V-200/V-300 Series

TK 50982-1-MM (Rev. 3, 02/03)

The maintenance information in this manual covers unit models:	
V-200-10 (918247)	V-300-10 (918260)
V-200-20 (918248)	V-300-20 (918261)
V-200 MAX-10 (918249)	V-300 MAX-10 (918262)
V-200 MAX-20 (918250)	V-300 MAX-20 (918263)
V-200 MAX TC-10 (918255)	V-300 MAX TC-10 (918264)
V-200 MAX TC-20 (918256)	V-300 MAX TC-20 (918265)
V-200 MAX TC-20 SAFEWAY (919966)	

For further information, refer to:	
V-200/V-300 Series Operating Manual	TK 51877
V200 Series Parts manual	TK 50781
V300 Series Parts Manual	TK 51308
V200 MAX TC	TK 51140
Diagnosing Thermo King Refrigeration Systems	TK 5984
Evacuation Station Operation and Field Application	TK 40612
Tool Catalog	TK 5955

The information in this manual is provided to assist owners, operators and service people in the proper upkeep and maintenance of Thermo King units.

This manual is published for informational purposes only and the information so provided should not be considered as all-inclusive or covering all contingencies. If further information is required, Thermo King Corporation should be consulted.

Sale of product shown in this manual is subject to Thermo King's terms and conditions including, but not limited to, the Thermo King Limited Express Warranty. Such terms and conditions are available upon request. Thermo King's warranty will not apply to any equipment which has been "so repaired or altered outside the manufacturer's plants as, in the manufacturer's judgment, to effect its stability."

No warranties, express or implied, including warranties of fitness for a particular purpose or merchantability, or warranties arising from course of dealing or usage of trade, are made regarding the information, recommendations, and descriptions contained herein. Manufacturer is not responsible and will not be held liable in contract or in tort (including negligence) for any special, indirect or consequential damages, including injury or damage caused to vehicles, contents or persons, by reason of the installation of any Thermo King product or its mechanical failure.

Recover 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.

In addition, service personnel must be aware of Federal regulations concerning the use of refrigerants and the certification of technicians. For additional information on regulations and technician certification programs, contact your local Thermo King dealer.

R-404A/R-134a

WARNING: Use ONLY Polyol Ester based refrigeration compressor oil (TK P/N 203-413) in R-404A and R-134a units.

DO NOT use Polyol Ester based oil in standard Thermo King units.

DO NOT mix Polyol Ester and standard synthetic compressor oils.

Keep Polyol Ester compressor oil in tightly sealed containers. If Polyol Ester oil becomes contaminated with moisture or standard oils, dispose of properly—DO NOT USE!

WARNING: When servicing Thermo King R-404A and R-134a units, use only those service tools certified for and dedicated to R-404A or R-134a refrigerant and Polyol Ester compressor oils. Residual non-HFC refrigerants or oils will contaminate R-404A and R-134a systems.

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Safety Precautions

General Practices

1. ALWAYS WEAR GOGGLES OR SAFETY GLASSES. Refrigerant liquid, refrigeration oil, and battery acid can permanently damage the eyes (see First Aid under Refrigeration Oil).
2. Never operate the unit with the compressor discharge valve closed.
3. Keep your hands, clothing and tools clear of the fans and belts when the unit is running. This should also be considered when opening and closing the compressor service valves.
4. Make sure gauge manifold hoses are in good condition. Never let them come in contact with a belt, fan motor pulley, or any hot surface.
5. Never apply heat to a sealed refrigeration system or container.
6. Fluorocarbon refrigerants, in the presence of an open flame or electrical short, produce toxic gases that are severe respiratory irritants capable of causing death.
7. Make sure all mounting bolts are tight and are of correct length for their particular application.
8. Use extreme caution when drilling holes in the unit. The holes may weaken structural components, and holes drilled into electrical wiring can cause fire or explosion.
9. Use caution when working around exposed coil fins. The fins can cause painful lacerations.
10. Use caution when working with a refrigerant or refrigeration system in any closed or confined area with a limited air supply (for example, a truck box or garage). Refrigerant tends to displace air and can cause oxygen depletion resulting in suffocation and possible death.
11. EPA Section 608 Certification is needed to work on refrigeration systems.

Refrigerant

Although fluorocarbon refrigerants are classified as safe refrigerants, certain precautions must be observed when handling them or servicing a unit in which they are used. When exposed to the atmosphere from the liquid state, fluorocarbon refrigerants evaporator rapidly, freezing anything they contact.

First Aid

In the event of frost bite, the objectives of First Aid are to protect the frozen area from further injury, to warm the affected area rapidly and to maintain respiration.

- EYES: For contact with liquid, immediately flush eyes with large amounts of water and get prompt medical attention.
- SKIN: Flush area with large amounts of lukewarm water. Do not apply heat. Remove contaminated clothing and shoes. Wrap burns with dry, sterile, bulky dressing to protect from infection/injury. Get medical attention. Wash contaminated clothing before reuse.
- INHALATION: Move victim to fresh air and use CPR if necessary. Stay with victim until arrival of emergency medical personnel.

Refrigeration Oil

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

First Aid

In case of eye contact, immediately flush with plenty of water for at least 15 minutes. Wash skin with soap and water. CALL A PHYSICIAN.

Electrical Hazards

High Voltage

When servicing or repairing a refrigeration unit, the possibility of serious or even fatal injury from electrical shock exists. Extreme care must be used

when working with an operating refrigeration unit. Lethal voltage potentials can exist on connections in the high voltage tray of the control box.

Precautions

1. When working on high voltage circuits on the refrigeration unit, do not make any rapid moves. If a tool drops, do not grab for it. People do not contact high voltage wires on purpose. It occurs from an unplanned movement.
2. Use tools with insulated handles that are in good condition. Never hold metal tools in your hand if exposed, energized conductors are within reach.
3. Treat all wires and connections as high voltage until a meter and wiring diagram show otherwise.
4. Never work alone on high voltage circuits on the refrigeration unit, another person should always be standing by in the event of an accident to shut off the refrigeration unit and to aid a victim.
5. Have electrically insulated gloves, cable cutters and safety glasses available in the immediate vicinity in the event of an accident.

First Aid

IMMEDIATE action must be initiated after a person has received an electrical shock. Obtain immediate medical assistance if available.

The source of shock must be immediately removed by either shutting down the power or removing the victim from the source. If it is not possible to shut off the power, the wire should be cut with either an insulated instrument (e.g., a wooden handled axe or cable cutters with heavy insulated handles) or by a rescuer wearing electrically insulated gloves and safety glasses. Whichever method is used do not look at the wire while it is being cut. The ensuing flash can cause burns and blindness.

If the victim has to be removed from a live circuit, pull the victim off with a non-conductive material. Use the victim's coat, a rope, wood, or loop your belt around the victim's leg or arm and pull the victim off. DO NOT TOUCH the victim. You can receive a shock from current flowing through the victim's body. After separating the victim from power source, check immediately for the presence of a pulse and respiration. If a pulse is not present, start CPR (Cardio Pulmonary Resuscitation) and call for emergency medical assistance. If a pulse is present, respiration may be restored by using mouth-to-mouth resuscitation, but call for emergency medical assistance.

Low Voltage

Control circuits used in the refrigeration unit are low voltage (12/24 volts dc). This voltage potential is not considered dangerous, but the large amount of current available (over 30 amperes) can cause severe burns if shorted or ground.

Do not wear jewelry, watch or rings. These items can short out electrical circuits and cause severe burns to the wearer.

Specifications

GENERAL

Compressor		TK208R, or SELTEC TM-13XD or SELTEC TM-15XD
Compressor Oil Charge	1 Compressor systems	12 oz. (354.8 ml)
	2 Compressor systems	24 oz. (709.7 ml)
Compressor Oil Type		Polyol Ester P/N 203-413
Defrost Method:		Hot gas
Defrost Timer:	Initiation Interval	Adjustable, 1 hour to 10 hours
	Termination Interval	Termination is not timed. Defrost is terminated by Klixon switch.

R-134A REFRIGERATION SYSTEM (V-200/V-300-10, V-200/V-300-20)

Refrigerant Charge	V-200	3.0 lbs. (1.36 Kg)
	V-300	3.85 lbs. (1.75 Kg)
Defrost Termination Switch:	Opens	48.0 ± 5.4 F (8.9 ± 3.0 C)
	Closes	36.0 ± 5.4 F (2.2 ± 3.0 C)
High Pressure Cutout Switch:	Opens	300 ± 10 psi (2068 ± 69 kPa)
	Closes	200 ± 20 psi (1378 ± 69 kPa)
Low Pressure Cutout:	Opens	5 to 11 in. Hg vacuum (-17 to -34 kPa)
	Closes	4 to 7 psi (28 to 48 kPa)
Condenser Fan Pressure Switch:	Opens	130 ± 10 psi (896 ± 69 kPa)
	Closes	180 ± 10 psi (1241 ± 69 kPa)

R-404A REFRIGERATION SYSTEM (V-200/V-300 Max-10, V-200/V-300 Max-20, V-200/V-300 Max TC-10, V200/300-Max TC-20)

Refrigerant Charge	V-200	2.75 lbs. (1.25 Kg)
	V-200TC	4.00 lbs. (1.81 Kg)
	V-300	4.00 lbs. (1.81 Kg)
Defrost Termination Switch:	Opens	48.0 ± 5.4 F (8.9 ± 3.0 C)
	Closes	36.0 ± 5.4 F (2.2 ± 3.0 C)
Liquid Injection Switch:	Opens	200 ± 5 F (93 ± 3 C)
	Closes	230 ± 5 F (110 ± 3 C)
High Pressure Cutout Switch:	Opens	450 ± 10 psi (3100 ± 69 kPa)
	Closes	375 ± 10 psi (2585 ± 69 kPa)
Low Pressure Cutout:	Opens	5 to 11 in. Hg vacuum(-17 to -34 kPa)
	Closes	4 to 7 psi (28 to 48 kPa)
Suction Pressure Regulator		26 psi (180 kPa)
Condenser Solenoid Pressure Switch:	Opens	300 ± 10 psi (2068 ± 69 kPa)
	Closes	200 ± 20 psi (1378 ± 69 kPa)

ELECTRICAL SYSTEM

Fuses

Fuse 1: Evaporator Fan Motor (EF1)	12V Units = 15 amps, 24V Units = 10 amps
Fuse 2: Evaporator Fan Motor (EF2)	12V Units = 15 amps, 24V Units = 10 amps
Fuse 3: 2A Circuits	12V Units = 25 amps, 24V Units = 20 amps
Fuse 4: 2R1 Circuit	12V & 24V Units = 3 amps
Fuse 4/1: Cab Control Box	12V & 24V Units = 3 amps
Fuse 5 on TC Units: Remote Evaporator Fan Motor (EF3)	12V Units = 5 amps, 24V Units = 3 amps
Fuse 6 on TC Units: Transformer Fuse	12V & 24V Units = 4 amps
Fuse 7: Defrost Circuit	12V & 24V Units = 1 amps

Condenser Fan Motors

Voltage	Full Load rpm	Full Load Current
12 Vdc	2800	8.0 to 9.5 amps @ 13Vdc
24 Vdc	2800	3.9 to 4.1 amps @ 26Vdc

Evaporator Fan Motors

Voltage	Full Load rpm	Full Load Current
12 Vdc	2800	6.1 to 6.2 amps @ 13Vdc
24 Vdc	2800	3.5 to 3.9 amps @ 26Vdc

Coils for Hot Gas Solenoids, Condenser Solenoids, and Liquid Line Solenoids

Voltage	Current	Resistance
12 Vdc	2.3 amps	5.2 ohms
24 Vdc	1.3 amps	20 ohms

Liquid Injection Solenoid Coils

Voltage	Current	Resistance
12 Vdc	0.7 amps	17 ohms
24 Vdc	0.2 amps	67 ohms

BELT TENSION (Using Tool P/N 204-427)

	Field Reset
Engine Driven Compressor Belt	58
Electric Standby Compressor Belt	58

Maintenance Inspection Schedule

Weekly	Monthly	Semi-Annual	Annual	Inspect/Service These Items
				ELECTRICAL
		•	•	Check defrost initiation and termination.
		•	•	Check thermostat cycle sequence.
		•	•	Check operation of protection shutdown circuits.
			•	Check thermostat and thermometer calibration in 0 C (32 F) ice-water bath.
			•	Inspect wire harness for damaged wires or connections.
			•	Inspect/replace DC fan motor brushes.
				REFRIGERATION
		•	•	Check refrigerant level.
			•	Replace dehydrator.
				STRUCTURAL
•	•	•	•	Visually inspect unit and refrigerant hoses for fluid leaks.
•	•	•	•	Visually inspect unit for damaged, loose or broken parts.
•	•	•	•	Clean defrost drains.
	•	•	•	Inspect belts for condition and proper tension (belt tension tool P/N 204-427).
	•	•	•	Clean entire unit including evaporator coil and condenser coil.
		•	•	Check all unit mounting bolts, brackets, lines, hoses, etc.

Unit Description

Introduction

The Thermo King V-200/V-300 and V-200/V-300 MAX truck refrigeration systems are designed for low and medium temperature applications on vans and small-sized trucks with one compartment. The V-200/V-300 MAX TC systems control the temperatures in two compartments. There are two basic models:

- Model 10: Cool and defrost on truck engine driven compressor operation.
- Model 20: Cool and defrost on both truck engine driven compressor operation and electric standby compressor operation.

The system consists of at least three separate assemblies: the condenser, the evaporator, and the compressor. TC units have an additional evaporator for the second compartment and an optional TC/heat kit.

Condenser

The condenser has a unique design that allows it to be mounted horizontally on the roof, or on the front of the truck box.

Evaporator

An evaporator is mounted on the ceiling inside the truck box. The additional evaporator for the TC unit is also mounted on the ceiling inside the truck box.

Compressor

The compressor is mounted on and driven by the truck engine. Refrigeration hoses or lines are used to connect the condenser, the evaporator, the compressor and any other components. Model 20 units have another compressor and an electric motor mounted in the condenser section for electric standby operation.

The engine compressor is driven by a belt from the engine. The electric standby compressor is connected in parallel with the engine-driven compressor. The standby compressor is driven by a belt from the electric motor. Both compressors use the same refrigeration system circuit. Check valves isolate one compressor from the other during operation.

Compressor operation is controlled by the thermostat, which energizes the compressor clutch during engine operation or starts the electric motor and energizes the compressor clutch on electric standby operation. The refrigeration system is protected by a high pressure cutout switch and a low pressure cutout switch.

When plugged into standby power, engine operation is automatically locked out. If the truck engine is turned on while the power cord is still plugged into a power receptacle, the unit will remain working in electric mode; the engine driven compressor cannot be started until the power cord is unplugged from the unit as the selection of engine operation or standby operation is automatic.

Control Circuits

The control circuits operate on 12V or 24V DC supplied by the truck batteries for engine operation. On standby operation, the power is rectified from an AC transformer.

In-Cab Control Box

Unit operation is controlled with an in-cab control box, which is mounted in the truck cab. It includes an On-Off switch, manual defrost switch, thermometer, thermostat, thermostat adjustment, and indicator lights.

The TC unit has an additional in-cab control box to operate the second compartment. It is switched on and off from the main in-cab control box and includes a thermometer, thermostat, thermostat adjustment and indicator lights.

Oil Separator

An oil separator is a standard feature on all these units. The oil separator separates compressor oil from refrigerant vapor and returns the oil to the compressor through the suction line. The oil separator helps provide positive oil return at high compressor speeds and low operating temperatures. This feature enhances compressor lubrication and extends compressor life.

Refrigerant

The V-200-10/V-300 and V-200/V-300-20 units use R-134a refrigerant. The V-200/V-300 Max-10, V-200/V-300 Max-20, V-200/V-300 Max TC-10, V-200/V-300 Max TC-20 units use R-404A refrigerant.

Liquid Injection System

V-200/V-300 MAX and V-200/V-300 MAX TC units use R-404A and have a liquid injection system to limit discharge temperature of the engine driven compressor. If the discharge gas leaving the compressor reaches a temperature of 230 ± 5 F (110 ± 3 C) the liquid injection switch closes, providing voltage to the liquid injection solenoid. The solenoid opens a valve, allowing liquid refrigerant to flow from the liquid line near the drier inlet to the metering orifice attached to the suction line fitting on the engine driven compressor. As the refrigerant passes through the metering orifice it expands and evaporates, cooling the suction gas entering the compressor. This cooling effect is transferred to the discharge gas leaving the compressor from the adjacent cavity in the compressor head. When the discharge gas is cooled to 200 ± 5 F (93 ± 3 C), the liquid injection switch opens, the liquid injection solenoid closes and refrigerant no longer flows through the liquid injection system.

Evaporator Drain Tube Heaters

Evaporator heaters are used in R-404A units to avoid drain tube blockage because of ice accumulation inside the evaporator. Two harnesses are located inside the drain tube. These resistive wires melt the ice while the unit is in DEFROST mode.

Electric Standby Operation

During electric standby operation, the thermostat controls the operation of the unit by energizing and de-energizing the power relay, the electric relays, and the heat contactor. The thermostat places the unit in cool by energizing the power relay and the electric relays.

The thermostat places the unit in null by de-energizing all the relays and contactors. The thermostat places the unit in heat by energizing the heat contactor.

When the power relay and the electric relays are energized, they close contacts that energize the fan relay, the motor contactor, and the electric standby compressor clutch.

When the heat contactor is energized, it energizes the electric evaporator heaters and the fan relay.

Unit Features

- Condenser
- ES200 Max Evaporator (V-200)
- ES300 Max Evaporator (V-300)
- Slim ES100 Max Evaporator for TC Units (V-200)
- Slim ES150 Max Evaporator for TC Units (V-300)
- In-Cab Control Box with Digital LED Thermometer (Standard)
- Electronic Thermostat (Standard)
- Defrost Timer (Standard)
- Automatic Hot Gas Defrost (Standard)
- Manual Defrost Switch (Standard)
- Oil Separator (Standard)
- Seltec TM-13XD Engine Driven Compressor (V-200 Standard)
- Seltec TM-13XD Electric Standby Compressor (V-200 Standard)
- Seltec TM-13XD Engine Driven Compressor (V-200 Standard)
- Seltec TM-13XD Electric Standby Compressor (V-200 Standard)
- Seltec TM-15XD Engine Driven Compressor (V-300 Standard)
- Seltec TM-15XD Electric Standby Compressor (V-300 Standard)
- Condenser Fan Pressure Switch (Standard with R-134a units)
- Liquid Injection (Standard with Max units)
- Suction Pressure Regulator (Standard with Max units)
- Evaporator Drain Heaters (Standard with Max units)
- Jet Lube™ Compressor Lubrication (Standard)
- Jet Cool™ Compressor injection cooling (Max Models) (Standard)

Protection Features

- High Pressure Cutout Switch - The High Pressure Cutout Switch is a pressure sensitive switch. It is located in the discharge line near the oil separator on Model 10 units. It is located in the discharge check valve on Model 20 units.

  If the discharge pressure rises above the switch's opening pressure, the switch opens the circuit to the PR Relay to stop the unit. The opening pressure for R-134a units is 300 psi (2068 kPa). The opening pressure for R-404A units is 450 psi (3100 kPa).

  When the discharge pressure falls below the switch's closing pressure, the switch closes to restart the unit. The closing pressure for R-134a units is 200 psi (1379 kPa). The closing pressure for R-404A units is 375 psi (2585 kPa).

- Condenser Fan Pressure Switch - V200-20 units with R-134a are equipped with a Condenser Fan Pressure Switch. This switch is located on the discharge line near the oil separator. It helps the unit to keep the condenser head pressure higher in cool ambients and on-road. This feature allows better control of the head pressure and the thermostatic expansion valve, and at the same time increases the evaporator pressure. Moreover, in cool ambients and on-road, the defrost is carried out quicker.

  When the condenser head pressure rises above 180 psi (1241 kPa), the condenser fan pressure switch closes, starting the condenser fan.

  When the condenser head pressure falls below 130 psi (896 kPa), the condenser fan pressure switch opens, stopping the condenser fan.

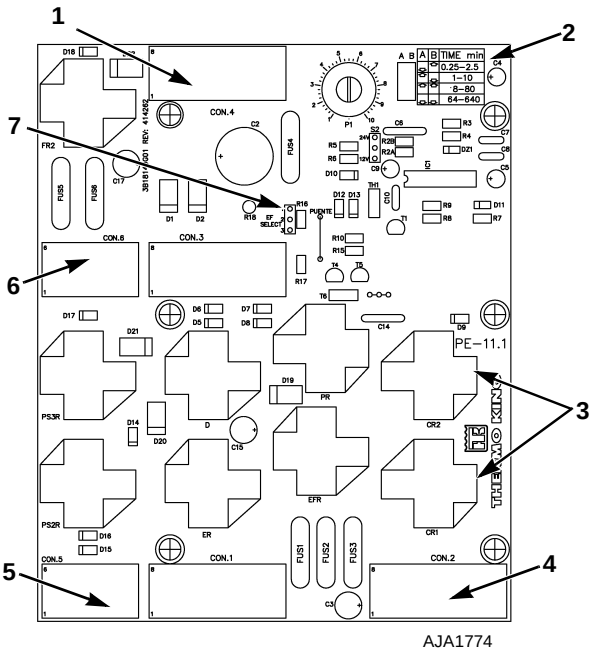
- Low Pressure Cutout Switch - The Low Pressure Cutout Switch is a pressure sensitive switch located in the suction line. If the pressure falls below 5 to 11 in. Hg vacuum (-17 to -34 kPa), the switch opens the circuit to the PR Relay to stop unit operation.

Control Box

P.C. Board

All Printed Circuit Boards manufactured by Thermo King can be easily identified by the Part Number stamped on them.

Even though that all P.C. Boards have a similar layout, there are some differences from one to another depending on the unit model and which functions they carry out.



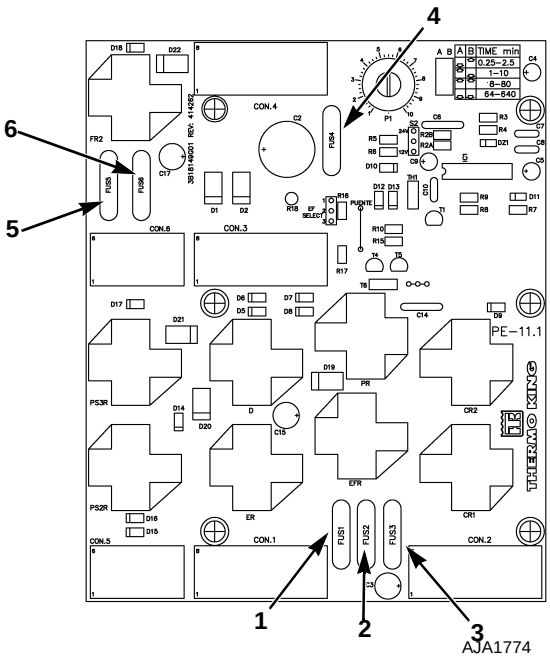
1.	Connector C-4	5.	Connector C-1
2.	Defrost Timer	6.	Connector C-4
3.	Relays	7.	EFR Selector
4.	Connector C-2		

Figure 1: Typical P.C. Board

Connectors

All connector codes (C-1, C-2, etc.) are stamped on the P.C. Board. Pins on the connectors are numbered counter-clockwise.

Fuses



1.	Fuse 1	4.	Fuse 4
2.	Fuse 2	5.	Fuse 5 (TC units only)
3.	Fuse 3	6.	Fuse 6(TC units only)

Figure 2: P.C. Board Fuses

Fuses 1, 2, 3, and 4 are located on the P.C. Board. TC units also have Fuse 5 and 6 on the P.C. Board.

Fuse 1 protects Evaporator Fan Motor 1 (EF1).
12V Units = 15 Amps
24V Units = 10 Amps

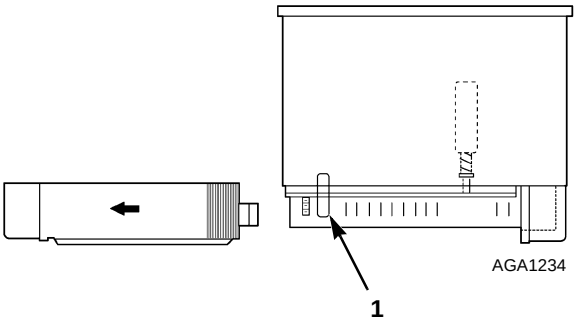
Fuse 2 protects Evaporator Fan Motor 2 (EF2).
12V Units = 15 Amps
24V Units = 10 Amps

Fuse 3 protects the 2A circuit.
12V Units = 30 Amps
24V Units = 25 Amps

Fuse 4 (Model 20 only) protects the 2R1 circuit.
12V and 24V Units = 3 Amps

Fuse 5 (TC units only) protects the Remote Evaporator Fan Motor (EF3).
12V Units = 15 Amps
24V Units = 10 Amps

Fuse 4/1 & Fuse 4/2 are located inside the In-Cab Control Box. They protect the In-Cab Control box from overload.
12V and 24V Units = 1 Amp



1.	Fuse 4/1

Figure 3: Fuse 4/1

Fuse 6 (TC units only)

12V Units = 15 amps

24V Units = 10 Amps

Fuse 7 is located on the heat harness (optional equipment) in the control box.

12V and 24V Units = 1 Amps

Common Relays

The common relays are located on the P.C. Board.

Power Relay (PR)

The Power Relay is energized when the In-Cab Control Box ON/OFF Switch is pressed (Unit Start) and the box temperature is higher than the setpoint temperature.

Evaporator Fan Relay (EFR)

When the Fan Relay is energized, battery voltage energizes evaporator fan motors EF1 and EF2.

Defrost Relay (D)

The Defrost Relay controls operation of the defrost cycle.

The Defrost Relay is energized when the In-Cab Control Box Defrost Switch or by the Defrost Timer completes the circuit through the Defrost Termination Switch to ground.

The Defrost Relay will remain energized until the defrost cycle is terminated by the Defrost Termination Switch or the In-Cab Control Box ON/OFF Switch is pressed.

Standby Relays

The standby relays CR1, CR2 and ER are located on the P.C. Board in Model 20.

Commutation Relays (CR1 and CR2)

When the Commutation Relays are energized the electric power for the unit changes from Battery Supply to Power Cord Supply.

Electric Standby Relay (ER)

When the Electric Standby Relay is energized it turns on the AC Motor of the electric standby compressor and de-energized engine driven compressor clutch.

Overload Relay (OL)

The Overload Relay is located in the Control Box below the P. C. Board.

The Overload Relay switches off the unit when the current draw through the AC Motor is excessive.

Multi-Temp Relays

The multi-temp relays FR2, PS2R, and PS3R are located on the P.C. Board 11 used in TC units.

Remote Fan Relay (FR2)

When the Remote Fan Relay is energized, battery voltage energizes evaporator fan motor EF3 in the remote evaporator. It is controlled by the second compartment thermostat.

Pilot Solenoid Relay 2 (PS2)

When the Remote Fan Relay 2 is energized, battery voltage energizes the liquid line solenoid for the front evaporator. It is controlled by the first compartment thermostat.

Pilot Solenoid Relay 3 (PS3)

When the Remote Fan Relay 3 is energized, battery voltage energizes the liquid line solenoid for the remote evaporator. It is controlled by the second compartment thermostat.

Defrost Timer

The Defrost Timer automatically initiates the Defrost Cycle at the preset time intervals. The time interval can be set with the Red Round Selector and the A and B Switches.

The Defrost Timer is powered directly by truck battery, this means that the Defrost Timer is always counting (while the Defrost Termination Switch is closed) even when the unit is turned off.

Clutch Timer

The clutch timer is located on the P.C. Board. It delays stand-by compressor clutch activation for 12 to 15 seconds when the stand-by electric motor is first started. The clutch timer LED indicator (P.C. Board) will be lit during this period of time.

EFR Selector

The EFR selector allows the user to choose if the evaporator fan keeps running or not in Null mode. If the jumper is between 1 and 2 the evaporator fan will run in Null mode. If the jumper is between 2 and 3 the fan will not run in the Null mode.

Unit Operation

These units cycle between Cool and Null to maintain the box temperature at the thermostat setpoint. Heat is available as an option. The operating modes are: Cool, Null, Heat (optional) and Defrost.

The thermostat controls the operation of the unit by energizing and de-energizing the Power Relay (PR). When PR is energized it energizes the evaporator fans, the condenser fans, and the compressor clutch (or the compressor motor contactor during electric stand-by operation). On TC units PR is energized by either thermostat and is de-energized when neither thermostat is calling for cool.

The condenser fan is also controlled by the condenser fan pressure switch (CFPS) on R-134a units. This normally open switch monitors the compressor discharge pressure. When the discharge pressure rises to 180 psi (1241 kPa) the switch closes and energizes the condenser fan. When the discharge pressure drops below 130 psi (896 kpa) the switch opens and de-energizes the condenser fan.

Thermostat Operation

Cool

The thermostat energizes the (PR) at box temperatures higher than 5.4 F (3.0 C) above setpoint. The thermostat keeps PR energized while the box temperature is higher than setpoint. The fans and the compressor run and the unit cools.

Null

The thermostat de-energizes PR at box temperatures lower than setpoint. The thermostat keeps PR de-energized while the box temperature is lower than 5.4 F (3.0 C) above the setpoint temperature. When PR is de-energized and the unit does not operate. On TC units PR is de-energized only when the condition is required from both thermostats.

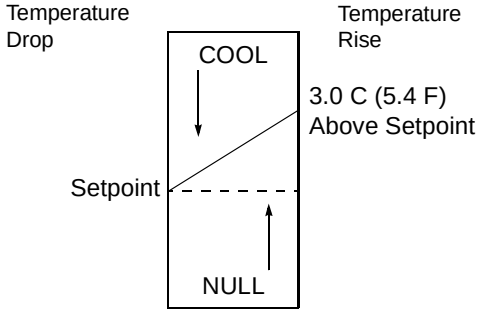


Figure 4: Thermostat Algorithm

Defrost

The defrost cycle can be initiated any time the evaporator coil temperature is below 36 F (2.2 C). Defrost is initiated automatically by the defrost timer, or manually by pressing the manual defrost switch.

The defrost relay energizes the defrost solenoid valve (and the condenser solenoid valve on units equipped with the heat option) to route hot refrigerant gas to the evaporator when PR is energized. The defrost relay also interrupts power to the evaporator and condenser fans during defrost.

The defrost cycle will continue until the evaporator coil temperature rises 48 F (8.9 C), causing the defrost termination switch to open ending the defrost cycle. Defrost cycle can be also terminated stopping the unit pressing the ON/OFF Switch twice.

Serial Number Locations

CONDENSER: Nameplate located on the front inside edge of condenser frame.

EVAPORATOR: Nameplate located on the outside edge of the evaporator cover.

ENGINE DRIVEN COMPRESSOR: Nameplate located on compressor body. The engine driven compressor is located in the truck engine compartment.

STANDBY COMPRESSOR: Nameplate located on compressor body. The Standby compressor is located inside the Condenser assembly.

