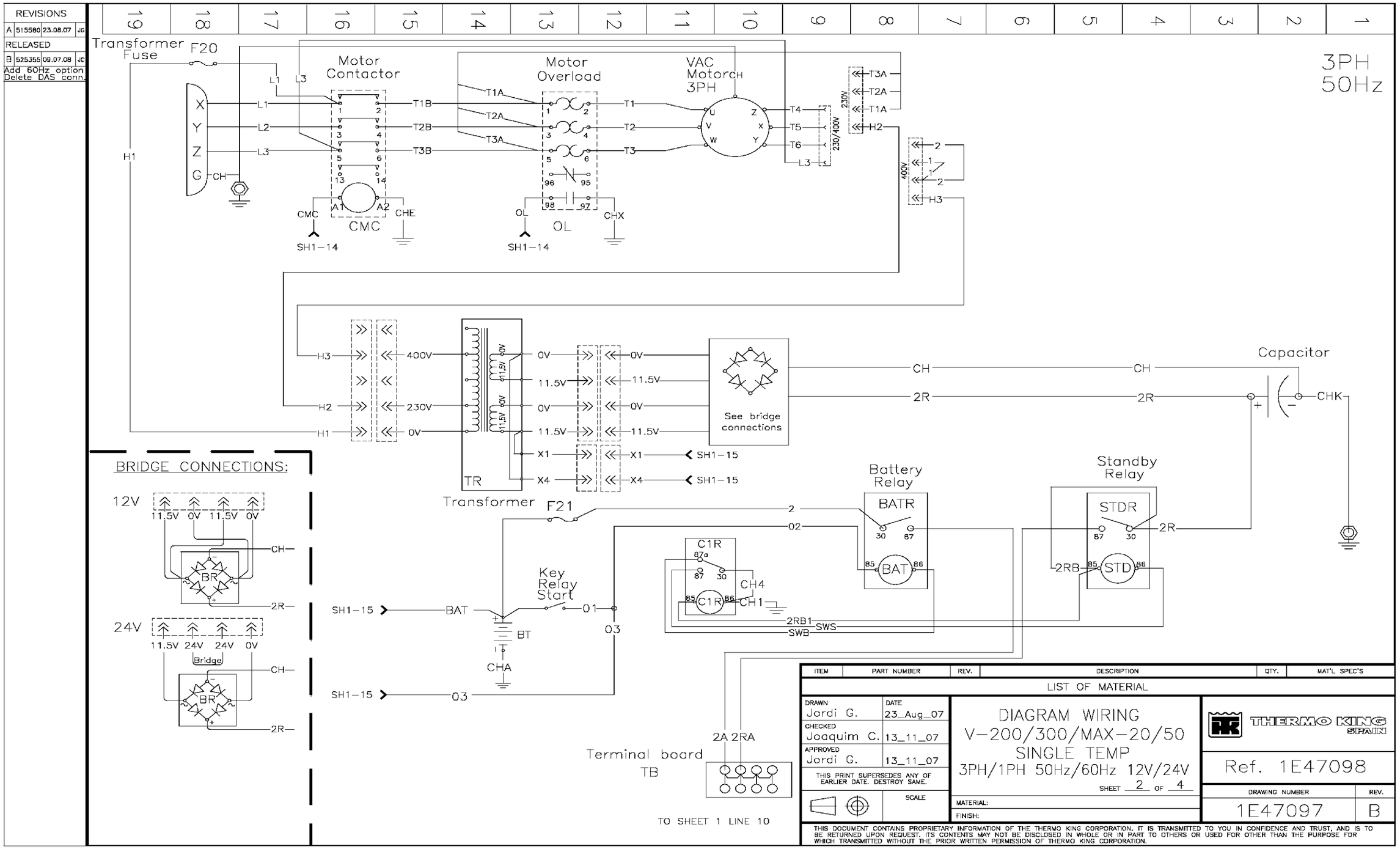
1E47098 DSR MICROPROCESSOR CONTROLLER SCHEMATIC DIAGRAM, V-200, V-300 MAX, 20/50 - PAGE 2 OF 3



1E47098 DSR MICROPROCESSOR CONTROLLER SCHEMATIC DIAGRAM, V-200, V-300 MAX, 20/50 - PAGE 3 OF 3




REVISIONS
A 515580 23.08.07 JG
RELEASED
B 525355 09.07.08 JC
Add 60Hz option
Delete DAS conn.
EVAPORADOR SECTION
Low Pressure Cutout Switch
LPCO
CHV
Defrost Tem. Switch
DK
12
CHB
Door switch 1
DSW
DSW1
CHW
SN
PNK
BLK
Sensor Thermostat
CONDENSADOR SECTION
THPCO
CHT
5V
HP
CONTROL BOX
Terminal Board
TB
SH2,3,4–13,16
SH2,3,4–15
LPCO
DSW1
PNK
CHB
CHH
BAT
03
CMC
OL
NC
BLK
RXD
TXD
X1
5A
12
CHT
HP
5V
CH
GND
9V
X4
SH2,3,4–11,12
CHVCHWCHX CHFCHGCHL
26A
A1
A2
A3
A4
A5
A6
A7
A8
B1
B2
B3
B4
B5
B6
B7
B8
C1
C2
C3
C4
C5
C6
C7
C8
C–2
PC BOARD 2 – UP2
C–1
EF1–01
EF2–01
CF1–01
PC
EXR1–01
1
2
3
4
5
6
7
8
9
10
11
12
EF1
EF2
CF1
CLU2
26
CLU1–01
27–01
splice
27
27A
CHF–CHL
CHB
CHH
CHG
CHF–CHG–CHL
CLU1
CLU
TRUCK SECTION
CCL1
Clutch1
CLU1
Liquid Inject
Temp. Switch
LIS
CLU
CH 1
TXD 2
RXD 3
9V 4
GND 5
THERMO KING
F20: IN ELECTRIC BOX, NEAR CONTACTOR&OVERLOAD
F21: NEAR BATTERY, IN TRUCK
(*)F2,F3,F4,F5,F6: IN ELECTRIC PC BOARD
Capacitor
C1
68000µF 40V
Power
12A
24V
Fuses
F20 5A
F21 40A
F2 (*) 15A 10A
F3 (*) 15A 10A
F4 (*) 15A 10A
F5 (*) 20A 10A
F6 (*) 10A 7.5A
Wire In Cab Box
TXD blue
RXD black
9V red
CH yel/gr
GND shielded
Note (1): LIS, LIV and HT1,HT2 only for MAX units.
Note (2): EF2 will not be connected for MULTITEMP units.
Note (3): PS5 only for HEAT OPTION.
EVAPORADOR SECTION
CONDENSADOR SECTION
CHI CHJ CHD CHC CHM CHH CHA CHB
CHM–CHS
27
CHI
27A
CHJ
26
CHF
EF1
CHD
EF2
CHC
LIS
CHL
CF1
CHG
CHS
26A
CLU2
CHM
HT2
Heater 1
Note (1)
HT1
Heater 2
Note (1)
PS1
Pilot Solenoid 1
EF21
Evaporator Fan 1
EF2
Evaporator Fan 2
Note (2)
LIV
Liquid Inject. Solenoid Valve
CF
Condenser Fan
PS5
Pilot Solenoid 5 Note (3)
CCL2 Clutch2
ITEM
PART NUMBER
REV.
DESCRIPTION
QTY.
MAT'L SPEC'S
LIST OF MATERIAL
DRAWN Jordi G. DATE 23_Aug_07
CHECKED Joaquim C. 13_11_07
APPROVED Jordi G. 13_11_07
THIS PRINT SUPERSEDES ANY OF EARLIER DATE. DESTROY SAME.
SCALE
MATERIAL:
FINISH:
DIAGRAM WIRING
V–200/300/MAX–20/50
SINGLE TEMP
3PH/1PH 50Hz/60Hz 12V/24V
SHEET 1 OF 4
THERMO KING SPAIN
Ref. 1E47098
DRAWING NUMBER 1E47097
REV. B
THIS DOCUMENT CONTAINS PROPRIETARY INFORMATION OF THE THERMO KING CORPORATION. IT IS TRANSMITTED TO YOU IN CONFIDENCE AND TRUST, AND IS TO BE RETURNED UPON REQUEST. ITS CONTENTS MAY NOT BE DISCLOSED IN WHOLE OR IN PART TO OTHERS OR USED FOR OTHER THAN THE PURPOSE FOR WHICH TRANSMITTED WITHOUT THE PRIOR WRITTEN PERMISSION OF THERMO KING CORPORATION.


REVISIONS
A 515580 23.08.07 JG
RELEASED
B 525355 09.07.08 JG
Add 60Hz option
Delete DAS conn.
3PH
50Hz
Transformer Fuse
F20
Motor Contactor
Motor Overload
VAC Motorch 3PH
CMC
OL
SH1–14
SH1–15
H1
H2
H3
400V
230V
0V
11.5V
TR
X1
X4
See bridge connections
CH
2R
Capacitor
CHK
Standby Relay
STDR
STD
2RB
Battery Relay
BATR
BAT
Transformer F21
Key Relay Start
BT
CHA
C1R
CH4
CH1
2RB1
SWS
SWB
2A 2RA
Terminal board TB
TO SHEET 1 LINE 10
BRIDGE CONNECTIONS:
12V
24V
Bridge
BR
ITEM
PART NUMBER
REV.
DESCRIPTION
QTY.
MAT'L SPEC'S
LIST OF MATERIAL
DRAWN Jordi G. 23_Aug_07
CHECKED Joaquim C. 13_11_07
APPROVED Jordi G. 13_11_07
THIS PRINT SUPERSEDES ANY OF EARLIER DATE. DESTROY SAME.
SCALE
MATERIAL:
FINISH:
DIAGRAM WIRING
V–200/300/MAX–20/50
SINGLE TEMP
3PH/1PH 50Hz/60Hz 12V/24V
SHEET 2 OF 4
THERMO KING SPAIN
Ref. 1E47098
DRAWING NUMBER
1E47097
REV.
B
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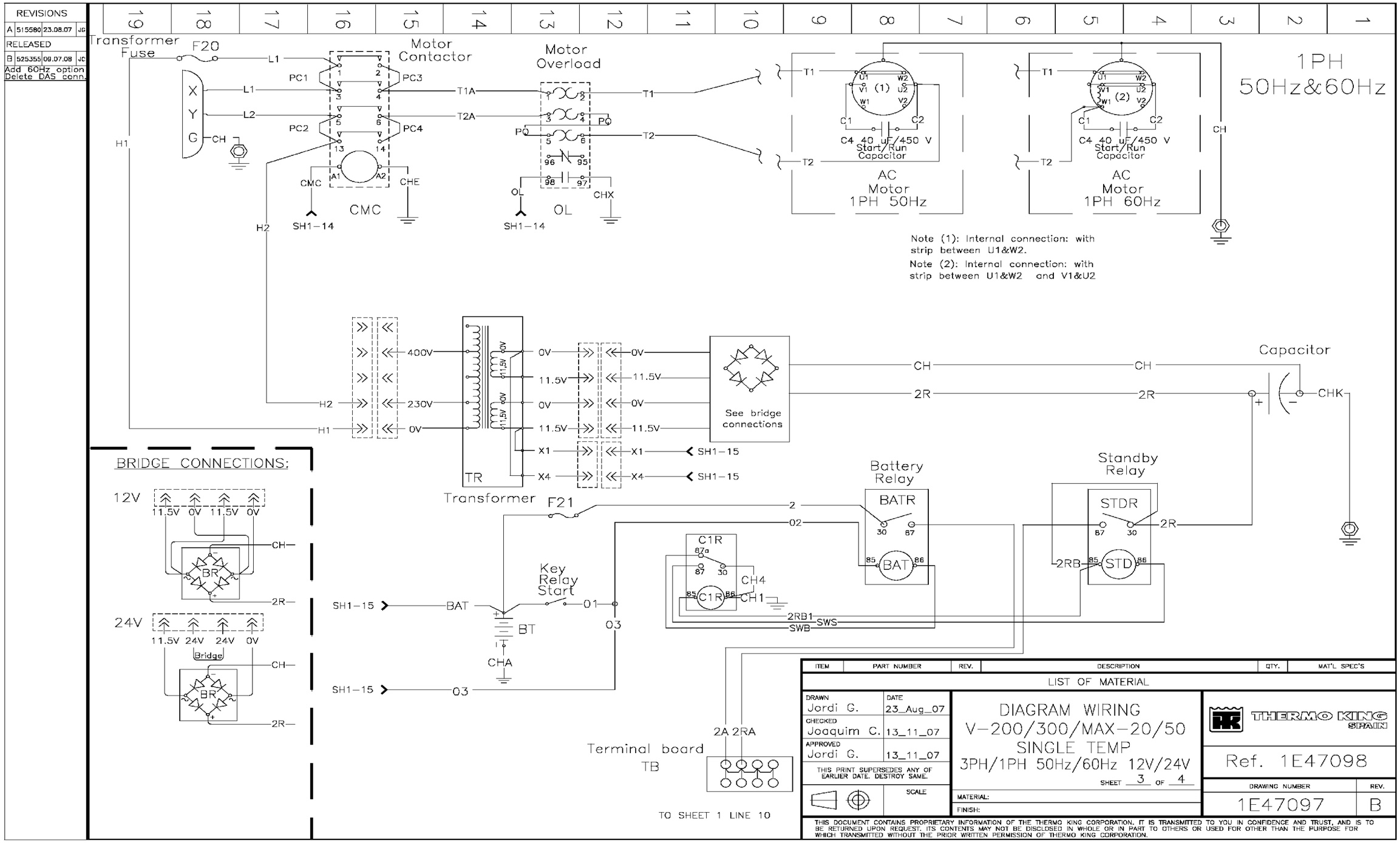


ITEM	PART NUMBER	REV.	DESCRIPTION	QTY.	MAT'L SPEC'S

LIST OF MATERIAL

DRAWN Jordi G.	DATE 23_Aug_07
CHECKED Joaquim C.	13_11_07
APPROVED Jordi G.	13_11_07

THIS PRINT SUPERSEDES ANY OF EARLIER DATE. DESTROY SAME.

SCALE

DIAGRAM WIRING
V-200/300/MAX-20/50
SINGLE TEMP
3PH/1PH 50Hz/60Hz 12V/24V

SHEET 3 OF 4

MATERIAL:

FINISH:

THERMO KING SPAIN

Ref. 1E47098

DRAWING NUMBER	REV.
1E47097	B

REVISIONS			
A	515580	23.08.07	JG
RELEASED			
B	525355	09.07.08	JC
Add 60Hz option Delete DAS conn.			

19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1

230/3PH 60Hz

Transformer Fuse F20

Motor Contactor

Motor Overload

VAC Motorch 3PH

See note (1)

NOTE (1): Internal connections WITH 3 STRIPS

X Y Z G CH H1 L1 L2 L3 T1B T2B T3B T1 T2 T3

CMC A1 A2 CHE SH1−14

OL CHX SH1−14

400V 230V 0V H2 H1 TR

0V 11.5V 0V 11.5V 0V 11.5V 0V 11.5V

X1 X4 SH1−15

See bridge connections

CH 2R Capacitor CHK

Standby Relay STDR 87 30 2R 2RB 85 STD 86

Battery Relay BATR 30 87 85 BAT 86

C1R 87a 87 30 85 C1R 86 CH4 CH1

2RB1 SWS SWB

Transformer F21 2 02

Key Relay Start 01 03

SH1−15 BAT BT CHA

SH1−15 03

BRIDGE CONNECTIONS:

12V 11.5V 0V 11.5V 0V BR CH 2R

24V 11.5V 24V 24V 0V Bridge BR CH 2R

Terminal board TB 2A 2RA

TO SHEET 1 LINE 10

ITEM	PART NUMBER	REV.	DESCRIPTION	QTY.	MAT'L SPEC'S

LIST OF MATERIAL

DRAWN Jordi G.	DATE 23_Aug_07
CHECKED Joaquim C.	13_11_07
APPROVED Jordi G.	13_11_07

THIS PRINT SUPERSEDES ANY OF EARLIER DATE. DESTROY SAME.

SCALE

DIAGRAM WIRING
V−200/300/MAX−20/50
SINGLE TEMP
3PH/1PH 50Hz/60Hz 12V/24V

SHEET 4 OF 4

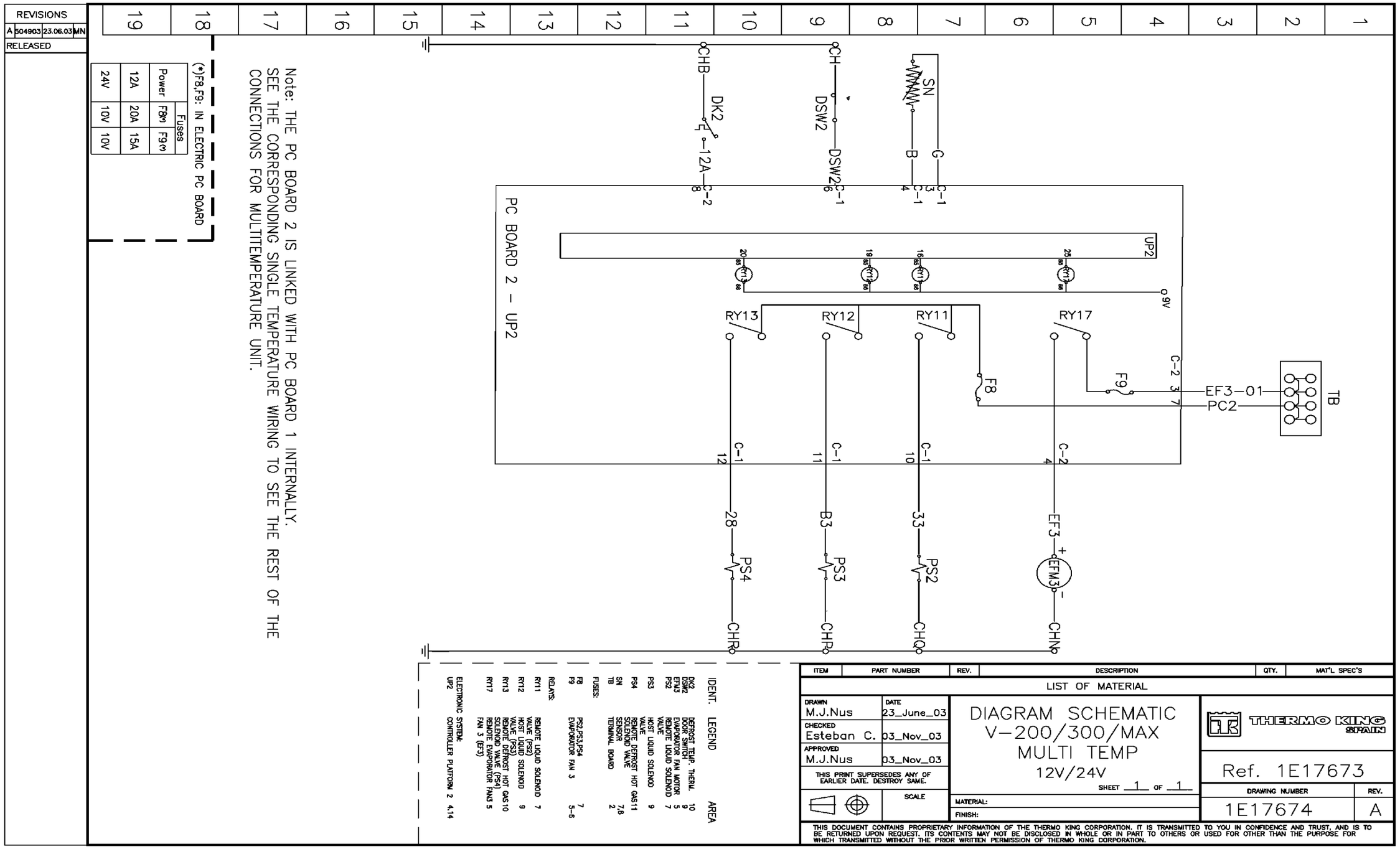
MATERIAL:

FINISH:

THERMO KING SPAIN

Ref. 1E47098

DRAWING NUMBER	REV.
1E47097	B


REVISIONS
A 504903 23.06.03 MN
RELEASED
Note: THE PC BOARD 2 IS LINKED WITH PC BOARD 1 INTERNALLY.
SEE THE CORRESPONDING SINGLE TEMPERATURE WIRING TO SEE THE REST OF THE CONNECTIONS FOR MULTITEMPERATURE UNIT.
(*)F8,F9: IN ELECTRIC PC BOARD
Fuses
Power F8(*) F9(*)
12A 20A 15A
24V 10V 10V
PC BOARD 2 – UP2
UP2
RY13 RY12 RY11 RY17
9V
F8 F9
EF3-01
PC2
TB
CH CHB
DSW2 DK2 12A
SN
G B
DSW2
C-1 C-2
28 B3 33 EF3
PS4 PS3 PS2
EFM3
CHR CHQ CHN
IDENT. LEGEND AREA
DK2 DEFROST TEMP. THERM. 10
DSW2 DOOR SWITCH 9
EFM3 EVAPORATOR FAN MOTOR 5
PS2 REMOTE LIQUID SOLENOID VALVE 7
PS3 HOST LIQUID SOLENOID VALVE 9
PS4 REMOTE DEFROST HOT GAS SOLENOID VALVE 11
SN SENSOR 7,8
TB TERMINAL BOARD 2
FUSES:
F8 PS2,PS3,PS4 7
F9 EVAPORATOR FAN 3 5–6
RELAYS:
RY11 REMOTE LIQUID SOLENOID VALVE (PS2) 7
RY12 HOST LIQUID SOLENOID VALVE (PS3) 9
RY13 REMOTE DEFROST HOT GAS SOLENOID VALVE (PS4) 10
RY17 REMOTE EVAPORATOR FAN 3 (EF3) 5
ELECTRONIC SYSTEM:
UP2 CONTROLLER PLATFORM 2 4.14
ITEM PART NUMBER REV. DESCRIPTION QTY. MAT'L SPEC'S
LIST OF MATERIAL
DRAWN M.J.Nus DATE 23_June_03
CHECKED Esteban C. 03_Nov_03
APPROVED M.J.Nus 03_Nov_03
THIS PRINT SUPERSEDES ANY OF EARLIER DATE. DESTROY SAME.
SCALE
MATERIAL:
FINISH:
DIAGRAM SCHEMATIC
V-200/300/MAX
MULTI TEMP
12V/24V
SHEET 1 OF 1
THERMO KING SPAIN
Ref. 1E17673
DRAWING NUMBER 1E17674
REV. A
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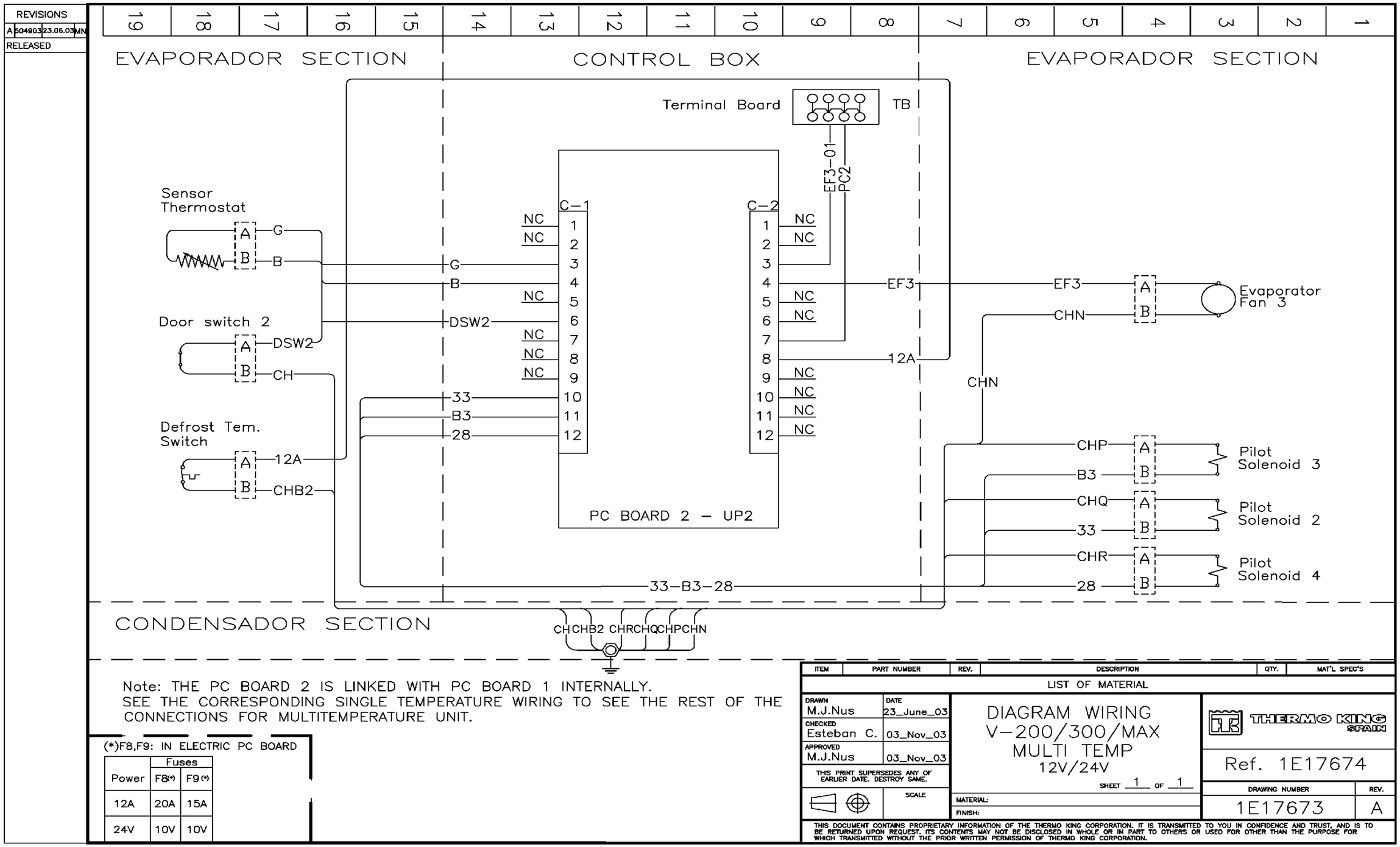
1E17673 DSR MICROPROCESSOR CONTROLLER WIRING DIAGRAM, V-200, V-300 MAX, MULTI-TEMP - PAGE 1 OF 1

REVISIONS			
A	504803	23.06.03	MN
RELEASED			



Note: THE PC BOARD 2 IS LINKED WITH PC BOARD 1 INTERNALLY.
SEE THE CORRESPONDING SINGLE TEMPERATURE WIRING TO SEE THE REST OF THE CONNECTIONS FOR MULTITEMPERATURE UNIT.

(*)F8,F9: IN ELECTRIC PC BOARD

	Fuses	
Power	F8(*)	F9(*)
12A	20A	15A
24V	10V	10V

ITEM	PART NUMBER	REV.	DESCRIPTION	QTY.	MAT'L SPEC'S

LIST OF MATERIAL

DRAWN M.J.Nus	DATE 23_June_03
CHECKED Esteban C.	03_Nov_03
APPROVED M.J.Nus	03_Nov_03

THIS PRINT SUPERSEDES ANY OF EARLIER DATE. DESTROY SAME.

SCALE

DIAGRAM WIRING
V-200/300/MAX
MULTI TEMP
12V/24V

SHEET 1 OF 1

MATERIAL:

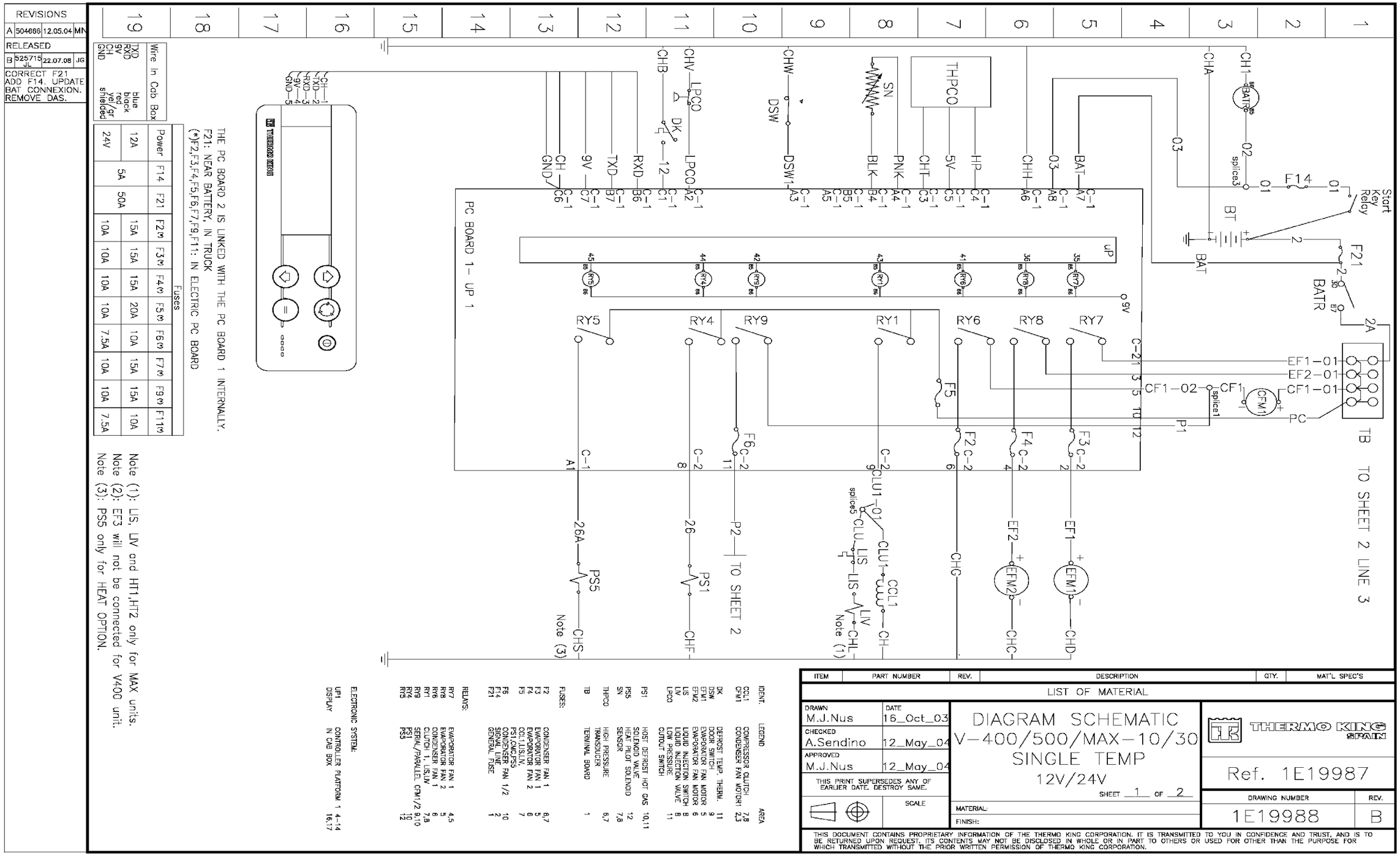
FINISH:

THERMO KING SPAIN

Ref. 1E17674

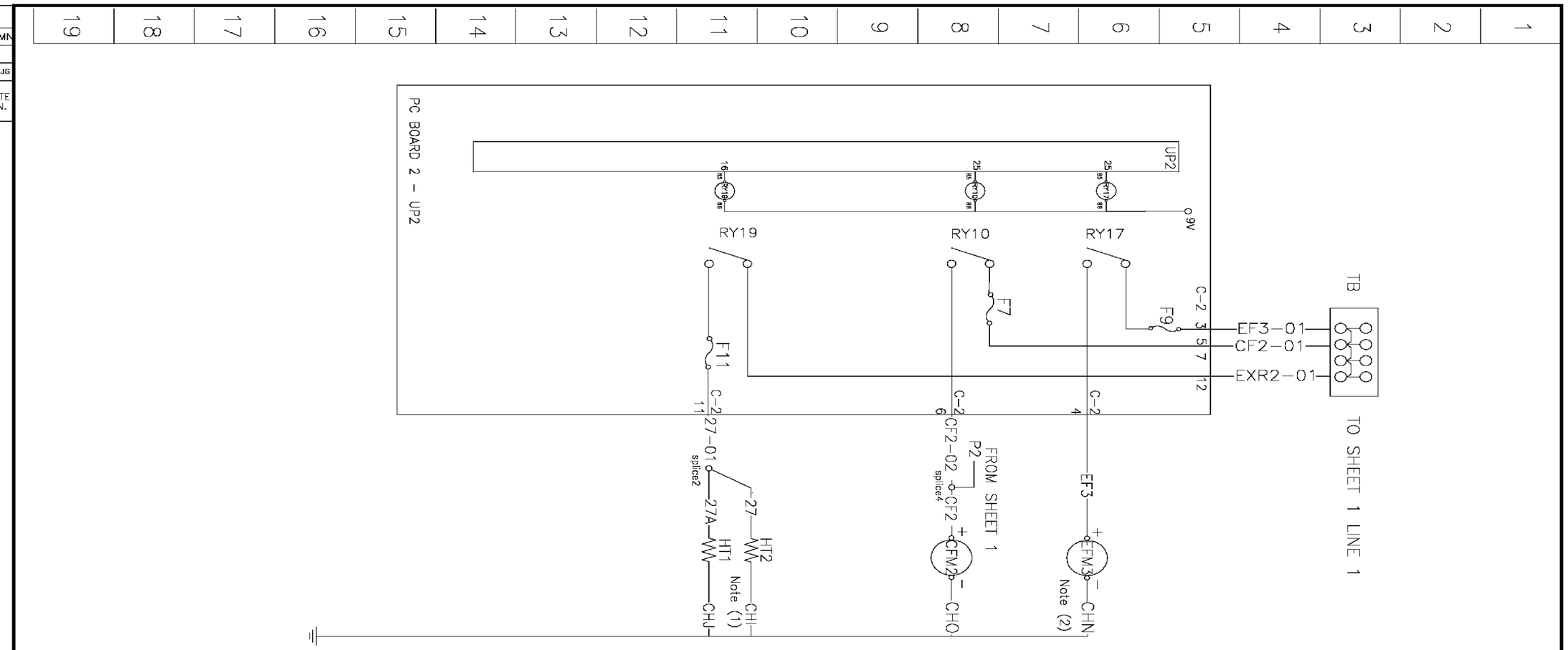
DRAWING NUMBER	REV.
1E17673	A

1E19988 DSR MICROPROCESSOR CONTROLLER SCHEMATIC DIAGRAM, V-400, V-500 MAX, 10/30 - PAGE 1 OF 2



1E19988 DSR MICROPROCESSOR CONTROLLER SCHEMATIC DIAGRAM, V-400, V-500 MAX, 10/30 - PAGE 2 OF 2

REVISIONS			
A	504666	12.05.04	MN
RELEASED			
B	525715 JL	22.07.08	JG
CORRECT F21 ADD F14. UPDATE BAT CONNEXION. REMOVE DAS.			



IDENT.	LEGEND	AREA
CFM2	CONDENSER FAN MOTOR	8
EFM3	EVAPORATOR FAN MOTOR	6
HT1	HEATERS 1	11
HT2	HEATERS 2	10
TB	TERMINAL BOARD	3

FUSES:

F7	CONDENSER FAN 2	7,8
F9	EVAPORATOR FAN 3	5,6
F11	HT1,HT2	11

RELAYS:

RY17	EVAPORATOR FAN 3	6
RY10	CONDENSER FAN 2	8
RY19	HT1,HT2	11

ELECTRONIC SYSTEM:

UP2	CONTROLLER PLATFORM 2 5-15

ITEM	PART NUMBER	REV.	DESCRIPTION	QTY.	MAT'L SPEC'S

LIST OF MATERIAL

DRAWN M.J.Nus	DATE 16_Oct_03
CHECKED A.Sendino	12_May_04
APPROVED M.J.Nus	12_May_04

THIS PRINT SUPERSEDES ANY OF EARLIER DATE. DESTROY SAME.

SCALE

DIAGRAM SCHEMATIC
V–400/500/MAX–10/30
SINGLE TEMP
12V/24V
SHEET 2 OF 2

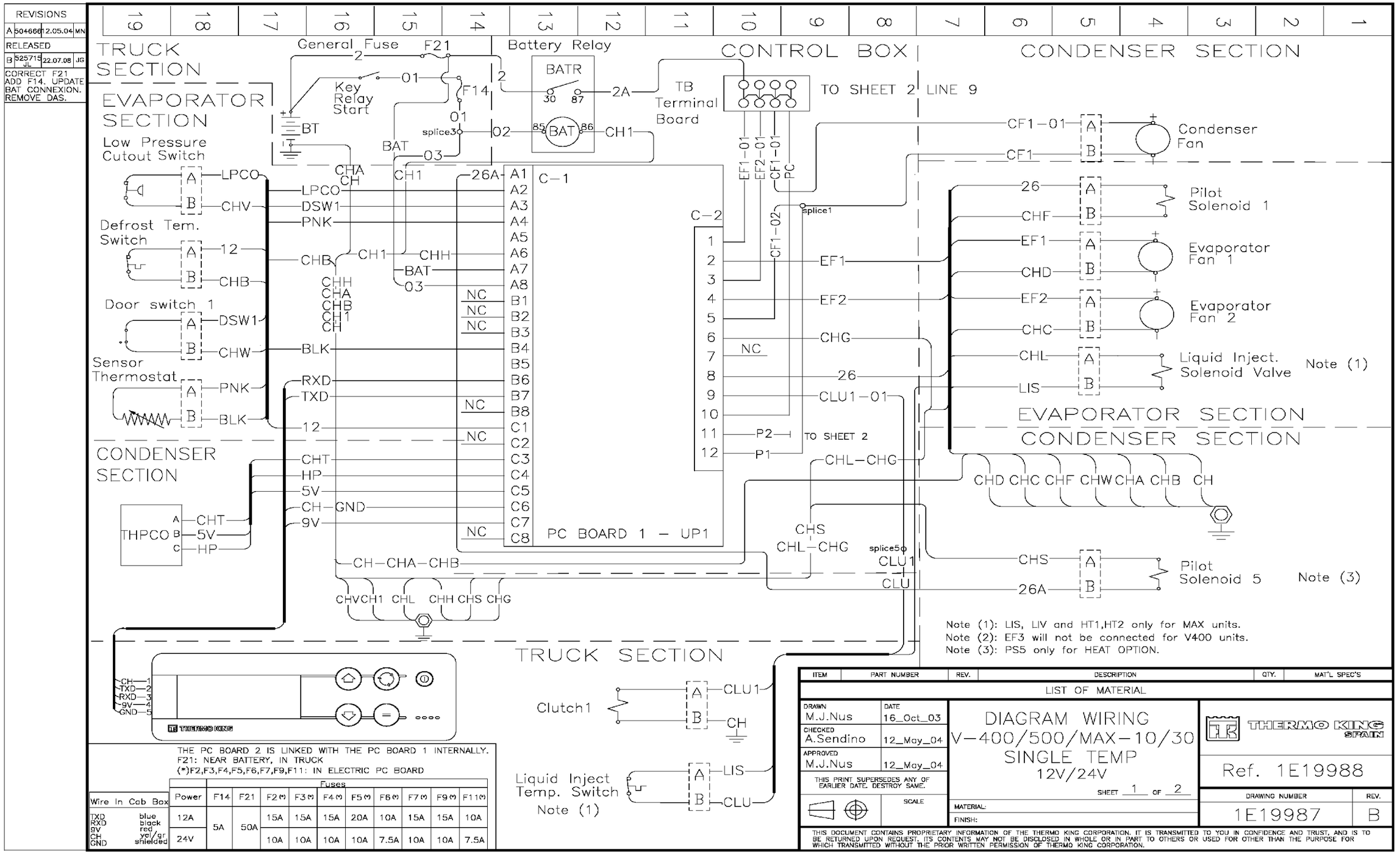
MATERIAL:

FINISH:

THERMO KING SPAIN

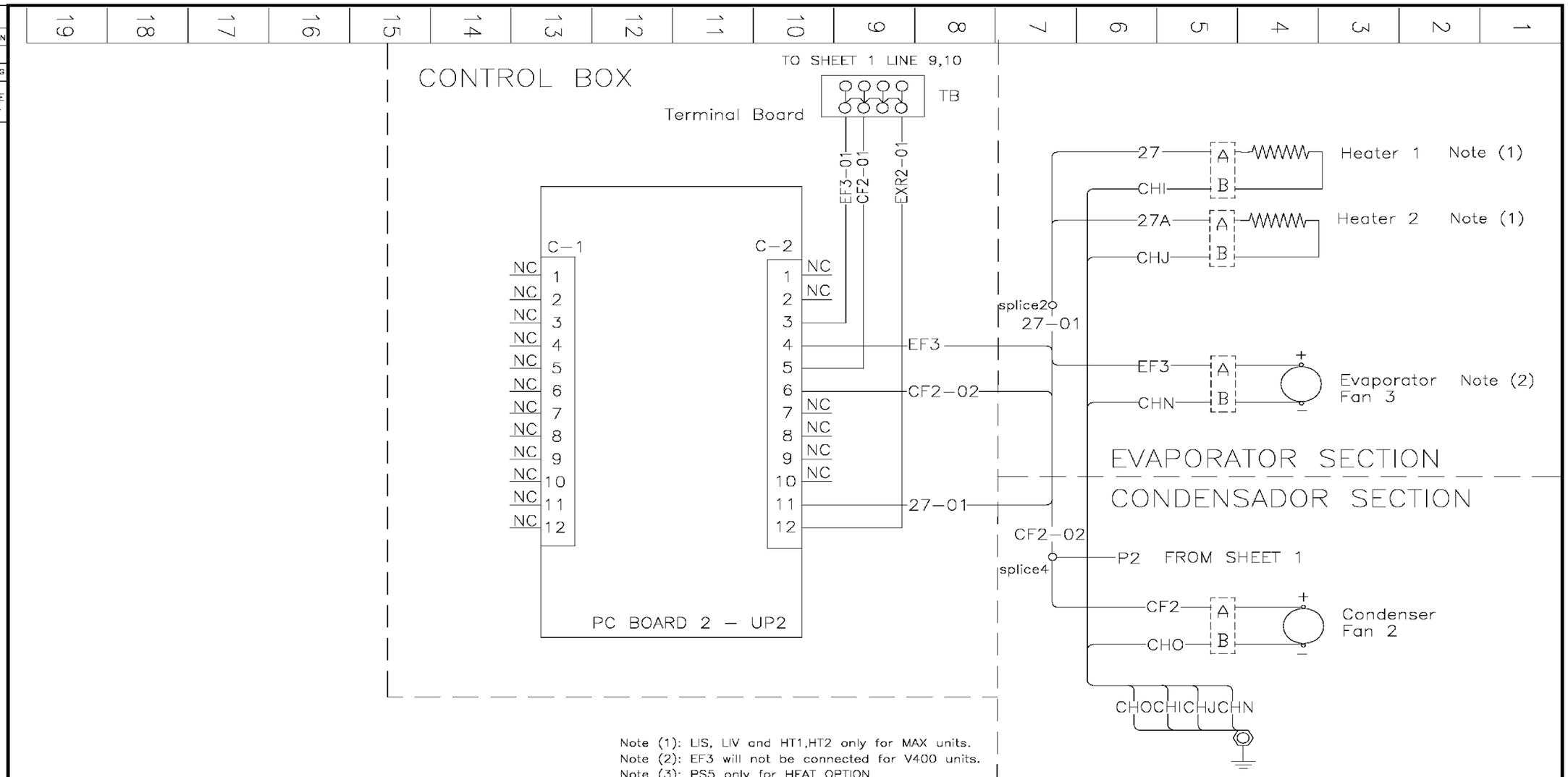
Ref. 1E19987

DRAWING NUMBER	REV.
1E19988	B



Wire In Cab Box		Power	F14	F21	F2 (*)	F3 (*)	F4 (*)	F5 (*)	F6 (*)	F7 (*)	F9 (*)	F11 (*)
			Fuses									
TXD	blue	12A	5A	50A	15A	15A	15A	20A	10A	15A	15A	10A
RXD	black											
9V	red	24V			10A	10A	10A	10A	7.5A	10A	10A	7.5A
CH	yel/gr											
GND	shielded											

REVISIONS			
A	504666	12.05.04	MN
RELEASED			
B	525715 JL	22.07.08	JG
CORRECT F21 ADD F14. UPDATE BAT CONNEXION. REMOVE DAS.			



Note (1): LIS, LIV and HT1,HT2 only for MAX units.
Note (2): EF3 will not be connected for V400 units.
Note (3): PS5 only for HEAT OPTION.

ITEM	PART NUMBER	REV.	DESCRIPTION	QTY.	MAT'L SPEC'S

LIST OF MATERIAL

DRAWN M.J.Nus	DATE 16_Oct_03
CHECKED A.Sendino	12_May_04
APPROVED M.J.Nus	12_May_04

THIS PRINT SUPERSEDES ANY OF EARLIER DATE. DESTROY SAME.