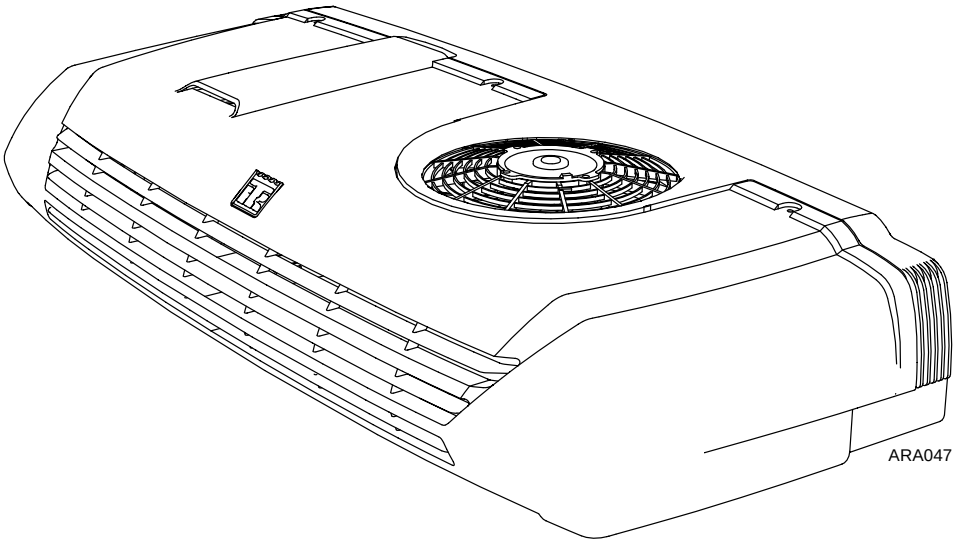


Figure 5: Condenser

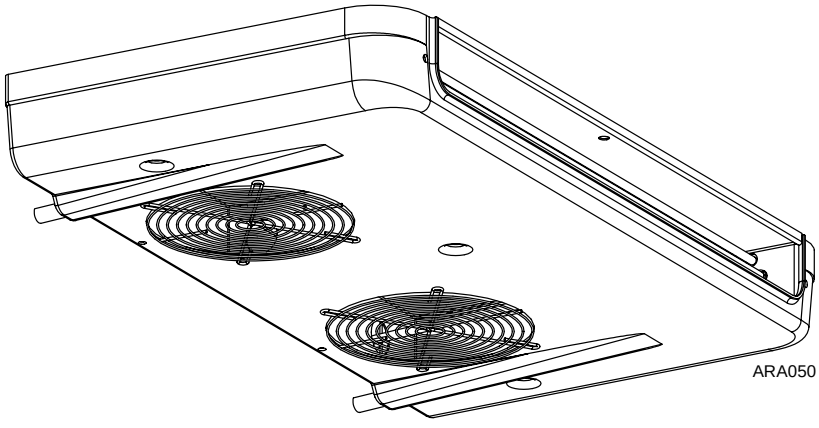
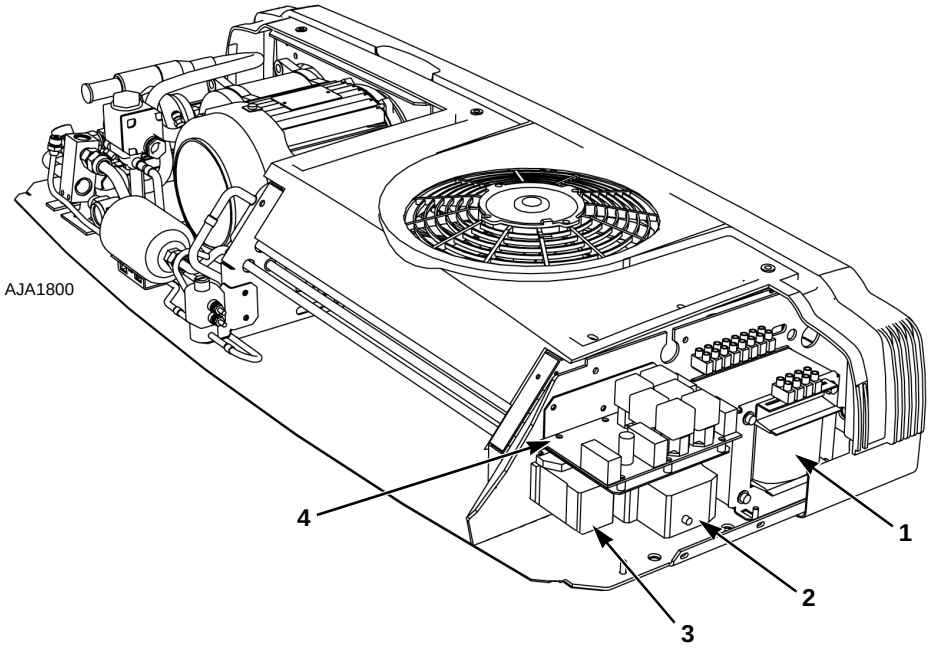
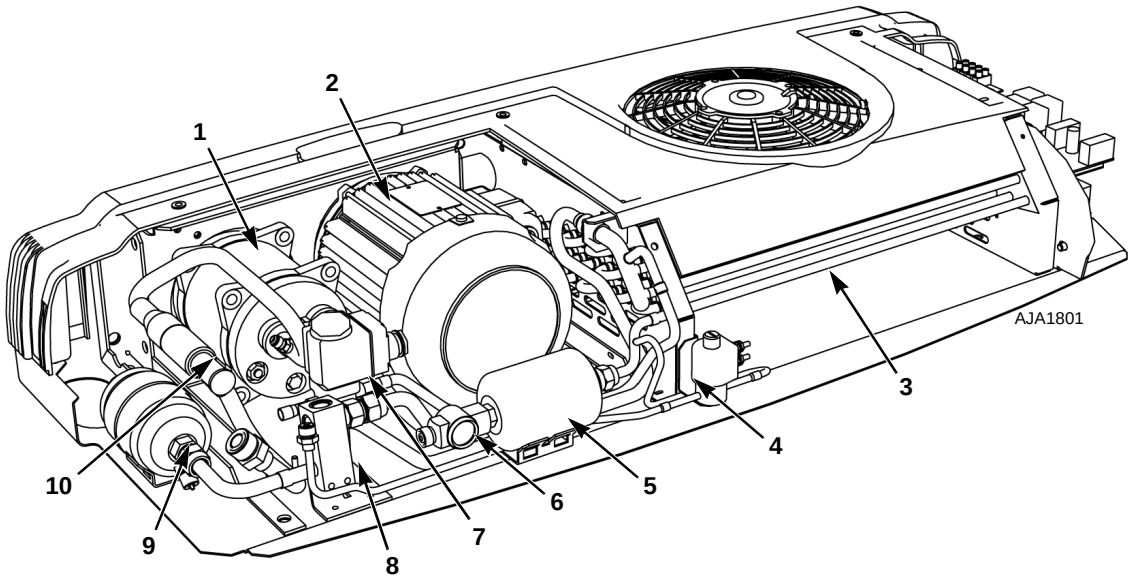


Figure 6: Evaporator



1.	Transformer	3.	Motor Contactor
2.	Overload Relay	4.	P.C. Board

Figure 7: Control Box Side Of Model 20 Condenser



1.	Compressor	6.	Liquid Line Sight Glass
2.	Electric Motor	7.	Defrost Solenoid Valve
3.	Condenser Coil	8.	Discharge Check Valve
4.	Liquid Injection Valve	9.	Oil Separator
5.	Drier	10.	Suction Pressure Regulator Valve

Figure 8: Refrigeration Component Side of Model 20 Condenser

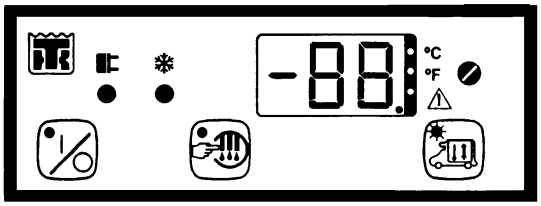


Figure 9: M13 & 16 In-Cab Control Box

Introduction

Unit operation is controlled with a in-cab control box, which is mounted in the truck cab. It includes an on-off switch, manual defrost switch, thermometer, thermostat, thermostat adjustment, and indicator lights. The in-cab controller comes in several model numbers as follow:

- V-200/V-300 =Model M-13 Control Box
- V-200/V-300 Max=Model M-13 Control Box
- V-200/V-300 MaxTC=Model M-16 Control Box

The M-13 controller cools single temp units.

The M-16 controller cools multi-temp units. It can function as a master on a TC unit.

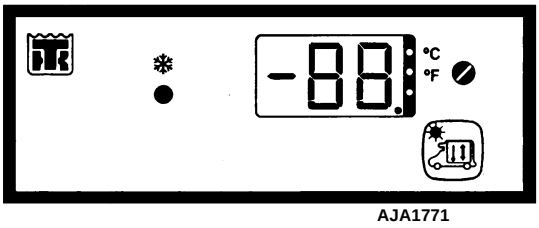


Figure 10: M-17 In-Cab Control Box

The TC unit has an additional in-cab control box to operate the second compartment (M-17 control box). It is switched on and off from the main in-cab control box and includes a thermometer, thermostat, thermostat adjustment and indicator lights.

The M-17 controller is a remote, and cools the second compartment on TC units. It operates as a slave of M-16 with only a thermostat adjustment for the second compartment.

Description

1. ON-OFF KEY (M-13, and M-16 only)
   It is used to start/stop the unit. The internal return air temperature will be automatically displayed.
2. ON LED Indicator (M-13, and M-16 only)
   When on, it indicates that the unit has been started by pressing the on-off key.

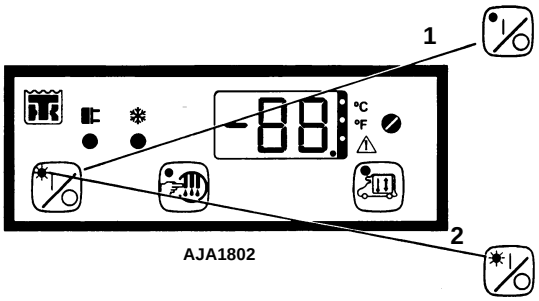


Figure 11: On/Off Key & LED

3. Celsius LED Indicator (M-13, M-16, M-17)
   When on, it indicates the temperature being displayed is in degrees celsius.
4. Minus Sign
   Indicates the temperature being displayed is below zero.
5. Fahrenheit LED Indicator (M-13, M-16, M-17) When on, it indicates the temperature being displayed is in degrees fahrenheit.

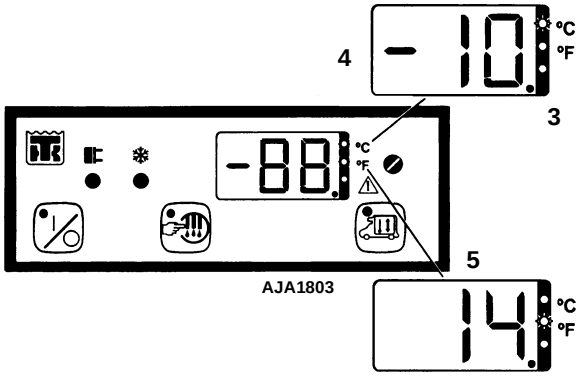


Figure 12: Celsius/Fahrenheit LED

6. Setpoint Adjust Dial (M-13, M-16, M-17)
   It is used to adjust the setpoint temperature.
7. Setpoint Key (M-13, M-16, M-17)
   It is used to display the setpoint temperature.

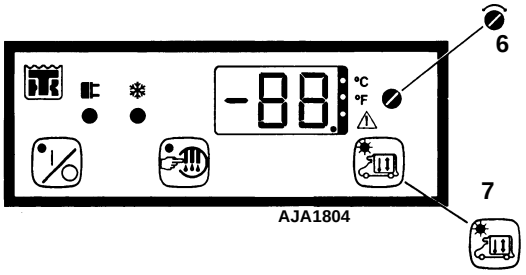


Figure 13: Setpoint Key & Dial

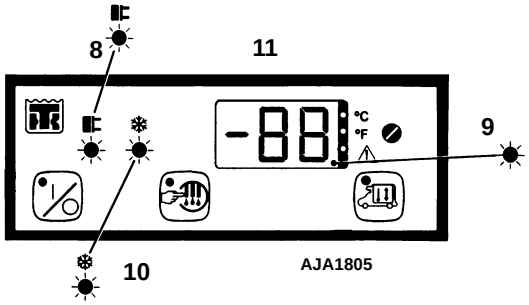


Figure 14: Misc. LED's

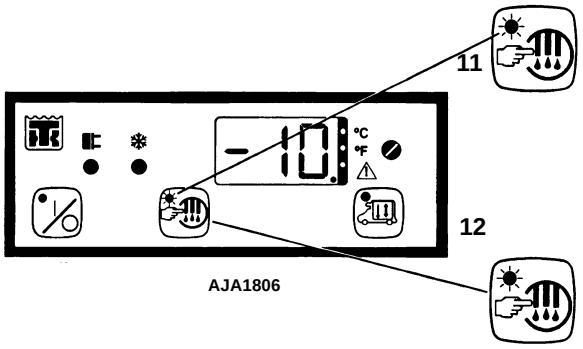


Figure 15: Defrost Key & LED

8. Power Cord LED (M-13, and M-16 only)
   When on, it indicates the unit is plugged to the A.C. voltage power supply.
9. AC Overload LED (M-13, and M-16 only)
   When on, it indicates the unit has been stopped by the AC overload relay.
10. Unit Operation LED (M-13, M-16, M-17)
    When on, it indicates the unit is cooling. When the unit is Stopped by the Thermostat, HPCO or LPCO, the Unit Operation LED must be "OFF" and the ON LED Indicator must remain "ON".
11. Defrost LED Indicator (M-13, and M-16 only)
    When on, it indicates the unit is working on defrost mode.
12. Manual Defrost Key (M-13 and M-16 only)
    It is used to initiate the defrost cycle manually.

In-Cab Control Box Operating Instructions (M-13, M-16, M-17)

Display Return Air (Box) Temperature

During normal operation (unit is ON and cooling), the ON LED Indicator, the Unit Operation LED and Celsius/Fahrenheit LED Indicator should be ON; the return air (box) temperature should be displayed on the screen. (See Figure 16.)

Display Setpoint Temperature

During normal operation, press the Setpoint Key to display the Setpoint Temperature.

Enter Setpoint Temperature

Press and hold the Setpoint Key. The Setpoint Temperature will be displayed on the screen. (See Figure 17.)

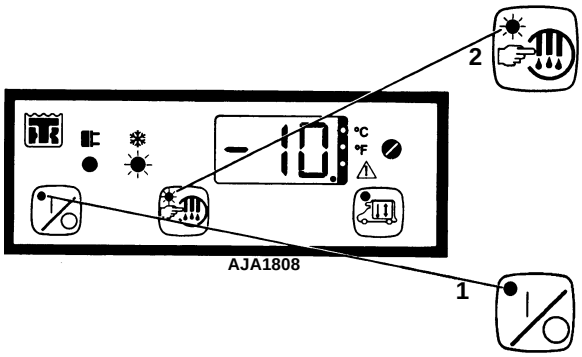
13. At the same time, turn the Setpoint Adjust Dial until the display shows desired temperature.(See Figure 18.)
14. Release the Setpoint Key. The box temperature will be displayed on the screen. (See Figure 17.)

Defrost Mode Operation (M-13, and M-16 only).

Initiate a Manual Defrost : Pressing the Manual Defrost Key will start the defrost cycle if the evaporator coil temperature is below 36 F (2.2 C). The defrost LED will go ON. The unit will return to the cool mode automatically when the defrost cycle is finished. (See Figure 16.)

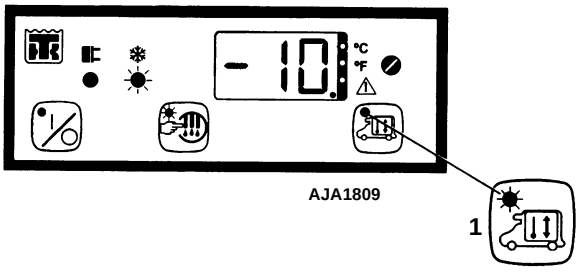
Initiate a Automatic Defrost: If the evaporator coil temperature is below 36 F (2.2 C), the defrost timer will initiate a defrost cycle. The defrost LED will go ON. The unit will return to the cool mode automatically when the defrost is finished.(See Figure 16.)

Stop the Defrost Cycle: Press and release the On-Off Key twice to stop the defrost cycle.



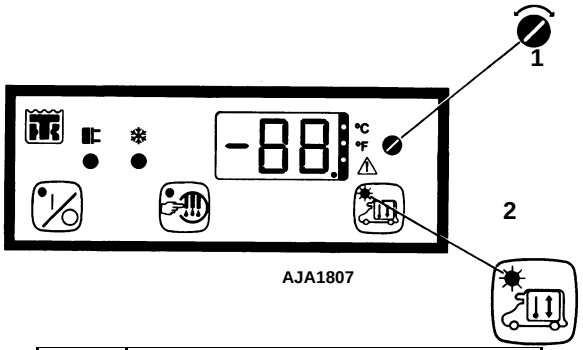
1.	On/Off Key
2.	Manual Defrost Key

Figure 16: On/Off Key and Defrost Key



1.	Setpoint Key

Figure 17: Setpoint Key



1.	Setpoint Adjustable Dial
2.	Setpoint Key

Figure 18: Entering Setpoint

NOTE: The M-17 In-Cab control boxes do not have all components shown in the illustrations.

Unit Operation

Weekly Pretrip Inspection

The following Weekly Pretrip Inspection should be completed before loading the truck. While the weekly inspection in not a substitute for regularly scheduled maintenance inspections, it is important part of the preventive maintenance program designed to head off operating problems before they happen.

1. LEAKS. Inspect for refrigerant leaks and worn refrigerant lines.
2. BELTS. Inspect for cracks, wear and proper belt tension.
3. MOUNTING BOLTS. Inspect bolts are properly tightened.
4. ELECTRICAL. Electrical connections should be securely fastened. Wires and terminals should be free of corrosion, cracks or moisture.
5. DEFROST DRAINS. Check the defrost drain hose and fittings to be sure that they are open so condensate can run out during defrosting. Check the bottom end of drain hose to be sure that is not plugged or crushed.
6. STRUCTURAL. Visually check for physical damage.
7. REFRIGERANT CHARGE. Check for proper refrigerant charge level.

Starting the unit

Engine Operation

1. Start the truck engine.
2. Press the On-Off switch on the In-Cab Control Box, the ON/OFF LED must go ON.
3. Adjust the thermostat setting. Adjust the thermostat setting in the second In-Cab Control Box on TC units.

Electric Standby Operation

1. Connect the external power supply to the power receptacle. Make sure that the power supply voltage is correct for the unit. The Power Cord LED should go ON.
2. Press the On-Off switch in the In-Cab Control Box, the ON LED should go ON.
3. Adjust the thermostat setting. Adjust the thermostat setting in the second In-Cab Control Box on TC units.

NOTE: The unit will work on Electric Standby even though the truck engine is started if the power cord is plugged in.

After Start Inspection

1. THERMOSTAT. Dial the thermostat setting above and below the box temperature to check thermostat operation.
2. PRE-COOLING. With the thermostat set at the desired temperature, allow the unit to run for one-half to one hour (longer if possible) before loading the truck. Pre-cooling will remove residual body heat and moisture from the box interior and provide a good test of the refrigeration system.
3. DEFROST. When the unit has finished pre-cooling the truck interior (evaporator temperature dropped below 36 F [2.2 C), initiate a defrost cycle with the manual defrost switch. The defrost cycle should end automatically.

Loading Procedure

1. Be sure the unit is OFF before opening the doors to minimize frost accumulation on the evaporator coil and heat gain inside the box. (Unit may be running when loading the truck from a warehouse with door seals.)
2. Spot check and record load temperature while loading. Especially note any off-temperature product.
3. Load product so that there is adequate space for air circulation completely around the load. DO NOT block the evaporator inlet or outlet.
4. Products should be pre-cooled before loading. Thermo King units are designed to maintain loads at the temperature at which they were loaded. Transport refrigeration units are not designed to pull hot loads down to temperature.

Post Load Procedure

1. Be sure all the doors are closed and locked.
2. Adjust the thermostat(s) to the desired temperature setpoint(s).
3. Start the unit.
4. Half an hour after loading, defrost the unit by momentarily pressing the Manual Defrost switch. If the coil temperature has dropped below 36 F (2.2 C), the unit will defrost. The defrost cycle should stop automatically.

Weekly Post Trip Checks

1. Wash the unit.
2. Check for leaks.
3. Check for loose or missing hardware.
4. Check for physical damage to unit.

Electrical Maintenance

Trouble Shooting In-Cab Control Box M-13 and M-16

Before starting this trouble shooting, verify that the In-Cab Control Box 12/24V selector is placed in the correct position and check the ground circuit through Pin 9 Connector C-9.

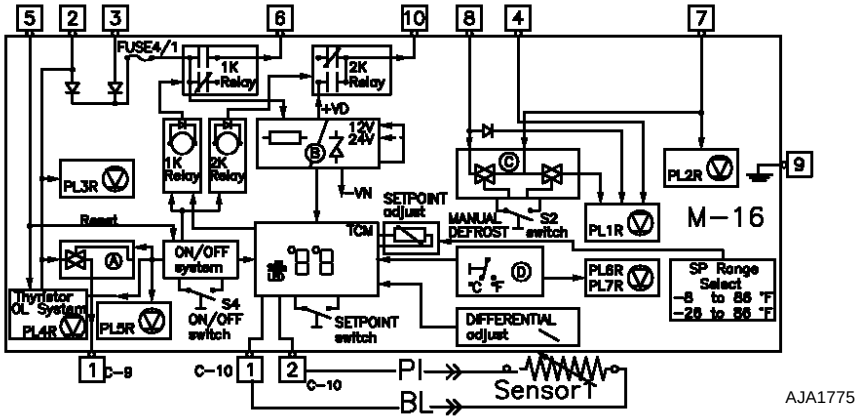


Figure 19: BLOCK DIAGRAM M-13, M-16

IMPORTANT: This trouble shooting only covers In-Cab Control Box functions and should not be considered as all-inclusive or meant to cover all other electric contingencies; on these cases you should check wiring against diagram.

SYMPTOMS	REMEDY
Blank display when the ON/OFF Switch is pressed.	**1st.** Check voltage on **Pin 3 C-9** (Pin 2 when is working in electric mode). **2nd.** Check **Fuse 4/1** located inside the Cab Control Box. **3rd.** Replace Cab Control Box.
Unit is not cooling when the Box Temperature is higher than the Setpoint Temperature.	**1st.** Check voltage on **Pin 6 C-9**. **2nd.** Replace Cab Control Box.
Unit Operation LED is OFF when the unit is cooling.	**1st.** Check voltage on **Pin 7 C-9**. **2nd.** Replace Cab Control Box.

SYMPTOMS	REMEDY
Defrost cycle is not initiated when the Manual Defrost Switch is pressed.	**1st.** Box temperature must be higher than Setpoint temperature: unit must be in cool mode. **2nd.** Evaporator coil temperature must be lower than 36.0 ± 5.4 F (2.2 ± 3.0 C) (defrost termination switch closed). **3rd.** Keeping pressed the Manual Defrost Switch check voltage on **Pin 8 C-9**. **4th.** Replace Cab Control Box.
Defroster LED is OFF when the unit is in Defrost Mode.	**1st.** Check for open circuit on **Wire Y**, between **Pin 4 C-9** and **Pin 2 C-3**. **2nd.** Check voltage on **Pin 8 C-9**. **3rd.** Replace Cab Control Box.
Temperature displayed is out of range.	**1st.** Check that the Cab Control Box 12/24V selector is in the correct position. **2nd.** Check the thermostat sensor.
Unit is not working in Electric Mode.	**1st.** Check the AC Overload Relay (AC Overload Led must be OFF). **2nd.** Check the fuses on the P.C. Board. **3rd.** Check voltage on **Pin 2 C-9**. **4th.** Check voltage on **Pin 1 C-9**. **5th.** Replace Cab Control Box.
Unit is stopped by the AC OL Relay, but the AC Overload LED is OFF.	**1st.** Check voltage on **Pin 5 C-9**. **2nd.** Replace Cab Control Box.

Trouble Shooting M-17 In-Cab Control Box (TC Units Only)

Before starting this trouble shooting, verify that the In-Cab Control Box 12/24V selector is placed in the correct position and check the ground circuit through Pin 9 Connector C-11.

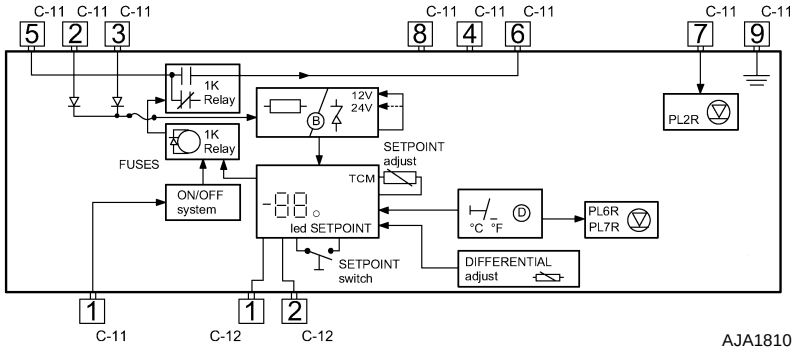


Figure 20: BLOCK DIAGRAM M-17

IMPORTANT: This trouble shooting only covers In-Cab Control Box functions and should not be considered as all-inclusive or meant to cover all other electric contingencies; on these cases you should check wiring against diagram.

SYMPTOMS	REMEDY
Blank display when the display on the main control box is reading.	**1st.** Check voltage on **Pin 3 C-11** (Pin 2 when is working in electric mode). **2nd.** Check **Fuse 4/1** located inside the Cab Control Box. **3rd.** Replace Cab Control Box.
Unit is not cooling when the Box Temperature is higher than the Setpoint Temperature.	**1st.** Check voltage on **Pin 6 C-11**. **2nd.** Replace Cab Control Box.
Unit Operation LED is OFF when the unit is cooling.	**1st.** Check voltage on **Pin 7 C-11**. **2nd.** Replace Cab Control Box.
Temperature displayed is out of range.	**1st.** Check that the Cab Control Box 12/24V selector is in the correct position. **2nd.** Check the thermostat Sensor.

Defrost System

A defrost cycle can be started by pressing the manual defrost switch or automatically by the defrost timer, when the defrost termination switch is closed and the unit is in cool mode.

The defrost cycle operates by energizing the defrost relay. The defrost relay energizes the defrost solenoid valve (and the condenser solenoid valve on units equipped with the heat option). The defrost relay also interrupts power to the evaporator and condenser fans, which stops the evaporator and condenser fans.

Energizing the defrost solenoid valve diverts hot gas into the evaporator coil, melting ice. A defrost termination switch de-energizes the defrost relay when evaporator temperature rises above 48 F (8.9 C).

To check the defrost cycle, run the unit on Cool to drop the evaporator coil to a temperature below 36 F (2.2 C).

Press the manual defrost switch. The unit should shift from Cool to Defrost Mode. If the unit continues to Cool, double check the evaporator coil temperature, and refer to Testing the Defrost System.

On TC units defrost is performed on both evaporators at the same time. Defrost termination is controlled by the defrost termination switch on the main evaporator.

Defrost Components

Defrost Timer Settings

NOTE: The defrost timer is directly connected to the battery. This means that the defrost timer is always timing, even if the unit is turned off.

The defrost timer has two selector switches (A and B) and a round red selector that are used to set the timer interval.

The factory setting for the defrost timer is four hours. Use the following information to change the setting of the defrost timer.

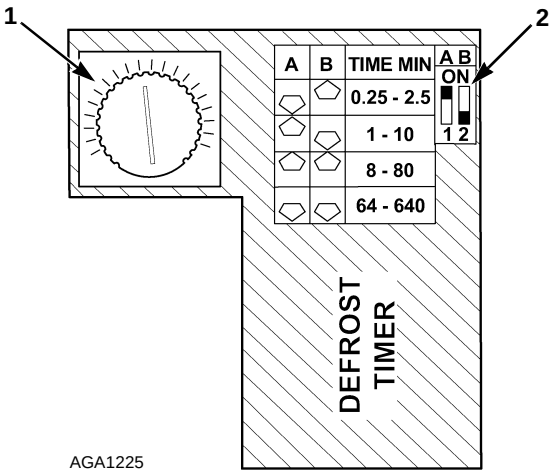


Figure 21: Defrost Timer

1. Refer the following timing table. A similar table is located on the printed circuit board.

TIMING TABLE	Switch		SCALE
	A	B	
0.25 - 2.5	Ø	¦	From 0.25 to 2.5 minutes
1 - 10	¦	Ø	From 1 to 10 minutes
8 - 80	¦	¦	From 8 to 80 minutes
64 - 640	Ø	Ø	From 1 to 10 hours

2. Choose the range in the timing table in which your timing needs are included and set switches A and B to the desired position.

   Example: Setting selector switches A and B to positions A:↓ and B:↓ chooses the time range of approximately 1 to 10 hours6 (4 to 640 minutes).

3. Set the round red selector to the desired value. The round red selector multiplies the minimum value of the chosen range by the value it is pointing at.

   Example: If the selector points to position 2, approximately. 2 hours (2 x 64 = 128 minutes)

   Example: If the selector points to position 4, approximately. 4 hours (4 x 64 = 256 minutes)

Manual Defrost Switch

A manual defrost switch is located in the In-Cab control box. Pressing the manual defrost switch initiates the defrost cycle if the defrost termination switch is closed and the unit is in cool mode.

Defrost Termination Switch

The switch is mounted in the evaporator coil and controls the defrost cycle in response to the evaporator coil temperature. The switch is closed when the evaporator coil temperature is below 36 F (2.2 C). completing the defrost circuit to ground and preparing the electrical system for the defrost cycle.

When the unit does shift into a defrost cycle, the evaporator fan stops, and heat from the hot refrigerant gas melts the frost from the evaporator coil. The switch opens and terminates the defrost cycle when the evaporator coil temperature rises above 48 F (8.9 C).

Defrost Relay

The defrost relay controls operation of the defrost cycle. When the defrost timer or the manual defrost switch completes the circuit through the defrost termination switch to ground, the defrost relay is energized. This energizes the defrost solenoid valve (wire 26) and de-energizes the fan relay.

The defrost relay stays energized until the defrost cycle is terminated by the defrost termination switch or the ON-OFF Key is pressed.

Defrost Solenoid Valve

The defrost solenoid valve is an electrical valve that controls the flow of refrigerant through the refrigeration system.

The defrost solenoid valve is energized by the 26 wire (Pin 1 C-1). When the defrost solenoid valve is energized it routes hot refrigerant gas to the evaporator.

Testing The Defrost System

To test the defrost system, run the unit on cool until the evaporator coil temperature is below 36.0 ± 5.4 F (2.2 ± 3.0 C) and press the manual defrost switch.

If the unit doesn't shift to defrost cycle go to step 1.

1. Check the evaporator temperature.

   Be sure the evaporator temperature is actually below 36.0 ± 5.4 F (2.2 ± 3.0 C), otherwise the unit will not defrost. Use a test thermometer to check the evaporator temperature.

2. Check the defrost termination switch.

   If the unit fails to defrost, place a jumper wire between the 12 and CH wires at the defrost termination switch. Press the manual defrost switch.

   If the unit shifts to defrost, the defrost termination switch is defective.

   If the unit does not shift to defrost, check for an open circuit in the 12 wire back to Pin 2 C-3. If the 12 wire is not open go to step 3.

3. Check voltage on Pin 1 C-3.

   If voltage is present on Pin 1 C-3, replace the defrost relay.

   If voltage is not present, go to step 4.

4. Check for open circuit on wire GR that goes to the In-Cab control box (Pin 8 C-9).

   If the wire GR is not open, go to step 5.

5. Press and hold manual defrost switch, check the voltage on Pin 8 C-9.

   If voltage is present on Pin 8 C-9 and the rest of the above mentioned points are correct, replace the printed circuit board.

   If voltage is not present on Pin 8 C-9, check the In-Cab control box.

Defrost Timer Test

The defrost timer initiates the defrost cycle.

1. Verify that the evaporator coil temperature is lower than 36.0 ± 5.4 F (2.2 ± 3.0 C). If not, place a jumper wire between the 12 and CH wires at the defrost termination switch.
2. Set the defrost timer to approximately 1 minute (selector switches A:↓, B:↓ and round red selector in position 4).

3. After approximately one minute, defrost should be initiated. The Defrost LED, defrost relay, and defrost solenoid valve must be activated.

Condenser Fan Pressure Switch (CFPS) R-134a Units Only

When the condenser head pressure rises above 180 ± 10 psi (1241 ± 69 kPa) the condenser fan pressure switch closes, starting the condenser fan.