SCALE

DIAGRAM WIRING
V-400/500/MAX-10/30
SINGLE TEMP
12V/24V

SHEET 2 OF 2

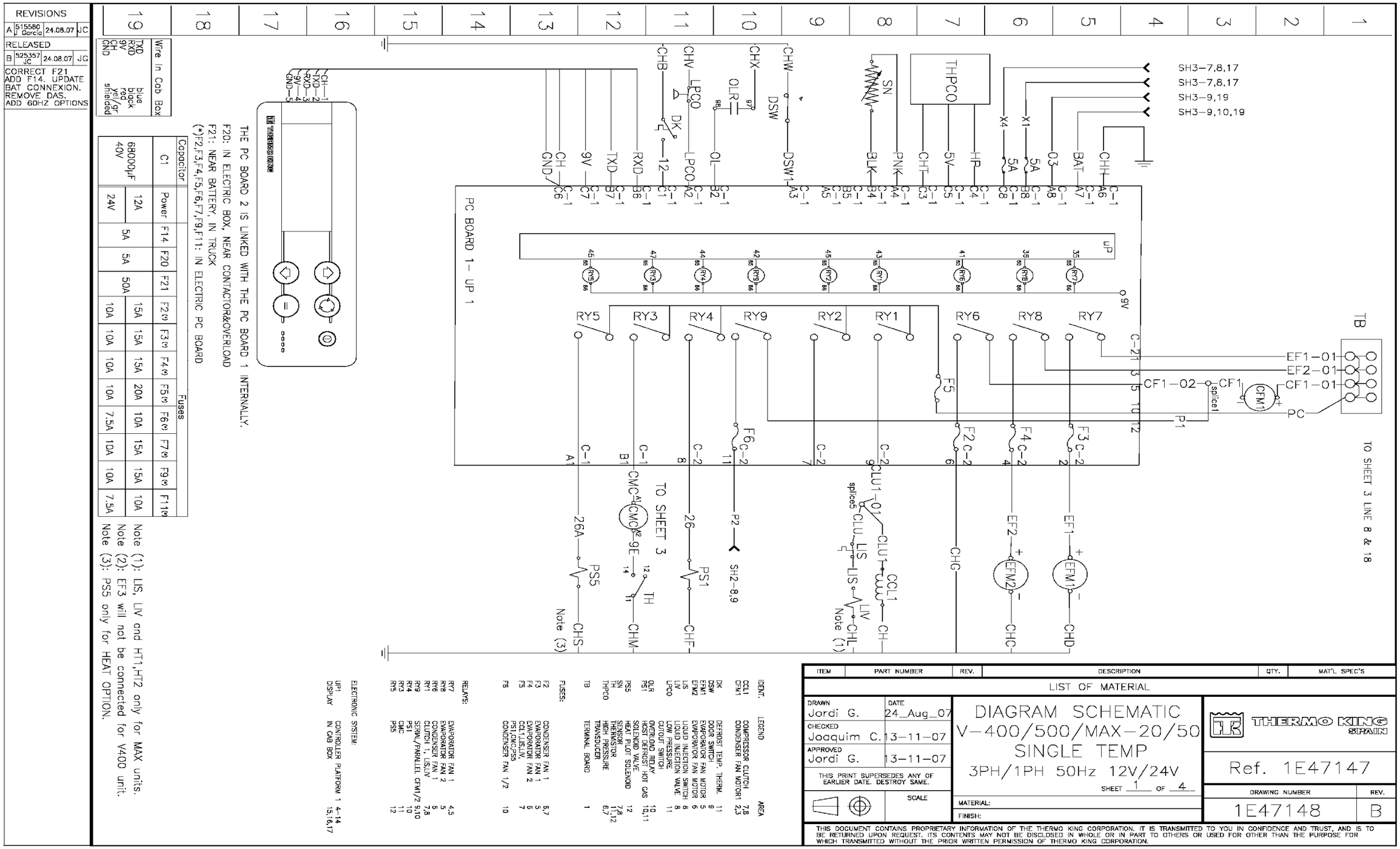
MATERIAL:
FINISH:

THERMO KING SPAIN

Ref. 1E19988

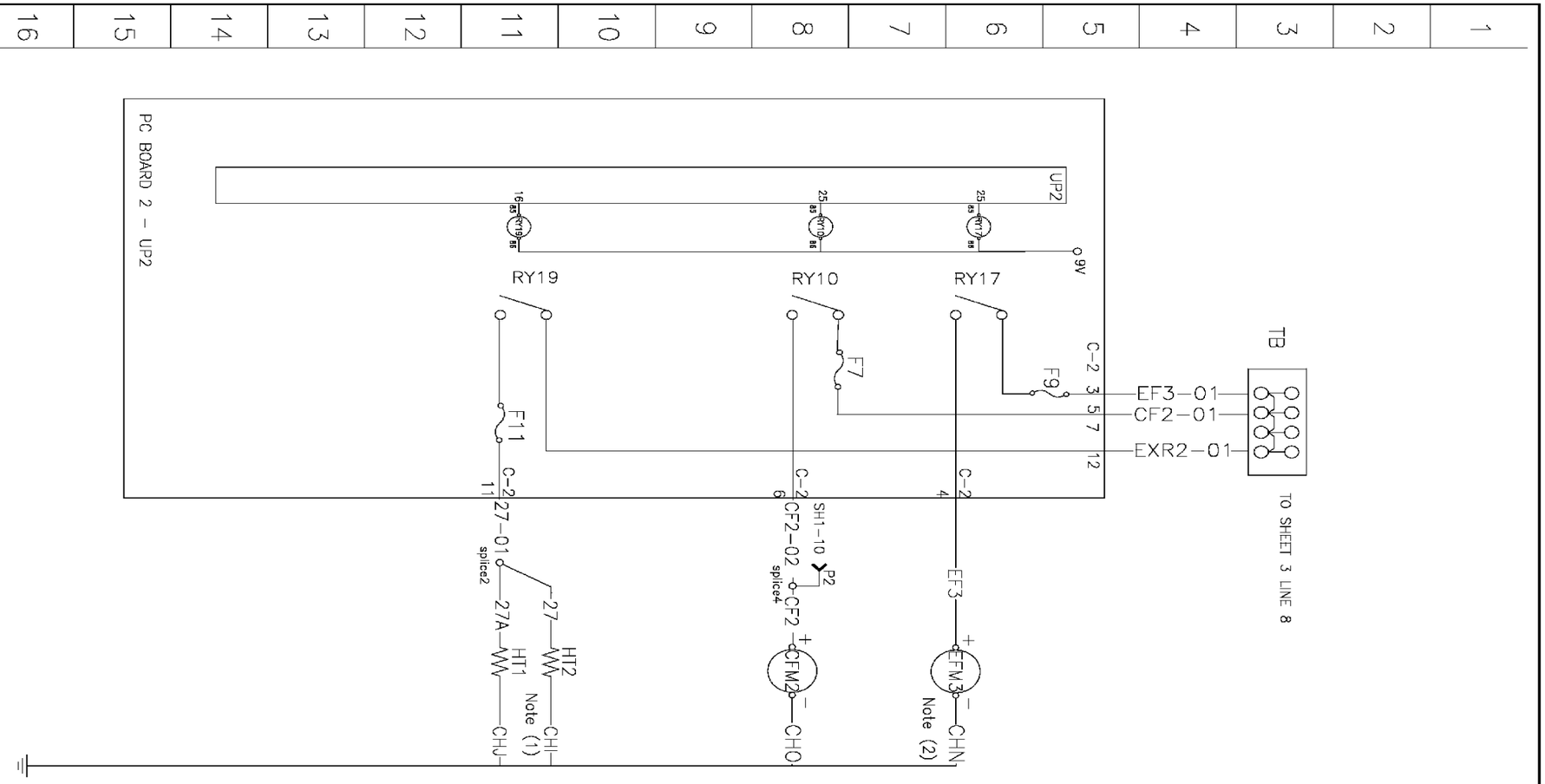
DRAWING NUMBER	REV.
1E19987	B

1E47148 DSR MICROPROCESSOR CONTROLLER SCHEMATIC DIAGRAM, V-400, V-500 MAX, 20/50 - PAGE 1 OF 4



REVISIONS			
A	515580 J. Garcia	24.08.07	JC
RELEASED			
B	525357 JC	24.08.07	JG

CORRECT F21
ADD F14. UPDATE
BAT CONNEXION.
REMOVE DAS.
ADD 60HZ OPTIONS



IDENT.	LEGEND	AREA
CFM2	CONDENSER FAN MOTOR	8
EFM3	EVAPORATOR FAN MOTOR	9
HT1	HEATERS 1	11
HT2	HEATERS 2	10
TB	TERMINAL BOARD	3

FUSES:

F7	CONDENSER FAN 2	7,8
F9	EVAPORATOR FAN 3	5,6
F11	HT1,HT2	11

RELAYS:

RY17	EVAPORATOR FAN 3	4,5
RY10	CONDENSER FAN 2	5
RY19	HT1,HT2	6

ELECTRONIC SYSTEM:

UP2 CONTROLLER PLATFORM 2 5-15

ITEM	PART NUMBER	REV.	DESCRIPTION	QTY.	MAT'L SPEC'S

LIST OF MATERIAL

DRAWN Jordi G.	DATE 24_Aug_07
CHECKED Joaquim C.	13-11-07
APPROVED Jordi G.	13-11-07

THIS PRINT SUPERSEDES ANY OF EARLIER DATE. DESTROY SAME.

SCALE

DIAGRAM SCHEMATIC
V-400/500/MAX-20/50
SINGLE TEMP
3PH/1PH 50Hz 12V/24V
SHEET 2 OF 4

MATERIAL:
FINISH:

THERMO KING SPAIN

Ref. 1E47147

DRAWING NUMBER	REV.
1E47148	B

REVISIONS			
A	515580 J Garcia	24.08.07	JC
RELEASED			
B	525357 JC	24.08.07	JG

CORRECT F21
ADD F14. UPDATE
BAT CONNEXION.
REMOVE DAS.
ADD 60HZ OPTIONS

3PH

1PH

TR

SEE BRIDGE CONNECTIONS

F14 Start Key Relay

F21 2A

BATR

STDR

C1R

C1

BT

TB

TH

OLR

PC1 PC2 PC3 PC4 CMC

VAC MOTOR 3PH

F20

H1B

H1–H2–H1B–H3

H2B–H3

230/400V

400V

230V

TO SHEET 1 LINE 1

TO SHEET 2 LINE 3

BRIDGE CONNECTIONS:

12V

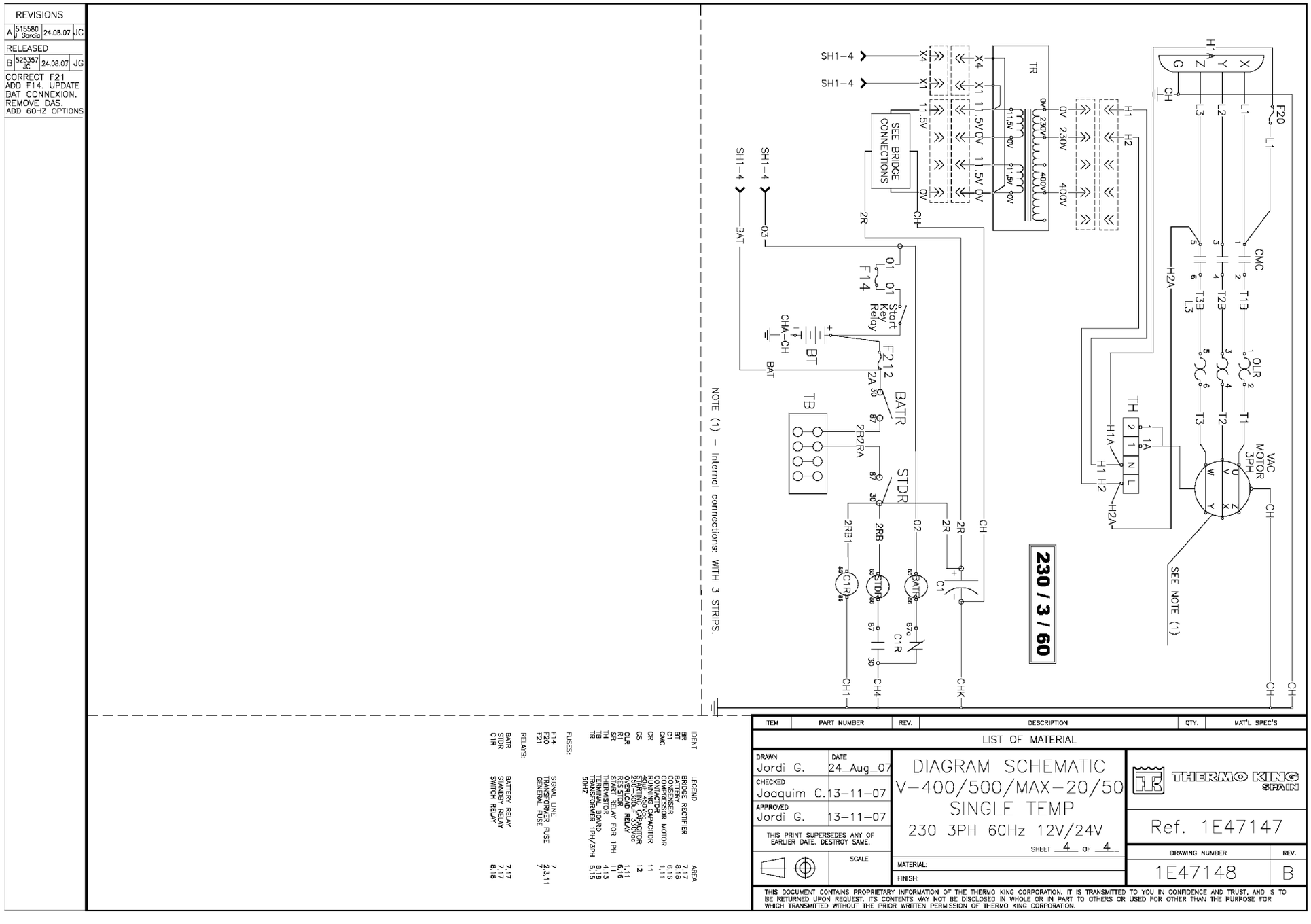
24V

IDENT	LEGEND	AREA
BR	BRIDGE RECTIFIER	7,17
BT	BATTERY	8,18
C1	CONDENSER	6,16
CMC	COMPRESSOR MOTOR CONTACTOR	1,11
CR	RUN/START CAPACITOR ALUMINUM CAP.	11
CS	STARTING CAPACITOR 250–300uF 330Vac	12
OLR	OVERLOAD RELAY	1,11
SR	START RELAY FOR 1PH	11
TH	THERMISTOR	4,13
TB	TERMINAL BOARD	8,18
TR	TRANSFORMER 1PH/3PH 50HZ	5,15
FUSES:		
F14	SIGNAL LINE	7,17
F20	TRANSFORMER FUSE	2,3,11
F21	GENERAL FUSE	7,17
RELAYS:		
BATR	BATTERY RELAY	7,17
STDR	STANDBY RELAY	7,17
C1R	SWITCH RELAY	8,18

ITEM	PART NUMBER	REV.	DESCRIPTION	QTY.	MAT'L SPEC'S

LIST OF MATERIAL

DRAWN Jordi G.	DATE 24_Aug_07	DIAGRAM SCHEMATIC V–400/500/MAX–20/50 SINGLE TEMP 3PH/1PH 50Hz 12V/24V
CHECKED Joaquim C.	13–11–07	THERMO KING SPAIN
APPROVED Jordi G.	13–11–07	Ref. 1E47147
THIS PRINT SUPERSEDES ANY OF EARLIER DATE. DESTROY SAME.		SHEET 3 OF 4
SCALE		MATERIAL:
		FINISH:
		DRAWING NUMBER 1E47148 REV. B


REVISIONS
A 515580 Garcia 24.08.07 JC
RELEASED
B 525357 JC 24.08.07 JG
CORRECT F21
ADD F14. UPDATE
BAT CONNEXION.
REMOVE DAS.
ADD 60HZ OPTIONS
NOTE (1) – Internal connections: WITH 3 STRIPS.
230 / 3 / 60
SEE NOTE (1)
SEE BRIDGE CONNECTIONS
LIST OF MATERIAL
ITEM
PART NUMBER
REV.
DESCRIPTION
QTY.
MAT'L SPEC'S
DRAWN Jordi G. DATE 24_Aug_07
CHECKED Joaquim C. 13-11-07
APPROVED Jordi G. 13-11-07
THIS PRINT SUPERSEDES ANY OF EARLIER DATE. DESTROY SAME.
SCALE
DIAGRAM SCHEMATIC
V-400/500/MAX-20/50
SINGLE TEMP
230 3PH 60Hz 12V/24V
SHEET 4 OF 4
MATERIAL:
FINISH:
THERMO KING SPAIN
Ref. 1E47147
DRAWING NUMBER 1E47148
REV. B
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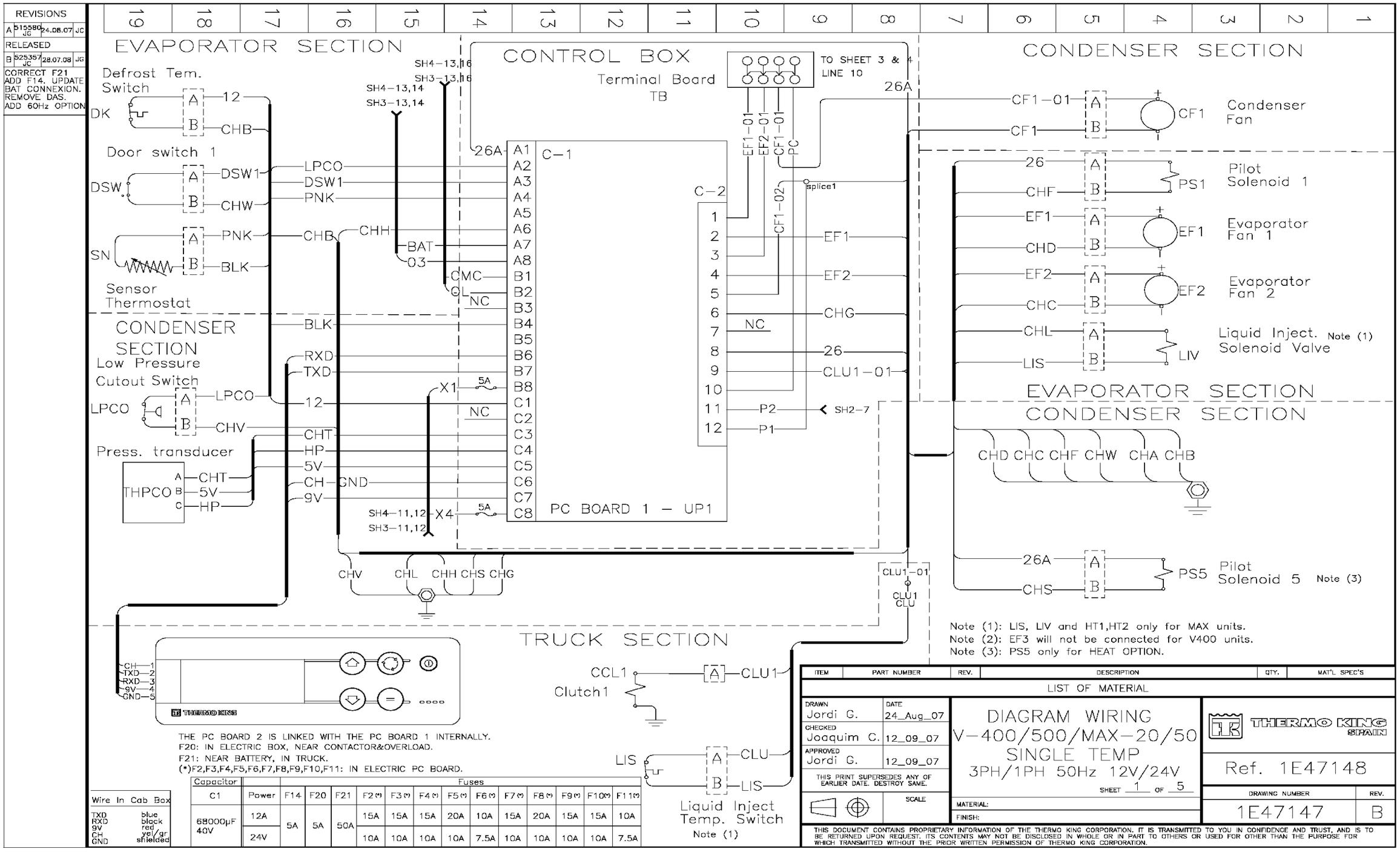
IDENT
LEGEND
AREA
BR BRIDGE RECTIFIER 7,17
BT BATTERY 8,18
C1 CONDENSER 6,16
CMC COMPRESSOR MOTOR 1,11
CR RUNNING CAPACITOR 50uF 450VAC 11
CS STARTING CAPACITOR 250-300uF 330VDC 12
OLR OVERLOAD RELAY 1,11
R1 RESTRICTOR 6,16
SR START RELAY FOR 1PH 11
TH THERMISTOR 4,13
TR TRANSFORMER 1PH/3PH 5,18
TB TERMINAL BOARD 50HZ 5,18
FUSES:
F14 SIGNAL LINE 7
F20 TRANSFORMER FUSE 2,3,11
F21 GENERAL FUSE 7
RELAYS:
BATR BATTERY RELAY 7,17
STDR STANDBY RELAY 7,17
C1R SWITCH RELAY 8,18
THIS PRINT SUPERSEDES ANY OF EARLIER DATE. DESTROY SAME.


REVISIONS
A 515580 JC 24.08.07 JC
RELEASED
B 525357 JC 28.07.08 JG
CORRECT F21
ADD F14, UPDATE
BAT CONNEXION.
REMOVE DAS.
ADD 60Hz OPTION
EVAPORATOR SECTION
CONTROL BOX
Terminal Board
TB
TO SHEET 3 & 4
LINE 10
CONDENSER SECTION
Defrost Tem.
Switch
DK
Door switch 1
DSW
Sensor
Thermostat
SN
CONDENSER
SECTION
Low Pressure
Cutout Switch
LPCO
Press. transducer
THPCO
C-1
C-2
PC BOARD 1 – UP1
CF1 Condenser Fan
PS1 Pilot Solenoid 1
EF1 Evaporator Fan 1
EF2 Evaporator Fan 2
LIV Liquid Inject. Note (1) Solenoid Valve
EVAPORATOR SECTION
CONDENSER SECTION
CHD CHC CHF CHW CHA CHB
PS5 Pilot Solenoid 5 Note (3)
CHV CHL CHH CHS CHG
TRUCK SECTION
CCL1
Clutch1
CLU1
LIS
Liquid Inject
Temp. Switch
Note (1)
THERMO KING
THE PC BOARD 2 IS LINKED WITH THE PC BOARD 1 INTERNALLY.
F20: IN ELECTRIC BOX, NEAR CONTACTOR&OVERLOAD.
F21: NEAR BATTERY, IN TRUCK.
(*)F2,F3,F4,F5,F6,F7,F8,F9,F10,F11: IN ELECTRIC PC BOARD.
Note (1): LIS, LIV and HT1,HT2 only for MAX units.
Note (2): EF3 will not be connected for V400 units.
Note (3): PS5 only for HEAT OPTION.
Wire In Cab Box
TXD blue
RXD black
9V red
CH yel/gr
GND shielded
Capacitor
C1
68000µF 40V
Fuses
Power F14 F20 F21 F2(*) F3(*) F4(*) F5(*) F6(*) F7(*) F8(*) F9(*) F10(*) F11(*)
12A 5A 5A 50A 15A 15A 15A 20A 10A 15A 20A 15A 15A 10A
24V 10A 10A 10A 10A 7.5A 10A 10A 10A 10A 7.5A
ITEM PART NUMBER REV. DESCRIPTION QTY. MAT'L SPEC'S
LIST OF MATERIAL
DRAWN Jordi G. DATE 24_Aug_07
CHECKED Joaquim C. 12_09_07
APPROVED Jordi G. 12_09_07
THIS PRINT SUPERSEDES ANY OF EARLIER DATE. DESTROY SAME.
SCALE
MATERIAL:
FINISH:
DIAGRAM WIRING
V-400/500/MAX-20/50
SINGLE TEMP
3PH/1PH 50Hz 12V/24V
SHEET 1 OF 5
THERMO KING SPAIN
Ref. 1E47148
DRAWING NUMBER 1E47147
REV. B
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REVISIONS

A	515580 JC	24.08.07	JC
RELEASED			
B	525357 JC	28.07.08	JG

CORRECT F21
ADD F14, UPDATE BAT CONNEXION.
REMOVE DAS.
ADD 60Hz OPTION

19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1

CONTROL BOX

Terminal Board

SH1-9,10

TB

EF3-01

CF2-01

EXR2-01

C-1

C-2

NC 1
NC 2
NC 3
NC 4
NC 5
NC 6
NC 7
NC 8
NC 9
NC 10
NC 11
NC 12

1 NC
2 NC
3
4 EF3
5
6 CF2-02
7 NC
8 NC
9 NC
10 NC
11 27-01
12

PC BOARD 2 - UP2

EVAPORATOR SECTION

27 — A — HT2 — B — CHI

Heater 1
Note (1)

27A — A — HT1 — B — CHJ

Heater 2
Note (1)

splice10

27-01

EF3 — A — EF3 — B — CHN

Evaporator Fan 3
Note (2)

CONDENSER SECTION

CF2-02

P2

SH1-9,10

splice4

CF2 — A — CF2 — B — CHO

Condenser Fan 2

CHOCHICHJCHN

Note (1): LIS, LIV and HT1,HT2 only for MAX units.
Note (2): EF3 will not be connected for V400 units.
Note (3): PS5 only for HEAT OPTION.

ITEM	PART NUMBER	REV.	DESCRIPTION	QTY.	MAT'L SPEC'S

LIST OF MATERIAL

DRAWN Jordi G.	DATE 24_Aug_07
CHECKED Joaquim C.	12_09_07
APPROVED Jordi G.	12_09_07
THIS PRINT SUPERSEDES ANY OF EARLIER DATE. DESTROY SAME.	
SCALE	

DIAGRAM WIRING
V-400/500/MAX-20/50
SINGLE TEMP
3PH/1PH 50Hz 12V/24V
SHEET 2 OF 5

MATERIAL:
FINISH:

THERMO KING SPAIN

Ref. 1E47148

DRAWING NUMBER	REV.
1E47147	B

REVISIONS

A	515580 JG	24.08.07	JC
RELEASED			
B	525357 JC	28.07.08	JG

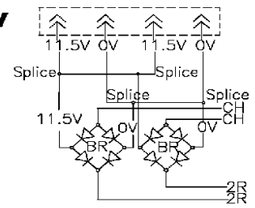
CORRECT F21
ADD F14. UPDATE BAT CONNEXION.
REMOVE DAS.
ADD 60Hz OPTION

3PH

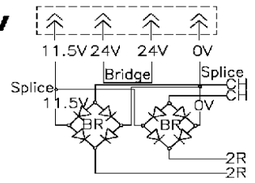
Transformer Fuse F20
Motor Contactor
Motor Overload
VAC Motorch 3PH
CMC
OL
TH
CHM
CHX
SH1–14
9E
H1B
H1 H2
H2B
T1A T2A T3A
T1B T2B T3B
T1 T2 T3
T4 T5 T6 L3
230/400V
400V
H3 H2 H1
400V 230V 0V
0V 11.5V 0V 11.5V X1 X4
TR
See bridge connections
CH 2R
Capacitor
CHK
SH1–15

BRIDGE CONNECTIONS:

12V



24V



Transformer
F21
BAT
Key Relay Start
F14
01 01
03
BT
CHA
C1R
CH4
CH1
2RB1
SWB
SWS
Battery Relay
BATR
BAT
Standby Relay
STDR
STD
2RB
2R
2 2A 02
Terminal board TB
2B 2RA

TO SHEET 1 LINE 10

ITEM	PART NUMBER	REV.	DESCRIPTION	QTY.	MAT'L SPEC'S

LIST OF MATERIAL

DRAWN Jordi G.	DATE 24_Aug_07
CHECKED Joaquim C.	12_09_07
APPROVED Jordi G.	12_09_07

THIS PRINT SUPERSEDES ANY OF EARLIER DATE. DESTROY SAME.

SCALE

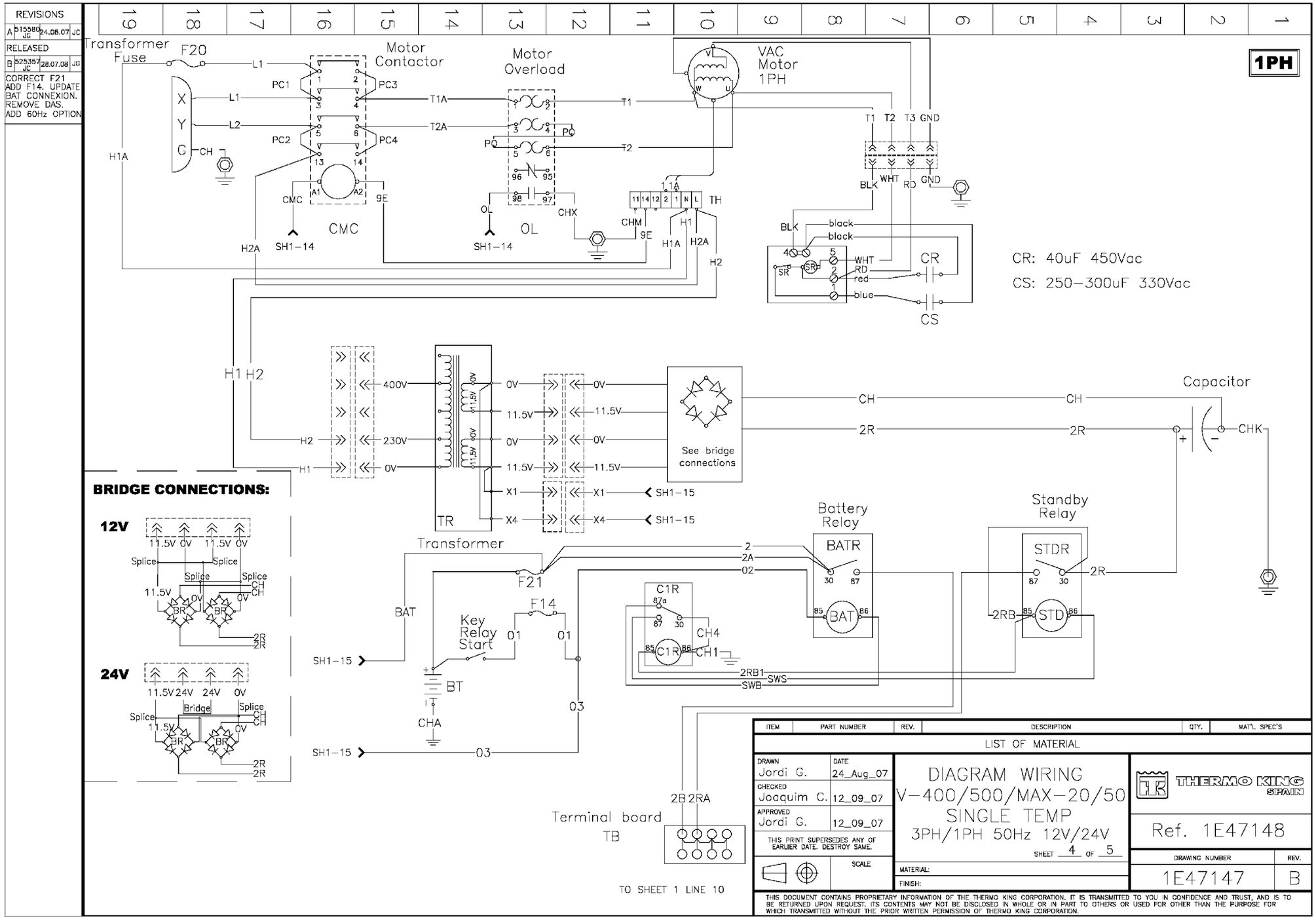
DIAGRAM WIRING
V-400/500/MAX-20/50
SINGLE TEMP
3PH/1PH 50Hz 12V/24V
SHEET 3 OF 5

MATERIAL:
FINISH:

THERMO KING SPAIN

Ref. 1E47148

DRAWING NUMBER	REV.
1E47147	B


REVISIONS
A 515580 JG 24.08.07 JC
RELEASED
B 525357 JC 28.07.08 JG
CORRECT F21
ADD F14. UPDATE
BAT CONNEXION.
REMOVE DAS.
ADD 60Hz OPTION.
1PH
Transformer
Fuse
F20
Motor
Contactor
Motor
Overload
VAC
Motor
1PH
CMC
OL
TH
CR: 40uF 450Vac
CS: 250–300uF 330Vac
CR
CS
Capacitor
CHK
See bridge
connections
Battery
Relay
Standby
Relay
Transformer
F21
F14
Key
Relay
Start
BT
CHA
C1R
BATR
STDR
STD
BAT
Terminal board
TB
2B 2RA
TO SHEET 1 LINE 10
BRIDGE CONNECTIONS:
12V
24V
ITEM
PART NUMBER
REV.
DESCRIPTION
QTY.
MAT'L SPEC'S
LIST OF MATERIAL
DRAWN Jordi G. DATE 24_Aug_07
CHECKED Joaquim C. 12_09_07
APPROVED Jordi G. 12_09_07
THIS PRINT SUPERSEDES ANY OF EARLIER DATE. DESTROY SAME.
SCALE
DIAGRAM WIRING
V-400/500/MAX-20/50
SINGLE TEMP
3PH/1PH 50Hz 12V/24V
SHEET 4 OF 5
MATERIAL:
FINISH:
THERMO KING SPAIN
Ref. 1E47148
DRAWING NUMBER 1E47147
REV. B
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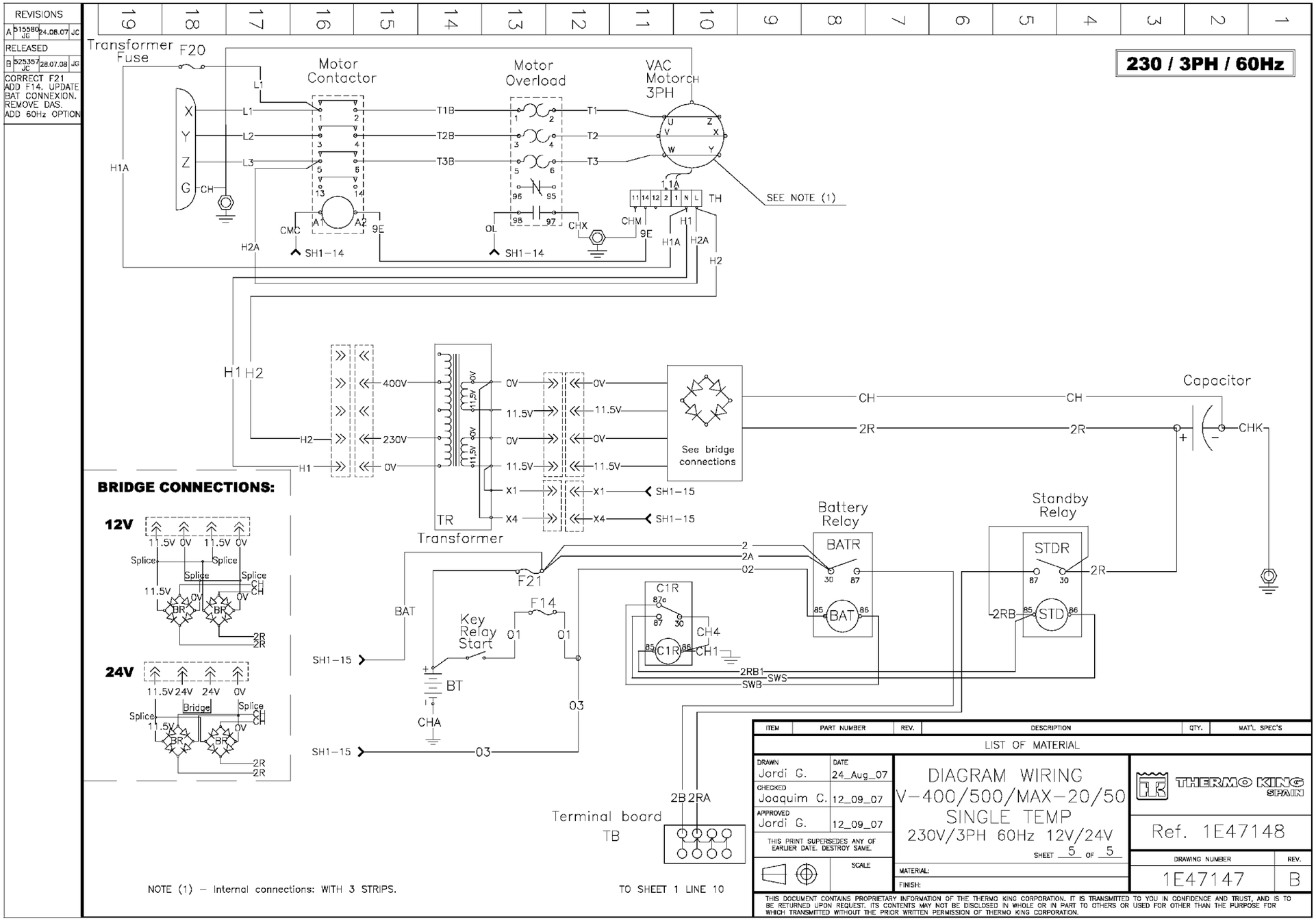
REVISIONS
A 515580 JG 24.08.07 JC
RELEASED
B 525357 JC 28.07.08 JG
CORRECT F21
ADD F14. UPDATE
BAT CONNEXION.
REMOVE DAS.
ADD 60Hz OPTION
230 / 3PH / 60Hz
Transformer Fuse
F20
Motor Contactor
Motor Overload
VAC Motorch 3PH
SEE NOTE (1)
H1A
H2A
H2
H1 H2
400V
230V
0V
11.5V
TR
Transformer
See bridge connections
CH
2R
Capacitor
CHK
BRIDGE CONNECTIONS:
12V
24V
Battery Relay
BATR
Standby Relay
STDR
Key Relay Start
F14
F21
BT
CHA
BAT
C1R
CH4
CH1
2RB1
SWB
SWS
2B 2RA
Terminal board TB
SH1−15
SH1−14
TO SHEET 1 LINE 10
NOTE (1) − Internal connections: WITH 3 STRIPS.
LIST OF MATERIAL
DRAWN Jordi G. 24_Aug_07
CHECKED Joaquim C. 12_09_07
APPROVED Jordi G. 12_09_07
THIS PRINT SUPERSEDES ANY OF EARLIER DATE. DESTROY SAME.
DIAGRAM WIRING
V−400/500/MAX−20/50
SINGLE TEMP
230V/3PH 60Hz 12V/24V
SHEET 5 OF 5
THERMO KING SPAIN
Ref. 1E47148
DRAWING NUMBER 1E47147
REV. B
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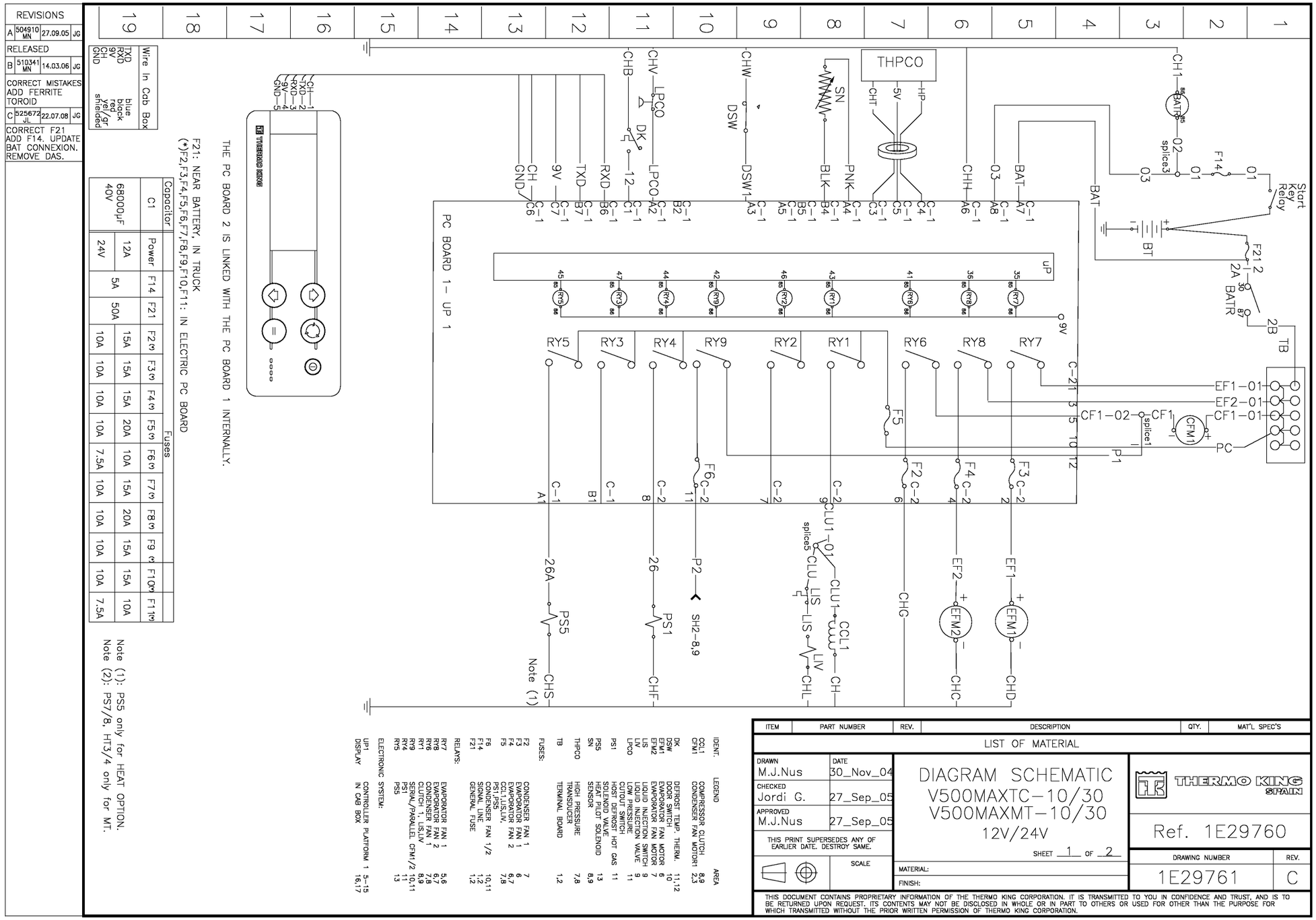
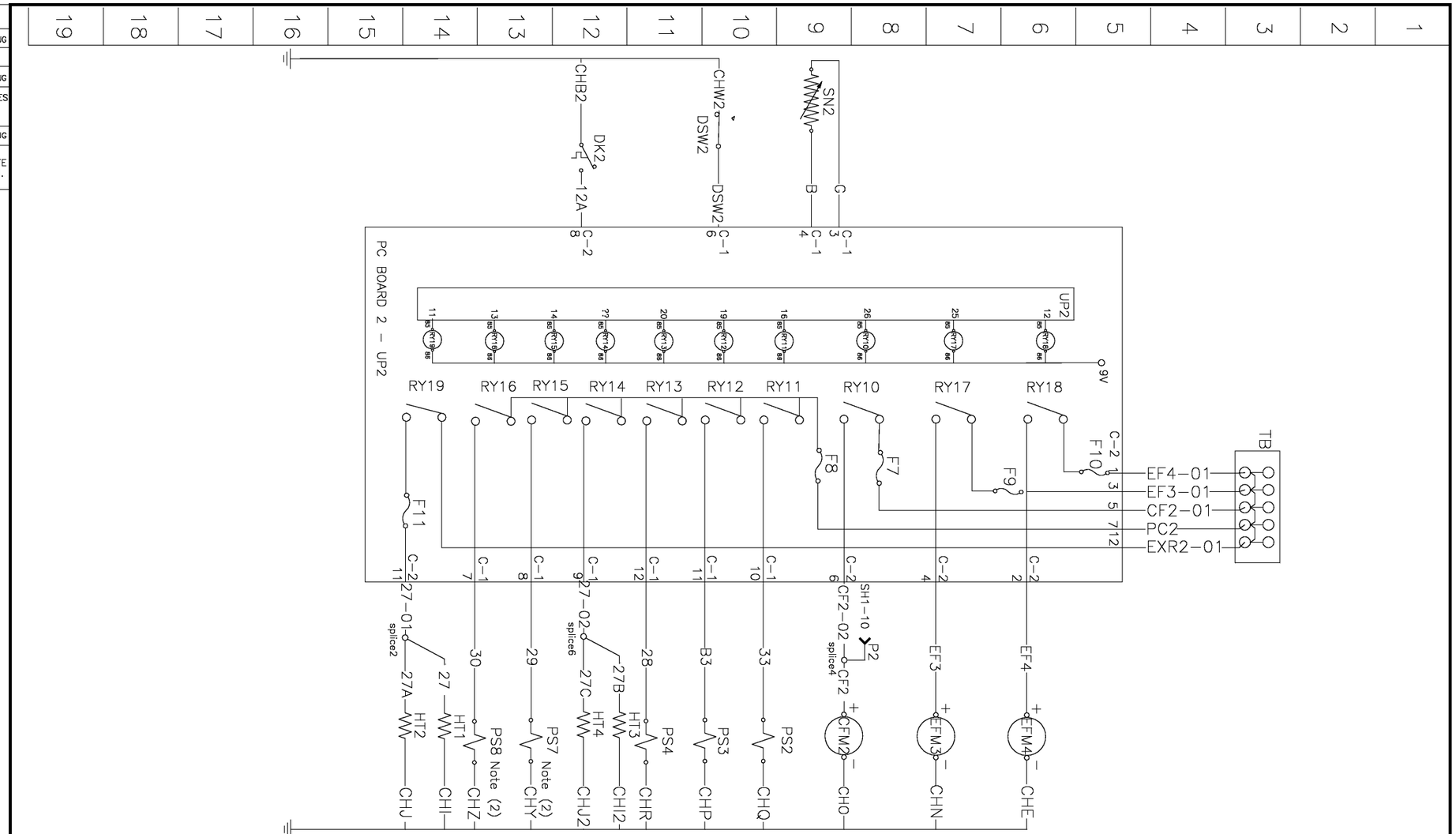
1E29761 DSR MICROPROCESSOR CONTROLLER SCHEMATIC DIAGRAM, V-500 MAX TC, 10/30 - PAGE 1 OF 2



1E29761 DSR MICROPROCESSOR CONTROLLER SCHEMATIC DIAGRAM, V-500 MAX TC, 10/30 - PAGE 2 OF 2

REVISIONS			
A	504910 MN	27.09.05	JG
RELEASED			
B	510341 MN	14.03.06	JG
CORRECT MISTAKES ADD FERRITE TOROID			
C	525672 JL	22.07.08	JG
CORRECT F21 ADD F14. UPDATE BAT CONNEXION. REMOVE DAS.			



ITEM	PART NUMBER	REV.	DESCRIPTION	QTY.	MAT'L SPEC'S

LIST OF MATERIAL

IDENT.	LEGEND	AREA
CFM2	CONDENSER FAN MOTOR	9
DK2	DEFROST TEMP. THERM.	12
DSW2	DOOR SWITCH	10,11
EFM3	EVAPORATOR FAN MOTOR	8
EFM4	EVAPORATOR FAN MOTOR	7
HT1	HEATERS 1	15
HT2	HEATERS 3	15
HT3	HEATERS 4	12
HT4	REMOTE LIQUID SOLENOID VALVE	10
PS2	HOST LIQUID SOLENOID VALVE	11
PS3	REMOTE DEFROST HOT GAS	11
PS4	SOLENOID VALVE (PS4)	
PS7	PRESSURE REGULATING VALVE BYPASS ON HOST EVAPORATOR SUCTION LINE	13
PS8	PRESSURE REGULATING VALVE BYPASS ON REMOTE EVAPORATOR SUCTION LINE	14
SN2	SENSOR	9
TB	TERMINAL BOARD	3
FUSES:		
F7	CONDENSER FAN 2	9
F8	PS7,PS8,HT3,HT4	10
F9	EVAPORATOR FAN 3	7
F10	EVAPORATOR FAN 4	6
F11	HT1,HT2	14
RELAYS:		
RY10	CONDENSER FAN 2	8,9
RY11	REMOTE LIQUID SOLENOID VALVE (LSV2)	9,10
RY12	HOST LIQUID SOLENOID VALVE (PS3)	10
RY13	REMOTE DEFROST HOT GAS SOLENOID VALVE (PS4)	11
RY14	HT3,HT4	12
RY15	HEATERS 1	12,13
RY16	BYPASS ON HOST EVAPORATOR SUCTION LINE (PS7) PRESSURE REGULATING VALVE BYPASS ON REMOTE EVAPORATOR SUCTION LINE (PS8)	13,14
RY17	EVAPORATOR FAN 3	7,8
RY18	EVAPORATOR FAN 4	6,7
RY19	HT1,HT2	14
ELECTRONIC SYSTEM:		
UP2	CONTROLLER PLATFORM 2	5–15

DRAWN M.J.Nus	DATE 30_Nov_04
CHECKED Jordi G.	27_Sep_05
APPROVED M.J.Nus	27_Sep_05

THIS PRINT SUPERSEDES ANY OF EARLIER DATE. DESTROY SAME.