When the condenser head pressure falls below 130 ± 10 psi (896 ± 69 kPa), the condenser fan pressure switch opens, stopping the condenser fan.

Testing CFPS

The CFPS is located on the discharge line. Electrically it is located between wires CF and CF1.

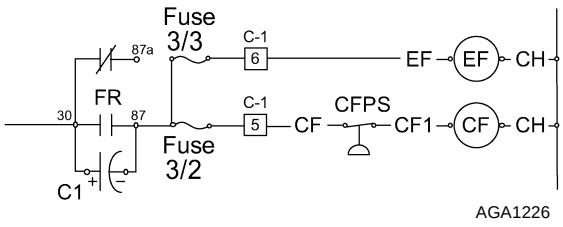


Figure 22: Testing CFPS

Use the following procedure to test the CFPS:

1. Install a manifold gauge set on the compressor.
2. Connect a voltmeter between the CF and the CF1 wires by CFPS switch connector.
3. Run the unit on Cool. When the condenser head pressure is higher than 180 ± 10 psi (1241 ± 69 kPa) the condenser fan motor must be running and the voltmeter should indicate approximately 0 volts.
4. Run the unit on Cool. When the condenser head pressure is lower than 130 ± 10 psi (896 ± 69 kPa) the condenser fan motor must be stopped and the voltmeter should indicate approximately truck battery voltage.

Liquid Injection System (R-404A Units Only)

This liquid injection switch is a temperature sensitive switch located on the discharge fitting of the truck engine compressor. When the discharge temperature rises above 230 ± 5 F (110 ± 3 C), the switch closes to open the liquid injection solenoid. When the discharge temperature falls below 200 ± 5 F (93 ± 3 C), the switch opens to close the liquid injection solenoid.

Testing Liquid Injection Valve And Metering Orifice

1. Disconnect the LIS wire from the liquid injection solenoid.
2. Install the gauge manifold set on the engine-driven compressor.
3. Set thermostat on the lowest setting.
4. Start and run the unit on the engine-driven compressor until the suction pressure stabilizes.
5. Place a jumper between CH and LIS terminal on the liquid injection solenoid. This simulates that the discharge temperature is higher than 230 F (110C).
6. With the jumper wire in place the suction pressure should rise.
7. Remove the jumper. The suction pressure should return to the stabilized pressure in step 4.
8. If the suction pressure does not change, check the CLU wire for voltage, the liquid injection solenoid valve, or the metering orifice.
9. Shut off the unit and the truck, remove the gauge manifold set, and replace the LIS wire.

Electric Standby Circuits

If the unit does not run in the electric standby mode use the following procedure.

Make sure the unit is connected to the proper power source.

Check the power cable receptacle for power. If power is there, check for power at the unit terminal plug.

If the contactor is pulled down and the overload relay is closed, but the standby motor fails to start, the trouble is probably in the standby motor.

If the contactor is not pulling down proceed as follows:

1. Check the AC line voltage and the transformer fuse. If the AC line voltage is acceptable and the transformer fuse is intact, go to step 2.
2. Measure the transformer output voltage (AC) at the terminal board. Measure the voltage between wires X1 and X4. The voltage reading should be approximately 12/24V (depending on the unit voltage). If not, the transformer is defective. If the transformer output voltage is acceptable, go to step 3.
3. Check the rectifier output voltage (DC) on the 2R wire (Pin 3 C-2). If this voltage is less than approximately 12/24V, the rectifier bridge is defective. If the rectifier output voltage is acceptable, go to step 4.
4. Check the voltage on 2R1 wire (Pin 4 C-4). If voltage is not present, check Fuse 4. If Fuse 4 is intact, go to step 5.
5. Check the voltage on Pin 2 C-9. If voltage is not present, check for open circuits on wires 2R1 and R. If voltage is present on Pin 2 C-9, check the cab control box.

NOTE: The following procedures involve servicing the refrigeration system. Some of these service procedures are regulated by Federal, and in some cases, by State and Local laws.

All regulated refrigeration service procedures must be performed by an EPA certified technician, using approved equipment and complying with all Federal, State and Local laws.

Refrigerant Charge

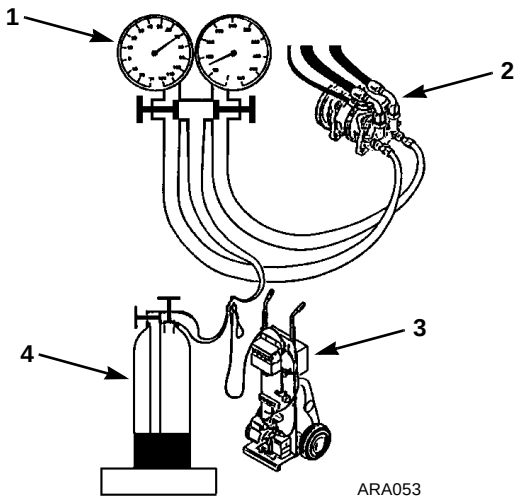
Charging the Refrigeration System

The liquid line sight glass helps the operator to determine the amount of charge under established operating conditions. These units can be damaged by an overcharge of refrigerant. The amount of refrigerant the system can hold depends on circuit volume which is affected by hose length.

The most satisfactory method of charging the engine driven compressor circuit and the electric standby driven compressor circuit is as follows:

1. Connect a gauge manifold set to the suction and discharge service ports on the engine driven compressor.
2. Connect the center hose of the gauge manifold to the manifold of an evacuation station. The use of Thermo King Evacuation Station P/N 204-725 is recommended.
3. Connect the hose from a drum of refrigerant to the manifold of the evacuation station. Make sure the valve on the refrigerant drum is closed.
4. Open the valves on the gauge manifold and the valves on the evacuation station.
5. Start the vacuum pump and evacuate the system to 500 microns. After the system reaches 500 microns, evacuate the system for an additional hour.

   NOTE: If the system will not come down to 500 microns, there is probably a leak in the system or in the evacuation and charging equipment hoses. Find and repair the leak.



1.	Gauge Manifold Set
2.	Engine Driven Compressor
3.	Evacuation Station
4.	Refrigerant Drum

Figure 23: Charging Refrigeration System

6. After the additional hour of evacuation, close the valve at the evacuation pump, stop the vacuum pump, and observe the reading on the vacuum gauge for 5 minutes. The pressure should not exceed 2000 microns.

   NOTE: If it does, repeat steps 5. and This time if the pressure exceeds 2000 microns within 5 minutes, look for a leak in the system or in the evacuation and charging equipment hoses. Find and repair the leak.

7. Open the vacuum valve at the vacuum pump, start the vacuum pump, and evacuate the system to 500 microns.
8. When the system reaches 500 microns, close the vacuum valve at the evacuation station manifold. The system is now ready to charge.
9. Close the low side valve on the gauge manifold, leave the high side valve on the gauge manifold open, and open the valve on the refrigerant drum to deliver liquid.
10. Allow 2.60 lb (1.20 kg) of R-134a or 2.75 lb (1.25 kg of R- 404A refrigerant to enter the system. Then close the valve on the refrigerant drum and the high side valve on the gauge manifold.

11. Start the unit on engine operation and run the truck engine at approximately 1000 rpm.
12. Set the thermostat at 32 F (0 C), and run the unit in cool until the box temperature approaches 32 F (0 C).
13. Make sure that the unit is running in cool, the compressor is running at approximately 1000 rpm, the suction pressure is 2 to 8 psi (14 to 55 kPa), and the head pressure is at least 180 psi (1241 kPa) for R-134a systems or 275 psi (1896 kPa) for R-404A systems. If necessary, raise the head pressure by covering the condenser.
14. With these conditions established, open the valve on the refrigerant drum to deliver liquid.
15. Observe the suction pressure and slowly open the low side gauge manifold valve to allow liquid refrigerant to flow into the compressor suction service valve.
16. Control the liquid flow so the suction pressure increases approximately 138 kPa (20 psi).
17. Observe the liquid line sight glass. Close the valve on the refrigerant drum when the bubbles disappear from the sight glass.
18. Close the low side valve on the gauge manifold and operate the unit for 15 minutes.
19. Model 20 only.
    a. Turn the unit OFF and shut off the truck engine.
    b. Connect the electric power receptacle to an appropriate electric power supply. Start and run the unit in cool on electric operation for a minimum of 15 minutes.
    c. Turn the unit OFF and disconnect the electric power supply. Start the truck and run the unit in cool on engine operation for a minimum of 15 minutes.
20. Check the liquid line sight glass for bubbles. Repeat steps 13. through 20. if bubbles are visible.
21. Stop the unit, shut OFF the truck engine and remove the gauge manifold set.
22. The above conditions MUST be established each time the refrigerant level is checked or if refrigerant needs to be added for any reason.

    NOTE: To prevent oil migration from one compressor to another, and for proper oil return when a compressor is operating, operate a compressor for a minimum of 15 minutes. Do not operate the compressor for shorter intervals.

Checking the Refrigerant Charge

If the unit has an insufficient charge of refrigerant, the evaporator will be “starved” and the box temperature will rise even though the unit is operating. Also, an insufficient charge does not circulate enough oil to properly lubricate the compressor. The charge may be determined by inspection of the refrigerant through the sight glass with the following conditions established:

Testing the Refrigerant Charge with an Empty Box

1. Place a test box over the evaporator.
2. Install gauge manifold set.
3. Run the unit in cool on engine driven compressor operation until the thermometer reads 32 F (0 C).
4. Establish head pressure of 180 psi (1241 kPa) for R-134a systems or 275 psi (1896 kPa) for R-404A systems. It may be necessary to partially cover the condenser grille on the front of the unit to create the desired head pressure.
5. Look at the liquid line sight glass. Under these conditions there should be no bubbles in the flow of refrigerant through the liquid line sight glass. Bubbles in the refrigerant indicate the unit is low on refrigerant. Refer to add refrigerant.

Testing the Refrigerant Charge with a Loaded Box

1. Install a gauge manifold.
2. Run the unit in cool on engine driven compressor operation.
3. Cover the condenser to drive any excess refrigerant from the condenser into the receiver tank.
4. As the head pressure rises, check the liquid line sight glass. There should be no bubbles in the flow of refrigerant through the liquid line sight glass. Bubbles in the refrigerant indicate the unit is low on refrigerant. Refer to add refrigerant.

   NOTE: If no bubbles are present, there is sufficient refrigerant in the unit for that load at that particular box temperature. This test does not determine if the unit contains a full charge of refrigerant.

Checking Compressor Oil Charge

The compressors are furnished with the amount of oil shown in. The oil level in the compressor will change after the compressor is initially run, making any level measurements inaccurate.

To ensure an adequate oil supply, the following procedure must be followed whenever the refrigerant charge is lost or removed from a unit:

1. Install a compressor on the system having a residual oil supply and self-lubricating system such as a TK 214 model. Connect an oil separator on the discharge or suction line to collect and drain out circulated oil.

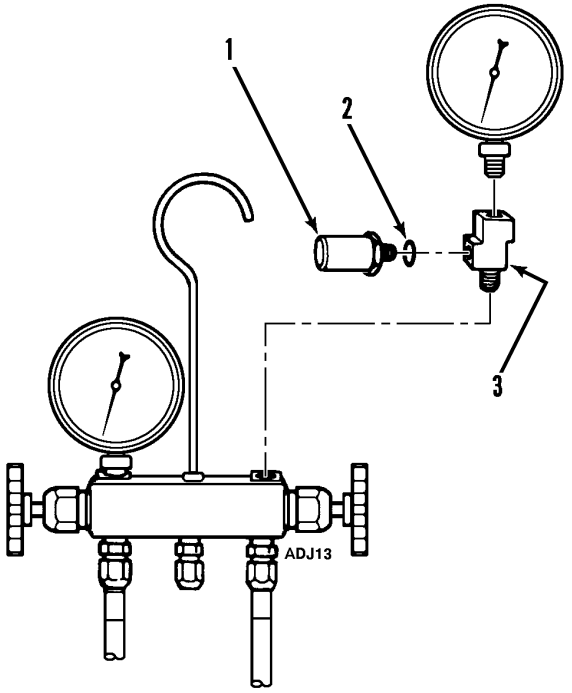
   NOTE: A suction line oil separator can be improvised by installing a suction filter upside down in the suction line near the compressor. Cap off both access ports, and use the lower one to drain off the accumulated oil.

2. Place a normal amount of oil in the cleanup compressor before operating.
3. Charge with 6.0 to 7.0 lb (2.7 to 3.2 kg) of refrigerant.
4. Operate at a low speed (600 to 800 rpm) for 2 hours, or until the compressor oil level reaches a minimum allowable level, whichever occurs first. Drain the collected oil from the oil separator as it fills, taking care to not allow any collected oil to recirculate.
5. Prepare the original compressor that was removed from the unit (or a replacement) by draining out any existing oil and replacing the oil with the amount of oil shown in the Specifications chapter.
6. Install the original compressor (or its replacement), and proceed with the manual evacuation and refrigerant charging procedure.

High Pressure Cutout Switch (HPCO)

The high pressure cutout switch is located on a discharge line inside the condenser unit. If the discharge pressure rises above 300 psi (2068 kPa) on R-134a units or 450 psi (3102 kPa) on R-404A units, the switch opens the 7A circuit de-energizing the power relay.

To test the switch, rework a gauge manifold per the High Pressure Cutout Manifold illustration.



1.	Relief Valve (66-7392)
2.	O-Ring (33-1015)
3.	Adapter Tee Weather Head (No. 552X3)

Figure 24: High Pressure Cutout Manifold

7. Connect the gauge manifold to the compressor discharge service port.

   NOTE: Service manifold hoses must have Schrader valve (tube valve) depressors.

8. Set the thermostat well below the box temperature so that the unit will be in cool.
9. Raise the discharge pressure of the compressor by blocking the condenser coil air flow. When the discharge pressure reaches 300 psi (2068 kPa) on R-134a units, or 450 psi (3102 kPa) on R-404A units, the High Pressure Cutout will switch off the unit.

   NOTE: The discharge pressure should never be allowed to exceed a pressure of 450 psi (3102 kPa).

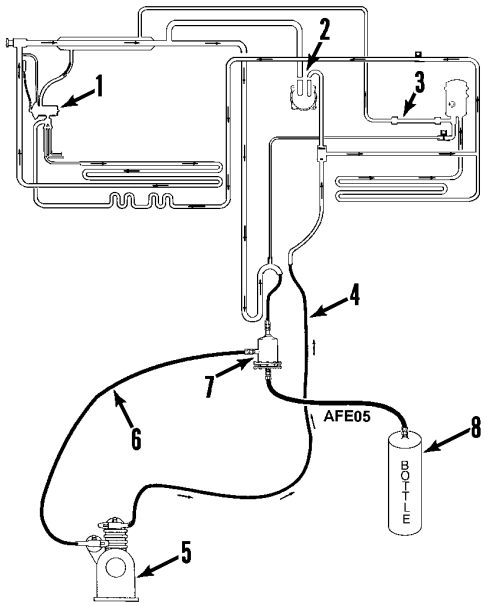
10. Failure of the high pressure cutout system to stop compressor operation should be investigated first by checking the control circuit operation and second by high pressure cutout switch replacement.

Low Pressure Cutout Switch (LPCO)

The low pressure cutout switch is located on the suction line in the evaporator. If the suction pressure drops below 5 to 11 in. Hg of vacuum (-17 to -37 kPa), it opens the circuit to the power relay to stop the unit. To check the low pressure cutout:

1. Install a gauge manifold at the compressor.
2. Close the receiver tank outlet valve and run the unit in cool.
3. When the suction pressure drops below 5 to 11 in. Hg of vacuum (-17 to -37 kPa), the LPCO should open and the unit should stop.

Cleanup Procedure for Small Truck Units



1.	Remove Internal Parts From Expansion Valve
2.	Disconnect and Cap (If So Equipped)
3.	Replace Drier With Tube
4.	Discharge Line
5.	Flushing Compressor
6.	Suction Line
7.	Suction Oil
8.	Recovered Oil

Figure 25: Connecting Flushing Compressor to Unit

NOTE: If a Van Steenburgh reclaimer is available, do not use this procedure. Follow procedure described in Service Bulletin T&T 134.

Tools Required:

- Motor-driven TK 214 “Flushing Compressor”
- Suction Line Filter (P/N 204-498 with Filter P/N 66-2988)
- Pipes (In Place of Oil Separator, Check Valve, Oil Separator and Standby Compressor)

Clean-up Procedure

1. Make sure all hose routing is correct.
2. Make sure that the oil trap is correctly installed.
3. Recover contaminated refrigerant from system.
4. Remove lines from compressors (engine driven and standby).
5. Flush each compressor using the flushing compressor and an HFC refrigerant. (Always recover the refrigerant before disconnecting flushing compressor.)
6. Remove check valve (or check valve seats) from system to ensure flow in all directions.
7. Remove oil separator and install a connecting pipe.
8. Remove internals from expansion valve.
9. Open suction pressure regulator (CPR) valve to highest setting.
10. Install temporary suction line filter (P/N 204-498 and P/N 66-2988) in suction line.
11. Install connecting pipe in place of standby compressor.
12. Connect flushing system to **engine driven** discharge and suction lines (see illustration).
13. Evacuate the system and check for leaks. Continue to evacuate to remove moisture and air.
14. Install HFC refrigerant and flush the system. (Energize defrost solenoid during 30% to 40% of the clean-up. Solid contaminants will collect in the suction line filter. Oil from the system and from the flushing compressor will drain out of the suction line filter. (Add compressor oil as required.) Refrigerant oil in the flushing compressor will absorb acids from the system.
15. Test compressor oil for acid contamination.
16. Continue flushing until compressor oil is clean.

Putting the Unit Back Into Operation

1. Replace check valve (or check valve seats).
2. Install new oil separator.
3. Install new liquid injection orifice.
4. Install new drier.
5. Install new expansion valve.
6. Install compressors and lines.
7. Use dry nitrogen to pressurize system to 150 psi (1034 kPa).
8. Use bubble solution to check for leaks.
9. Install correct amount of oil.
10. If no leaks, evacuate unit. A leak-free and dry unit will maintain a 1000 micron vacuum for five minutes or longer.
11. Charge unit with proper amount of the correct refrigerant.
12. Operate and check for proper operation. (Adjust suction pressure regulator.)
13. After two weeks of operation, change the drier.

NOTE: It is generally good practice to replace the filter drier whenever the high side is opened or when the low side is opened for an extended period of time.

WARNING: Disconnect the power supply before servicing the unit to prevent personal injury.

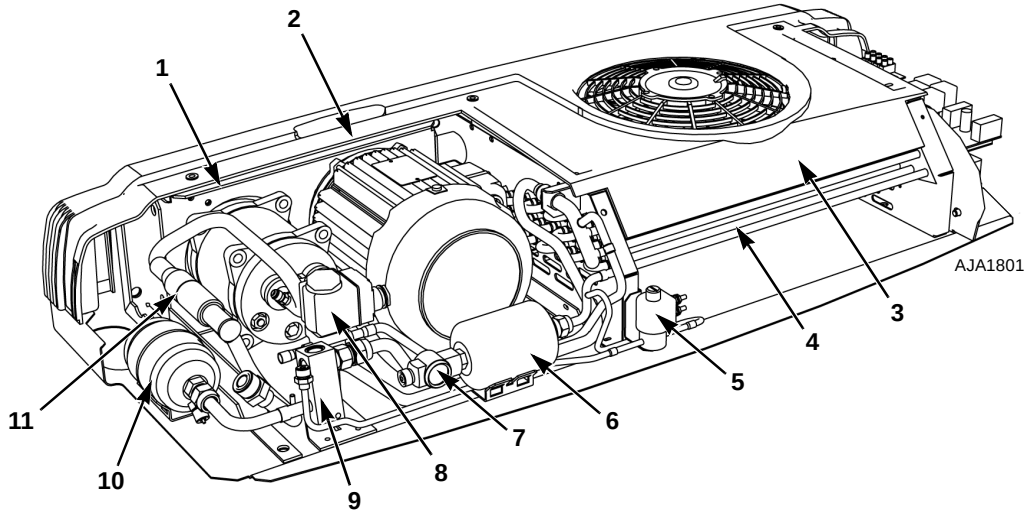
Compressor

Removal

1. Recover the refrigerant charge from the system.
2. Loosen and remove the compressor drive belt.
3. Disconnect the clutch wire and the discharge and suction lines (and liquid injection hose if necessary).
4. Keep the compressor ports and the suction and discharge lines for the compressor covered to prevent contamination of system components.
5. Remove the compressor mounting screws. Remove the compressor.

Installation

NOTE: Any compressor installed in this system must contain the proper amount of compressor oil. Always check to make sure that the compressor contains the proper amount of oil. Follow the system cleanup procedures to remove old oil from the system.



1.	Electric Standby Compressor	7.	Liquid Line Sight Glass
2.	Electric Motor	8.	Defrost Solenoid Valve
3.	Canalizer	9.	Discharge Check Valve
4.	Condenser Coil	10.	Oil Separator
5.	Liquid Injection Valve	11.	Suction Pressure Regulator Valve
6.	Drier		

Figure 26: Refrigeration Systems In Model 20 Configurations

6. Place the compressor in position and install the mounting screws and the belt.
7. Use belt tension tool P/N 204-427 to adjust belt tension to a reading of 58 on the gauge.
8. Connect clutch wire and the refrigeration hoses. Pour 2 oz. (59 ml) of compressor oil into the suction hose before installation.
9. Pressurize the system and test for leaks.
10. Evacuate the system and recharge.

Condenser Coil

Removal

1. Recover the refrigerant charge.
2. Remove the condenser cover.
3. Remove the canalizer.
4. Disconnect the inlet and liquid lines.
5. Remove the mounting hardware.
6. Remove the condenser coil.

Installation

1. Clean the tubes for soldering.
2. Place the coil in the unit and install the mounting hardware.
3. Connect the inlet and liquid line connections.
4. Pressurize the system and test for leaks.
5. Evacuate the system.
6. Reinstall the canalizer.
7. Reinstall the condenser cover.
8. Recharge the unit.

Drier

Removal

1. Recover the refrigerant charge.
2. Remove the condenser cover.
3. Disconnect the ORS nuts at the ends of the drier.
4. Loosen the mounting hardware and remove the drier.

Installation

1. Coat the new O-rings with refrigerant oil (same type that is used in the system) and place the new rings in the ORS fittings on the ends of the drier.
2. Install the new drier and tighten the mounting screws and nuts.
3. Install and tighten the ORS nuts. Hold the drier with a back-up wrench on the hex behind the ORS fitting.
4. Pressurize the system and test for leaks.
5. Evacuate the system.
6. Reinstall the condenser cover.
7. Recharge the unit.

High Pressure Cutout And Condenser Fan Pressure Switches

Removal

1. Recover the refrigerant charge.
2. Remove the condenser cover.
3. Disconnect the wires and remove the switch.

Installation

1. Apply a refrigerant loctite to the threads of the switch.
2. Install and tighten the switch and reconnect the wires.
3. Pressurize the system and test for leaks.
4. Evacuate the system.
5. Reinstall the condenser cover.
6. Recharge the unit.

Solenoid Valves

NOTE: Valves that have nylon seats must be disassembled before soldering.

Removal

1. Recover the refrigerant charge.
2. Remove the condenser cover or the TC/Heat kit cover to access the solenoid valve.
3. Remove the coil and disassemble the valve if unsoldering the valve.
4. Unsolder or disconnect the refrigeration lines from the valve, remove the and remove the valve from the unit. Note the direction of the flow arrow on the valve.

CAUTION: Use a heat sink to prevent damaging the valve when soldering.

Installation

1. Clean the tubes for soldering if necessary.
2. Remove the coil and disassemble the valve if soldering.
3. Place the valve in position with the flow arrow pointing in the direction noted when removed.
4. Solder or connect the inlet and outlet connections. After the valve cools, assemble the valve and install the coil.

CAUTION: Use a heat sink to prevent damaging the valve when soldering.

5. Pressurize the refrigeration system and test for leaks.
6. Evacuate the system.
7. Reinstall the cover.
8. Recharge the unit.

Oil Separator

Removal

1. Recover the refrigerant charge.
2. Remove the condenser cover.
3. Disconnect the ORS nuts at the end of the oil separator.
4. Loosen the mounting hardware and remove the oil separator.

Installation

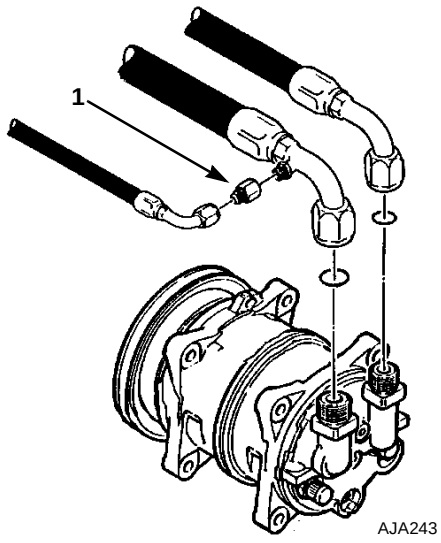
1. Coat the new O-rings with refrigerant oil (same type that is used in the system) and place the new rings in the ORS fittings on the ends of the oil separator.
2. Install and tighten the inlet and outlet ORS nuts. Hold the oil separator with a backup wrench on the hex behind the ORS fitting.
3. Pressurize the system and check for leaks.
4. Evacuate the system.
5. Reinstall the condenser cover.
6. Recharge the unit.

Liquid Injection Metering Orifice

Removal

1. Recover the refrigerant charge.
2. Disconnect the refrigeration hose from the metering orifice and remove the metering orifice from the suction hose fitting.

   NOTE: This orifice may become plugged with dirt unless the refrigeration hose and solenoid valve are kept clean.



1.	Liquid Injection Metering Orifice

Figure 27: Engine Driven Compressor

Installation

1. Install the metering orifice on the suction hose fitting.
2. Connect the refrigeration hose to the metering orifice fitting.
3. Pressurize the system and check for leaks.
4. Evacuate the system.
5. Recharge the unit.

Testing the Liquid Injection Solenoid Valve and Metering Orifice

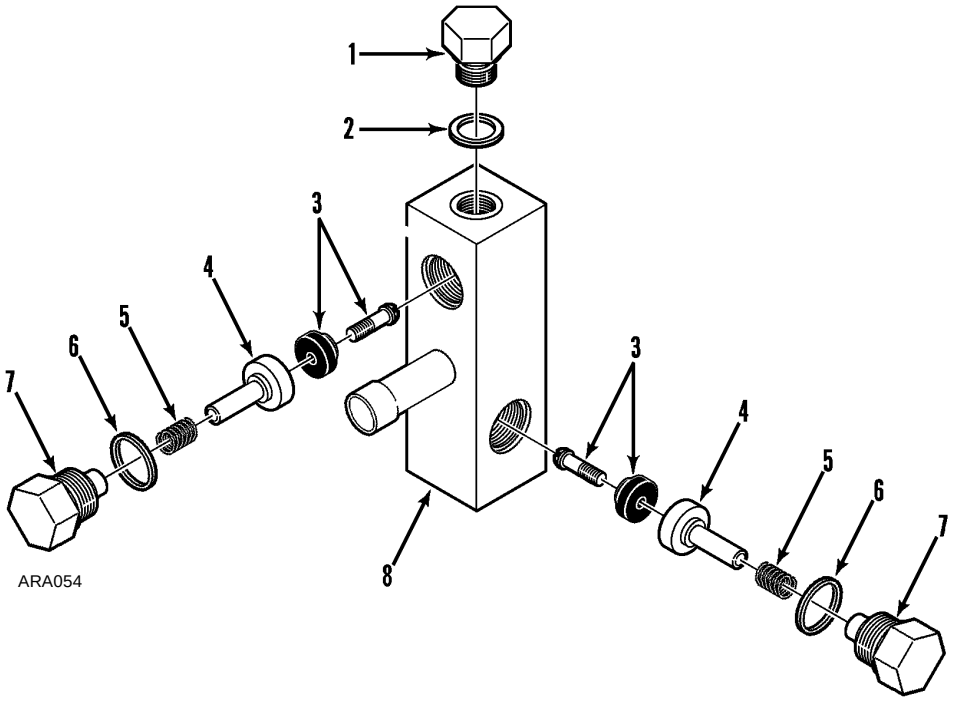
1. Disconnect the CLU and LIS wires from the liquid injection switch.
2. Install a gauge manifold set on the engine driven compressor.
3. Set the thermostat on the lowest setting.
4. Start the truck and run the unit on the engine driven compressor until the suction pressure stabilizes.
5. Place a jumper wire between CLU and the LIS wires that were disconnected from the liquid injection switch.
6. With the jumper wire in place the suction pressure should rise.
7. With the jumper wire removed the suction pressure should return to the stabilized pressure in step 4.
8. If the suction pressure does not change, check the CLU wire for voltage, the liquid injection solenoid valve, or the metering orifice.
9. Shut off the unit and the truck, remove the gauge manifold set and reconnect the CLU and LIS wire to the liquid injection switch.

Discharge Check Valve (Model 20 Only)

Testing the Discharge Check Valve

The discharge check valve is a very important part of the Model 20 system. The discharge check valve isolates the engine driven compressor from the electric standby compressor, ensuring the compressor oil and refrigerant do not migrate between compressors. The check valve should be tested when the system is initially charged and operating and anytime the system has been opened for service or repair. Testing the check valve requires two gauge manifold sets.

1. Disconnect the liquid injection solenoid valve wires.
2. With the unit off, install a gauge manifold set on each compressor.
3. Observe the gauge manifold readings of the electric standby compressor. If the high side and low side readings are not the same, open the gauge manifold valves and equalize the pressures. Close the gauge manifold valves.
4. Adjust the thermostat so the unit will run in cool. Start the truck and run the unit with the engine driven compressor.
5. Observe the gauge manifold readings of the engine driven compressor. The head pressure should increase and the suction pressure should decrease.
6. Observe the gauge manifold readings of the electric standby compressor. The high side pressure should remain the same as the pressure in step 3 after the high and low sides were equalized. If the high side pressure is increasing or has increased noticeably, the discharge check valve is leaking internally.
7. Turn the unit off and shut off the truck engine. Connect the remote control box to an appropriate electric power source.



1.	Cover Nut	5.	Piston Spring
2.	Sealing Washer	6.	Sealing Washer
3.	Piston Screw/Piston Seat	7.	Cap Nut
4.	Piston	8.	Valve Body

Figure 28: Check Valve Assembly

8. Observe the gauge manifold reading of the engine driven compressor. If the high side and low side readings are not the same, open the gauge manifold valves and equalize the pressures. Close the gauge manifold valves.
9. Adjust the thermostat so the unit will run in cool. Start the unit and run on electric standby.
10. Observe the gauge manifold readings of the electric standby compressor. The head pressure should increase and the suction pressure should decrease.
11. Observe the gauge manifold readings of the engine driven compressor. The high side pressure should remain the same as the pressure in step 8 after the high and low sides were equalized. If the high side pressure is increasing or has increased noticeably, the discharge check valve is leaking internally. Stop the unit.
12. Remove the gauge manifold sets and the electric standby power source. Connect the wires to the liquid injection solenoid valve.

    If the check valve is leaking internally, refer to the repair procedures.

Check Valve Repair

Disassembly

1. Recover the refrigerant charge.
2. Loosen the cap nut and remove the cap nut, sealing washer, spring, and piston assembly.
3. Check the spring. The free length should be 0.57 in. (14.4 mm). Replace the spring if the free length is less than 0.51 in. (13.0 mm).
4. Inspect the pistons and the piston seats. Replace the pistons or the piston seats if they are worn or damaged.
5. Inspect the valve body. The piston bores and the valve body seats should be clean and undamaged. The pistons should move freely in the piston bores. Clean or replace if necessary.

Assembly

NOTE: Coat all parts with compressor oil before assembly.

1. Place the sealing washer on the cap nut.
2. Place the spring on the piston assembly.
3. Place the piston and spring in the cap nut.
4. Carefully place the piston and cap nut in the valve body.
5. Tighten the cap nut.

Check Valve Replacement

Removal

1. Recover the refrigerant charge.
2. Disconnect the refrigeration line connections.
3. Remove the mounting hardware and remove the check valve.

Installation

1. Place the check valve in position and install the mounting hardware.
2. Connect the refrigeration lines.
3. Pressurize the refrigeration system and test for leaks.
4. If no leaks are found, evacuate the system.
5. Recharge the unit with refrigerant and check compressor oil.

Evaporator Coil

Removal

1. Recover the refrigerant charge.
2. Remove the evaporator cover. Disconnect the evaporator fan motor wires.
3. Disconnect the expansion valve from the distributor.
4. Disconnect the hot gas line from the distributor.
5. Remove the defrost termination switch wire.
6. Unsolder the suction line from the evaporator coil.
7. Remove the mounting bolts and slide the coil from the unit.

Installation

1. Place the coil in the housing.
2. Install the mounting bolts and tighten them.
3. Clean the tubes for soldering.
4. Solder the suction line to the evaporator coil.
5. Connect the hot gas line to the distributor.
6. Connect the expansion valve to the distributor.
7. Connect the defrost termination switch wire.
8. Pressurize the refrigeration system and test for leaks.
9. If no leaks are found, evacuate the system.
10. Connect the evaporator fan motor wires. Install the evaporator cover.
11. Recharge the unit with refrigerant and check compressor oil.

Expansion Valve Assembly

Removal

1. Recover the refrigerant charge.
2. Remove the evaporator cover. Disconnect the evaporator fan motor wires.
3. Remove the feeler bulb from the suction line clamps. Note the position of the feeler bulb on the suction line.
4. Disconnect the equalizer line from the expansion valve.
5. Disconnect the liquid line and the distributor from the expansion valve.
6. Remove the expansion valve from the unit.

Installation

1. Install the expansion valve assembly in the unit.
2. Connect the liquid line and the distributor to the expansion valve.
3. Connect the equalizer line to the expansion valve.
4. Clean the suction line to a bright, polished condition. Install the feeler bulb clamps and the feeler bulb on the side of the suction line in its former position. The feeler bulb must make good contact with the suction line or operation will be faulty. Wrap the bulb with insulating tape.

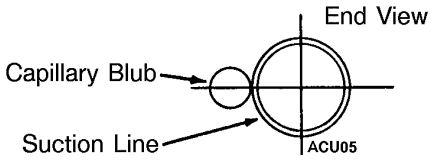


Figure 29: Location of Expansion Valve Bulb

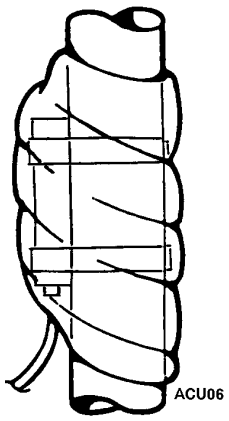


Figure 30: Completely Wrap Bulb with Tape

1. Pressurize the refrigeration system and test for leaks.
2. If no leaks are found, evacuate the system.
3. Connect the evaporator fan motor wires. Install the evaporator cover.
4. Recharge the unit with refrigerant and check compressor oil.

Low Pressure Cutout Switch

Removal

1. Recover the refrigerant charge.
2. Remove the evaporator cover. Disconnect the evaporator fan motor wires.
3. Disconnect the wires and remove the switch.

Installation

1. Apply refrigerant locktite to the threads of the switch.
2. Install and tighten the switch and reconnect the wires.
3. Pressurize the refrigeration system and test for leaks.
4. If no leaks are found, evacuate the system.
5. Connect the evaporator fan motor wires. Install the evaporator cover.
6. Recharge the unit with refrigerant and check compressor oil.

Suction Receiver Tank (Heat Option Only)

Removal

1. Recover the refrigerant charge.
2. Remove the TC/heat kit cover.
3. Unsolder the suction receiver tank from the suction tubes.

Installation

1. Clean the tubes for soldering.
2. Place the suction receiver tank in position and solder the connections.
3. Pressurize the refrigeration system and test for leaks.
4. If no leaks are found, evacuate the system.
5. Install the TC/heat kit cover.
6. Recharge the unit with refrigerant and check compressor oil.

Suction Pressure Regulator Valve (TC Units Only)

Removal

1. Recover the refrigerant charge.
2. Remove the TC kit cover.
3. Unsolder the suction pressure regulator valve from the suction tubes.

Installation

1. Clean the tubes for soldering.
2. Place the valve in position and solder the connections.
3. Pressurize the refrigeration system and test for leaks.
4. If no leaks are found, evacuate the system.
5. Install the TC kit cover.
6. Recharge the unit with refrigerant and check compressor oil.

In-line Check Valves (TC Units Only)

TC units use in-line check valve in the hot gas and/or liquid lines. These check valves are located in the TC/heat kit. An in-line check valve is not repairable and must be replaced if it fails. A heat sink must be used on the in-line check valve when it is being soldered in place to prevent damage to the neoprene seal.

Removal

1. Recover the refrigerant charge.
2. Remove the TC/heat kit cover.
3. Remove the mounting hardware from the check valve if used.
4. Place a heat sink on the check valve.
5. Unsolder the lines and remove the check valve.

Installation

NOTE: A heat sink must be used on the in-line check valve when it is being soldered in place to prevent damage to the neoprene seal.

1. Clean the tubes for soldering.
2. Place the check valve in position. The arrow on the valve body indicates the direction of refrigerant flow through the valve.
3. Place a heat sink on the check valve.
4. Solder the inlet and outlet connections.
5. Install the mounting hardware for the check valve if used.
6. Pressurize the refrigeration system and test for leaks.
7. If no leaks are found, evacuate the system.
8. Install the TC/heat kit cover.
9. Recharge the unit with refrigerant and check compressor oil.

Replacing Refrigerant Hoses (Speedy Clip System)

Disassembly

1. Drain the refrigerant charge or drain the low pressure side.
2. Loosen the hose fittings using two spanner wrenches.
3. Remove the hose and the hose connectors.

Assembly

1. Cut the hose to the desired length. Use the recommended hose-cutting tool. Do not use saws, knives or similar tools.

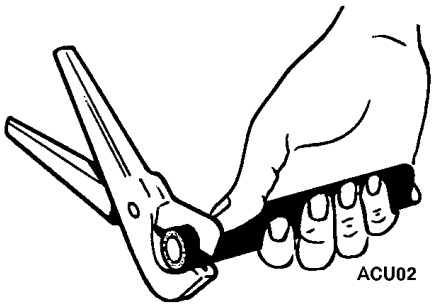


Figure 31: Cutting The Hose

2. Fit two clips of appropriate diameter over the hose. Use only one clip for hose #4.

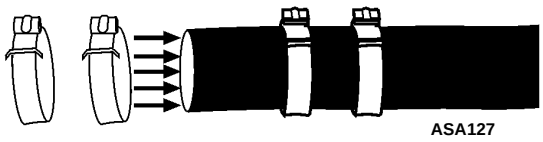


Figure 32: Fitting The Clips

3. Lubricate the cylinder of the fitting to be inserted in the hose using Thermo King refrigerant oil.

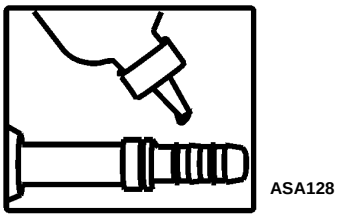


Figure 33: Lubricating The Cylinder Of The Fitting

4. Manually insert the fitting into the hose. The hose should touch the projecting part of the fitting without rising over it. Clean off excess oil.

Figure 34: Manually Inserting The Fitting

5. Place the clamp for the clips into the fitting slot. The clamp is properly positioned when it can rotate in the slot.

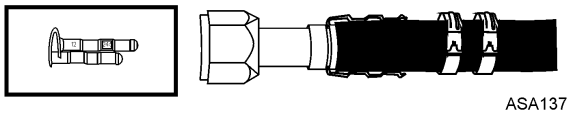


Figure 35: Positioning The Clamp

6. Fit the clips in the clamp arm seat.

Figure 36: Fitting The Clips

7. Tighten both clips using recommended pliers. Check that the clips are properly positioned and tightened.

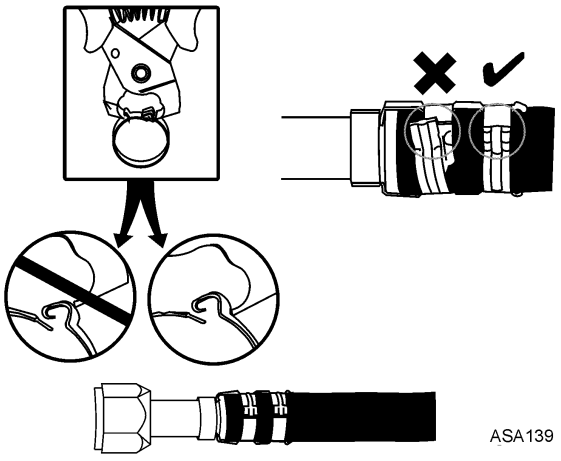


Figure 37: Tightening Both Clips

Structural Maintenance

Unit Inspection

Inspect the unit during the pre-trip inspection and during scheduled maintenance inspections for loose or broken wires or hardware, compressor oil leaks, or other physical damage which might affect unit performance and require repair or replacement of parts.

Evaporator Coil

Clean the coils during scheduled maintenance inspections. Remove any debris (e.g., leaves or plastic wrap) that reduces the air flow. Clean dirty coils with compressed air or a pressure washer. Be careful not to bend the fins when cleaning a coil. If possible, blow the air or water through the coil in the direction opposite the normal air flow. Repair bent fins and any other noticeable damage.

CAUTION: Air pressure should not be high enough to damage coil fins.

Condenser Coil

Clean the coils during scheduled maintenance inspections. Remove any debris (e.g., leaves or plastic wrap) that reduces the air flow. Clean dirty coils with compressed air or a pressure washer. Be careful not to bend the fins when cleaning a coil. If possible, blow the air or water through the coil in the direction opposite the normal air flow. Repair bent fins and any other noticeable damage.

Unit Mounting Bolts

Periodically check and torque the unit mounting bolts.

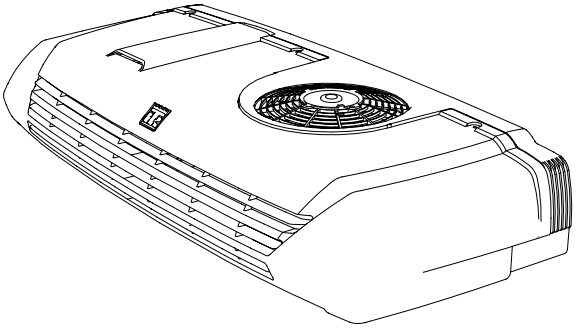


Figure 38: Condenser

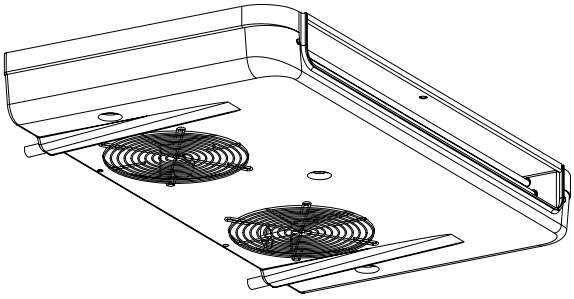


Figure 39: Evaporator

Clutch Maintenance

Clutch Test

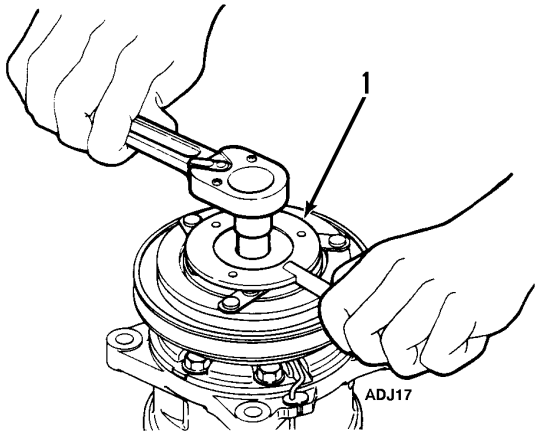
1. If the field coil lead wire is broken, replace the field coil.
2. Check the amperage and voltage. The amperage range should be 3.6 to 4.2 amps at 12 volts or 1.8 to 2.1 amps at 24 volts. Note the following symptoms and conditions.
   a. A very high amperage reading—a short within the field coil.
   b. No amperage reading—an open circuit in the winding.
   c. An intermittent or poor system ground results in lower voltage at the clutch. Check for tight fit of the coil retaining snap ring or coil retaining screws for good ground.
   d. Replace field coil if it has an open or short circuit.
3. Air Gap—An incorrect air gap could cause erratic engagement or disengagement and/or clutch rattle. Check the air gap with a feeler gauge (0.01 to 0.02 in. [0.3 to 0.6 mm]).

Clutch Removal

NOTE: Make sure the proper tools are available before performing maintenance procedures. Refer to the tool listing at the end of this chapter for tools required. Contact your local Thermo King dealer for further information.

Removal

1. Remove the center bolt using the puller arbor (P/N 204-804) to prevent drive plate rotation.



1.	Holder

Figure 40: Remove Center Bolt

2. Remove the drive plate using the shaft seal kit (P/N 204-805). Then remove the shims from either the drive shaft or the drive plate.

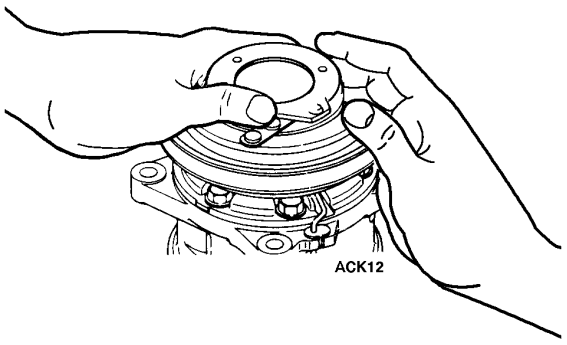
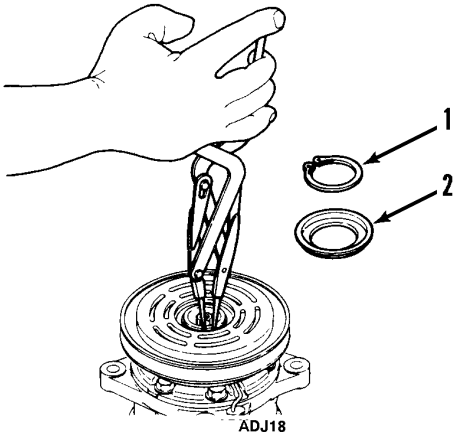


Figure 41: Remove Drive Plate

3. Remove the snap ring using external snap ring pliers (P/N 204-808).
4. Remove the cover



1.	Snap Ring
2.	Cover

Figure 42: Remove Snap Ring and Cover

5. Remove the pulley assembly using the clutch remover (P/N 204-806) and the spacer positioned on the cylinder head hub.

   NOTE: To avoid damaging the pulley groove, the pulley claws should be hooked into (NOT UNDER) the pulley groove.

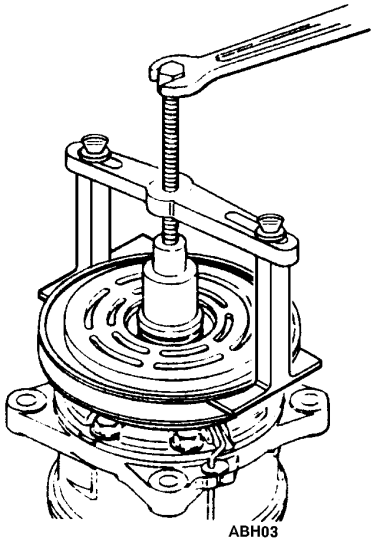


Figure 43: Remove Pulley

6. Remove the coil's lead wire from the holder on the top of the compressor.
7. Remove the three screws that attach the coil to the compressor and remove the coil.

   NOTE: DO NOT hold the coil by the lead wire.

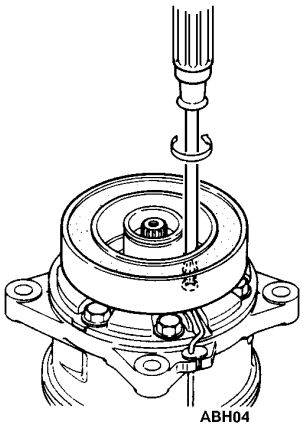


Figure 44: Remove Coil

Inspection

1. **Drive Plate**

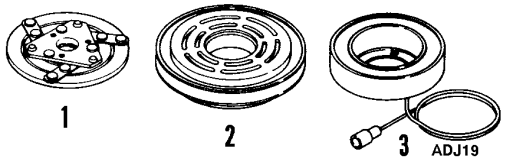
   If the contact surface is scorched, the drive plate and pulley should be replaced.

2. **Pulley Assembly**

   Inspect the appearance of the pulley assembly. If the pulley's contact surface is excessively grooved due to slippage, both the pulley and drive plate must be replaced. There should also be no foreign matter, such as oil or grit, lodged between the clutch plate and pulley. Thoroughly clean these contact surfaces and the drive plate.

3. **Coil**

   Inspect the coil for a loose connector or cracked insulation. If the insulation is cracked, replace the coil. If the field coil lead wire is broken, replace the field coil.



1.	Drive Plate
2.	Pulley Assembly
3.	Coil

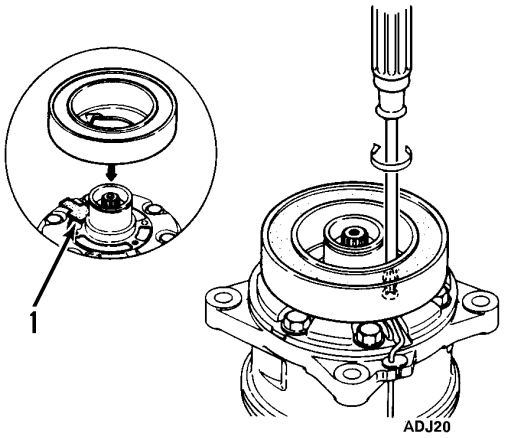
Figure 45: Inspect Components

Clutch Installation

NOTE: Before installation refer to "Inspection" above.

1. Confirm that the felt is installed on the front of the cylinder head.
2. Install the coil on the compressor (with the lead wire on top). At this time, confirm that the coil's concave portion is aligned with the felt and then tighten the mounting screws to the specified torque.

   NOTE: Specified torque: 2.9 to 4.3 ft-lbs (3.9 to 0.6 N•m).
3. Install the lead wire in the wire holder on the compressor.



1.	Felt

Figure 46: Install Coil

4. Install the pulley assembly using the compressor holder (P/N 204-807) and a hand press.

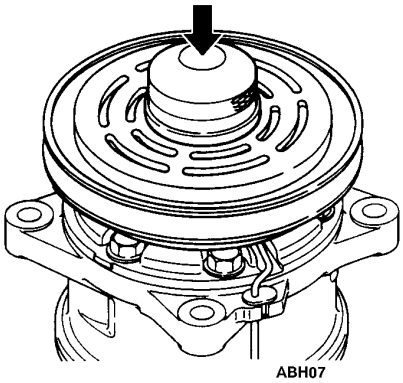
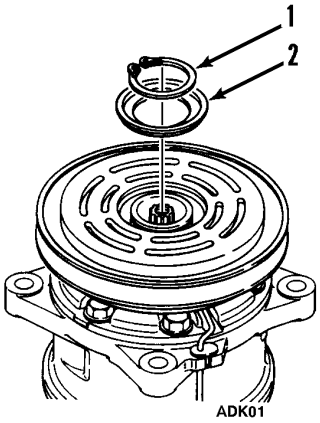


Figure 47: Install Pulley

5. Install the cover and the snap ring using external ring pliers (P/N 204-808).

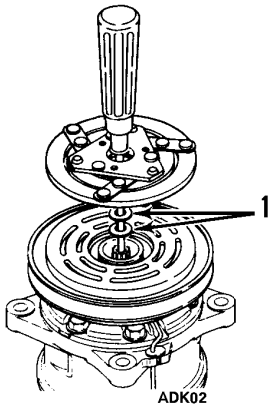
   NOTE: When installing the snap ring, the chamferred inner edge of the snap ring should face upward.



1.	Snap Ring
2.	Cover

Figure 48: Install Cover and Snap Ring

6. Install the driver plate on the drive shaft, together with the original shim(s). Press the drive plate down by hand.



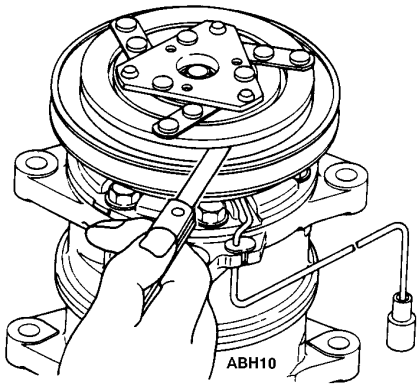
1.	Shims

Figure 49: Install Shims and Drive Plate

7. Tighten the bolt to the specified torque using the puller arbor (P/N 204-804) to prevent drive-plate rotation.

   NOTE: Specified torque: 8.7 to 10.1 ft-lbs (11.8 to 13.7 N•m).

   After tightening the bolt, ensure that the pulley rotates smoothly.



8. Ensure that the clutch clearance is as specified. If necessary, adjust the clearance using shims.

   Adjusting shims are available in the following thicknesses:

Shim P/N	Thickness
11-8031	0.004 in. (0.1 mm)
11-8032	0.012 in. (0.3 mm)
11-8033	0.020 in. (0.5 mm)

   NOTE: Specified clearance: 0.01 to 0.02 in. (0.3 to 0.6 mm).

   Check Clearance

Electrical Connection

1. Connect the lead wire to the electrical circuit.

   NOTE: The stationary field is grounded at the factory; therefore, it is necessary only to connect the hot (lead) wire.

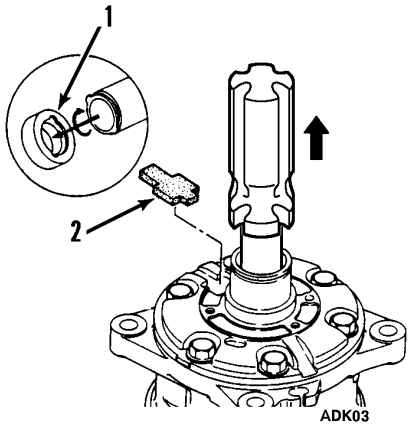
2. Engage and disengage the clutch several times to check the clutch engagement. The disc should snap firmly against the pulley.

Shaft Seal Cover and Shaft Seal: Removal And Installation

Removal

1. Remove the magnetic clutch assembly.
2. Remove the felt pad.
3. Use the seal remover (from the shaft seal kit P/N 204-805) to remove the shaft seal cover. Turn the seal remover to engage the hook on the seal remover with the hook on the shaft seal cover, then slowly pull the shaft seal cover out of the cylinder head.

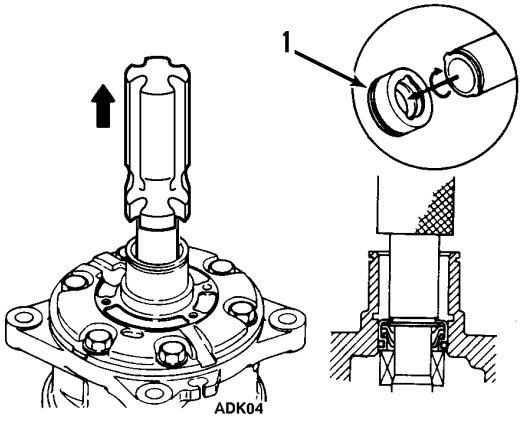
NOTE: The shaft seal cover SHOULD NOT be reused. Always use a new shaft seal cover when reassembling a compressor.



1.	Shaft Seal Cover
2.	Felt Pad

Figure 50: Remove Shaft Seal Cover

4. Use the seal remover (from the shaft seal kit P/N 204-805) to remove the shaft seal. Turn the seal remover to engage the hook on the seal remover with the hook on the shaft seal, then slowly pull the shaft seal out of the cylinder head.



1.	Shaft Seal

Figure 51: Remove Shaft Seal

Inspection

The shaft seal should not be reused. Always use a new shaft seal when reassembling a compressor. Be extremely careful to make sure the lip of the shaft seal that is being installed is not scratched or

damaged in any way. Make sure the shaft seal is free from lint and dirt that could damage the shaft seal surface.

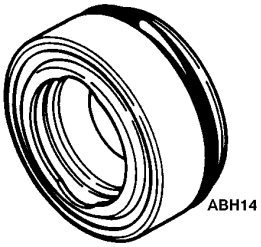
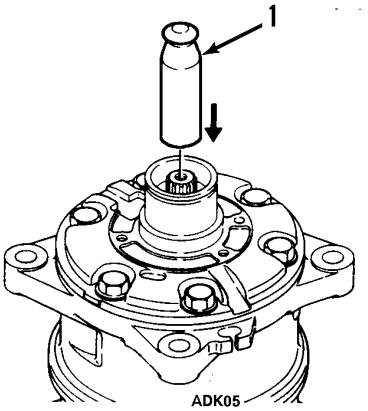


Figure 52: Inspect Shaft Seal

Shaft Seal Installation

Before installing a shaft seal inspect it carefully (see “Inspection” above).

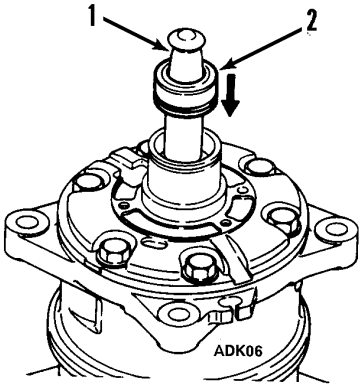
1. Clean the section of the front cylinder head that holds shaft seal.
2. Apply clean compressor oil to the new shaft seal and to the front cylinder head. If the slip surfaces are dirty, clean them with thinners, dry the clean surfaces and apply clean compressor oil.
3. Place the seal guide (from the shaft seal kit P/N 204-805) on the end of the shaft.



1.	Seal Guide

Figure 53: Place Guide on Shaft

4. Place the shaft seal on the seal guide and slide the seal into the cylinder head.



1.	Seal Guide
2.	Shaft Seal

Figure 54: Place Shaft Seal on Guide

5. Use the seal installer (from the shaft seal kit P/N 204-805) to press the shaft seal into the cylinder head as far as possible.
6. Remove the seal guide from the shaft.

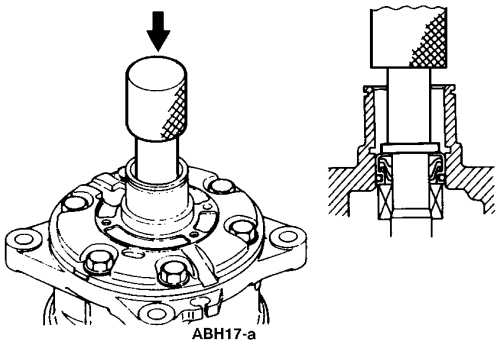


Figure 55: Press Seal Into Cylinder Head

7. Place the seal guide (from the shaft seal kit P/N 204-805) on the end of the shaft.

8. Place the shaft seal cover on the seal guide and slide the shaft seal cover into the cylinder head.

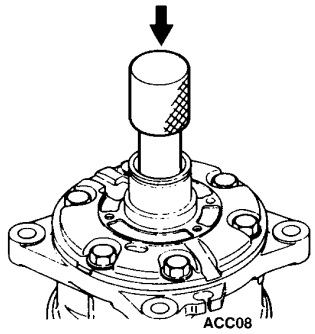


Figure 56: Install Shaft Seal Cover

9. Use the seal installer (from the shaft seal kit P/N 204-805) to press the shaft seal cover into the cylinder.
10. Remove the seal guide from the shaft.

NOTE: Position the shaft seal cover as shown in the illustration. The felt pad should also be replaced with a new one when the shaft seal is replaced.

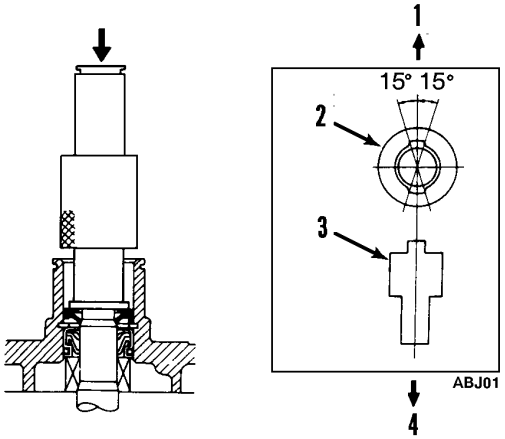


Figure 57: Proper Shaft Seal Cover Position

Special Tools

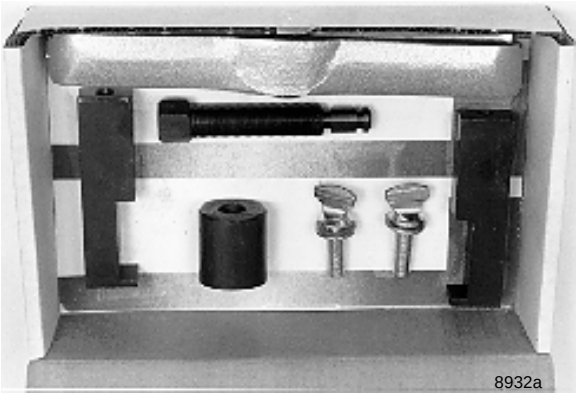


Figure 58: Clutch Remover P/N 204-806

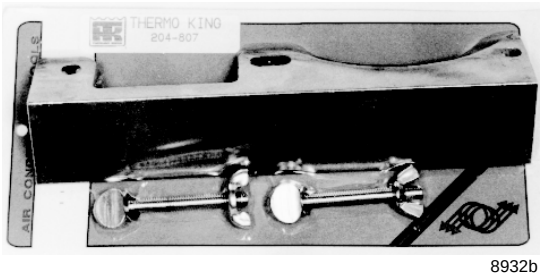
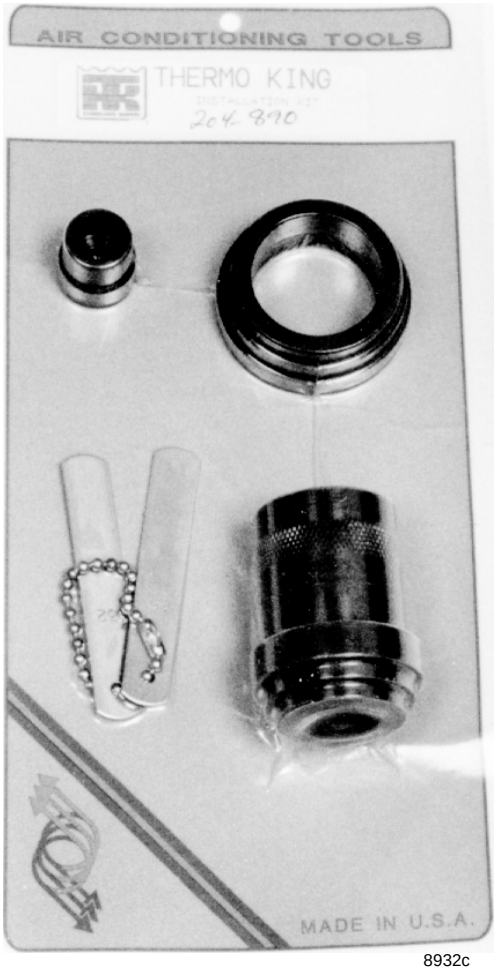


Figure 59: Compressor Holder P/N 204-807



8932c

Figure 60: Clutch Installation Kit P/N 204-890

8932d

Figure 61: Snap Ring Pliers P/N 204-808

8932e

Figure 62: Shaft Seal Kit P/N 204-805

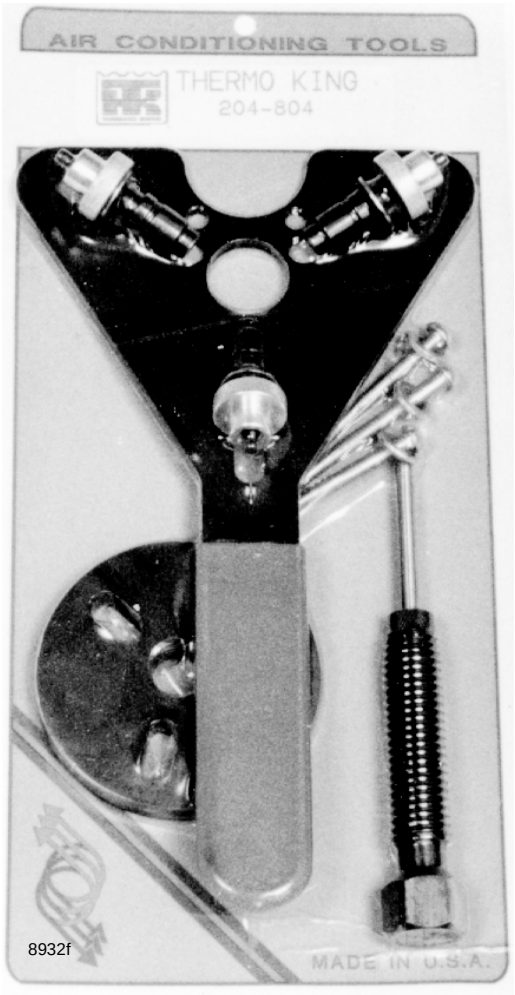


Figure 63: Pulley Arbor P/N 204-804

System Compressor and Oil

Installation of the Compressor

The compressor is mounted in the engine compartment. The side to side mounting angle of the compressor must remain ± 45° from the horizontal. The forward to backward angle must be within ± 10° of horizontal.