SCALE

DIAGRAM SCHEMATIC
V500MAXTC–10/30
V500MAXMT–10/30
12V/24V

SHEET 2 OF 2

MATERIAL:

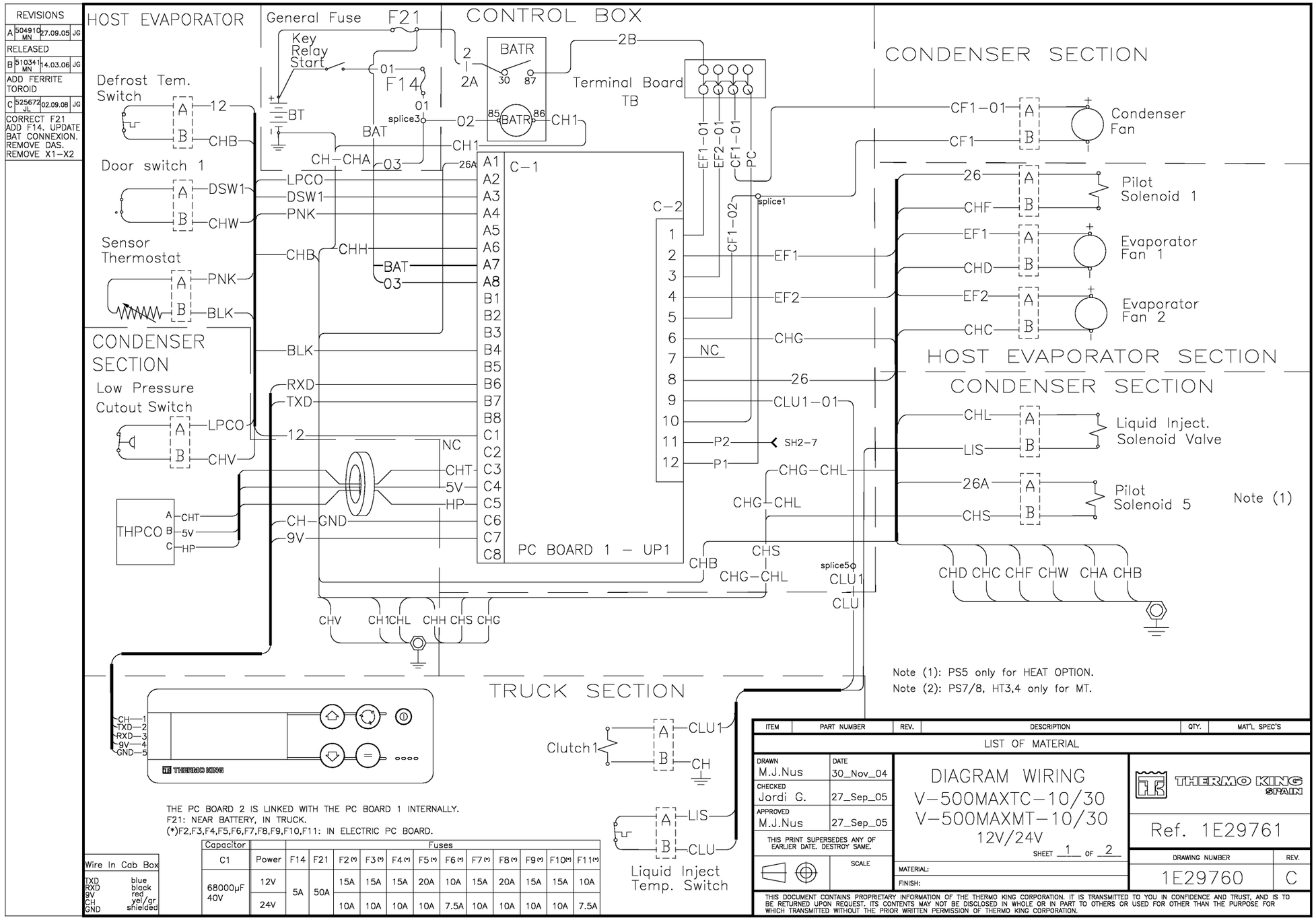
FINISH:

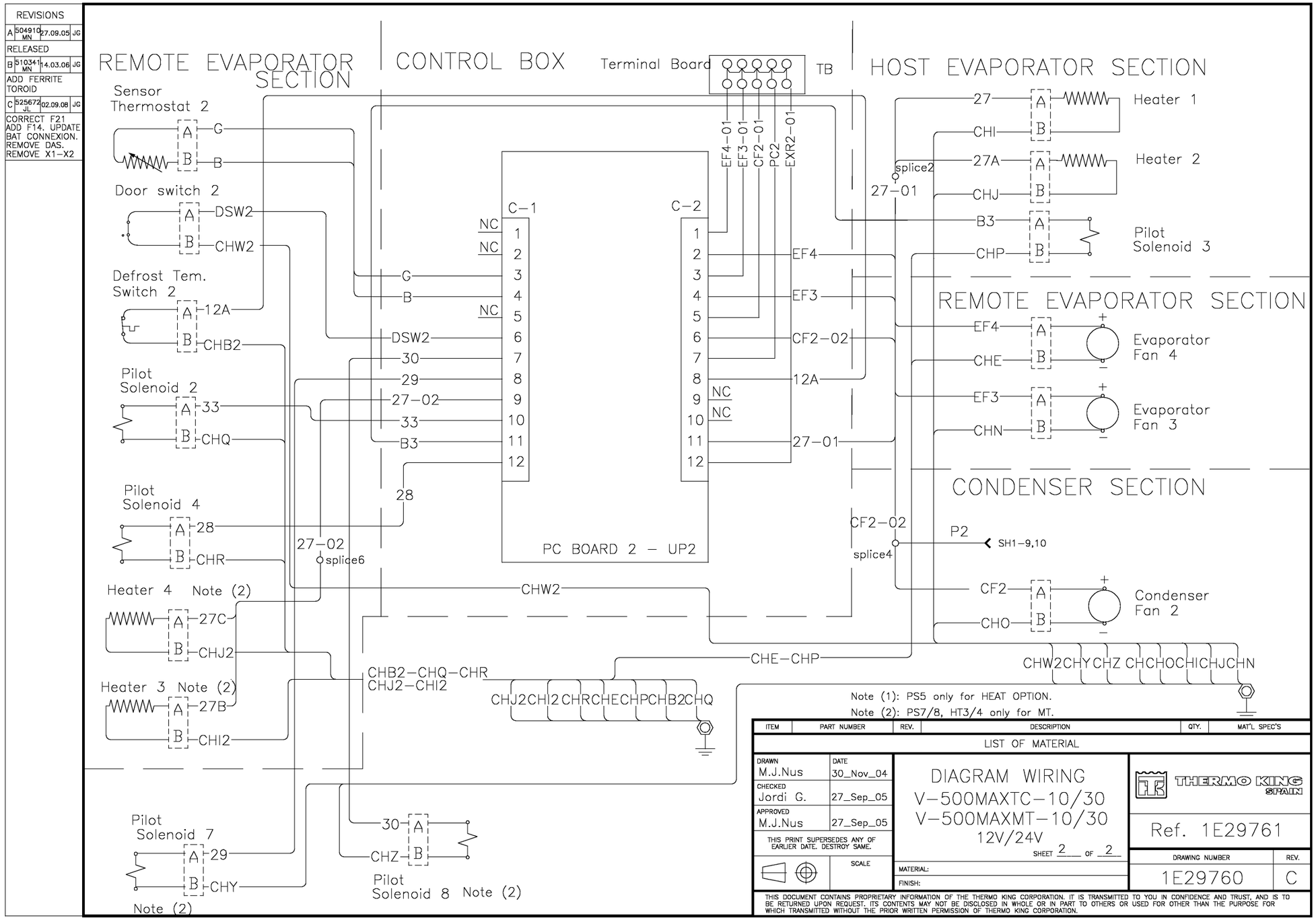
THERMO KING SPAIN

Ref. 1E29760

DRAWING NUMBER	REV.
1E29761	C

1E29760 DSR MICROPROCESSOR CONTROLLER WIRING DIAGRAM, V-500 MAX TC, 10/30 - PAGE 1 OF 2




REVISIONS
A 504910 MN 27.09.05 JG
RELEASED
B 510341 MN 14.03.06 JG
ADD FERRITE TOROID
C 525672 JL 02.09.08 JG
CORRECT F21
ADD F14. UPDATE BAT CONNEXION.
REMOVE DAS.
REMOVE X1-X2
REMOTE EVAPORATOR SECTION
CONTROL BOX
Terminal Board
TB
HOST EVAPORATOR SECTION
Sensor Thermostat 2
Door switch 2
Defrost Tem. Switch 2
Pilot Solenoid 2
Pilot Solenoid 4
Heater 4 Note (2)
Heater 3 Note (2)
Pilot Solenoid 7
Note (2)
Pilot Solenoid 8 Note (2)
C-1
C-2
PC BOARD 2 - UP2
EF4-01
EF3-01
CF2-01
PC2
EXR2-01
27-01
splice2
27-02
splice6
splice4
CF2-02
Heater 1
Heater 2
Pilot Solenoid 3
REMOTE EVAPORATOR SECTION
Evaporator Fan 4
Evaporator Fan 3
CONDENSER SECTION
P2
SH1-9,10
Condenser Fan 2
CHW2
CHE-CHP
CHB2-CHQ-CHR
CHJ2-CHI2
CHW2CHYCHZ CHCHOCHICHJCHN
CHJ2CHI2CHRCHECHPCHB2CHQ
Note (1): PS5 only for HEAT OPTION.
Note (2): PS7/8, HT3/4 only for MT.
ITEM
PART NUMBER
REV.
DESCRIPTION
QTY.
MAT'L SPEC'S
LIST OF MATERIAL
DRAWN M.J.Nus 30_Nov_04
CHECKED Jordi G. 27_Sep_05
APPROVED M.J.Nus 27_Sep_05
THIS PRINT SUPERSEDES ANY OF EARLIER DATE. DESTROY SAME.
SCALE
DIAGRAM WIRING
V-500MAXTC-10/30
V-500MAXMT-10/30
12V/24V
SHEET 2 OF 2
MATERIAL:
FINISH:
THERMO KING SPAIN
Ref. 1E29761
DRAWING NUMBER 1E29760
REV. C
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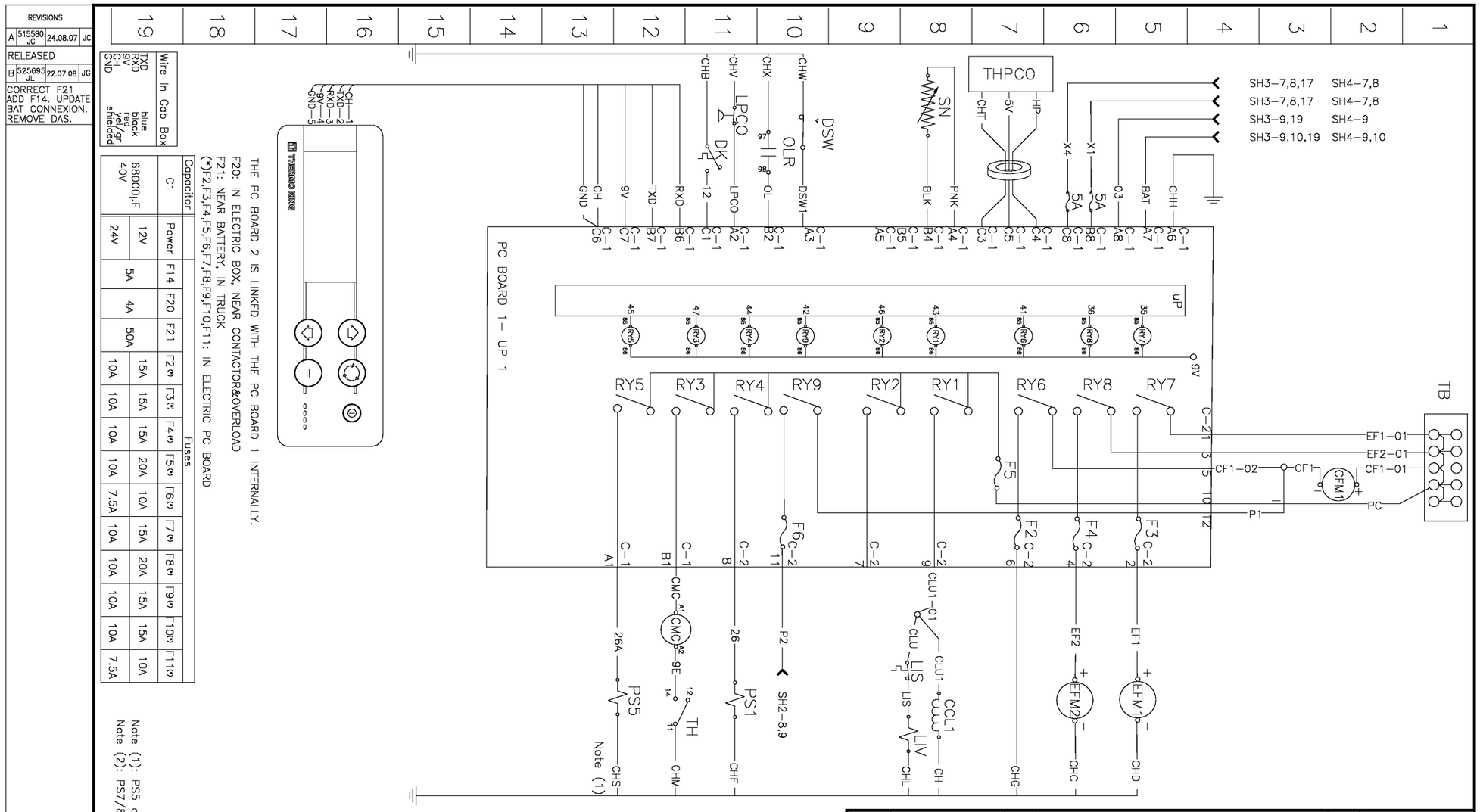
1E47150 DSR MICROPROCESSOR CONTROLLER SCHEMATIC DIAGRAM, V-500 MAX TC, 20/50 - PAGE 1 OF 4



REVISIONS				
A	515580 JG	24.08.07	JC
RELEASED				
B	525695 JL	22.07.08	JG
CORRECT F21 ADD F14. UPDATE BAT CONNEXION. REMOVE DAS.				

Wire In Cab Box	
TXD	blue
RXD	black
9V	red
CH	yel/gr
GND	shielded

THE PC BOARD 2 IS LINKED WITH THE PC BOARD 1 INTERNALLY.

F20: IN ELECTRIC BOX. NEAR CONTACTOR&OVERLOAD

F21: NEAR BATTERY, IN TRUCK

(*)F2,F3,F4,F5,F6,F7,F8,F9,F10,F11: IN ELECTRIC PC BOARD

Capacitor		
C1	68000µF 40V	

Fuses			
Power	12V		24V
F14	5A		
F20	4A		
F21	50A		
F2 (*)	10A	15A	
F3 (*)	10A	15A	
F4 (*)	10A	15A	
F5 (*)	10A	20A	
F6 (*)	7.5A	10A	
F7 (*)	10A	15A	
F8 (*)	10A	20A	
F9 (*)	10A	15A	
F10 (*)	10A	15A	
F11 (*)	7.5A	10A	

Note (1): PS5 only for HEAT OPTION.

Note (2): PS7/8, HT3/4 only for MT.

IDENT.	LEGEND	AREA
CCL1	COMPRESSOR CLUTCH	7,8
CFM1	CONDENSER FAN MOTOR1	2,3
DK	DEFROST TEMP. THERM.	11
DSW	DOOR SWITCH	9
EFM1	EVAPORATOR FAN MOTOR	5
EFM2	EVAPORATOR FAN MOTOR	6
LIS	LIQUID INJECTION SWITCH	8
LIV	LIQUID INJECTION VALVE	8
LPCO	LOW PRESSURE CUTOUT SWITCH	11
OLR	OVERLOAD RELAY	10
PS1	HOST DISCHARGE HOT GAS SOLENOID VALVE	10,11
PS5	HEAT PILOT SOLENOID	12
SN	SENSOR	7,8
TH	THERMISTOR, AIR TEMPERATURE	11,12
THPCO	HIGH PRESSURE TRANSDUCER	6,7
TB	TERMINAL BOARD	1

FUSES:		
F2	CONDENSER FAN 1	6,7
F3	EVAPORATOR FAN 1	5,6
F4	EVAPORATOR FAN 2	6
F5	CCL1,LIS,LIV, PS1,CMC,PS5	7
F6	CONDENSER FAN 1/2	10

RELAYS:		
RY7	EVAPORATOR FAN 1	4,5
RY8	EVAPORATOR FAN 2	5,6
RY6	CONDENSER FAN 1	6,7
RY1	CLUTCH, LIS,LIV	8
RY9	SERIAL/PARALLEL CFM1/2	10
RY4	PS1	10,11
RY3	CMC	11,12
RY5	PS5	12

ELECTRONIC SYSTEM:		
UP1	CONTROLLER PLATFORM 1	4–14
DISPLAY	IN CAB BOX	16,17

ITEM	PART NUMBER	REV.	DESCRIPTION	QTY.	MAT'L SPEC'S

LIST OF MATERIAL

DRAWN: Jordi G.	DATE: 24_Aug_07
CHECKED: Joaquim C.	13_Sep_07
APPROVED: Jordi G.	13_Sep_07

THIS PRINT SUPERSEDES ANY OF EARLIER DATE. DESTROY SAME.

SCALE

DIAGRAM SCHEMATIC
V500MAXTC–20/50
V500MAXMT–20/50

SHEET 1 OF 4

MATERIAL:

FINISH:

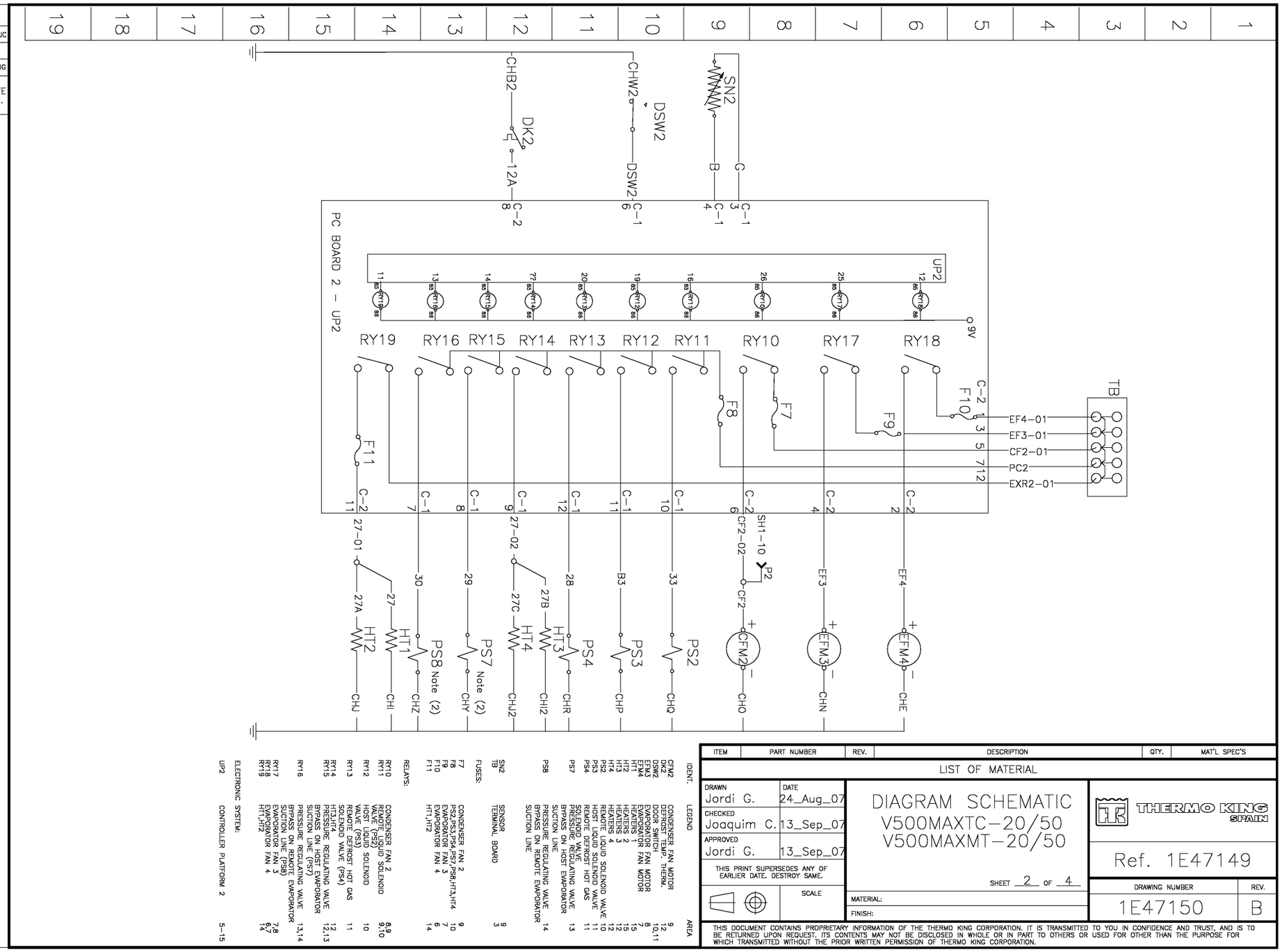
THERMO KING SPAIN

Ref. 1E47149

DRAWING NUMBER	REV.
1E47150	B

1E47150 DSR MICROPROCESSOR CONTROLLER SCHEMATIC DIAGRAM, V-500 MAX TC, 20/50 - PAGE 2 OF 4

REVISIONS				
A	515580 JG	24.08.07	JC	
RELEASED				
B	525695 JL	22.07.08	JG	
CORRECT F21 ADD F14. UPDATE BAT CONNEXION. REMOVE DAS.				



ITEM	PART NUMBER	REV.	DESCRIPTION	QTY.	MAT'L SPEC'S

LIST OF MATERIAL

IDENT.	LEGEND	AREA
CFM2	CONDENSER FAN MOTOR	9
DK2	DEFROST TEMP. THERM.	12
DSW2	DOOR SWITCH	10,11
EFM3	EVAPORATOR FAN MOTOR	8
EFM4	EVAPORATOR FAN MOTOR	7
HT1	HEATERS 1	15
HT2	HEATERS 3	15
HT3	HEATERS 4	12
HT4	REMOTE LIQUID SOLENOID VALVE	10
PS2	HOST LIQUID SOLENOID VALVE	11
PS3	REMOTE DEFROST HOT GAS SOLENOID VALVE	11
PS4	PRESSURE REGULATING VALVE BYPASS ON HOST EVAPORATOR SUCTION LINE	13
PS7	PRESSURE REGULATING VALVE BYPASS ON REMOTE EVAPORATOR SUCTION LINE	14
PS8		
SN2	SENSOR	9
TB	TERMINAL BOARD	3
FUSES:		
F7	CONDENSER FAN 2	9
F8	EVAPORATOR FAN 3,PS8,HT3,HT4	10
F9	EVAPORATOR FAN 4	7
F10	EVAPORATOR FAN 4	6
F11	HT1,HT2	14
RELAYS:		
RY10	CONDENSER FAN 2	8,9
RY11	REMOTE LIQUID SOLENOID VALVE (PS4)	9,10
RY12	HOST LIQUID SOLENOID VALVE (PS3)	10
RY13	REMOTE DEFROST HOT GAS SOLENOID VALVE (PS4)	11
RY14	HT3,HT4	12
RY15	PRESSURE REGULATING VALVE BYPASS ON HOST EVAPORATOR SUCTION LINE (PS7)	12,13
RY16	PRESSURE REGULATING VALVE BYPASS ON REMOTE EVAPORATOR SUCTION LINE (PS8)	13,14
RY17	EVAPORATOR FAN 3	7,8
RY18	EVAPORATOR FAN 4	6,7
RY19	HT1,HT2	14
ELECTRONIC SYSTEM:		
UP2	CONTROLLER PLATFORM 2	5–15

DRAWN	DATE
Jordi G.	24_Aug_07
CHECKED	
Joaquim C.	13_Sep_07
APPROVED	
Jordi G.	13_Sep_07

THIS PRINT SUPERSEDES ANY OF EARLIER DATE. DESTROY SAME.