Each compressor comes with a standard charge of Polyol Ester (POE) oil inside. This quantity of oil is enough to supply the compressor lubrication when it is installed into an already “oil wet” system. New systems require an extra quantity of oil be added to “wet” all the interior surfaces of the system.

During normal operation there is always a quantity of oil that travels around inside the system. This oil lubricates all the components, returns to the compressor for a while, and again travels around the system.

Adding Extra Oil to the System

The initial oil charge into a new system is based on the size of the system and the amount of oil, which remains in the compressor during operation.

The correct oil to use in a unit using R-134a or R-404A is Polyol Ester (POE) oil (P/N 203-413). Any extra or replacement oil should be placed into the system at the receiver tank port.

CAUTION: keep all oil containers tightly sealed from the air. oil tends to absorb moisture fro the air and can become contaminated if left open. If contaminated oil is put into a system, it may damage the components of the system.

Major Loss of Refrigerant

In case of a major loss of refrigerant, it must be assumed that some system oil is lost also. The oil level should be verified. Refer to the following, “Checking the Oil Level” for details.

Checking the Oil Level

Drain the Oil

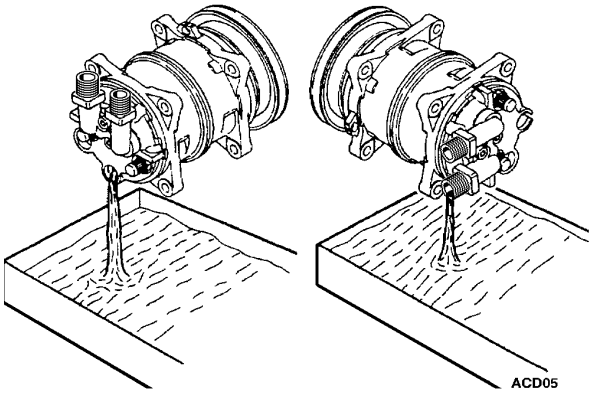
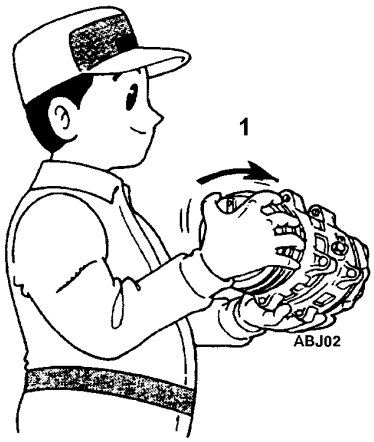


Figure 64: Draining the Oil

Remove the compressor from the unit and drain the oil from the compressor drain plug and all other ports. Turn the clutch (rotating the internal compressor parts) by hand and drain oil again. Repeat until all oil is removed from the compressor. Measure the oil removed from the compressor. Also, inspect the oil for signs of contamination.



Oil contamination.

1. Dirt in the oil.
2. Color changed to a varnish color.
3. Presence of foreign substances, metal shavings, etc. in the oil.

NOTE: Always replace oil with new fresh oil taken from a sealed container only.

NOTE: Always replace the system filter drier anytime the system has been opened for service.

When a System Becomes Contaminated

A severely contaminated system may be indicated by black oil in the compressor. If severe contamination occurs, it will be necessary to flush the complete system. If flushing is required, use industry approved materials.

In all cases when this occurs you must determine the extent of contamination. Do this by removing the filter-drier and determine if the darker colored oil is present at that point of the system too. If it is, flushing the system is recommended.

If the oil appears clean at the filter drier, install a new filter drier and replace the compressor with clean new oil. Refer to checking and draining the compressor oil section for details.

CAUTION: Any extra or replacement oil should be placed into the system at the receiver tank port.

Belt Tensions

Engine Driven Compressor Belt and Pulleys

Correct pulley alignment and proper belt tension are very important factors in compressor installation. The compressor clutch must be perfectly aligned with the engine pulley and any auxiliary idler or belt adjustment pulley components. When installing the clutch, be sure the shaft drive key is in place and the shaft bolt is properly tightened. Check the pulley alignment by holding a 24 to 35 in. (60 to 90 cm) long rod, 0.5 in.(13 mm) in diameter firmly into the V-groove of the clutch pulley and make sure the rod aligns squarely with the engine drive pulley groove. Double check by making sure the belt goes from pulley to pulley in perfect alignment with no indication of a sideward bend.

Adjust the belt tension to 58 to 60 on TK Gauge P/N 204-427. Check the belt tension again after 36 to 48 hours of initial operation of the unit because the belt may stretch slightly during the first hours of use. Remember, good alignment and proper belt tension ensure long belt life.

Electric Standby Compressor Belt

Loosen the four mounting bolts on the end of the electric motor. Move electric motor (rotate it on the gyrator axis) to obtain a belt tension of 58 to 60 on TK Gauge P/N 204-427. Tighten the electric motor mounting bolts and recheck the belt tension. Readjust the belt tension if necessary. Check the belt tension again after 36 to 48 hours of initial operation of the unit because the belt may stretch slightly during the first hours of use.

If desired box temperature cannot be obtained during engine driven compressor operation, any of the following may be indicated:

EXCESSIVE HEAT LOAD: An excessive heat load on the system will be caused by too many, or excessively long, stops with the doors open. Excessive heat loads will also be caused by loose doors, loose body panels, warm loads and poor insulation.

DIRT ON COILS: Dirt on the condenser or evaporator coil acts as an insulator reducing the capacity of the unit.

INCORRECT BELT TENSION: If the drive belt is not correctly tensioned, the compressor will not be driven at proper speed, and unit efficiency will be reduced. By contrast, too much tension will place an additional load on the bearings causing rapid wear.

SHORTAGE OF REFRIGERANT: Shortage of refrigerant reduces capacity of the unit. Find and remedy the cause of the shortage and recharge the system. DO NOT operate the unit if there is an indication of low charge.

FAULTY EXPANSION VALVE ADJUSTMENT: High superheat settings will starve the evaporator causing low suction pressure. Low superheat settings will flood the coil causing high suction pressure. The superheat setting should be adjusted ONLY by a trained refrigeration serviceman.

EXCESSIVE OIL: Too much compressor oil in the system may result in lower than normal suction pressure as well as lowered capacity.

MOISTURE IN THE SYSTEM: Symptom: Expansion valve freeze-up—will not refrigerate. Usually this can be checked by warming the expansion valve with either the hand or hot towels to see if the valve opens. Evacuate the system in the same manner used during installation. Install a new drier.

EXPANSION VALVE LOSES ITS CHARGE: If the expansion valve loses its charge, the valve will close causing the system to go into vacuum. Replace the valve.

AIR IN SYSTEM: Air is not condensable. Its presence in the system increases head pressure. When the compressor is stopped, air will gather at the high point of the high side. Reclaim the refrigerant, evacuate the system to 500 microns and recharge with the proper amount of refrigerant.

TEMPERATURE OF THE LIQUID LINE: During normal operation, the liquid line will be slightly warmer than surrounding air. An extremely hot line indicates either shortage of refrigerant or lack of a liquid seal at the receiver outlet. A cold line indicates a restriction, and some flashing takes place in the liquid line sight glass.

DIRTY OR WET FILTER DRIER: If the outlet line of the filter drier is colder than the inlet line, the filter is either saturated with moisture or is dirty and must be replaced.

DIRT IN THE EXPANSION VALVE SCREEN:

Reclaim the refrigerant charge, remove the screen and clean. Moisture is in the system will collect at the expansion valve and freeze. This is indicated by abnormally low suction pressure. Replace the drier, dry the system and recharge.

ICE ON THE EVAPORATOR COIL: Note operation under DEFROST CYCLE.

AIR FLOW: Do not load product directly in front of the air return or discharge. Insure that the fan is correctly positioned in the orifice to achieve maximum air flow.

COMPRESSOR LIFE: The following will shorten the life of the compressor:

- Operating a contaminated system
- No oil trap
- Clogged oil separator (JetLube™)
- Clogged liquid injection orifice (JetCool™)
- Defective liquid injection switch (JetCool™)
- Insufficient oil charge
- Wrong or mixed oil
- Lack of compressor lubrication on installation and startup
- Excessive compressor speed (maximum speed 3,000 rpm)

Electric Standby Mechanical Diagnosis

Condition	Possible Cause	Remedy
Compressor does not run	Improperly wired	Check wiring against diagram
	Low line voltage	Check line voltage, determine location of voltage drop
	Relay contacts not closing	Check by operating manually. Replace relay if defective
	Fuses blown	Replace fuses
	Open circuit in motor winding	Check stator leads
	High pressure cutout open	Eliminate cause of excessive pressure
	Thermostat faulty	Repair or replace
	Compressor faulty	Replace compressor
	Shortage of refrigerant	Recharge
	Low pressure cutout open	Recharge leak test
	Overload relay open	Locate overload, reset
Unit short cycles	Shortage of refrigerant (low pressure cutout)	Repair leak and recharge
	Restricted expansion valve	Clean expansion valve
	Refrigerant overcharge (high pressure cutout)	Remove excess charge
	Cycling on high pressure cutout	Check air flow and fan
	Dirty condenser coil	Clean coil

Condition	Possible Cause	Remedy
Unit operates long or continuously	Shortage of refrigerant	Repair leak and recharge
	Discharge valve leaking	Replace leak
	Thermostat faulty	Repair or replace
	Dirty condenser	Clean condenser
	Air in system	Evacuate and recharge system
	Compressor inefficient	Replace compressor
	Plugged expansion valve	Clean expansion valve
	Iced or plugged coil	Defrost or clean coil
	Defective truck body insulation	Correct or replace
	Too many door openings	Keep doors closed, install plastic curtains
	Load too warm	Precool hot product
	Excessive superheat at expansion valve	Adjust superheat
	Door seals worn	Repair/replace
Box temperature too high	Refrigerant shortage	Repair leak and recharge
	Thermostat setpoint too high	Reset thermostat
	Expansion valve or strainer plugged	Clean or replace
	Restricted lines	Clean restriction. Tubing pinched shut
	Hot load	Precool hot product
	Expansion valve superheat too high or too low	Adjust superheat
Head pressure too high	Refrigerant overcharge	Remove excess
	Air in system	Evacuate and recharge system
	Dirty condenser	Clean
	Restricted condenser	Clean condenser
	Condenser fan not running	Check fan motor
	Condenser fan rotation	Check fan motor polarity

Condition	Possible Cause	Remedy
Head pressure too low	Refrigerant shortage	Repair leak and recharge
	Compressor suction or discharge valve inefficient	Replace valve
Noisy unit	Insufficient compressor oil	Add oil to proper level
	Mounting bolts loose	Tighten
	Refrigerant flooding back	Adjust oil level or refrigerant charge. Check expansion valve for proper superheat
Compressor loses oil	Shortage of refrigerant	Repair leak and recharge
	Plugged expansion valve or strainer	Clean expansion valve
	Wrong oil viscosity	Use proper oil
	Short cycling	Refer to unit “short cycling”
	Superheat too high	Adjust expansion valve
Frosted or sweating suction line	Expansion valve set too low, admitting excess refrigerant	Adjust expansion valve
Hot liquid line	Shortage of refrigerant	Repair leak and recharge
	Condenser fan not running	Check fan motor
	Dirty condenser coil	Clean condenser
Frosted liquid line	Restricted dehydrator or strainer	Replace restricted part
Condenser coil is cool when unit is in cool operation	Refrigerant undercharge	Repair leak and recharge
	Compressor inefficient	Replace compressor
Unit in vacuum. Frost expansion valve only	Ice plugging expansion valve orifice	Apply hot wet cloth to expansion valve. Moisture indicated by increase in suction pressure. Replace drier
	Plugged expansion valve strainer	Clean strainer
	Sensor bulb lost charge	Replace expansion valve

Electric Standby Service Checks

1.Compressor does not run.	a.Check for power at source. b.Check for power at plug. c.Check for power at compressor contactor. d.Check for power at overload terminals (contactor closed). e.Check for power at motor terminals.
2.Power at compressor terminals but motor does not run.	a.Replace compressor.
3.Compressor hums but does not run.	a.Check for locked rotor. b.Check for worn bearings. Replace if necessary. c.Check for locked compressor and repair. d.Check power source for single phasing (on three phase units). e.Check capacitors (on single phase units). f.Check start relay.
4.Check transformer.	a.Check for power output.
5.Check rectifier.	a.Check for rectifier output.

Refrigeration Diagnosis Chart

Unit Not Heating	Rapid cycling	Unit cools in defrost cycle	High head pressure	Low head pressure	No head pressure	High suction pressure	Low suction pressure	No suction pressure	Unit operating in vacuum	Sight glass / empty	Suction line frosting back	Noisy compressor	Unit not refrigerating	Unit not defrosting	SYMPTOM / POSSIBLE CAUSES
			•									•			Overcharge of refrigerant
				•	•		•		•	•			•	•	Shortage of refrigerant
				•	•				•	•	•	•	•	•	No refrigerant
			•												Air through condenser too hot (ambient)
			•												Air flow through condenser restricted (dirty)
				•			•								Air through condenser too cold (ambient)
			•									•	•		Air in refrigerant system
			•												Condenser fan blades bent or broken
	•														Air short cycling around evaporator coil
							•		•	•	•				Air through evaporator restricted
							•		•	•	•	•	•		Evaporator needs defrosting
					•								•		Broken compressor belt
				•											Compressor discharge valves leaking
							•					•	•		Too much compressor oil in system
												•			Loose compressor pulley
												•			Compressor bearing loose or burned out
				•		•						•	•		Broken valve plate in compressor
							•		•			•	•		Expansion valve power element lost its charge
						•						•	•		Expansion valve feeler bulb improperly mounted
						•					•		•		Expansion valve feeler bulb making poor contact
						•				•	•		•		Expansion valve open too much
							•						•		Expansion valve closed too much
						•					•		•		Expansion valve needle eroded or leaking
				•			•		•				•		Expansion valve partially closed by ice, dirt or wax
		•													Hot gas solenoid stuck open
•															Water valves not open
•															Water pump not working.
•															Truck engine not running
						•					•	•	•		Liquid refrigerant entering compressor
							•		•				•		Restricted line on the low side
			•						•						Restricted line on the high side
							•		•				•		Restricted dehydrator
	•			•											Reverse fan rotation
		•				•							•	•	Faulty pilot solenoid
		•												•	Loose or broken electrical connections
						•	•	•	•						Gauge out of calibration
			•												Condenser fan motor not operating
•							•		•		•	•	•		Evaporator fan motor not operating

Index

Diagram Index

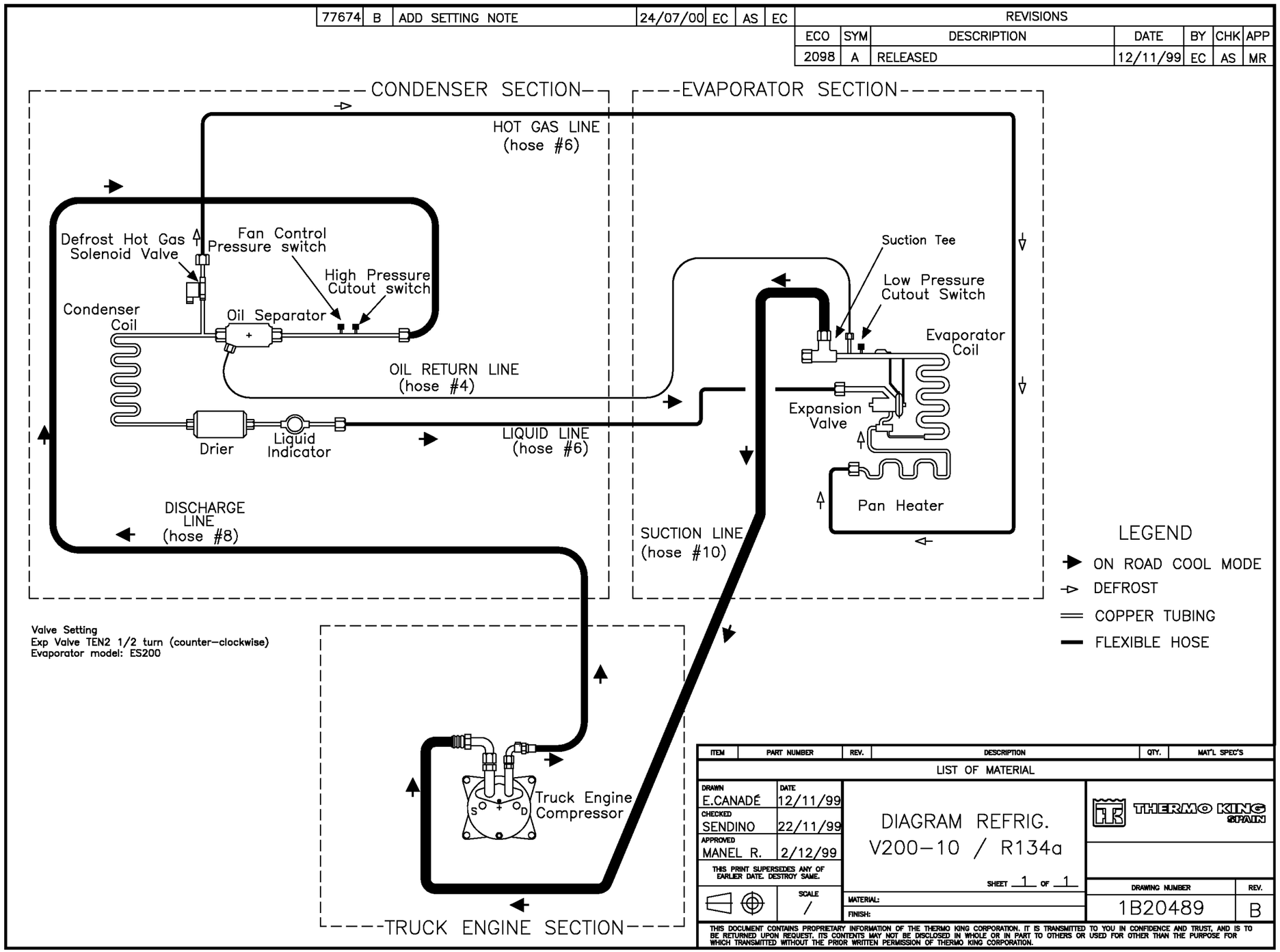
***Drawings included in this section reflect NAD units only. Pages not included do not apply to these NAD units.**

V200-10/R134a Refrigeration Diagram

77674	B	ADD SETTING NOTE	24/07/00	EC	AS	EC

REVISIONS

ECO	SYM	DESCRIPTION	DATE	BY	CHK	APP
2098	A	RELEASED	12/11/99	EC	AS	MR



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

LIST OF MATERIAL

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CHECKED: SENDINO	22/11/99
APPROVED: MANEL R.	2/12/99

THIS PRINT SUPERSEDES ANY OF EARLIER DATE. DESTROY SAME.

SCALE: /

DIAGRAM REFRIG.
V200-10 / R134a

SHEET 1 OF 1

MATERIAL:

FINISH:

THERMO KING SPAIN

DRAWING NUMBER	REV.
1B20489	B

V-200/V-300 Condenser Outline Drawing

REVISIONS						
ECO	SYM	DESCRIPTION	DATE	BY	CHK	APP
1727	A	RELEASED	01/03/99	RI	LG	MR
77244	B	CHANGED DRAWING NAME ADD NOTES & VIEW	03/01/00	RI	EC	LG
79516	C	UPDATE VIEWS & CHANGE DRAWING DESCRIPTION	14/03/01	JL	EC	MR
502833	D	ADD VIEW & DIMENSIONS	30-Jul-02	CM	JT	MR

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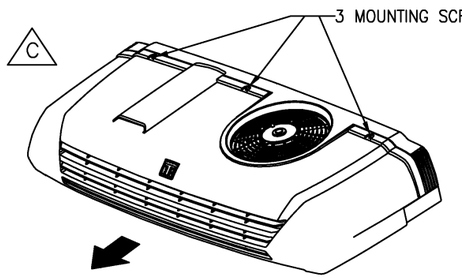
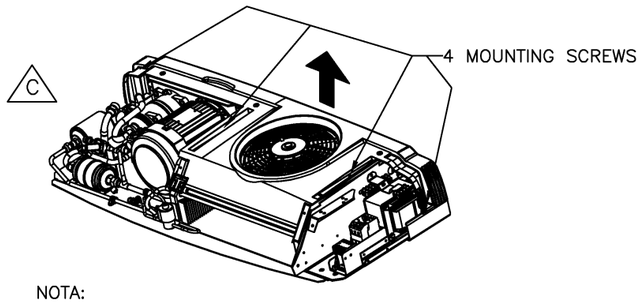


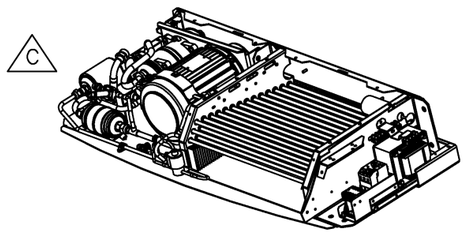
2 REMOVE THE COIL CANALIZER (Remove the fan connector)

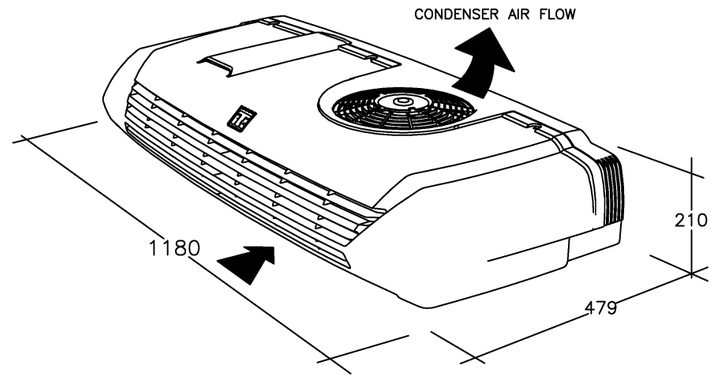


B
NOTA:
El aspecto y los componentes de la unidad pueden variar dependiendo del modelo en concreto

NOTA:
The components and the unit look's can changed depending on the model

3 UNIT READY TO FIX IT





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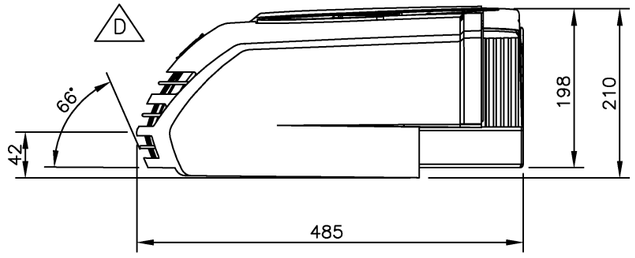

ITEM	PART NUMBER	REV.	DESCRIPTION	QTY.	MAT'L SPEC'S

LIST OF MATERIAL

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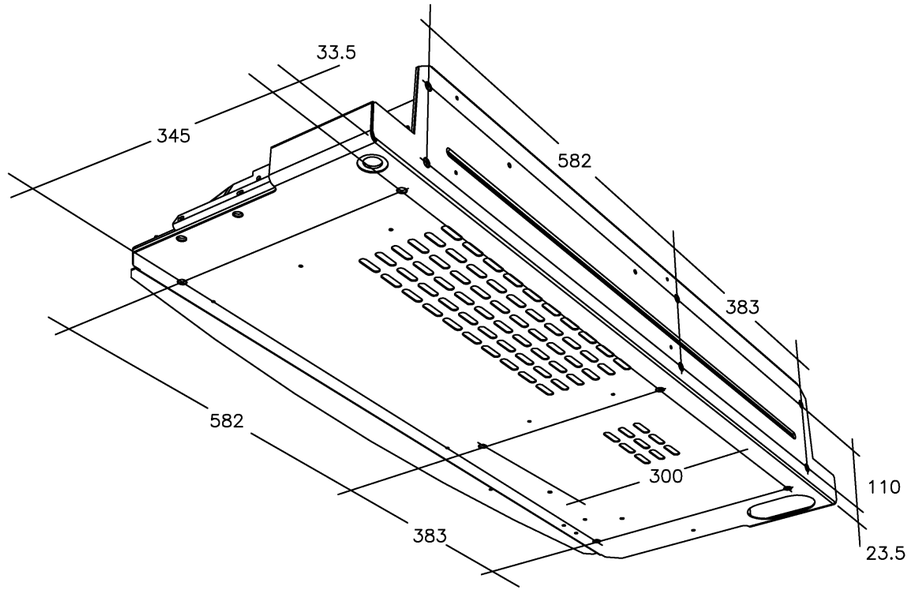
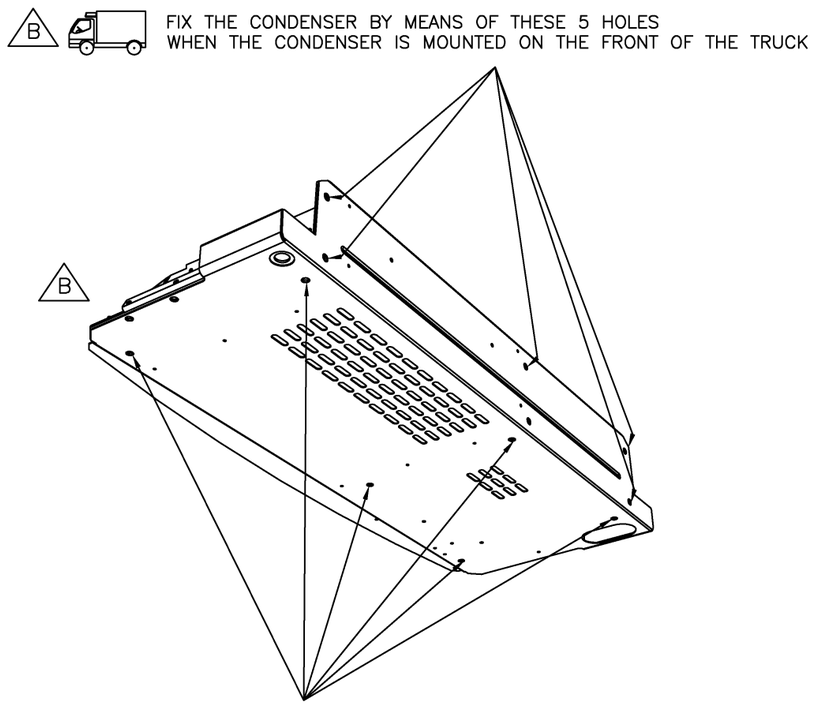
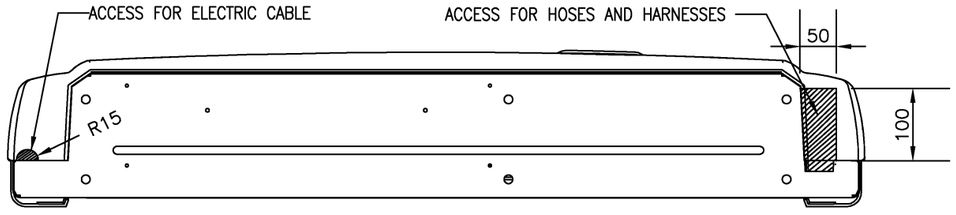
CHECKED LORENZO	16/03/99		.
APPROVED MANEL R.	16/3/99	SHEET 1 OF 2	DRAWING NUMBER 1B19462 / REV. D
THIS PRINT SUPERSEDES ANY OF EARLIER DATE. DESTROY SAME.		MATERIAL: .	
	SCALE ./.	FINISH: .	

V-200/V-300 Condenser Outline Drawing





WHEN THE CONDENSER IS MOUNTED ON THE FRONT OF THE TRUCK (A NON–ROOF MOUNTING);
THE SHADED MATERIAL MUST BE REMOVED FROM THE COVER AS SHOWN:



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

LIST OF MATERIAL

DRAWN R. IBAÑEZ	DATE 16/02/99
CHECKED LORENZO	16/03/99
APPROVED MANEL R.	16/3/99

THIS PRINT SUPERSEDES ANY OF EARLIER DATE. DESTROY SAME.

SCALE ./.

OUTLINE DRAWING
CONDENSER
V–200 / V–300

SHEET 2 OF 2

MATERIAL: .

FINISH: .