SCALE

DIAGRAM SCHEMATIC
V500MAXTC–20/50
V500MAXMT–20/50

SHEET 2 OF 4

MATERIAL:

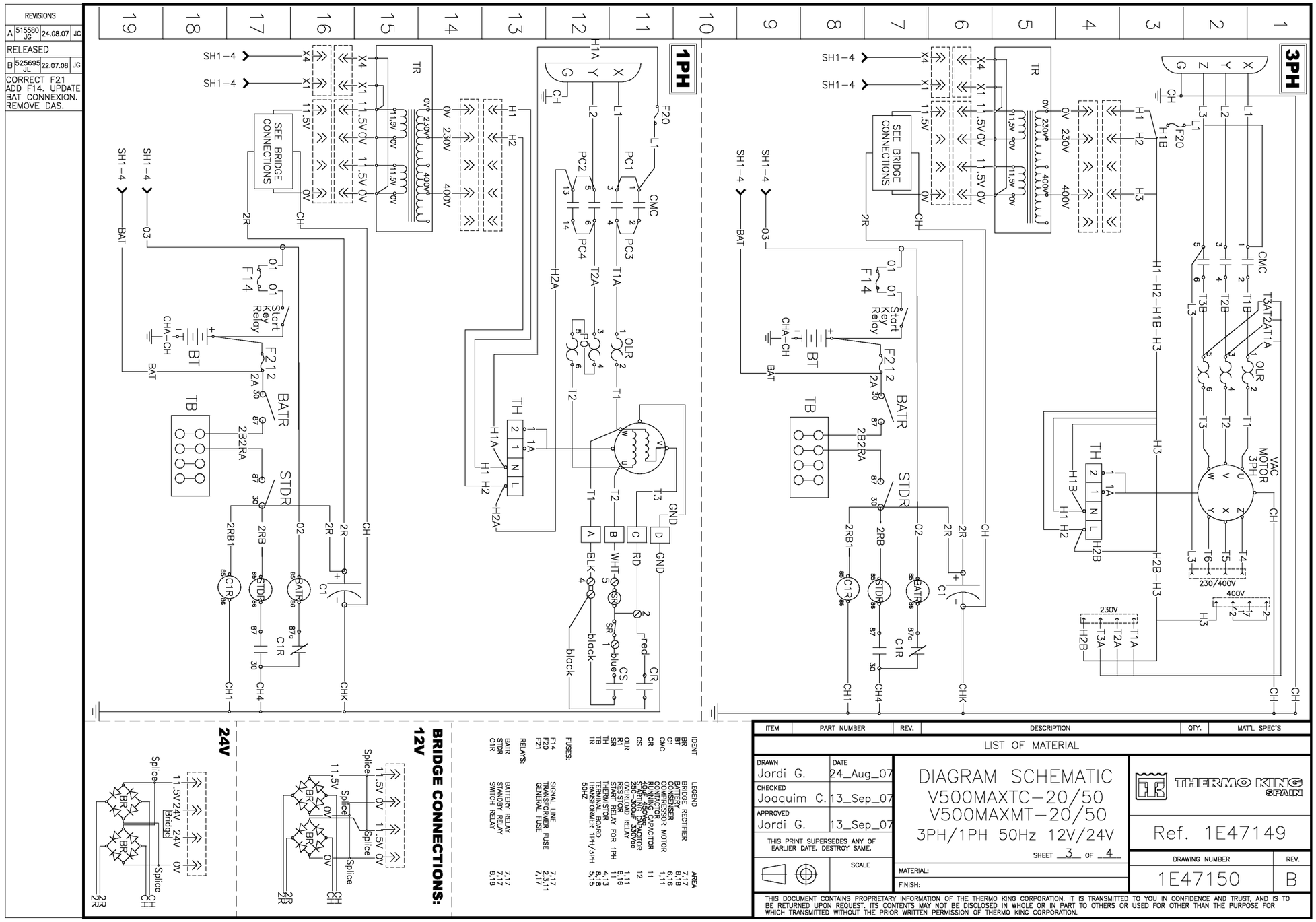
FINISH:

THERMO KING SPAIN

Ref. 1E47149

DRAWING NUMBER	REV.
1E47150	B

1E47150 DSR MICROPROCESSOR CONTROLLER SCHEMATIC DIAGRAM, V-500 MAX TC, 20/50 - PAGE 3 OF 4



ITEM	PART NUMBER	REV.	DESCRIPTION	QTY.	MAT'L SPEC'S

LIST OF MATERIAL

DRAWN	Jordi G.
DATE	24_Aug_07
CHECKED	Joaquim C.
DATE	13_Sep_07
APPROVED	Jordi G.
DATE	13_Sep_07

THIS PRINT SUPERSEDES ANY OF EARLIER DATE. DESTROY SAME.

SCALE

DIAGRAM SCHEMATIC
V500MAXTC-20/50
V500MAXMT-20/50
3PH/1PH 50Hz 12V/24V

SHEET 3 OF 4

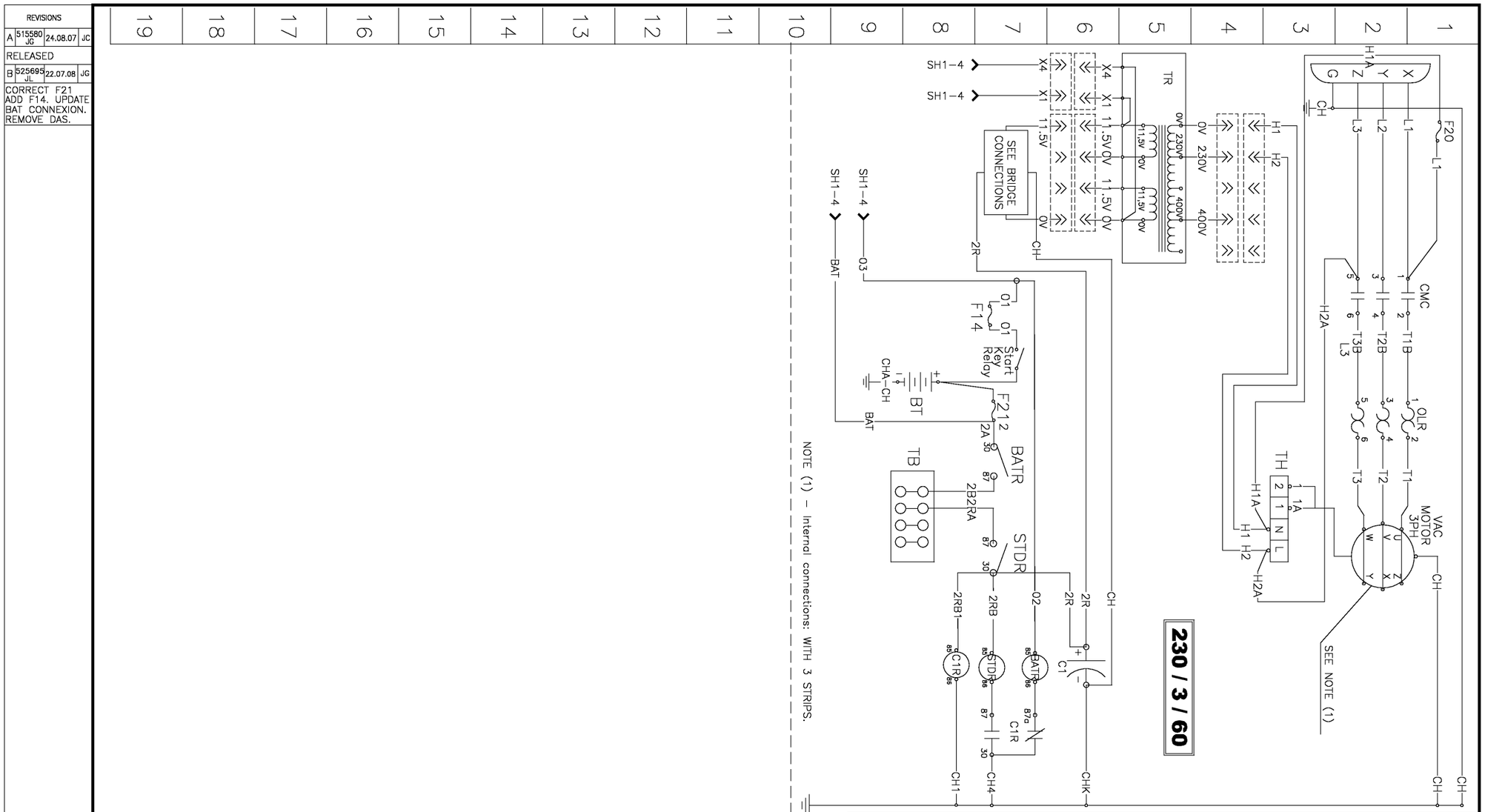
MATERIAL:

FINISH:

THERMO KING SPAIN

Ref. 1E47149

DRAWING NUMBER	REV.
1E47150	B



IDENT	LEGEND	AREA
BR	BRIDGE RECTIFIER	7,17
BT	BATTERY	8,18
C1	CONDENSER	6,16
CMC	CONTACTOR MOTOR COMPRESSOR	1,11
CR	RUNNING CAPACITOR 40 MFD 370VAC	11
CS	STARTING CAPACITOR 250-300µF 330VDC	12
OLR	OVERLOAD RELAY	1,11
R1	RESISTOR	6,16
SR	START RELAY FOR 1PH	11
TH	THERMISTOR	4,13
TB	TERMINAL BOARD	8,18
TR	TRANSFORMER 1PH/3PH 50HZ	5,15
	FUSES:	
F14	SIGNAL LINE	7
F20	TRANSFORMER FUSE	2,3,11
F21	GENERAL FUSE	7-
	RELAYS:	
BATR	BATTERY RELAY	7,17
STDR	STANDBY RELAY	7,17
C1R	SWITCH RELAY	8,18

ITEM	PART NUMBER	REV.	DESCRIPTION	QTY.	MAT'L SPEC'S

LIST OF MATERIAL

DRAWN: Jordi G.	DATE: 24_Aug_07
CHECKED: Joaquim C.	13_Sep_07
APPROVED: Jordi G.	13_Sep_07

THIS PRINT SUPERSEDES ANY OF EARLIER DATE. DESTROY SAME.

SCALE

DIAGRAM SCHEMATIC
V500MAXTC-20/50
V500MAXMT-20/50
230 3PH 60Hz 12V/24V

SHEET 4 OF 4

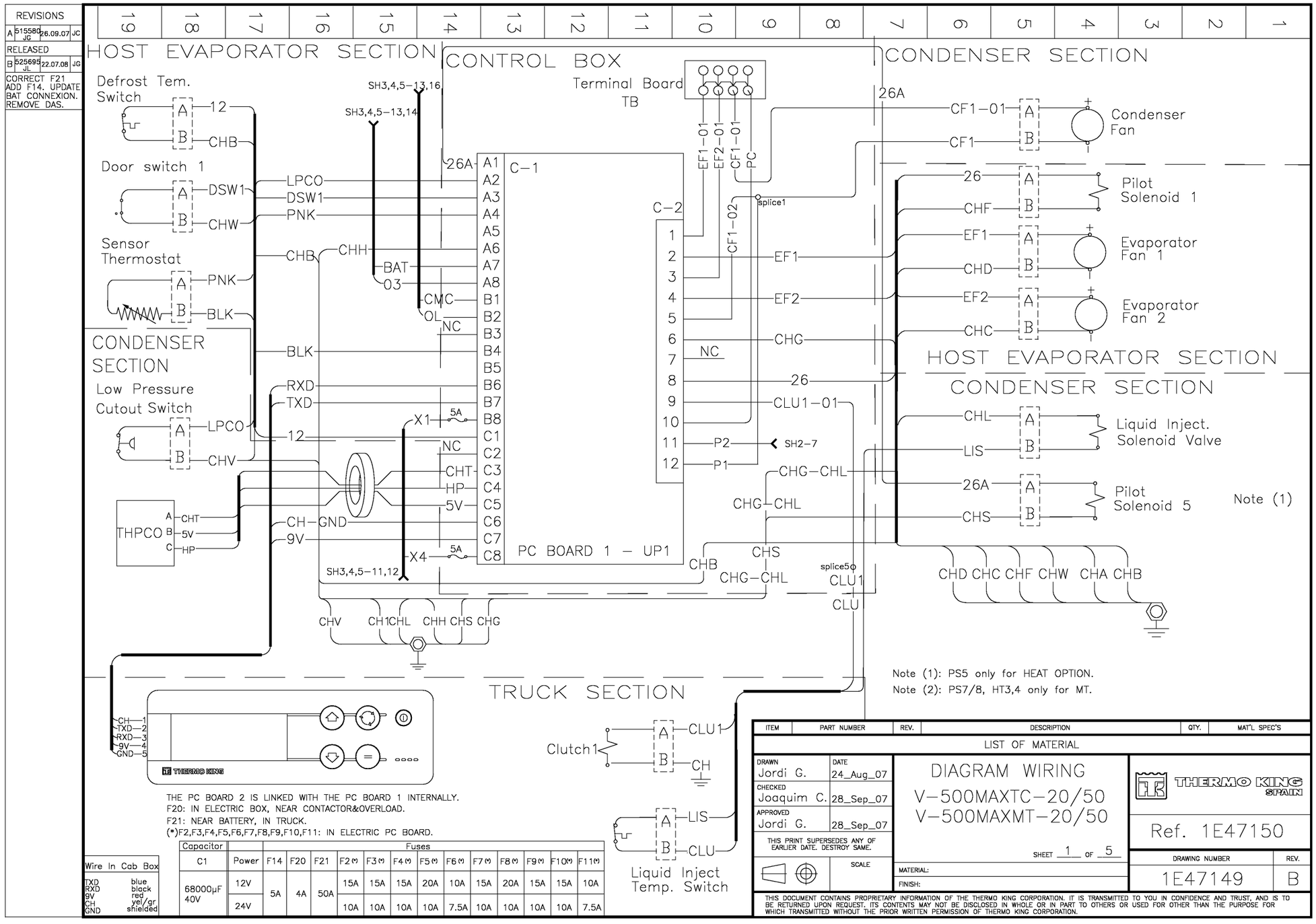
MATERIAL:

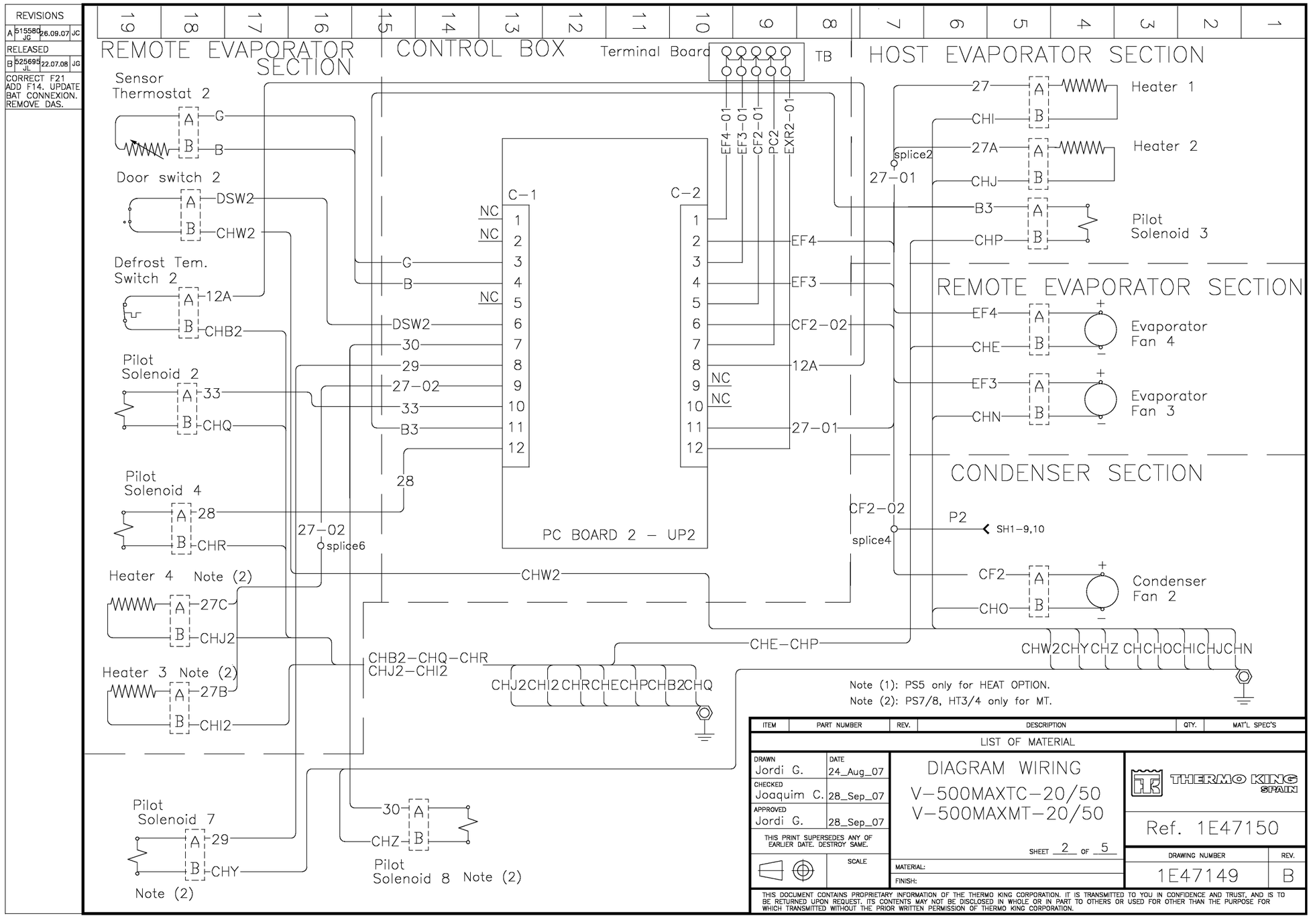
FINISH:

THERMO KING SPAIN

Ref. 1E47149

DRAWING NUMBER	REV.
1E47150	B


REVISIONS
A 515580 JG 26.09.07 JC
RELEASED
B 525695 JL 22.07.08 JG
CORRECT F21 ADD F14. UPDATE BAT CONNEXION. REMOVE DAS.
HOST EVAPORATOR SECTION
CONTROL BOX
Terminal Board TB
CONDENSER SECTION
Defrost Tem. Switch
Door switch 1
Sensor Thermostat
Low Pressure Cutout Switch
THPCO
C-1
C-2
PC BOARD 1 – UP1
Condenser Fan
Pilot Solenoid 1
Evaporator Fan 1
Evaporator Fan 2
Liquid Inject. Solenoid Valve
Pilot Solenoid 5
Note (1)
TRUCK SECTION
Clutch1
Liquid Inject Temp. Switch
THERMO KING
Note (1): PS5 only for HEAT OPTION.
Note (2): PS7/8, HT3,4 only for MT.
THE PC BOARD 2 IS LINKED WITH THE PC BOARD 1 INTERNALLY.
F20: IN ELECTRIC BOX, NEAR CONTACTOR&OVERLOAD.
F21: NEAR BATTERY, IN TRUCK.
(*)F2,F3,F4,F5,F6,F7,F8,F9,F10,F11: IN ELECTRIC PC BOARD.
Wire In Cab Box
TXD blue
RXD black
9V red
CH yel/gr
GND shielded
Capacitor C1 68000µF 40V
Fuses
12V: F14 5A, F20 4A, F21 50A; F2(*) 15A, F3(*) 15A, F4(*) 15A, F5(*) 20A, F6(*) 10A, F7(*) 15A, F8(*) 20A, F9(*) 15A, F10(*) 15A, F11(*) 10A
24V: 10A, 10A, 10A, 10A, 7.5A, 10A, 10A, 10A, 10A, 7.5A
LIST OF MATERIAL
DRAWN Jordi G. 24_Aug_07
CHECKED Joaquim C. 28_Sep_07
APPROVED Jordi G. 28_Sep_07
THIS PRINT SUPERSEDES ANY OF EARLIER DATE. DESTROY SAME.
SCALE
DIAGRAM WIRING
V-500MAXTC-20/50
V-500MAXMT-20/50
SHEET 1 OF 5
MATERIAL:
FINISH:
THERMO KING SPAIN
Ref. 1E47150
DRAWING NUMBER 1E47149
REV. B
THIS DOCUMENT CONTAINS PROPRIETARY INFORMATION OF THE THERMO KING CORPORATION. IT IS TRANSMITTED TO YOU IN CONFIDENCE AND TRUST, AND IS TO BE RETURNED UPON REQUEST. ITS CONTENTS MAY NOT BE DISCLOSED IN WHOLE OR IN PART TO OTHERS OR USED FOR OTHER THAN THE PURPOSE FOR WHICH TRANSMITTED WITHOUT THE PRIOR WRITTEN PERMISSION OF THERMO KING CORPORATION.


REVISIONS
A 515580 JG 26.09.07 JC
RELEASED
B 525695 JL 22.07.08 JG
CORRECT F21 ADD F14. UPDATE BAT CONNEXION. REMOVE DAS.
REMOTE EVAPORATOR SECTION
CONTROL BOX
Terminal Board
TB
HOST EVAPORATOR SECTION
Sensor Thermostat 2
Door switch 2
Defrost Tem. Switch 2
Pilot Solenoid 2
Pilot Solenoid 4
Heater 4 Note (2)
Heater 3 Note (2)
Pilot Solenoid 7
Note (2)
Pilot Solenoid 8 Note (2)
C-1
C-2
PC BOARD 2 – UP2
EF4-01
EF3-01
CF2-01
PC2
EXR2-01
splice2
27-01
27-02
splice6
splice4
CF2-02
Heater 1
Heater 2
Pilot Solenoid 3
REMOTE EVAPORATOR SECTION
Evaporator Fan 4
Evaporator Fan 3
CONDENSER SECTION
P2
SH1-9,10
Condenser Fan 2
CHW2
CHE-CHP
CHB2-CHQ-CHR
CHJ2-CHI2
CHW2 CHY CHZ CH CHO CHI CHJ CHN
CHJ2 CHI2 CHR CHE CHP CHB2 CHQ
Note (1): PS5 only for HEAT OPTION.
Note (2): PS7/8, HT3/4 only for MT.
ITEM
PART NUMBER
REV.
DESCRIPTION
QTY.
MAT'L SPEC'S
LIST OF MATERIAL
DRAWN Jordi G. DATE 24_Aug_07
CHECKED Joaquim C. 28_Sep_07
APPROVED Jordi G. 28_Sep_07
THIS PRINT SUPERSEDES ANY OF EARLIER DATE. DESTROY SAME.
SCALE
DIAGRAM WIRING
V-500MAXTC-20/50
V-500MAXMT-20/50
SHEET 2 OF 5
MATERIAL:
FINISH:
THERMO KING SPAIN
Ref. 1E47150
DRAWING NUMBER 1E47149
REV. B
THIS DOCUMENT CONTAINS PROPRIETARY INFORMATION OF THE THERMO KING CORPORATION. IT IS TRANSMITTED TO YOU IN CONFIDENCE AND TRUST, AND IS TO BE RETURNED UPON REQUEST. ITS CONTENTS MAY NOT BE DISCLOSED IN WHOLE OR IN PART TO OTHERS OR USED FOR OTHER THAN THE PURPOSE FOR WHICH TRANSMITTED WITHOUT THE PRIOR WRITTEN PERMISSION OF THERMO KING CORPORATION.

REVISIONS			
A	515580 JG	26.09.07	JC
RELEASED			
B	525695 JL	22.07.08	JG

CORRECT F21
ADD F14. UPDATE
BAT CONNEXION.
REMOVE DAS.