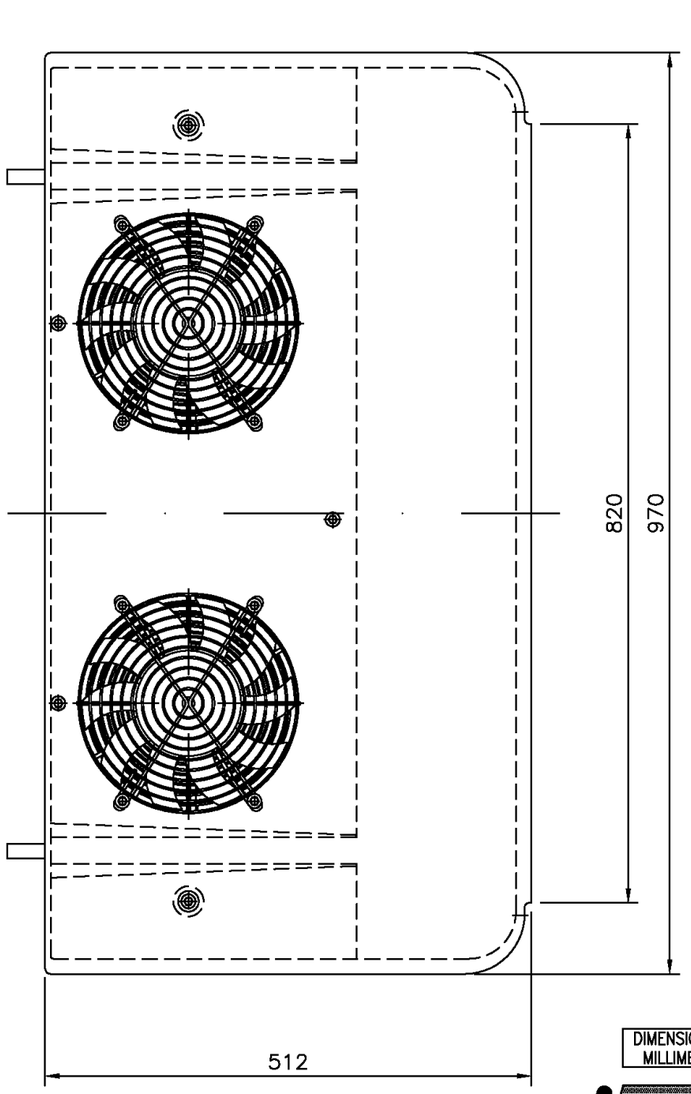
THERMO KING SPAIN

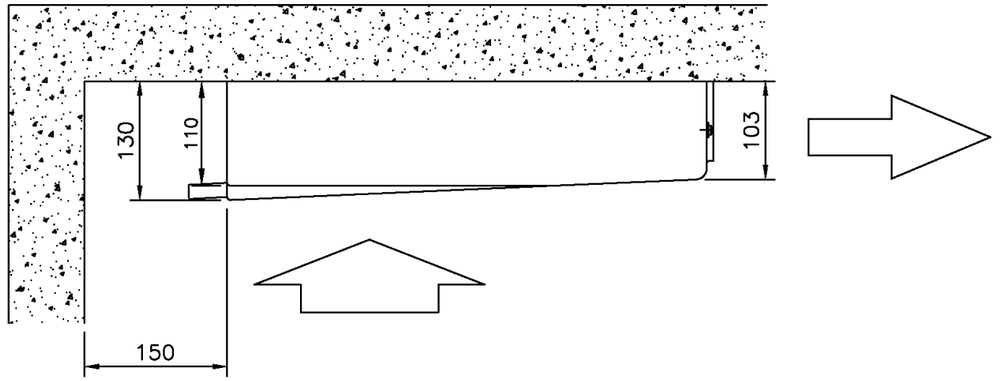
.

DRAWING NUMBER	REV.
1B19462	D

ES200 & ES200 MAX Evaporators Outline Drawing

REVISIONS						
ECO	SYM	DESCRIPTION	DATE	BY	CHK	APP
1727	A	RELEASED	01/03/99	RI	LG	MR
78379	B	CHNG. DESCP. ES200&ES200MAX	25.Oct.00	LG	EC	MR
WAS E970; ADD: OIL RETURN CONNECTION, NOTE DIM. IN MM; UPDATE: POSITION LPCO AND ADD NOTES						





DIMENSIONS IN MILLIMETERS

THIRD ANGLE PROJECTION

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

LIST OF MATERIAL

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CHECKED: LORENZO G	16.Mar.00
APPROVED: MANEL R	16.Mar.00
THIS PRINT SUPERSEDES ANY OF EARLIER DATE. DESTROY SAME.	
SCALE: 1/5	

OUTLINE DRAWING
EVAPORATORS
ES200&ES200MAX

SHEET 1 OF 2

MATERIAL:

FINISH:

THERMO KING SPAIN

DRAWING NUMBER	REV.
1B19463	B

ES200 & ES200 MAX Evaporators Outline Drawing

REVISIONS						
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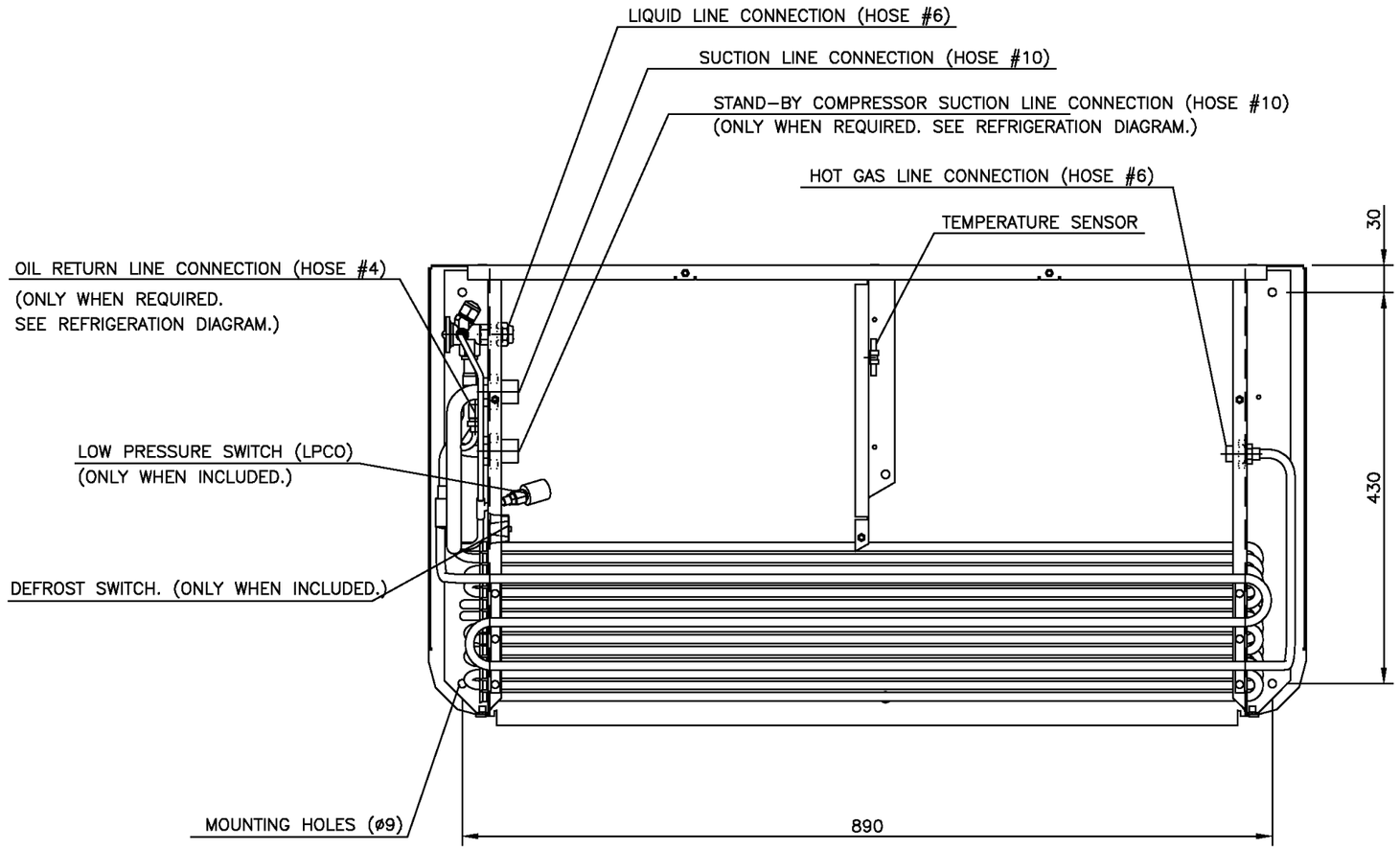

WEIGHT: 14.5 kg

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

LIST OF MATERIAL

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CHECKED: LORENZO G	16.Mar.00
APPROVED: MANEL R	16.Mar.00
THIS PRINT SUPERSEDES ANY OF EARLIER DATE. DESTROY SAME.	
SCALE: 1/5	

OUTLINE DRAWING
EVAPORATORS
ES200&ES200MAX

SHEET 2 OF 2

MATERIAL:

FINISH:

THERMO KING SPAIN

DRAWING NUMBER	REV.
1B19463	B

DIMENSIONS IN MILLIMETERS

THIRD ANGLE PROJECTION

V200-20/R134a Refrigeration Diagram

REVISIONS						
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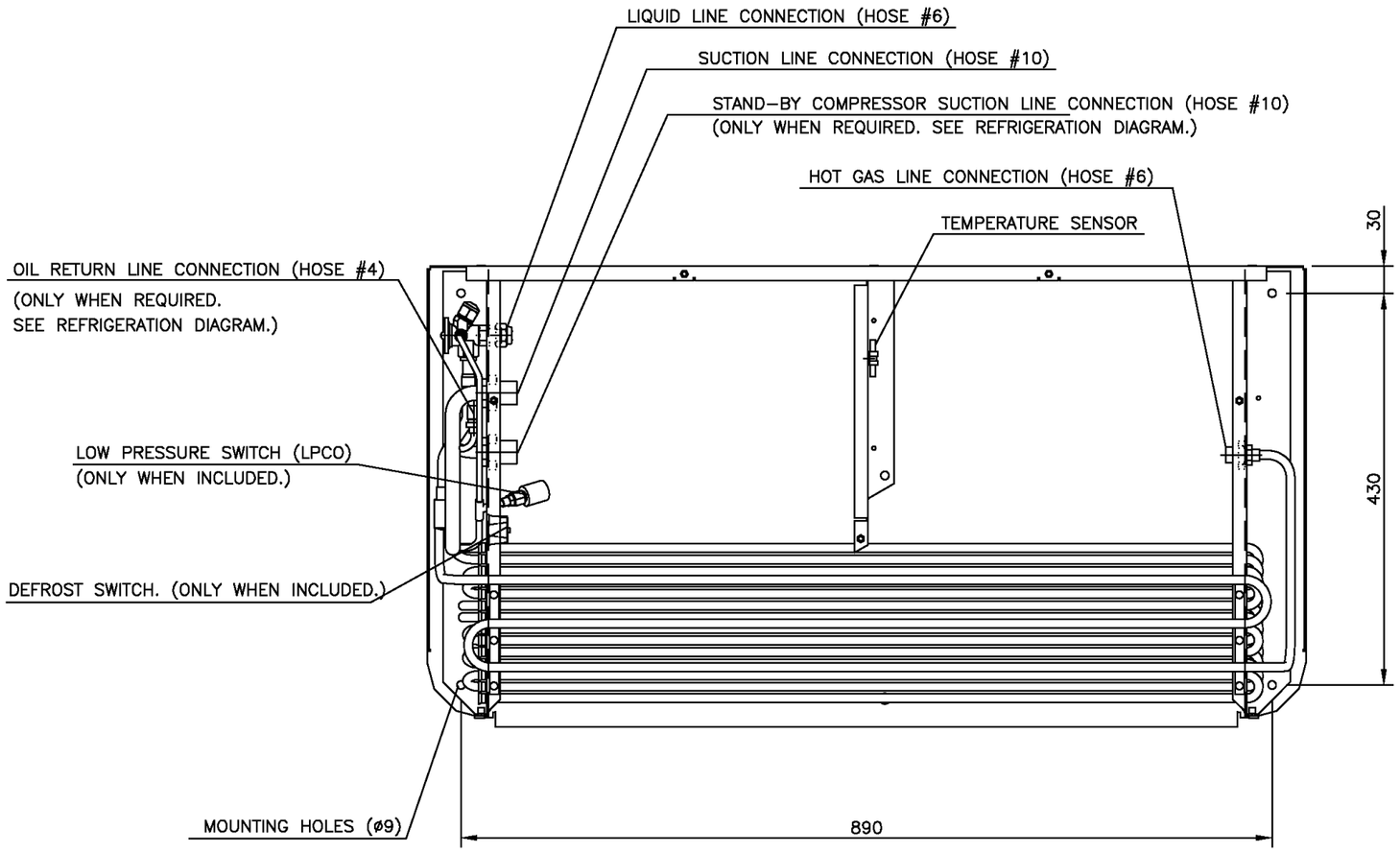

WEIGHT: 14.5 kg

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

LIST OF MATERIAL

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CHECKED: LORENZO G	16.Mar.00
APPROVED: MANEL R	16.Mar.00
THIS PRINT SUPERSEDES ANY OF EARLIER DATE. DESTROY SAME.	
SCALE: 1/5	

OUTLINE DRAWING
EVAPORATORS
ES200&ES200MAX

SHEET 2 OF 2

MATERIAL:

FINISH:

THERMO KING SPAIN

DRAWING NUMBER	REV.
1B19463	B

DIMENSIONS IN MILLIMETERS

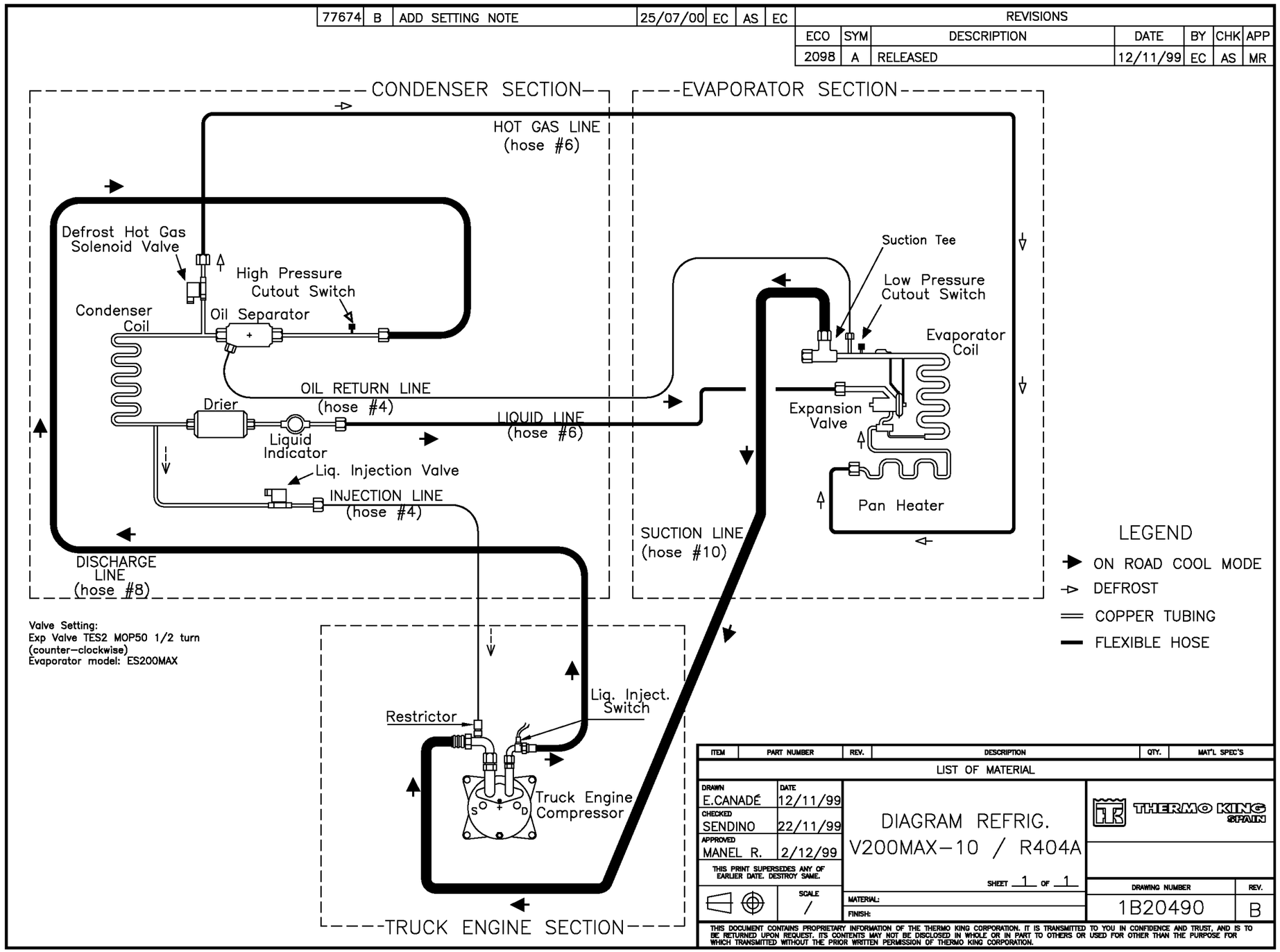
THIRD ANGLE PROJECTION

V200 MAX-10/R404A Refrigeration Diagram

77674	B	ADD SETTING NOTE	25/07/00	EC	AS	EC

REVISIONS

ECO	SYM	DESCRIPTION	DATE	BY	CHK	APP
2098	A	RELEASED	12/11/99	EC	AS	MR



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

LIST OF MATERIAL

DRAWN: E.CANADÉ	DATE: 12/11/99
CHECKED: SENDINO	22/11/99
APPROVED: MANEL R.	2/12/99

THIS PRINT SUPERSEDES ANY OF EARLIER DATE. DESTROY SAME.

SCALE: /

DIAGRAM REFRIG.
V200MAX-10 / R404A

SHEET 1 OF 1

MATERIAL:

FINISH:

THERMO KING SPAIN

DRAWING NUMBER	REV.
1B20490	B

REVISIONS						
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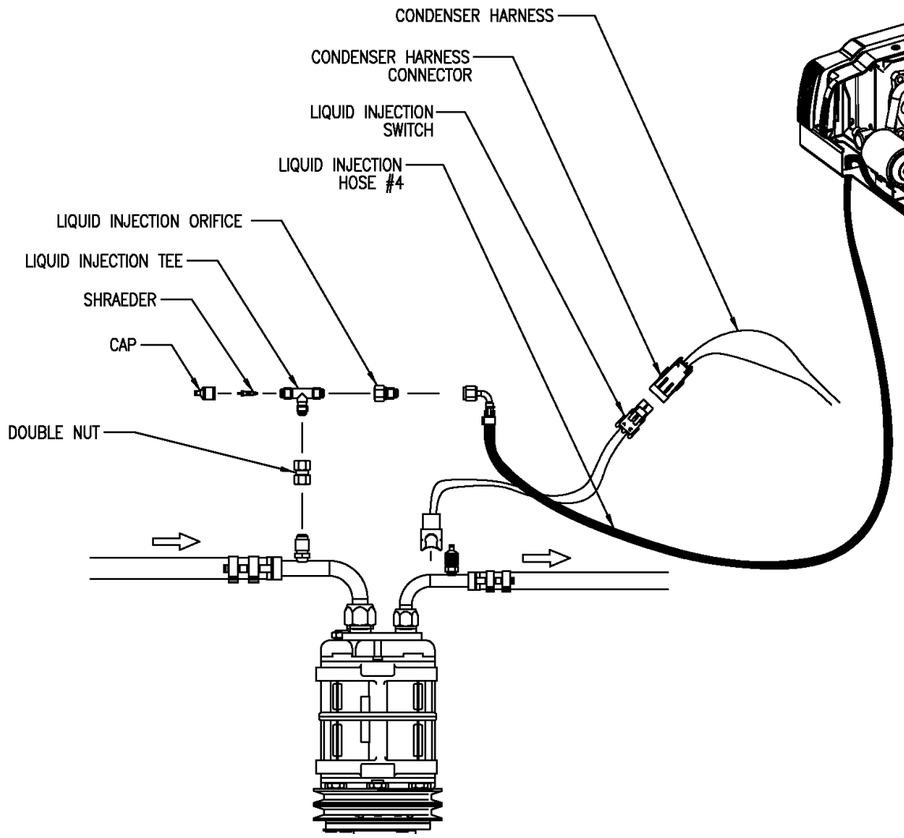
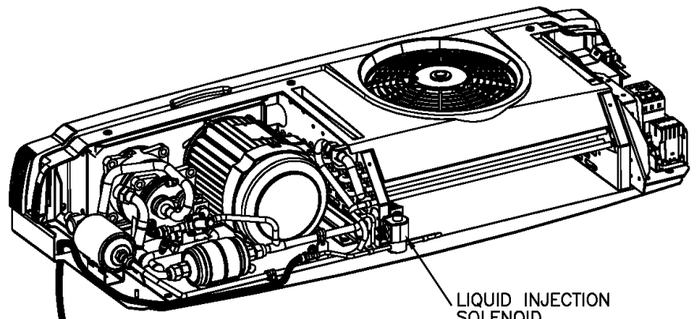
79818	B	ADD SCS & UPDATE VIEWS	14/06/01	JL	EC	LG





INSTALLATION RECOMMENDATIONS

1.–Recover the refrigerant from the unit, if neccesary.

2.–Remove the Shraeder from the suction service port. Mount the double nut, tee and orifice on the suction service port.

3.–Route and mount the liquid injection hose from the liquid injection solenoid down to the liquid injection orifice.

4.–Mount the liquid injection switch to the discharge fitting and connect the condenser harness.

5.–Evaquate, clean and leak check the refrigeration system as necessary.

6.–Recharge the unit with the proper amount os refrigerant. See the specifications section in the Maintenance Manual for the unit you are working on for the proper refrigerant charge.

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

LIST OF MATERIAL

DRAWN R. IBAÑEZ	DATE 16/02/99
CHECKED LORENZO G.	16/03/99
APPROVED MANEL R.	16/03/99

THIS PRINT SUPERSEDES ANY OF EARLIER DATE. DESTROY SAME.

SCALE ./.

JET COOL INSTALLATION V200–20MAX

SHEET 1 OF 1

MATERIAL: .

FINISH: .

THERMO KING SPAIN

.

DRAWING NUMBER	REV.
1B19464	B

V200 MAX-20/R404A Refrigeration Diagram

77674	B	ADD SETTING NOTE	25/07/00	EC	AS	EC

REVISIONS						
ECO	SYM	DESCRIPTION	DATE	BY	CHK	APP
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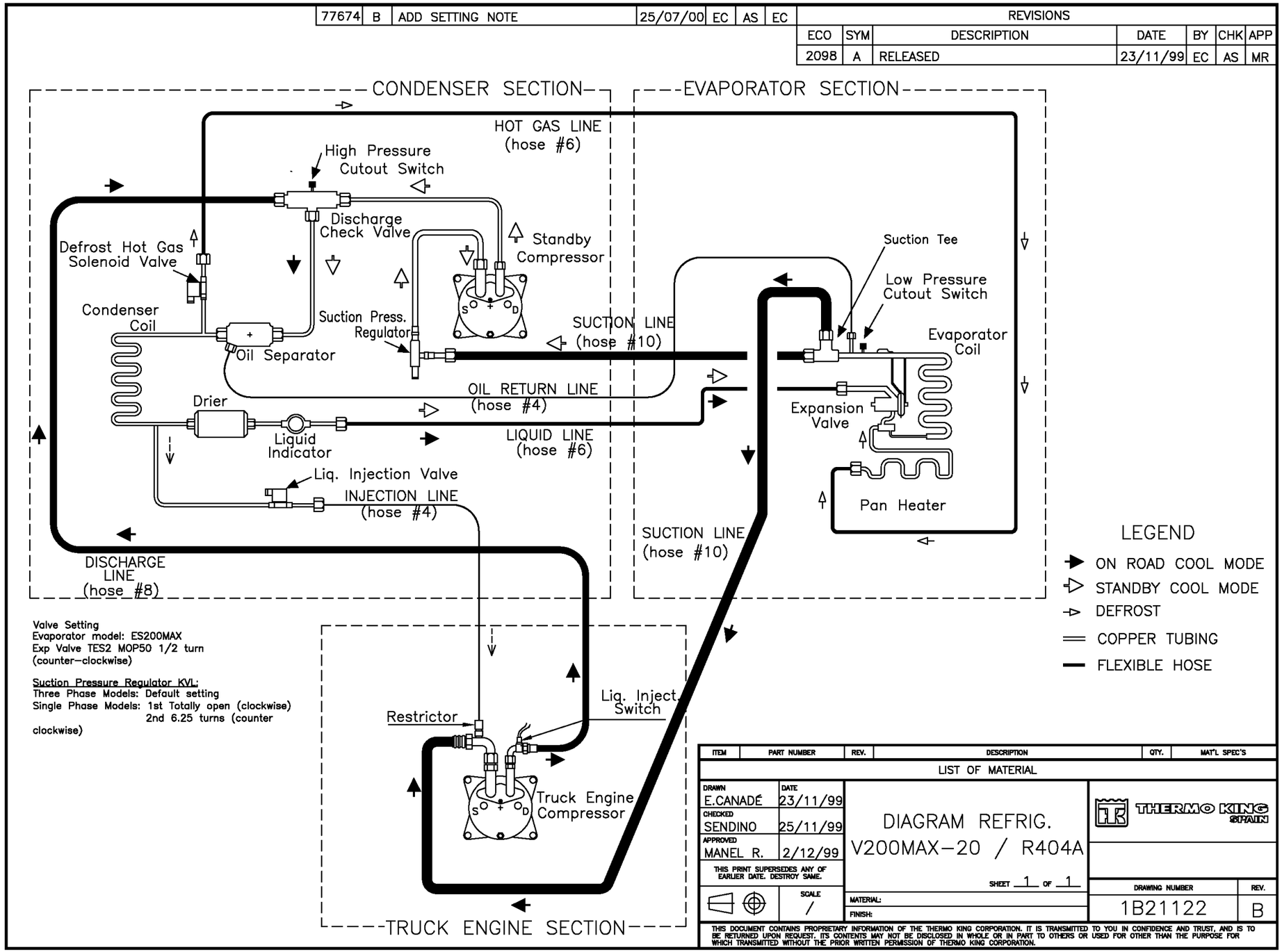


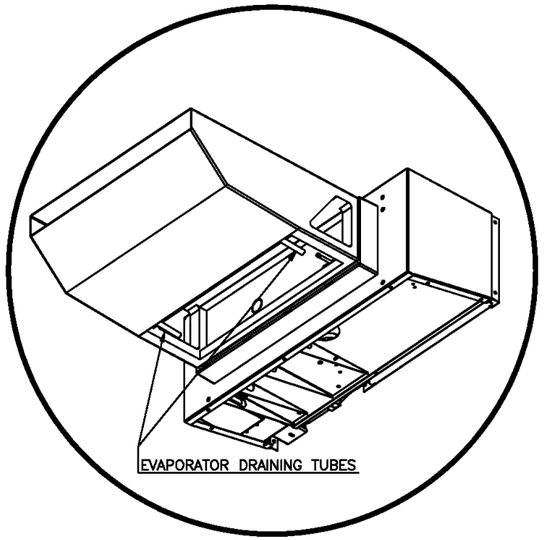
ITEM	PART NUMBER	REV.	DESCRIPTION	QTY.	MAT'L SPEC'S
LIST OF MATERIAL					

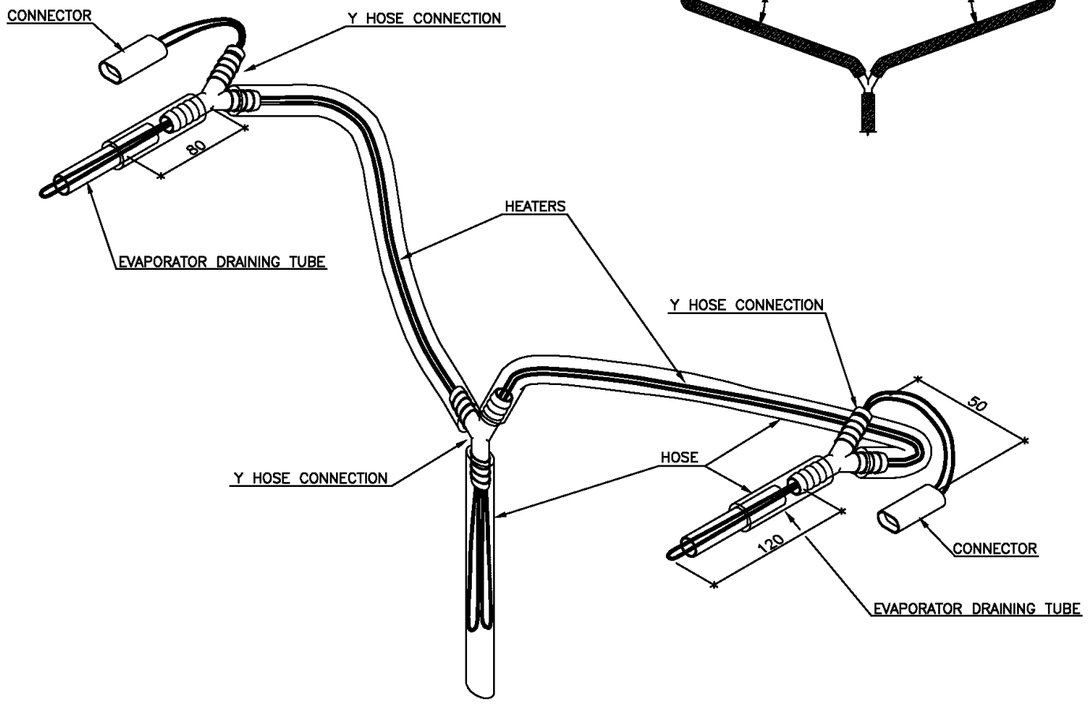
DRAWN E.CANADÉ	DATE 23/11/99	DIAGRAM REFRIG. V200MAX-20 / R404A	THERMO KING SPAIN
CHECKED SENDINO	25/11/99		
APPROVED MANEL R.	2/12/99	SHEET 1 OF 1	DRAWING NUMBER 1B21122 / REV. B
THIS PRINT SUPERSEDES ANY OF EARLIER DATE. DESTROY SAME.		MATERIAL:	
SCALE /		FINISH:	

Draining Tubes & Heaters Installation Drawing

REVISIONS						
ECO	SYM	DESCRIPTION	DATE	BY	CHK	APP
77452	A	RELEASED	19/05/00	JL	AS	JG
79813	B	ADD ES 300 EVAPORATOR (PAGE 2) ADD ES 500 EVAPORATOR (PAGE 3) ADD ES 150 EVAPORATOR (PAGE 4)	13/06/01	JL	AS	JG

EM 400 MAX evaporator

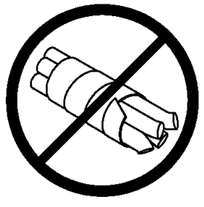




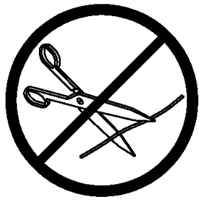
Minimum slope

DO NOT fit wrap band to hold the wires

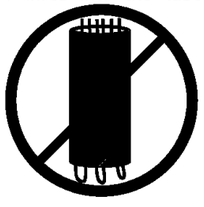
DO NOT cover the heaters



DO NOT cut the wires



DO NOT fit more than 4 wires into the tube



DIMENSIONS IN MILLIMETERS

THIRD ANGLE PROJECTION

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

LIST OF MATERIAL

DRAWN: JORDI L.	DATE: 19/05/00
CHECKED: A. SENDINO	22/5/00
APPROVED: JORDI G.	22/5/00

THIS PRINT SUPERSEDES ANY OF EARLIER DATE. DESTROY SAME.