3PH

Transformer Fuse F20

Motor Contactor

Motor Overload

VAC Motorch 3PH

CMC SH1–14

OL SH1–14

CHX

CHM

TH

9E

H1B

H1 H2

H2B

H3 400V

H2 230V

H1 0V

TR Transformer

0V 11.5V 0V 11.5V

X1 X4 SH1–15

See bridge connections

CH

2R

Capacitor

CHK

Battery Relay

BATR

Standby Relay

STDR

STD

2RB

F21

F14

Key Relay Start

BAT

SH1–15

BT

CHA

03

C1R

CH4

CH1

2RB1

SWS

SWB

2B 2RA

Terminal board TB

TO SHEET 1 LINE 10

BRIDGE CONNECTIONS:

12V

11.5V 0V 11.5V 0V

Splice

BR BF

24V

11.5V 24V 24V 0V

Bridge

ITEM	PART NUMBER	REV.	DESCRIPTION	QTY.	MAT'L SPEC'S

LIST OF MATERIAL

DRAWN Jordi G.	DATE 24_Aug_07
CHECKED Joaquim C.	28_Sep_07
APPROVED Jordi G.	28_Sep_07

THIS PRINT SUPERSEDES ANY OF EARLIER DATE. DESTROY SAME.

SCALE

DIAGRAM WIRING
V–500MAXTC–20/50
V–500MAXMT–20/50
3PH 50Hz 12V/24V

SHEET 3 OF 5

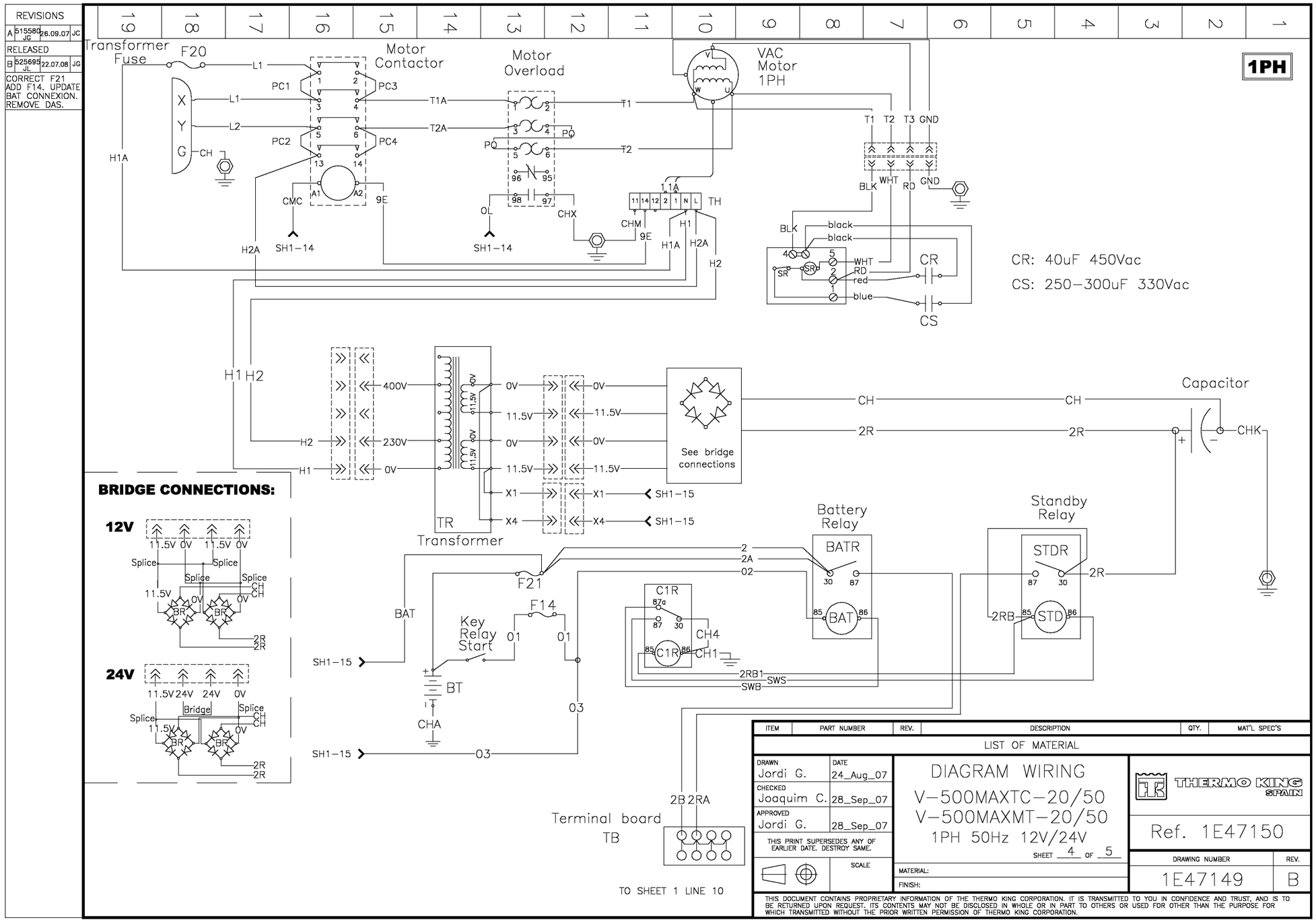
MATERIAL:

FINISH:

THERMO KING SPAIN

Ref. 1E47150

DRAWING NUMBER	REV.
1E47149	B


REVISIONS
A 515580 JG 26.09.07 JC
CORRECT F21 ADD F14. UPDATE BAT CONNEXION. REMOVE DAS.
RELEASED
B 525695 JL 22.07.08 JG
1PH
Transformer
F20
Motor Contactor
Motor Overload
VAC Motor 1PH
PC1
PC2
PC3
PC4
T1A
T2A
T1
T2
T3
GND
H1A
H2A
H2
CMC
9E
OL
CHX
CHM
TH
CR
CS
CR: 40uF 450Vac
CS: 250-300uF 330Vac
BLK
WHT
RD
black
red
blue
H1 H2
400V
230V
0V
11.5V
X1
X4
SH1-15
TR
Transformer
See bridge connections
Capacitor
CH
2R
CHK
BRIDGE CONNECTIONS:
12V
24V
Splice
Bridge
BR
BF
Battery Relay
BATR
Standby Relay
STDR
STD
BAT
C1R
CH4
CH1
2RB
2RB1
SWS
SWB
F21
F14
Key Relay Start
BT
CHA
BAT
2
2A
02
03
01
2B
2RA
Terminal board
TB
TO SHEET 1 LINE 10
ITEM
PART NUMBER
REV.
DESCRIPTION
QTY.
MAT'L SPEC'S
LIST OF MATERIAL
DRAWN Jordi G. 24_Aug_07
CHECKED Joaquim C. 28_Sep_07
APPROVED Jordi G. 28_Sep_07
THIS PRINT SUPERSEDES ANY OF EARLIER DATE. DESTROY SAME.
SCALE
DIAGRAM WIRING
V-500MAXTC-20/50
V-500MAXMT-20/50
1PH 50Hz 12V/24V
SHEET 4 OF 5
MATERIAL:
FINISH:
THERMO KING SPAIN
Ref. 1E47150
DRAWING NUMBER 1E47149
REV. B
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REVISIONS			
A	515580 JG	26.09.07	JC
RELEASED			
B	525695 JL	22.07.08	JG
CORRECT F21 ADD F14. UPDATE BAT CONNEXION. REMOVE DAS.			

230 / 3PH / 60Hz

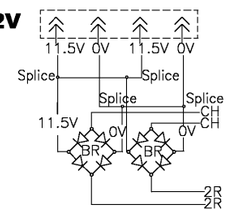
Transformer Fuse F20 — Motor Contactor — Motor Overload — VAC Motor CH 3PH

SEE NOTE (1)

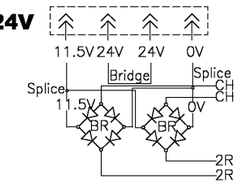
H1 H2 — 400V — 230V — 0V — TR Transformer — See bridge connections — CH — 2R — Capacitor — CHK

BRIDGE CONNECTIONS:

12V



24V



Battery Relay BATR — Standby Relay STDR — F21 — F14 — Key Relay Start — BAT — BT — CHA — C1R — CH4 — CH1 — 2RB1 — SWS — SWB — 2B 2RA — Terminal board TB

NOTE (1) – Internal connections: WITH 3 STRIPS.

TO SHEET 1 LINE 10

ITEM	PART NUMBER	REV.	DESCRIPTION	QTY.	MAT'L SPEC'S

LIST OF MATERIAL

DRAWN Jordi G.	DATE 24_Aug_07
CHECKED Joaquim C.	28_Sep_07
APPROVED Jordi G.	28_Sep_07

THIS PRINT SUPERSEDES ANY OF EARLIER DATE. DESTROY SAME.

SCALE

DIAGRAM WIRING
V-500MAXTC-20/50
V-500MAXMT-20/50
230V/3PH 60Hz 12V/24V
SHEET 5 OF 5

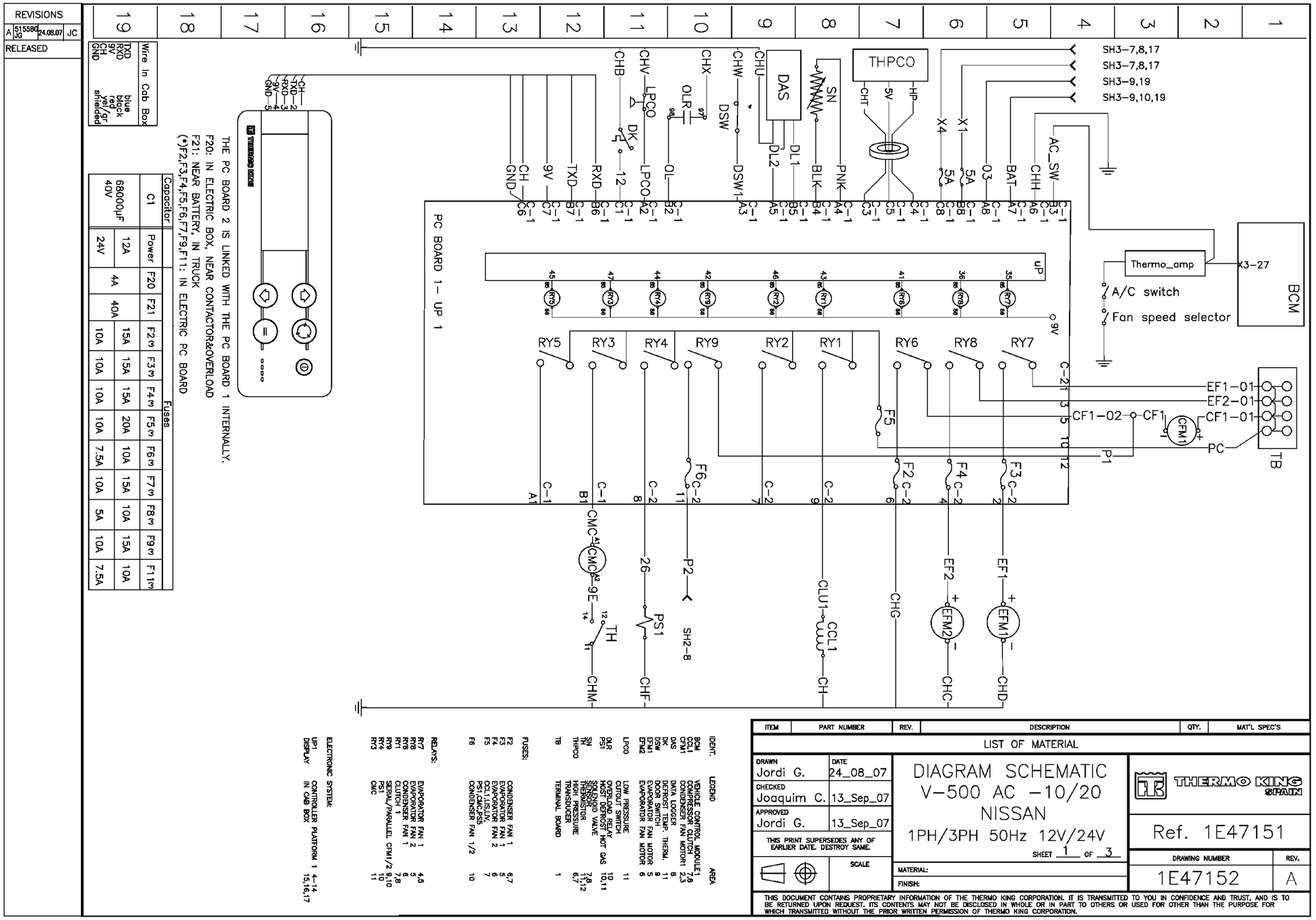
MATERIAL:
FINISH:

THERMO KING SPAIN

Ref. 1E47150

DRAWING NUMBER	REV.
1E47149	B

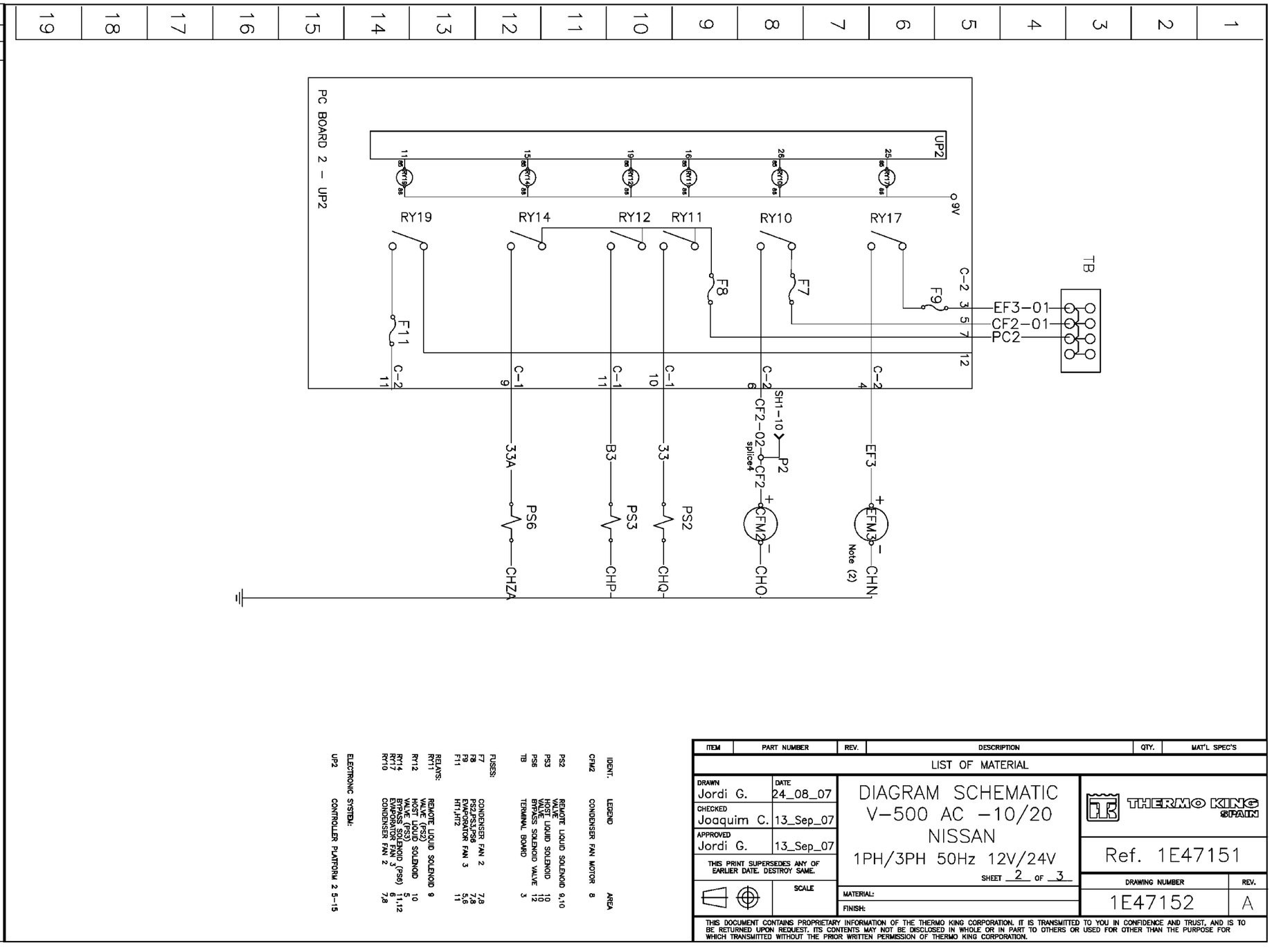
1E47152 DSR MICROPROCESSOR CONTROLLER SCHEMATIC DIAGRAM, V-500 AC, 10/20 - PAGE 1 OF 3



REVISIONS

A	51558Q JG	24.08.07	JC

RELEASED



IDENT.	LEGEND	AREA
CFM2	CONDENSER FAN MOTOR	8
PS2	REMOTE LIQUID SOLENOID VALVE	9,10
PS3	HOST LIQUID SOLENOID	10
PS6	BYPASS SOLENOID VALVE	12
TB	TERMINAL BOARD	3

FUSES:		
F7	CONDENSER FAN 2	7,8
F8	PS2,PS3,PS6	7,8
F9	EVAPORATOR FAN 3	5,6
F11	HT1,HT2	11

RELAYS:		
RY11	REMOTE LIQUID SOLENOID VALVE (PS2)	9
RY12	HOST LIQUID SOLENOID VALVE (PS3)	10
RY14	BYPASS SOLENOID (PS6)	5
RY17	EVAPORATOR FAN 3	11,12
RY19	CONDENSER FAN 2	6
		7,8

ELECTRONIC SYSTEM:

UP2 CONTROLLER PLATFORM 2 5-15

ITEM	PART NUMBER	REV.	DESCRIPTION	QTY.	MAT'L SPEC'S

LIST OF MATERIAL

DRAWN Jordi G.	DATE 24_08_07
CHECKED Joaquim C.	13_Sep_07
APPROVED Jordi G.	13_Sep_07

THIS PRINT SUPERSEDES ANY OF EARLIER DATE. DESTROY SAME.

SCALE

DIAGRAM SCHEMATIC
V-500 AC -10/20
NISSAN
1PH/3PH 50Hz 12V/24V

SHEET 2 OF 3

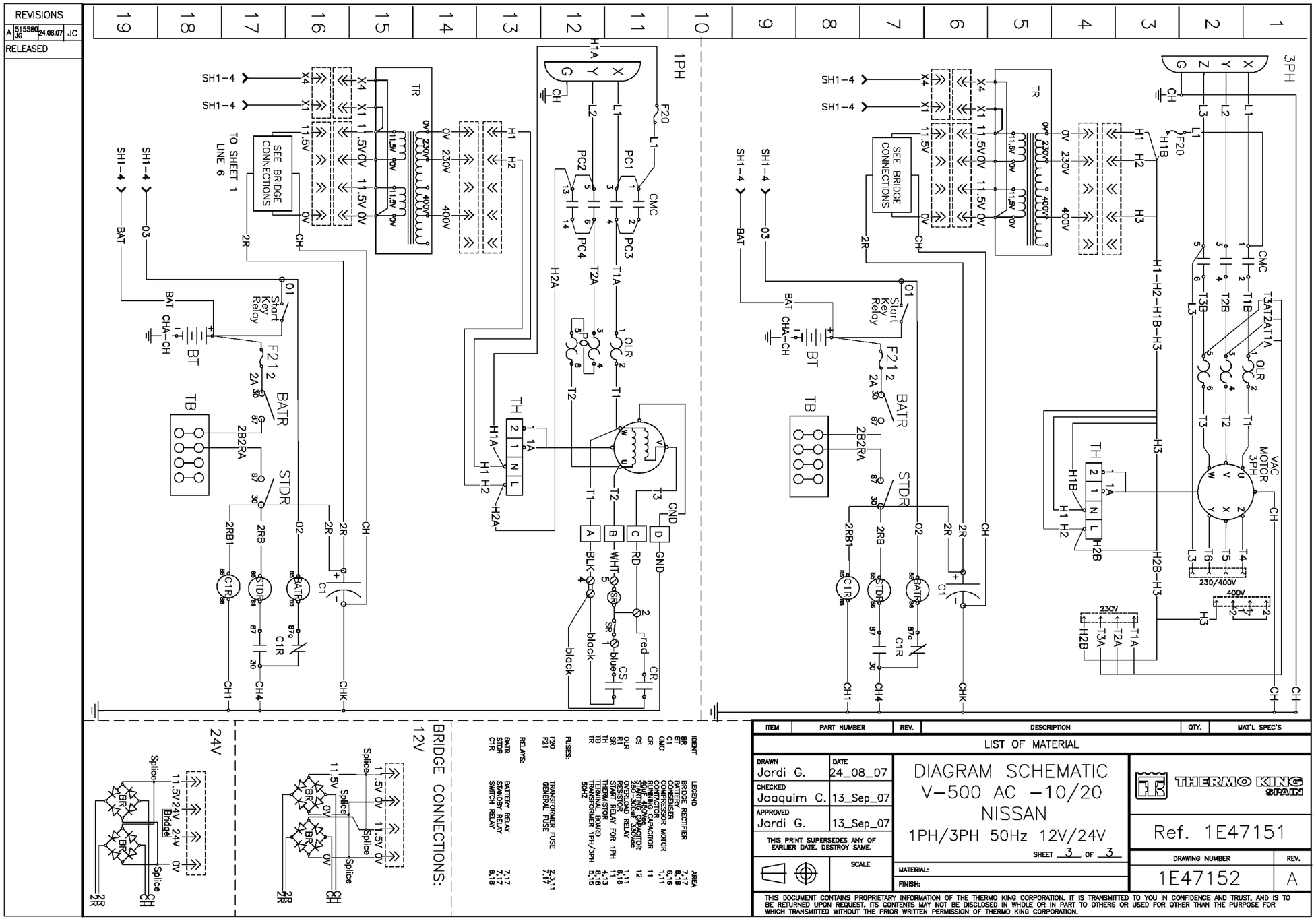
MATERIAL:

FINISH:

THERMO KING SPAIN

Ref. 1E47151

DRAWING NUMBER	REV.
1E47152	A


REVISIONS
A 515580 JG 24.08.07 JC
RELEASED
3PH
1PH
TR
SEE BRIDGE CONNECTIONS
TO SHEET 1 LINE 6
CMC
T3AT2AT1A
OLR
VAC MOTOR 3PH
TH
BT
F212
BATR
STDR
TB
C1R
C1
Start Key Relay
230/400V
400V
230V
H1-H2-H1B-H3
H2B-H3
H2A
BRIDGE CONNECTIONS:
12V
24V
Splice
Bridge
BR
LEGEND
FUSES:
RELAYS:
ITEM
PART NUMBER
REV.
DESCRIPTION
QTY.
MAT'L SPEC'S
LIST OF MATERIAL
DRAWN Jordi G. DATE 24_08_07
CHECKED Joaquim C. 13_Sep_07
APPROVED Jordi G. 13_Sep_07
THIS PRINT SUPERSEDES ANY OF EARLIER DATE. DESTROY SAME.
SCALE
DIAGRAM SCHEMATIC
V-500 AC -10/20
NISSAN
1PH/3PH 50Hz 12V/24V
SHEET 3 OF 3
MATERIAL:
FINISH:
THERMO KING SPAIN
Ref. 1E47151
DRAWING NUMBER 1E47152
REV. A
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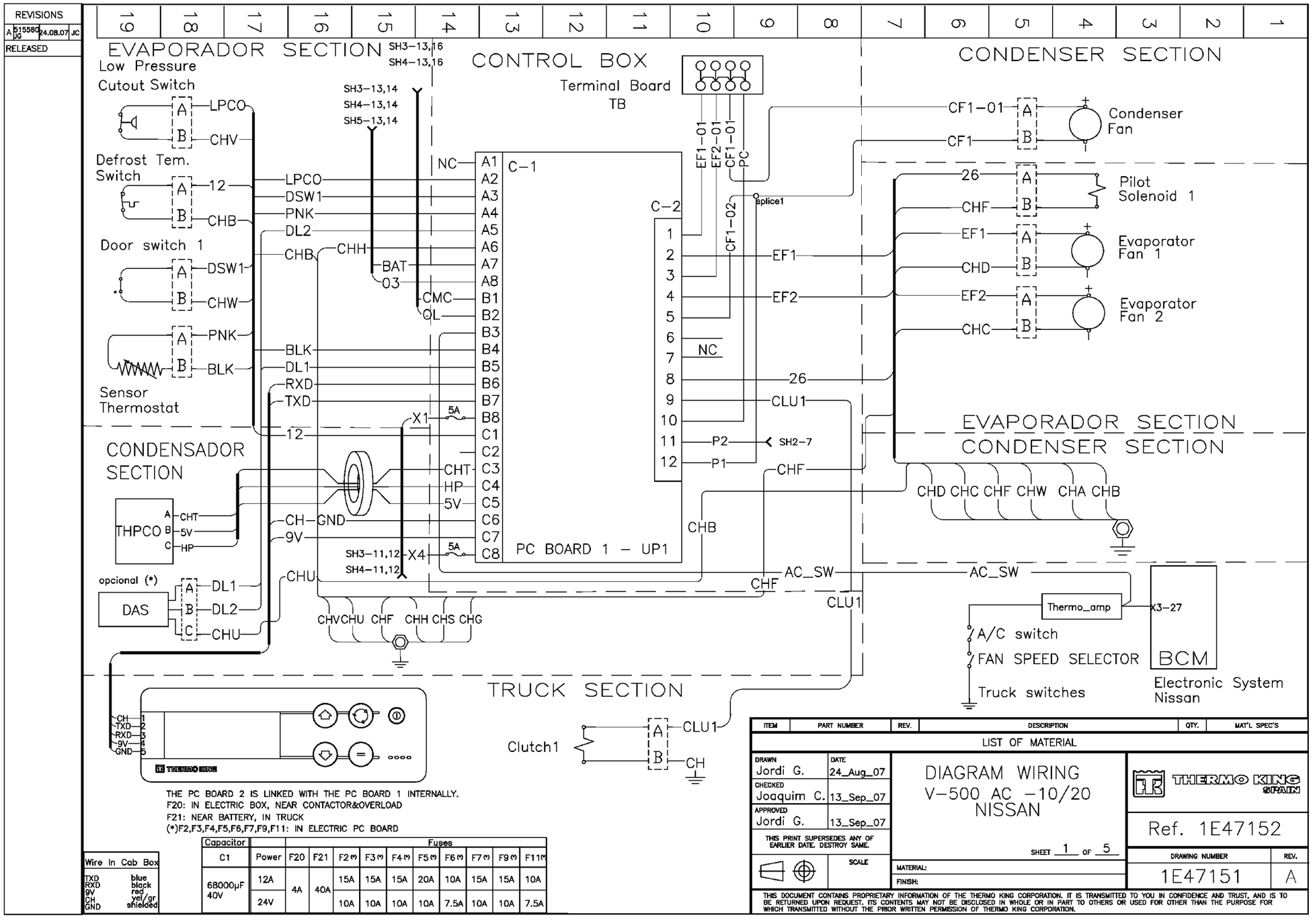
REVISIONS
A JG 515580 24.08.07 JC
RELEASED
EVAPORADOR SECTION
Low Pressure Cutout Switch
LPCO
CHV
Defrost Tem. Switch
12
CHB
Door switch 1
DSW1
CHW
PNK
BLK
Sensor Thermostat
CONDENSADOR SECTION
THPCO
CHT
5V
HP
opcional (*)
DAS
DL1
DL2
CHU
CONTROL BOX
Terminal Board TB
SH3–13,16
SH4–13,16
SH3–13,14
SH4–13,14
SH5–13,14
NC
C–1
A1
A2
A3
A4
A5
A6
A7
A8
B1
B2
B3
B4
B5
B6
B7
B8
C1
C2
C3
C4
C5
C6
C7
C8
CHH
BAT
03
CMC
OL
X1
5A
X4
SH3–11,12
SH4–11,12
CH
GND
9V
CHV CHU CHF CHH CHS CHG
PC BOARD 1 – UP1
EF1–01
EF2–01
CF1–01
PC
CF1–02
C–2
splice1
EF1
EF2
26
CLU1
P2
P1
SH2–7
CHF
CHB
AC_SW
CLU1
CONDENSER SECTION
CF1–01
CF1
Condenser Fan
26
CHF
Pilot Solenoid 1
EF1
Evaporator Fan 1
CHD
EF2
Evaporator Fan 2
CHC
EVAPORADOR SECTION
CONDENSER SECTION
CHD CHC CHF CHW CHA CHB
AC_SW
Thermo_amp
X3–27
A/C switch
FAN SPEED SELECTOR
Truck switches
BCM
Electronic System Nissan
TRUCK SECTION
CH
TXD
RXD
9V
GND
THERMO KING
Clutch1
CLU1
CH
THE PC BOARD 2 IS LINKED WITH THE PC BOARD 1 INTERNALLY.
F20: IN ELECTRIC BOX, NEAR CONTACTOR&OVERLOAD
F21: NEAR BATTERY, IN TRUCK
(*)F2,F3,F4,F5,F6,F7,F9,F11: IN ELECTRIC PC BOARD
Wire In Cab Box
TXD blue
RXD black
9V red
CH yel/gr
GND shielded
Capacitor
C1
6800OµF 40V
Fuses
Power F20 F21 F2(*) F3(*) F4(*) F5(*) F6(*) F7(*) F9(*) F11(*)
12A 4A 40A 15A 15A 15A 20A 10A 15A 15A 10A
24V 10A 10A 10A 10A 7.5A 10A 10A 7.5A
ITEM PART NUMBER REV. DESCRIPTION QTY. MAT'L SPEC'S
LIST OF MATERIAL
DRAWN Jordi G. DATE 24_Aug_07
CHECKED Joaquim C. 13_Sep_07
APPROVED Jordi G. 13_Sep_07
THIS PRINT SUPERSEDES ANY OF EARLIER DATE. DESTROY SAME.
SCALE
DIAGRAM WIRING V–500 AC –10/20 NISSAN
SHEET 1 OF 5
MATERIAL:
FINISH:
THERMO KING SPAIN
Ref. 1E47152
DRAWING NUMBER 1E47151
REV. A
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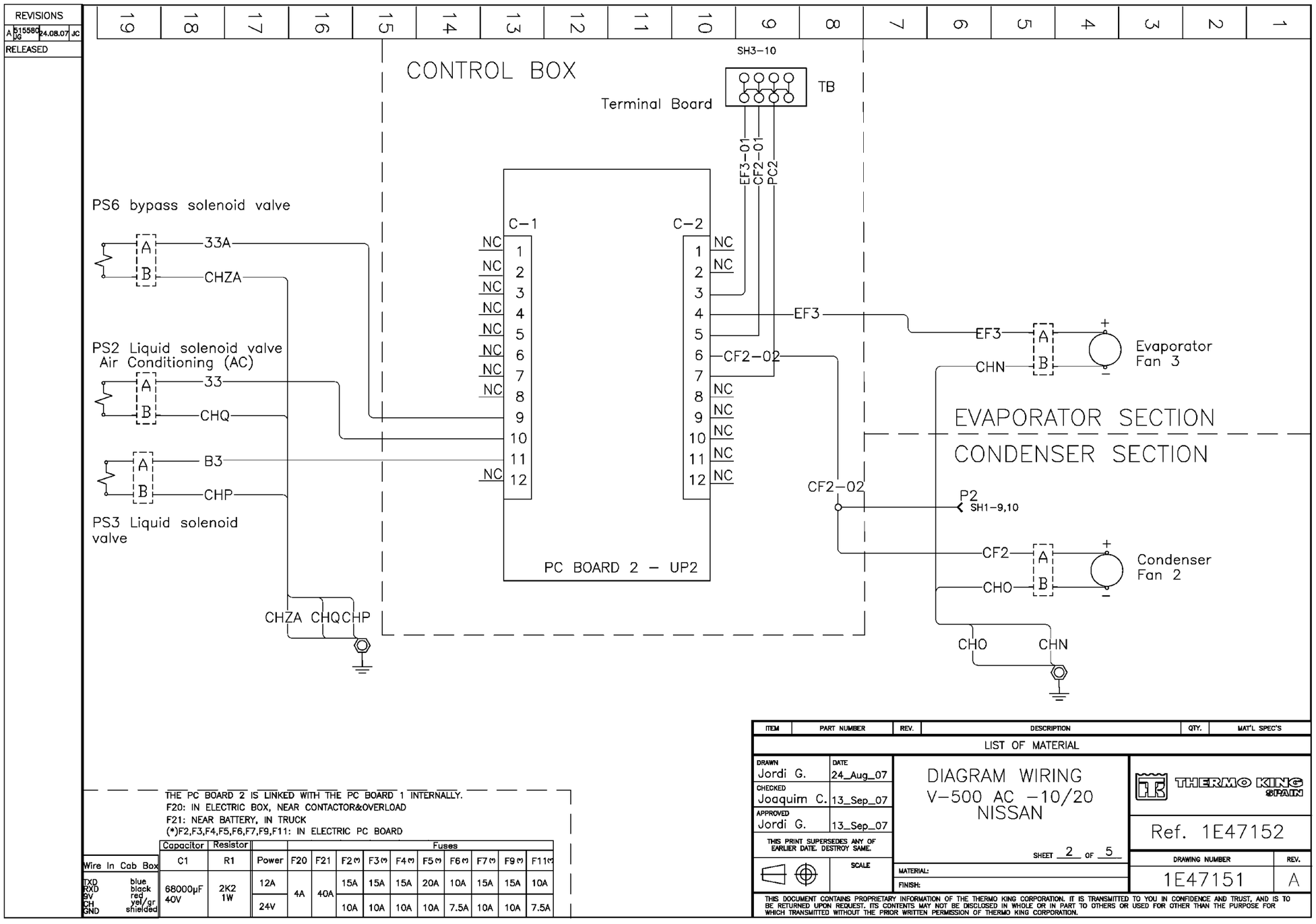

THE PC BOARD 2 IS LINKED WITH THE PC BOARD 1 INTERNALLY.
F20: IN ELECTRIC BOX, NEAR CONTACTOR&OVERLOAD
F21: NEAR BATTERY, IN TRUCK
(*)F2,F3,F4,F5,F6,F7,F9,F11: IN ELECTRIC PC BOARD

Wire In Cab Box		Capacitor	Resistor		Fuses									
		C1	R1	Power	F20	F21	F2 (*)	F3 (*)	F4 (*)	F5 (*)	F6 (*)	F7 (*)	F9 (*)	F11 (*)
TXD	blue	68000µF 40V	2K2 1W	12A	4A	40A	15A	15A	15A	20A	10A	15A	15A	10A
RXD	black													
9V	red													
CH	yel/gr			24V			10A	10A	10A	10A	7.5A	10A	10A	7.5A
GND	shielded													

ITEM	PART NUMBER	REV.	DESCRIPTION	QTY.	MAT'L SPEC'S

LIST OF MATERIAL

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SCALE	

DIAGRAM WIRING
V-500 AC -10/20
NISSAN

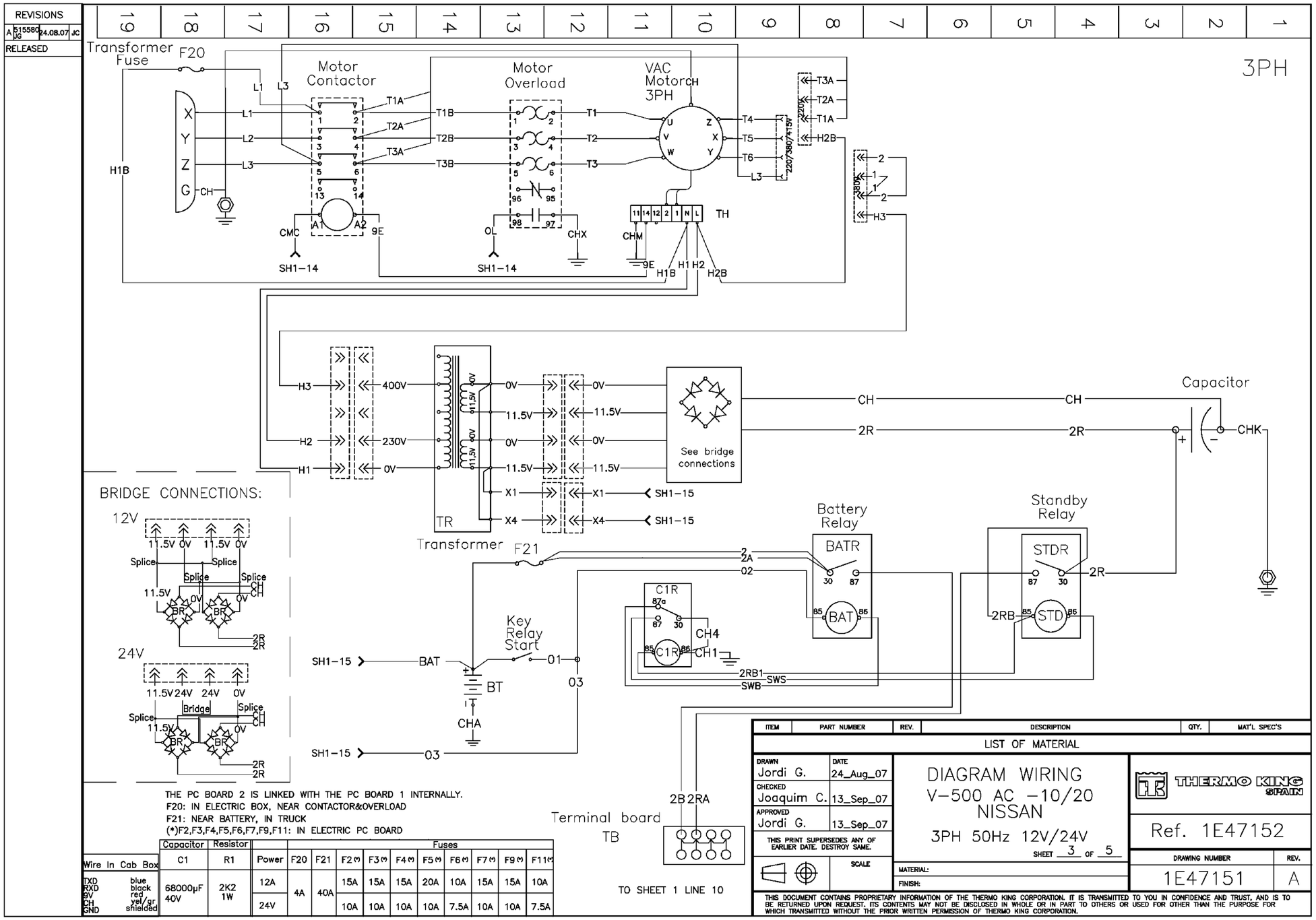
SHEET 2 OF 5

MATERIAL:
FINISH:

THERMO KING SPAIN

Ref. 1E47152

DRAWING NUMBER	REV.
1E47151	A


REVISIONS
A 51558 JG 24.08.07 JC
RELEASED
3PH
Transformer Fuse
F20
Motor Contactor
Motor Overload
VAC Motor 3PH
H1B
CH
L1
L2
L3
T1A
T2A
T3A
T1B
T2B
T3B
T1
T2
T3
T4
T5
T6
CMC
OL
CHX
CHM
TH
9E
H1
H2
H2B
SH1–14
H3
400V
230V
0V
11.5V
TR
X1
X4
SH1–15
See bridge connections
CH
2R
Capacitor
CHK
BRIDGE CONNECTIONS:
12V
24V
Splice
Bridge
BR
Transformer
F21
2
2A
02
Battery Relay
BATR
BAT
Standby Relay
STDR
STD
2RB
Key Relay Start
01
03
BT
CHA
BAT
C1R
CH4
CH1
2RB1
SWS
SWB
2B
2RA
Terminal board TB
TO SHEET 1 LINE 10
THE PC BOARD 2 IS LINKED WITH THE PC BOARD 1 INTERNALLY.
F20: IN ELECTRIC BOX, NEAR CONTACTOR&OVERLOAD
F21: NEAR BATTERY, IN TRUCK
(*)F2,F3,F4,F5,F6,F7,F9,F11: IN ELECTRIC PC BOARD
Capacitor
Resistor
Fuses
Wire In Cab Box
C1
R1
Power
F20
F21
F2(*)
F3(*)
F4(*)
F5(*)
F6(*)
F7(*)
F9(*)
F11(*)
TXD blue
RXD black
5V red
CH yel/gr
GND shielded
68000µF 40V
2K2 1W
12A
24V
4A
40A
15A
10A
20A
7.5A
ITEM
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SCALE
DIAGRAM WIRING
V-500 AC -10/20
NISSAN
3PH 50Hz 12V/24V
SHEET 3 OF 5
MATERIAL:
FINISH:
THERMO KING SPAIN
Ref. 1E47152
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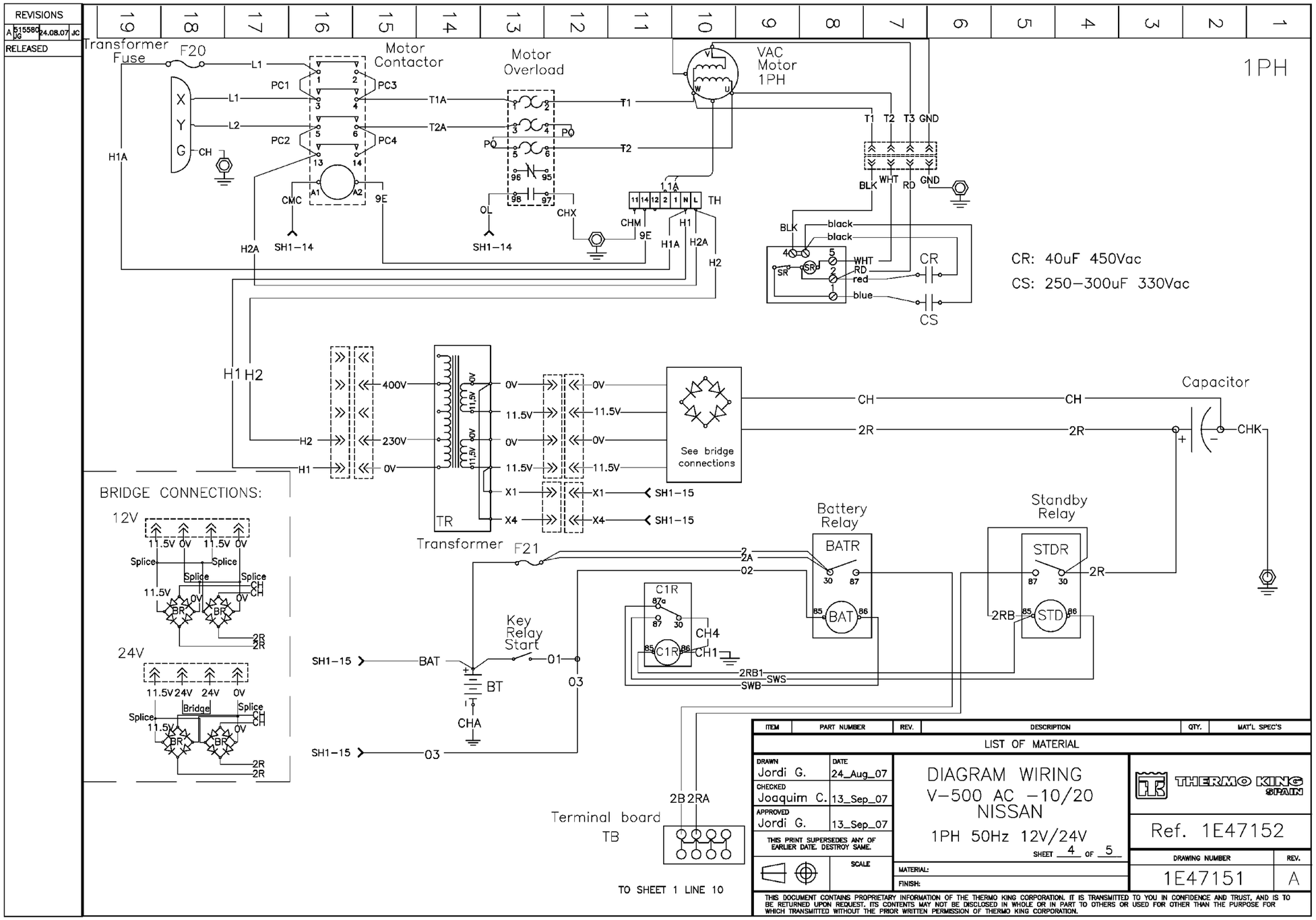
REVISIONS
A 515580 JG 24.08.07 JC
RELEASED
1PH
Transformer
Fuse
F20
Motor
Contactor
Motor
Overload
VAC
Motor
1PH
PC1
PC2
PC3
PC4
T1A
T2A
T1
T2
PO
CMC
OL
CHX
CHM
9E
H1A
H2A
H1
H2
SH1–14
TH
T1 T2 T3 GND
BLK WHT RD GND
black
WHT
RD
red
blue
CR
CS
CR: 40uF 450Vac
CS: 250–300uF 330Vac
H1 H2
400V
230V
0V
11.5V
X1
X4
SH1–15
TR
See bridge
connections
Capacitor
CH
2R
CHK
BRIDGE CONNECTIONS:
12V
24V
Splice
Bridge
BR
Transformer
F21
Key
Relay
Start
BAT
BT
CHA
01
03
02
2A
C1R
CH4
CH1
2RB1
SWB
SWS
Battery
Relay
BATR
Standby
Relay
STDR
STD
2RB
2B 2RA
Terminal board
TB
TO SHEET 1 LINE 10
ITEM
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REV.
DESCRIPTION
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DIAGRAM WIRING
V–500 AC –10/20
NISSAN
1PH 50Hz 12V/24V
SHEET 4 OF 5
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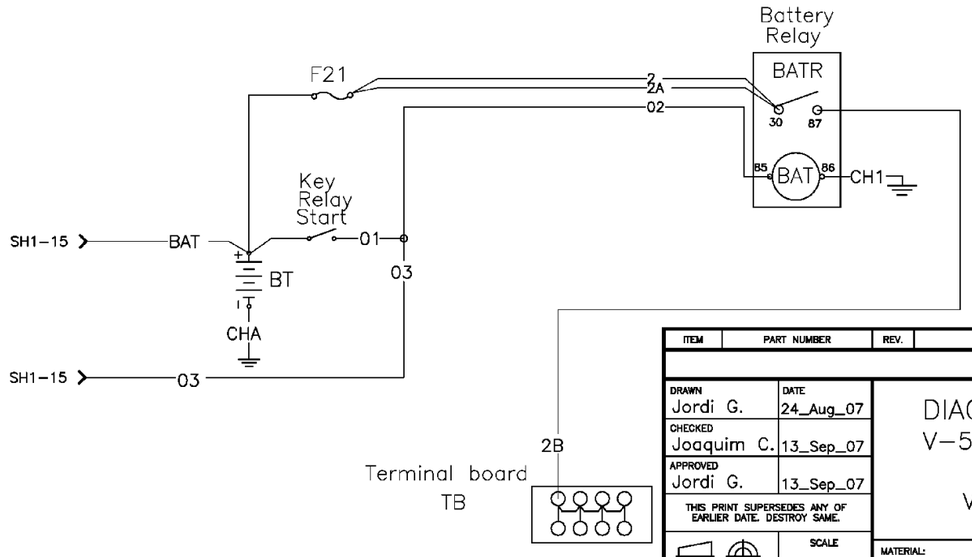
REVISIONS			
A	515580 JG	24.08.07	JC
RELEASED			

19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1



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SCALE

DIAGRAM WIRING
V-500 AC -10/20
NISSAN
V-500 AC-10

SHEET 5 OF 5

MATERIAL:

FINISH:

THERMO KING SPAIN

Ref. 1E47152

DRAWING NUMBER	REV.
1E47151	A

Changes and Comments

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