SCALE

DRAINING TUBES & HEATERS INSTALLATION DRAWING

SHEET 1 OF 4

MATERIAL:

FINISH:

THERMO KING SPAIN

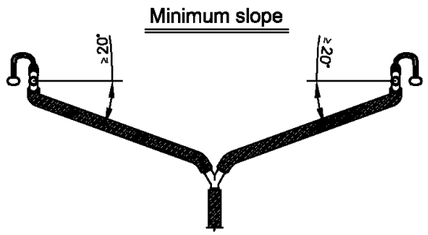
DRAWING NUMBER	REV.
1B22363	B

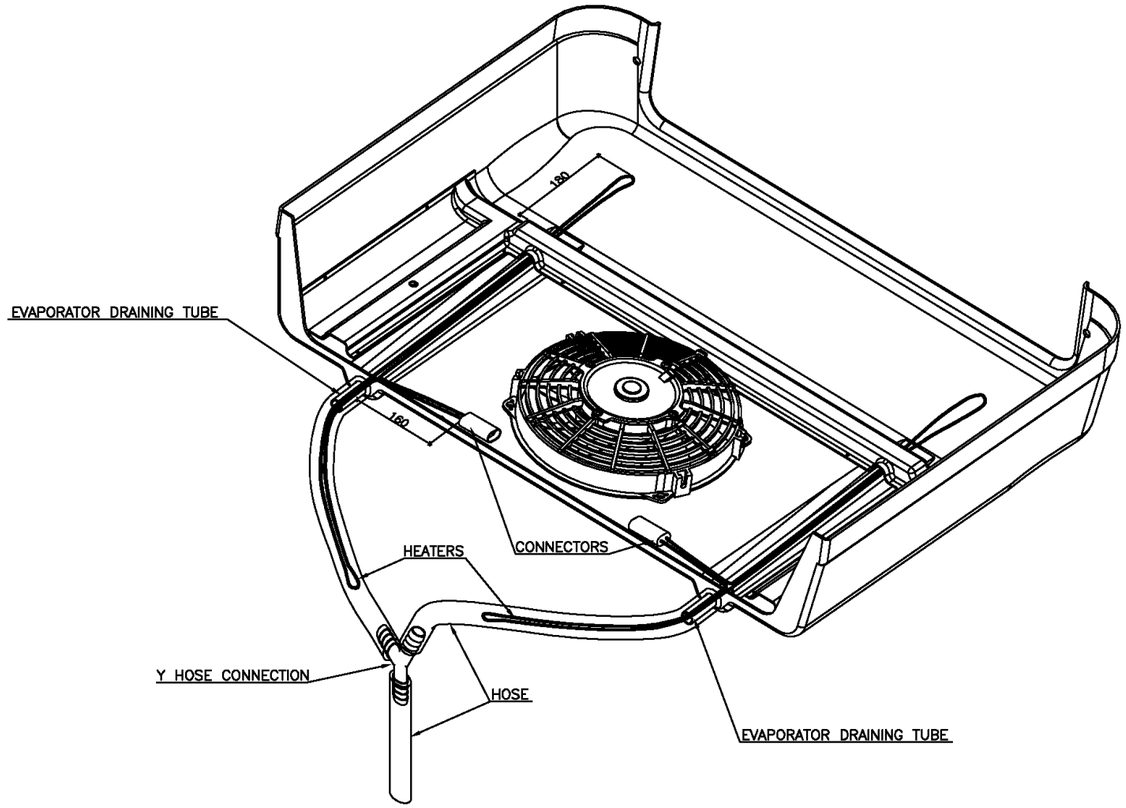
Draining Tubes & Heaters Installation Drawing

REVISIONS						
ECO	SYM	DESCRIPTION	DATE	BY	CHK	APP

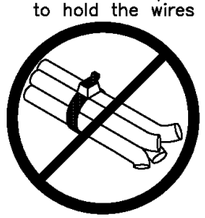
ES 150 MAX evaporator

Minimum slope

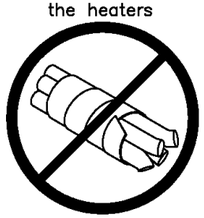




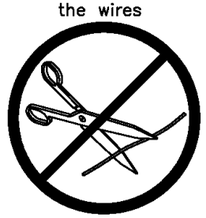
DO NOT fit wrap band to hold the wires



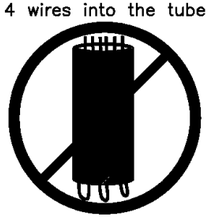
DO NOT cover the heaters



DO NOT cut the wires



DO NOT fit more than 4 wires into the tube



DIMENSIONS IN MILLIMETERS

THIRD ANGLE PROJECTION

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

LIST OF MATERIAL

DRAWN: JORDI L.	DATE: 19/05/00
CHECKED: A. SENDINO	22/5/00
APPROVED: JORDI G.	22/5/00

THIS PRINT SUPERSEDES ANY OF EARLIER DATE. DESTROY SAME.

SCALE

DRAINING TUBES & HEATERS INSTALLATION DRAWING

SHEET 4 OF 4

MATERIAL:

FINISH:

THERMO KING SPAIN

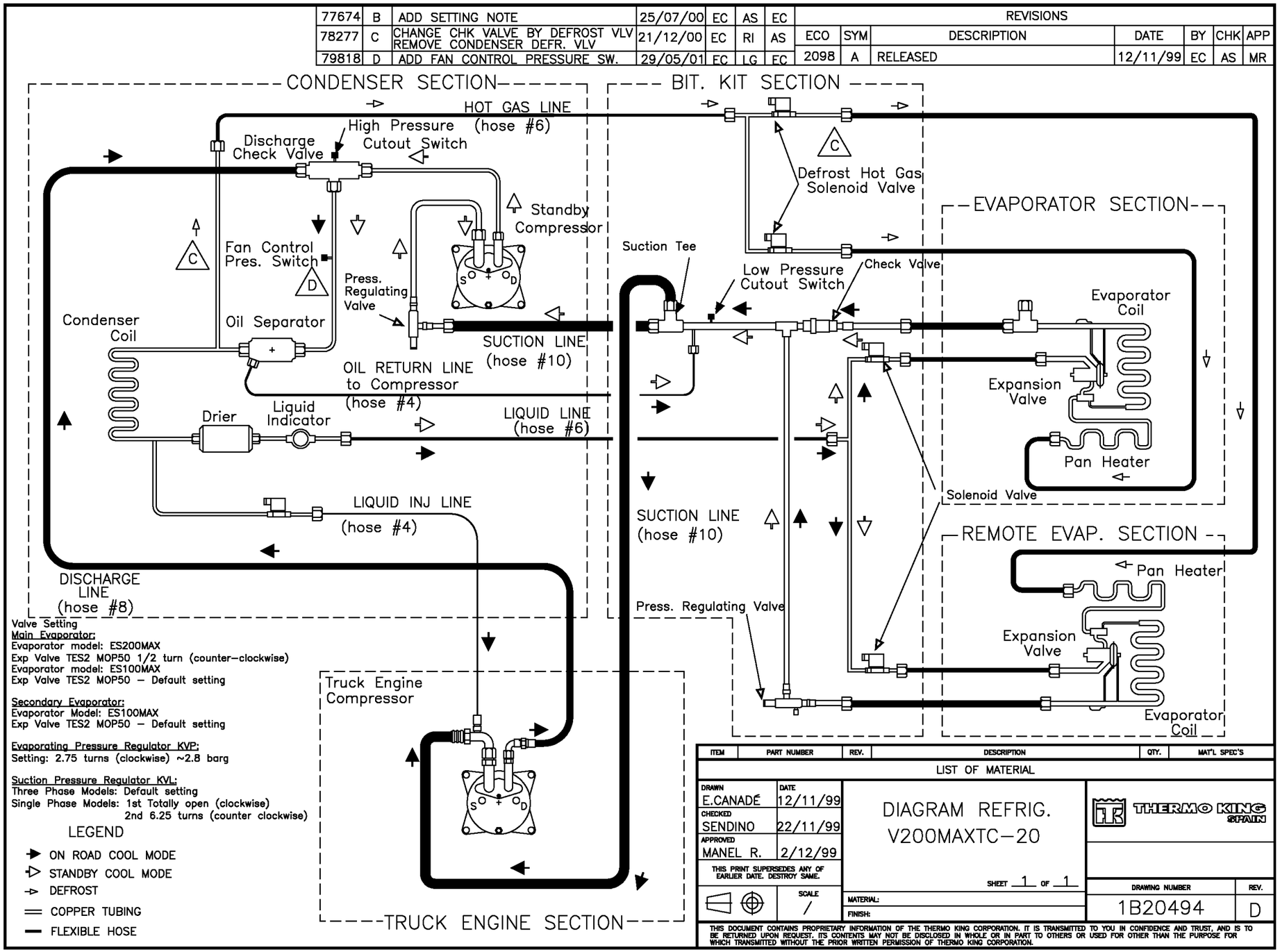
DRAWING NUMBER	REV.
1B22363	B

V200 MAXTC-20 Refrigeration Diagram

77674	B	ADD SETTING NOTE	25/07/00	EC	AS	EC
78277	C	CHANGE CHK VALVE BY DEFROST VLV REMOVE CONDENSER DEFR. VLV	21/12/00	EC	RI	AS
79818	D	ADD FAN CONTROL PRESSURE SW.	29/05/01	EC	LG	EC

REVISIONS

ECO	SYM	DESCRIPTION	DATE	BY	CHK	APP
2098	A	RELEASED	12/11/99	EC	AS	MR



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

LIST OF MATERIAL

DRAWN E.CANADÉ	DATE 12/11/99
CHECKED SENDINO	22/11/99
APPROVED MANEL R.	2/12/99
THIS PRINT SUPERSEDES ANY OF EARLIER DATE. DESTROY SAME.	
SCALE /	

DIAGRAM REFRIG.
V200MAXTC–20

SHEET 1 OF 1

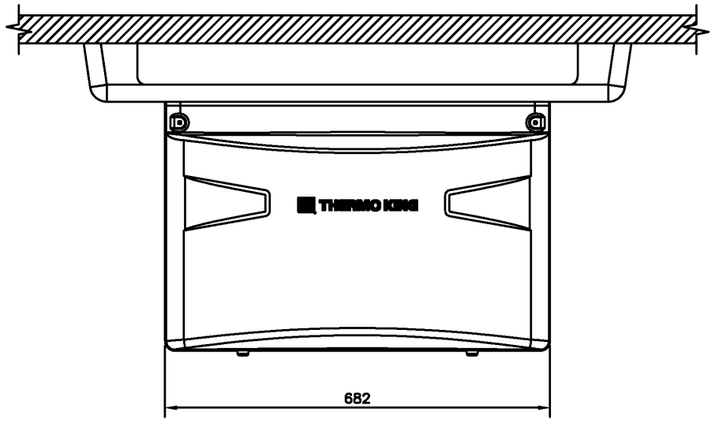
MATERIAL:
FINISH:

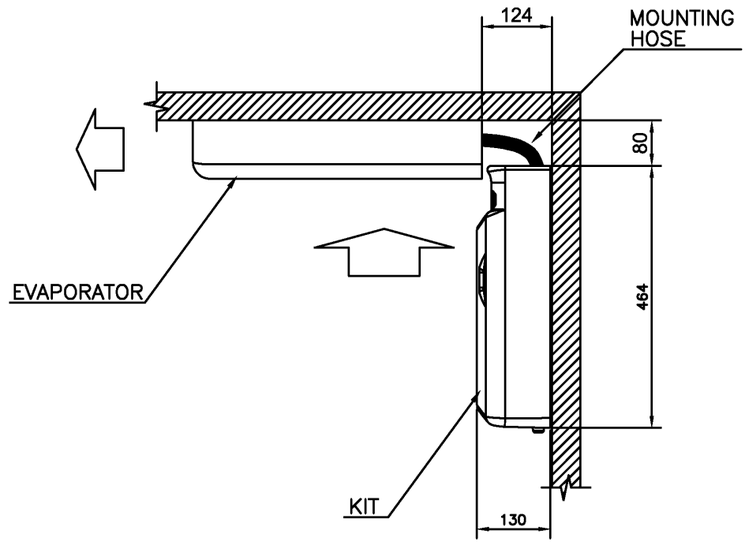
THERMO KING SPAIN

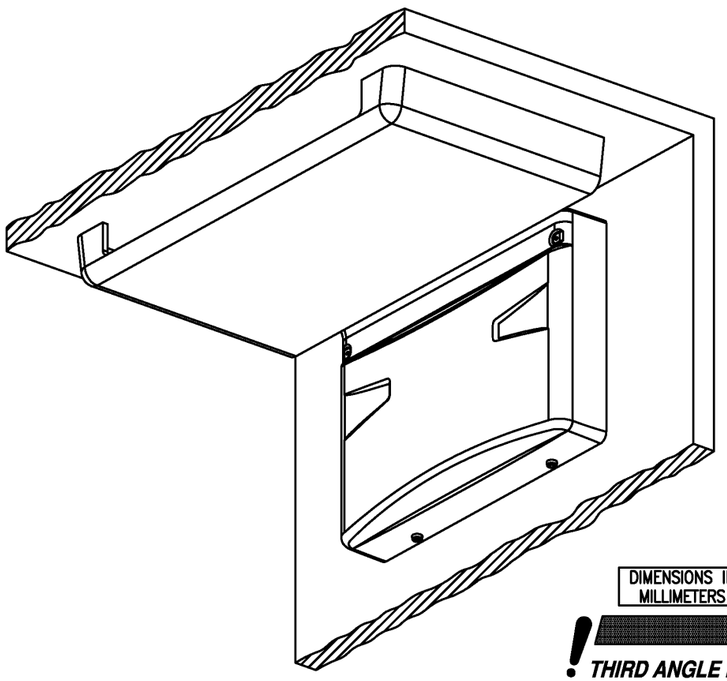
DRAWING NUMBER	REV.
1B20494	D

MTCH Kit Outline Drawing

REVISIONS						
ECO	SYM	DESCRIPTION	DATE	BY	CHK	APP
78277	A	RELEASED	29/08/00	JL	RI	EC
79837	B	ADD KIT MAC	07/06/01	FA	LG	MR







DIMENSIONS IN MILLIMETERS

THIRD ANGLE PROJECTION

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

LIST OF MATERIAL

DRAWN JORDI L.	DATE 29/08/00
CHECKED R.IBÁÑEZ	24/11/00
APPROVED E.CANADÉ	27/11/00
THIS PRINT SUPERSEDES ANY OF EARLIER DATE. DESTROY SAME.	
SCALE	

OUTLINE DRAWING
KIT MTCH

SHEET 1 OF 6

MATERIAL:

FINISH:

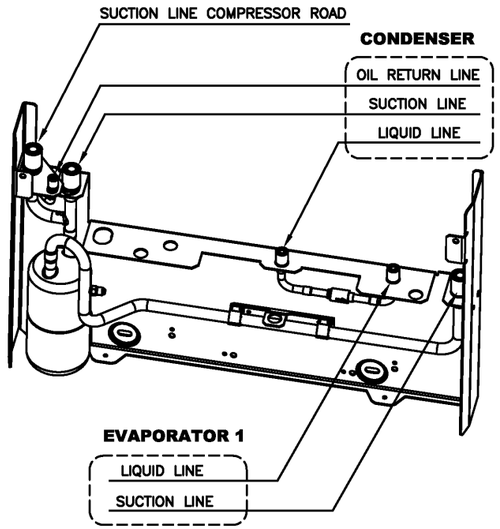
THERMO KING SPAIN

DRAWING NUMBER	REV.
3B15699	B

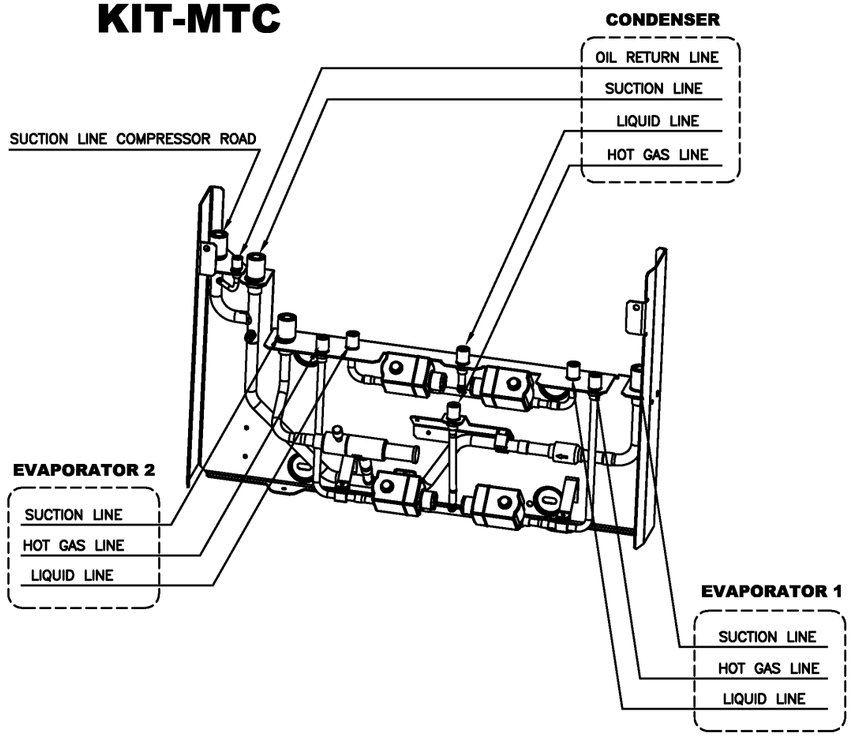
REVISIONS						
ECO	SYM	DESCRIPTION	DATE	BY	CHK	APP

3 CONEXIONADO DE MANGUERAS. *HOSE CONNECTIONS*

KIT-MH



KIT-MTC



DIMENSIONS IN MILLIMETERS

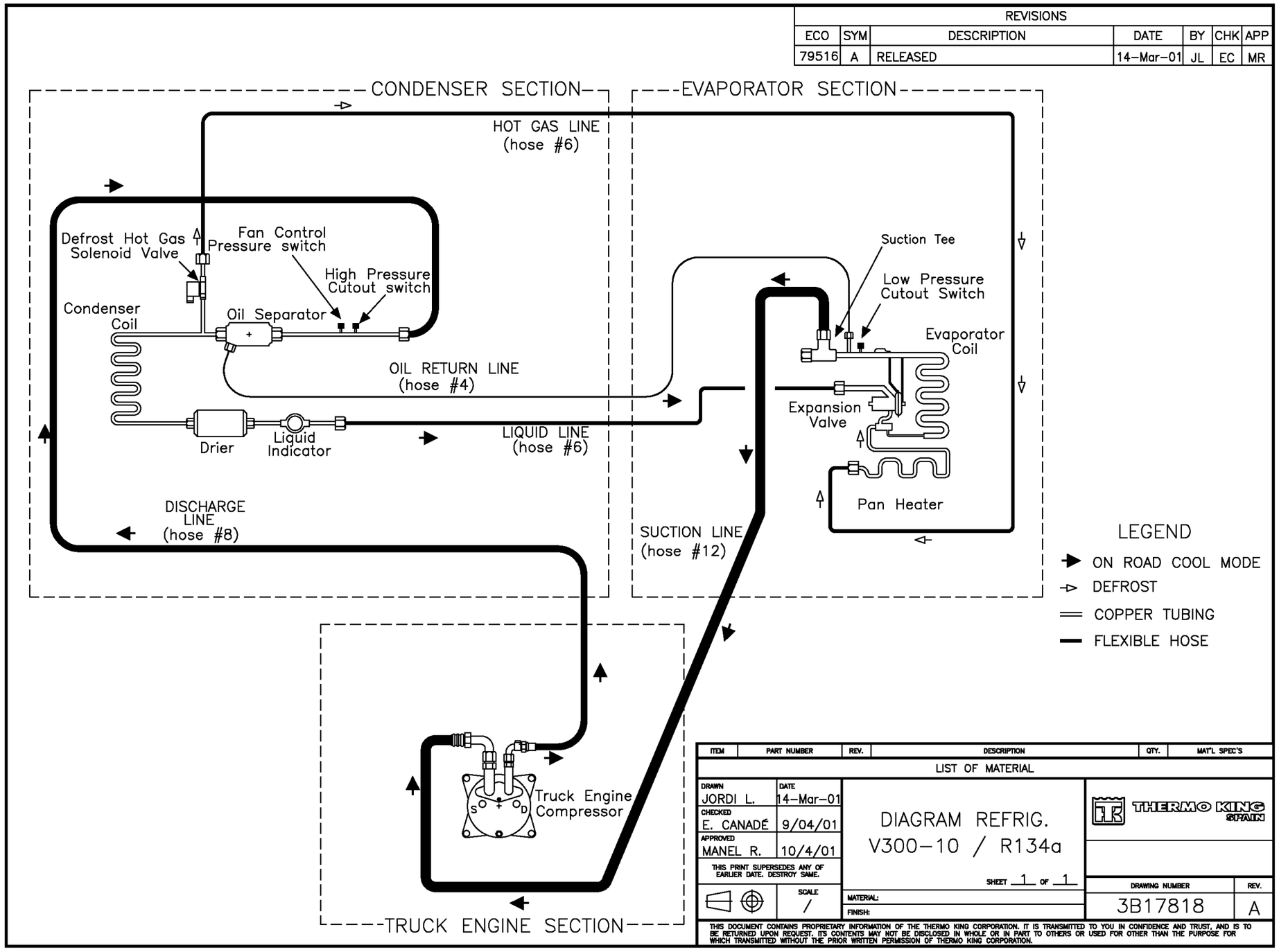
THIRD ANGLE PROJECTION

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

DRAWN JORDI L.	DATE 29/08/00	OUTLINE DRAWING KIT MTCH	THERMO KING SPAIN
CHECKED R.IBÁÑEZ	24/11/00		
APPROVED E.CANADÉ	27/11/00	SHEET 3 OF 6	DRAWING NUMBER 3B15699 / REV. B
THIS PRINT SUPERSEDES ANY OF EARLIER DATE. DESTROY SAME.		MATERIAL:	
	SCALE	FINISH:	

V-300-10/R134a Refrigeration Diagram

REVISIONS						
ECO	SYM	DESCRIPTION	DATE	BY	CHK	APP
79516	A	RELEASED	14-Mar-01	JL	EC	MR



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

LIST OF MATERIAL

DRAWN: JORDI L.	DATE: 14-Mar-01
CHECKED: E. CANADÉ	9/04/01
APPROVED: MANEL R.	10/4/01

THIS PRINT SUPERSEDES ANY OF EARLIER DATE. DESTROY SAME.

SCALE: /

DIAGRAM REFRIG.
V300-10 / R134a

SHEET 1 OF 1

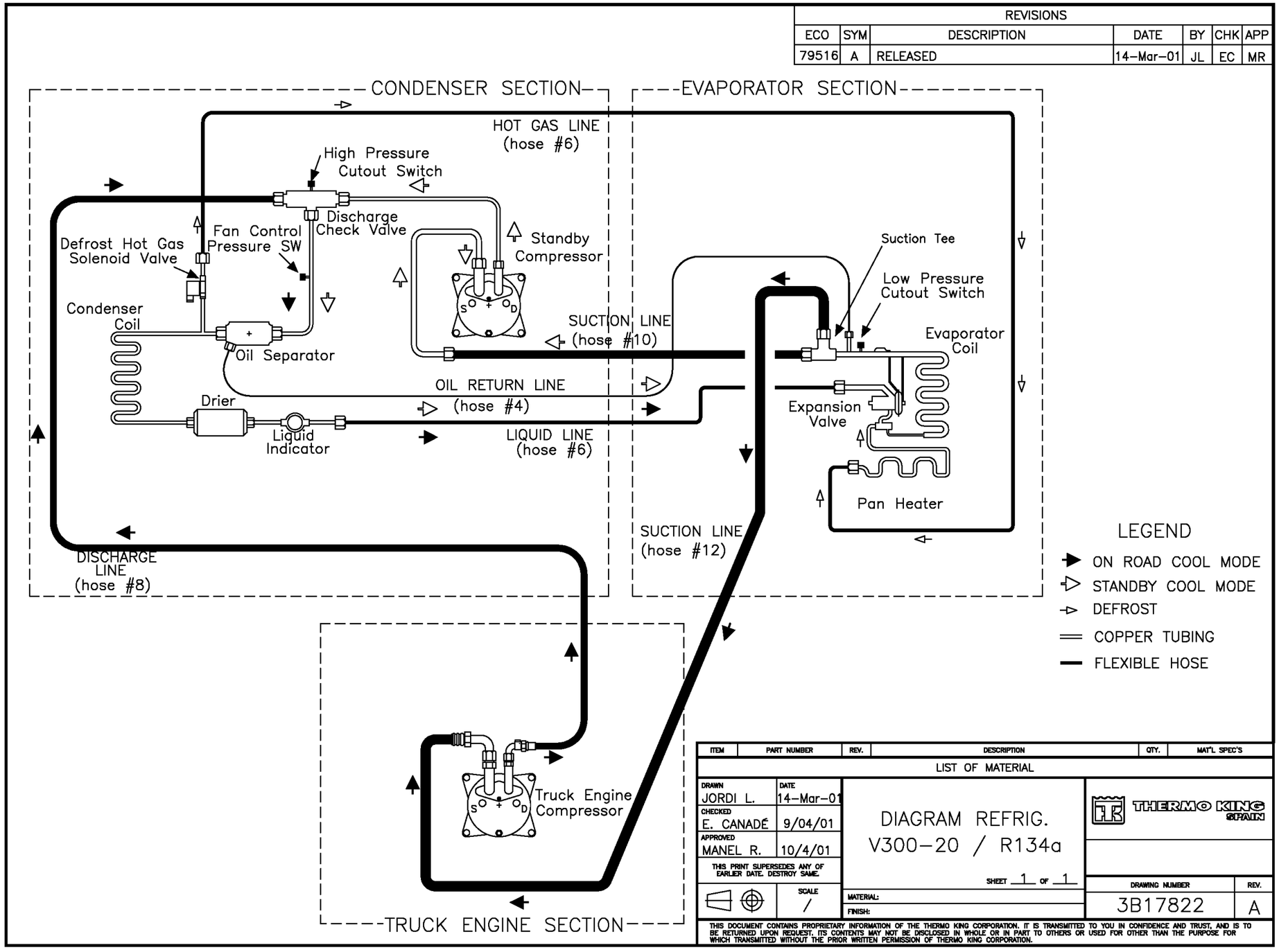
MATERIAL:

FINISH:

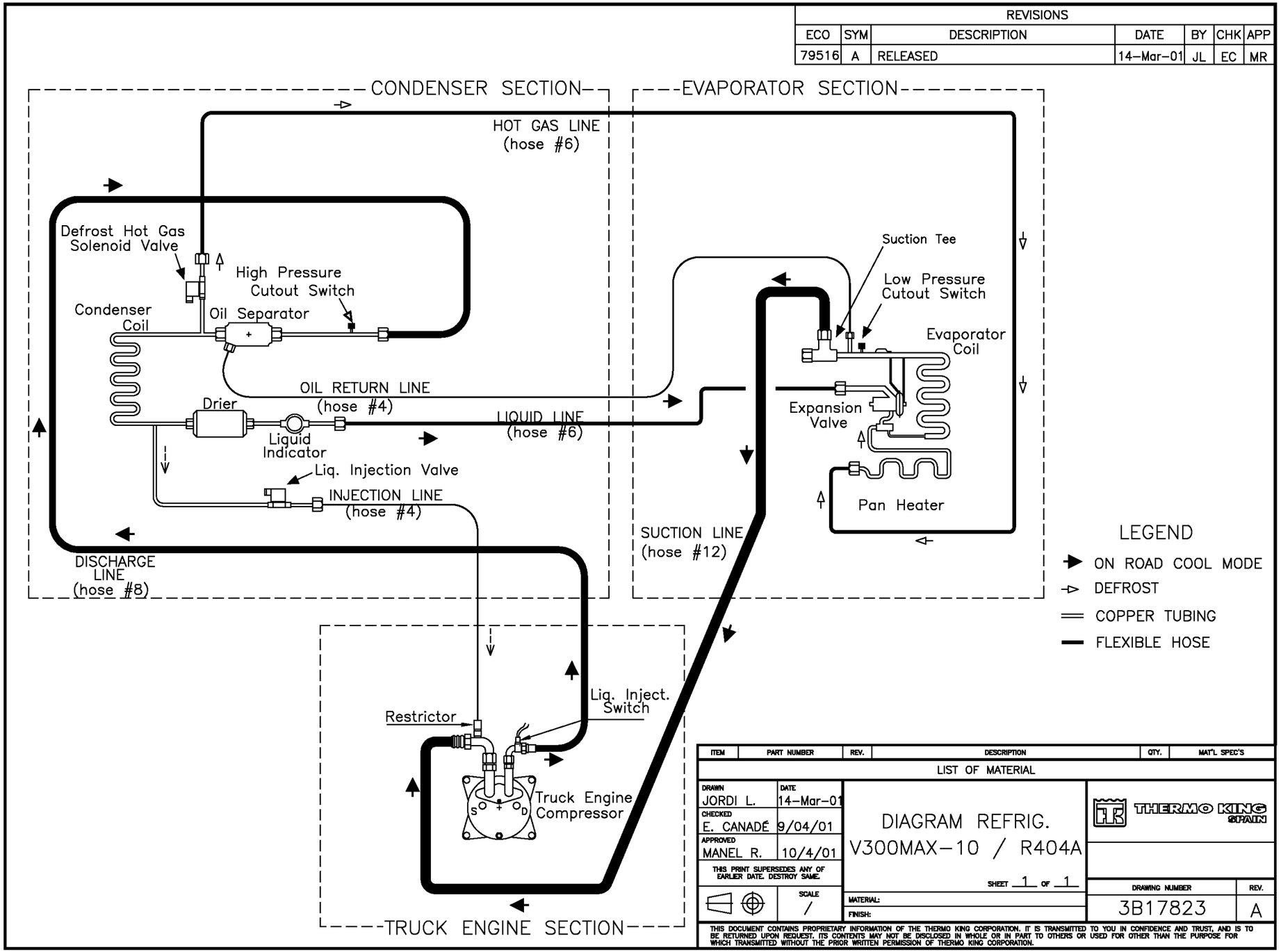
THERMO KING SPAIN

DRAWING NUMBER	REV.
3B17818	A

V300-20/R134a Refrigeration Diagram

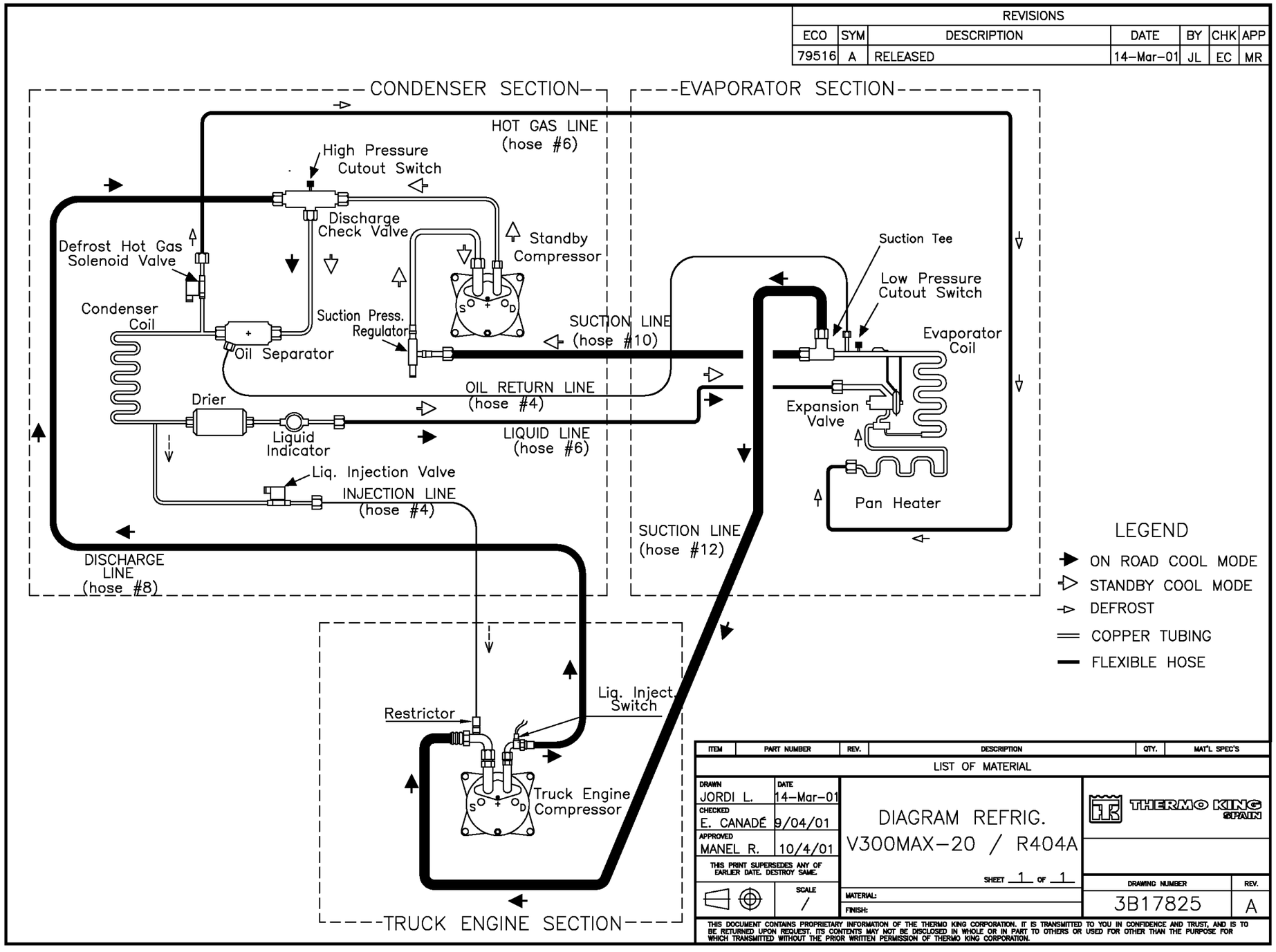


V300 MAX-10/R404A Refrigeration Diagram



V300 MAX-20/R404A Refrigeration Diagram

REVISIONS						
ECO	SYM	DESCRIPTION	DATE	BY	CHK	APP
79516	A	RELEASED	14–Mar–01	JL	EC	MR



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

LIST OF MATERIAL

DRAWN: JORDI L.	DATE: 14–Mar–01
CHECKED: E. CANADÉ	9/04/01
APPROVED: MANEL R.	10/4/01
THIS PRINT SUPERSEDES ANY OF EARLIER DATE. DESTROY SAME.	
SCALE: /	

DIAGRAM REFRIG.
V300MAX–20 / R404A

SHEET 1 OF 1

MATERIAL:

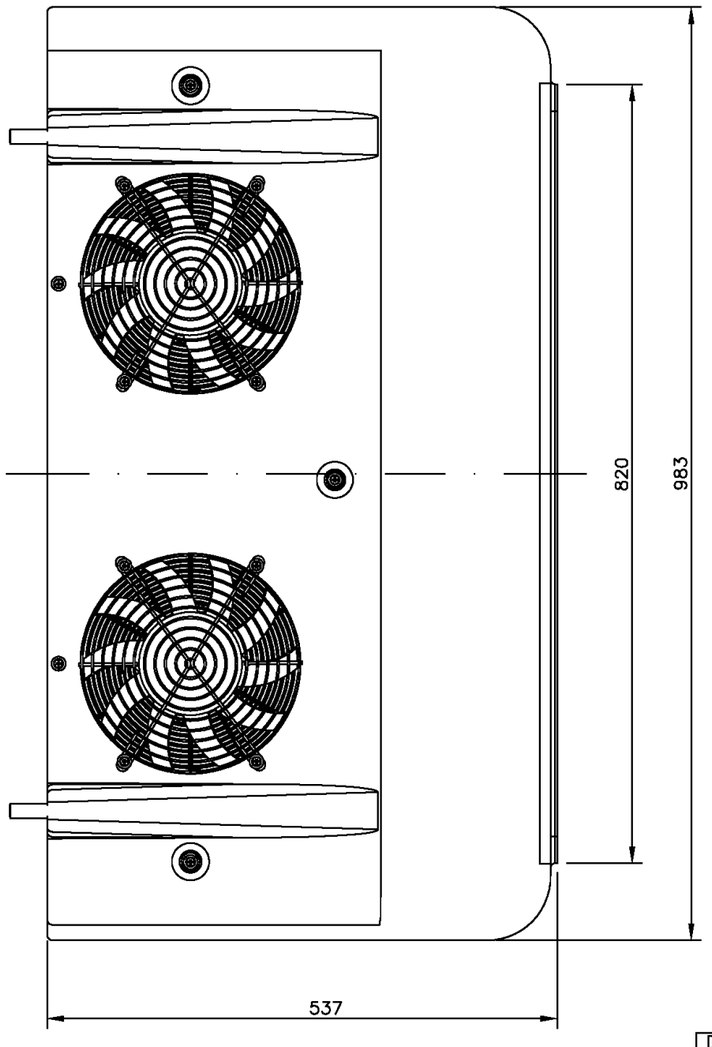
FINISH:

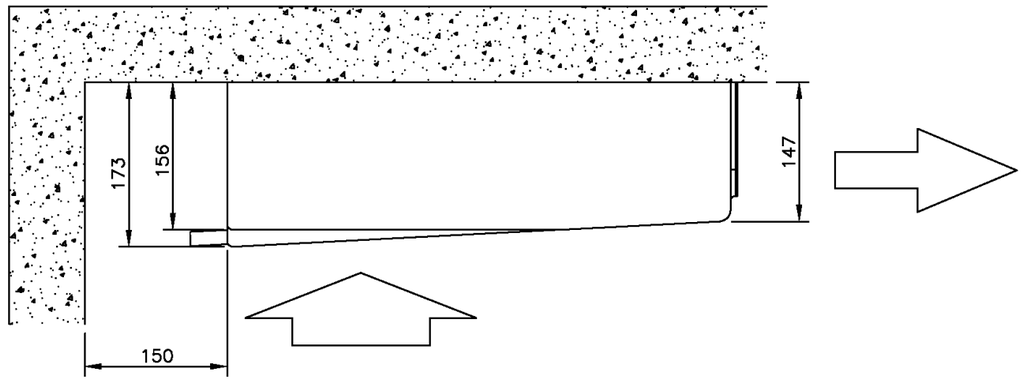
THERMO KING SPAIN

DRAWING NUMBER	REV.
3B17825	A

ES300 Evaporator Outline Drawing

REVISIONS						
ECO	SYM	DESCRIPTION	DATE	BY	CHK	APP
79140	A	RELEASED	05.Mar.01	JL	LG	EC





DIMENSIONS IN MILLIMETERS

THIRD ANGLE PROJECTION

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

LIST OF MATERIAL

DRAWN: JORDI L.	DATE: 05.Mar.01
CHECKED: LORENZO	2-May-01
APPROVED: E. CANADÉ	2-May-01

THIS PRINT SUPERSEDES ANY OF EARLIER DATE. DESTROY SAME.

SCALE 1/5

OUTLINE DRAWING
EVAPORATOR
ES300

SHEET 1 OF 2

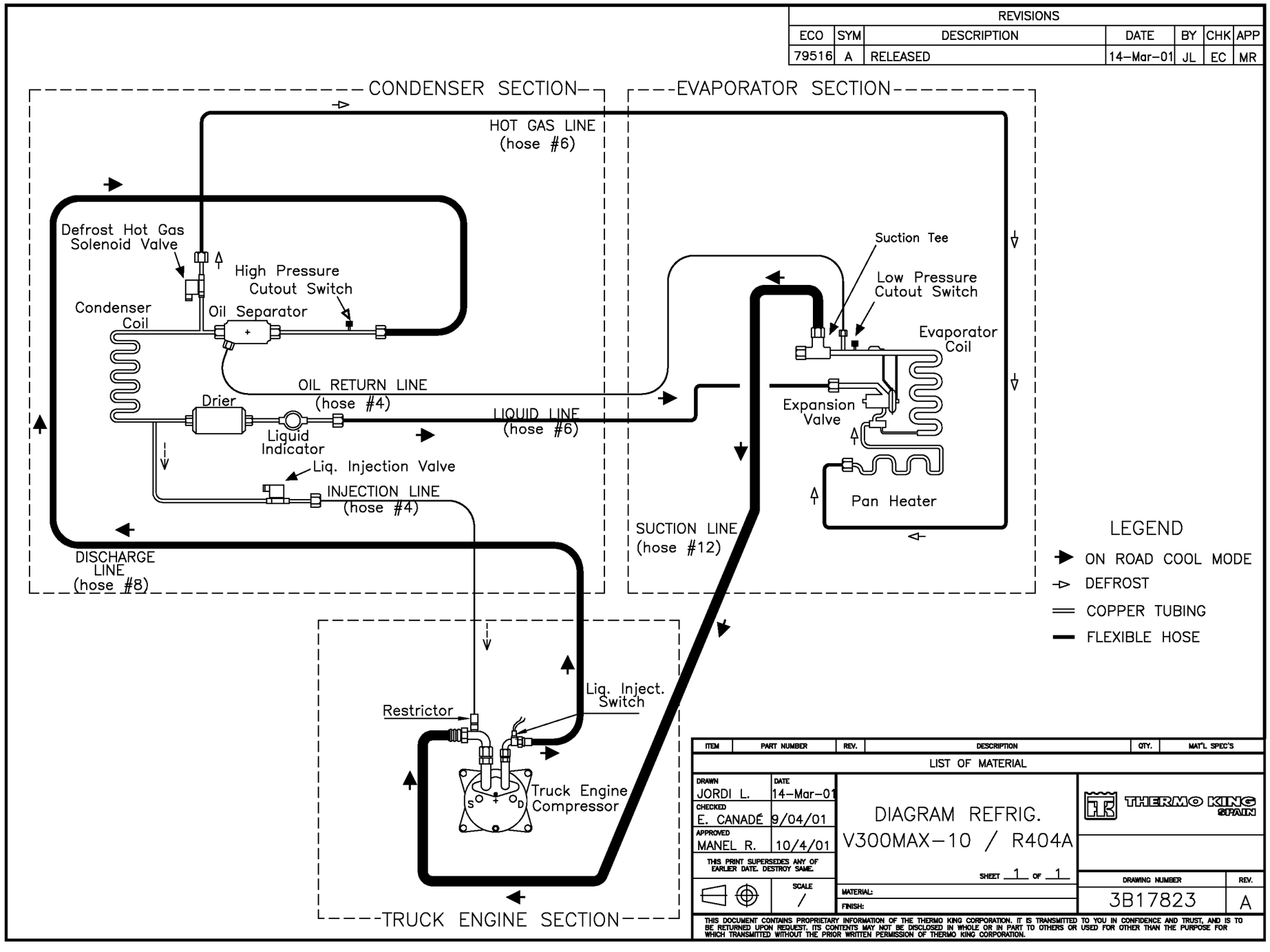
MATERIAL:

FINISH:

THERMO KING SPAIN

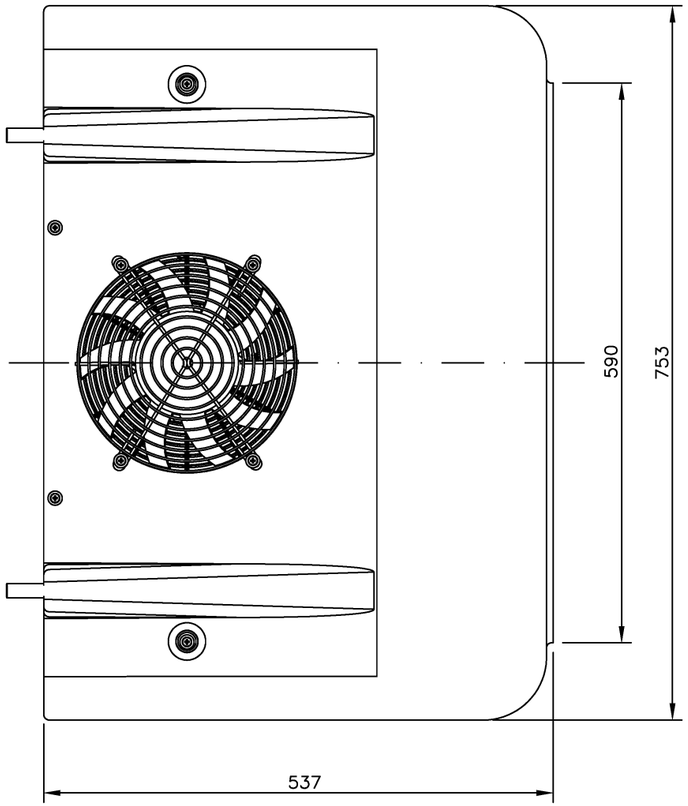
DRAWING NUMBER	REV.
3B17752	A

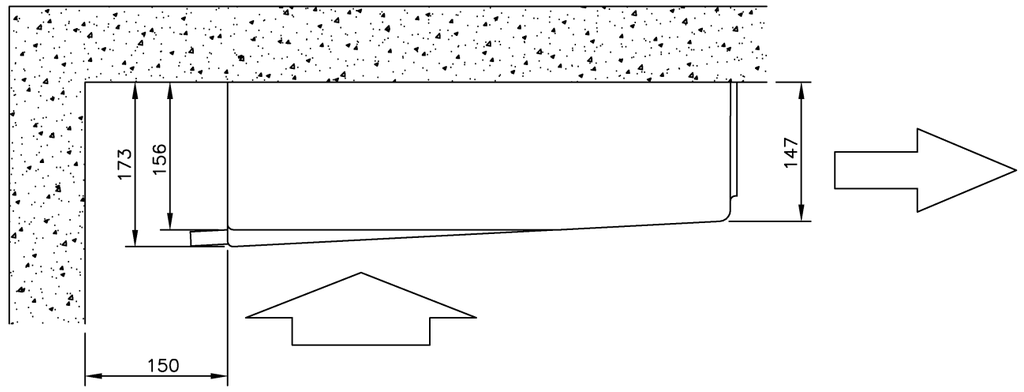
ES300 Evaporator Outline Drawing



ES150 Evaporator Outline Drawing

REVISIONS						
ECO	SYM	DESCRIPTION	DATE	BY	CHK	APP
500641	A	RELEASED	12–Jun–01	JL	EC	LG





DIMENSIONS IN MILLIMETERS

THIRD ANGLE PROJECTION

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

LIST OF MATERIAL

DRAWN: JORDI L.	DATE: 12–Jun–01
CHECKED: E. CANADÉ	09–Nov–01
APPROVED: LORENZO G.	19–Nov–01
THIS PRINT SUPERSEDES ANY OF EARLIER DATE. DESTROY SAME.	
SCALE: 1/5	

OUTLINE DRAWING
EVAPORATOR
ES150

SHEET 1 OF 2

MATERIAL:

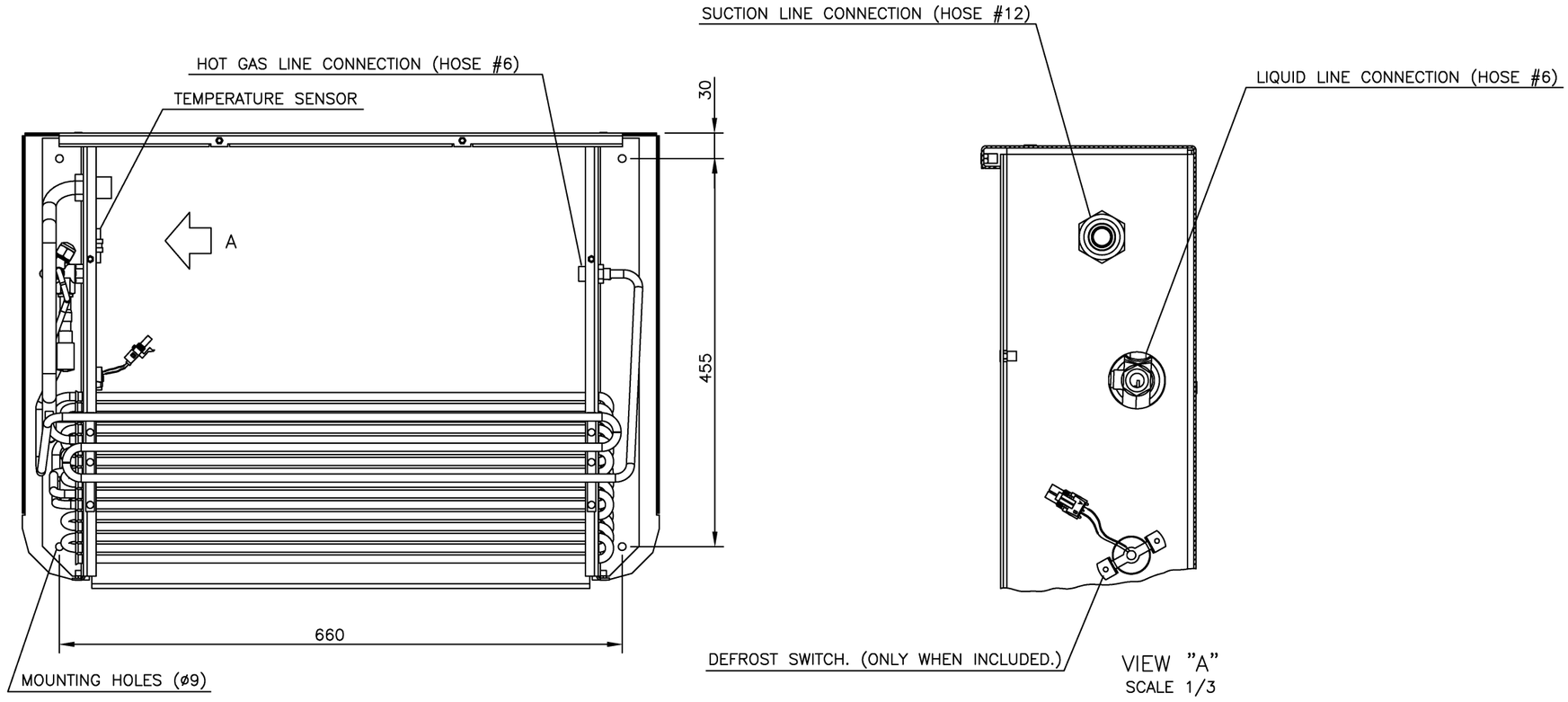
FINISH:

THERMO KING SPAIN

DRAWING NUMBER	REV.
3B18615	A

ES150 Evaporator Outline Drawing

REVISIONS						
ECO	SYM	DESCRIPTION	DATE	BY	CHK	APP



WEIGHT: 12.5 kg

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

LIST OF MATERIAL

DRAWN: JORDI L.	DATE: 12-Jun-01
CHECKED: E. CANADÉ	09-Nov-01
APPROVED: LORENZO G.	19-Nov-01
THIS PRINT SUPERSEDES ANY OF EARLIER DATE. DESTROY SAME.	
SCALE: 1/5	

DIMENSIONS IN MILLIMETERS

THIRD ANGLE PROJECTION

OUTLINE DRAWING
EVAPORATOR
ES150

SHEET 2 OF 2

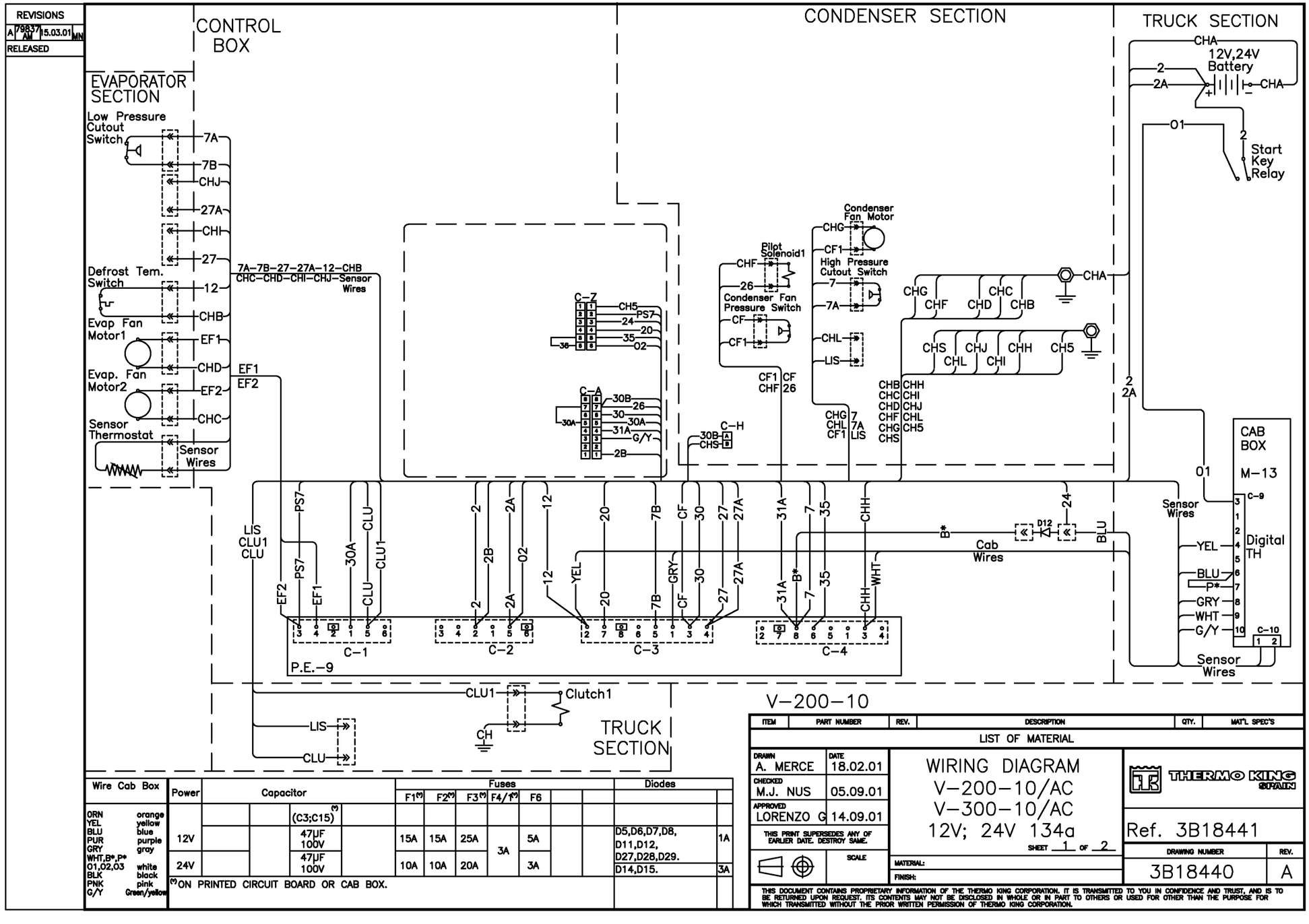
MATERIAL:

FINISH:

THERMO KING SPAIN

DRAWING NUMBER	REV.
3B18615	A

V-200-10/AC V-300-10AC 12V; 24V 134a Wiring Diagram

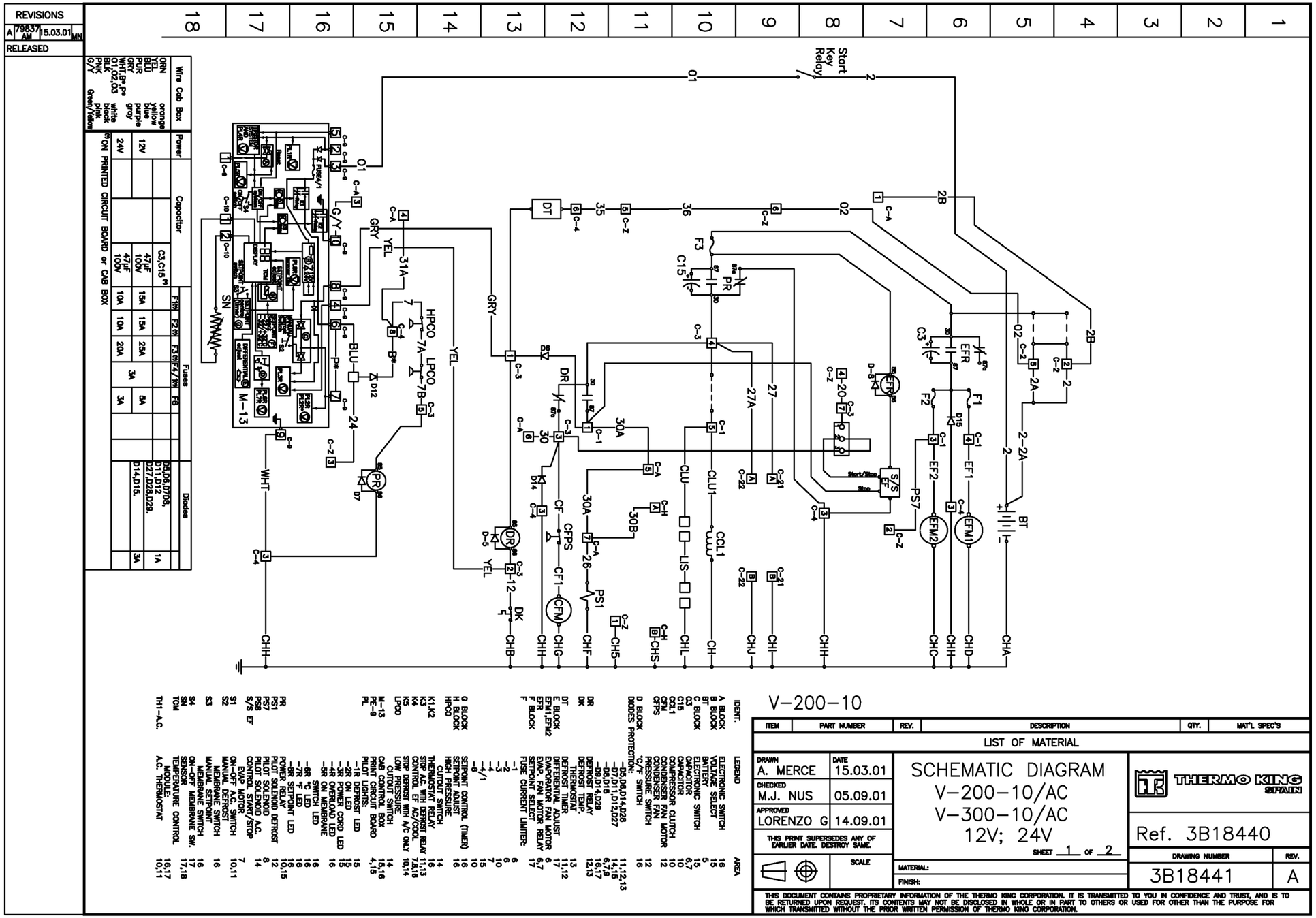


Wire Cab Box		Power	Capacitor	Fuses F1(*)	F2(*)	F3(*)	F4/1(*)	F6	Diodes	
ORN	orange		(C3;C15)(*)							
YEL	yellow	12V	47µF 100V	15A	15A	25A	3A	5A	D5,D6,D7,D8, D11,D12, D27,D28,D29.	1A
BLU	blue	24V	47µF 100V	10A	10A	20A		3A	D14,D15.	3A
PUR	purple									
GRY	gray									
WHT,B*,P*										
01,02,03	white									
BLK	black									
PNK	pink									
G/Y	Green/yellow									

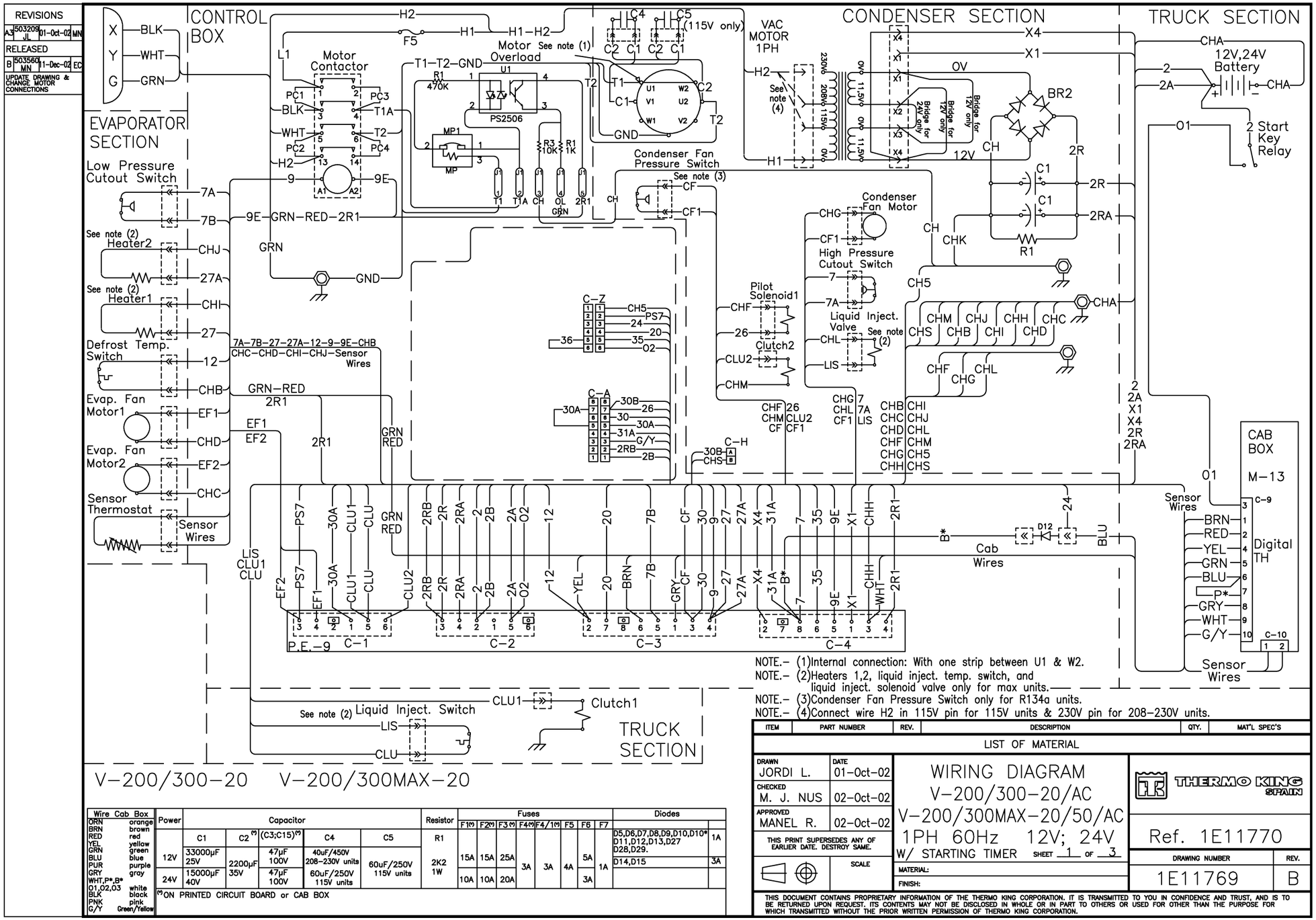
(*) ON PRINTED CIRCUIT BOARD OR CAB BOX.

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

V-200-10/AC V-300-10/AC 12V; 24V Schematic Diagram



V-200/V-300-20/AC V200/300 MAX-20/50/AC 1 PH 60Hz 12V; 24V Wiring Diagram



NOTE.- (1)Internal connection: With one strip between U1 & W2.
NOTE.- (2)Heaters 1,2, liquid inject. temp. switch, and liquid inject. solenoid valve only for max units.
NOTE.- (3)Condenser Fan Pressure Switch only for R134a units.
NOTE.- (4)Connect wire H2 in 115V pin for 115V units & 230V pin for 208-230V units.

Wire Cab Box	
ORN	orange
BRN	brown
RED	red
YEL	yellow
GRN	green
BLU	blue
PUR	purple
GRY	gray
WHT,P*,B*	white
01,02,03	white
BLK	black
PNK	pink
G/Y	Green/Yellow

Power	Capacitor C1	C2 (*)	(C3;C15)(*)	C4	C5	Resistor R1
12V	33000µF 25V	2200µF 35V	47µF 100V	40uF/450V 208-230V units	60uF/250V 115V units	2K2 1W
24V	15000µF 40V		47µF 100V	60uF/250V 115V units		

(*) ON PRINTED CIRCUIT BOARD or CAB BOX

Fuses								
F1(*)	F2(*)	F3(*)	F4(*)	F4/1(*)	F5	F6	F7	
15A	15A	25A	3A	3A	4A	5A	1A	
10A	10A	20A				3A		

Diodes	
D5,D6,D7,D8,D9,D10,D10* D11,D12,D13,D27 D28,D29.	1A
D14,D15	3A

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

LIST OF MATERIAL

DRAWN JORDI L.	DATE 01-Oct-02
CHECKED M. J. NUS	02-Oct-02
APPROVED MANEL R.	02-Oct-02

THIS PRINT SUPERSEDES ANY OF EARLIER DATE. DESTROY SAME.

SCALE

WIRING DIAGRAM
V-200/300-20/AC
V-200/300MAX-20/50/AC
1PH 60Hz 12V; 24V
W/ STARTING TIMER SHEET 1 OF 3

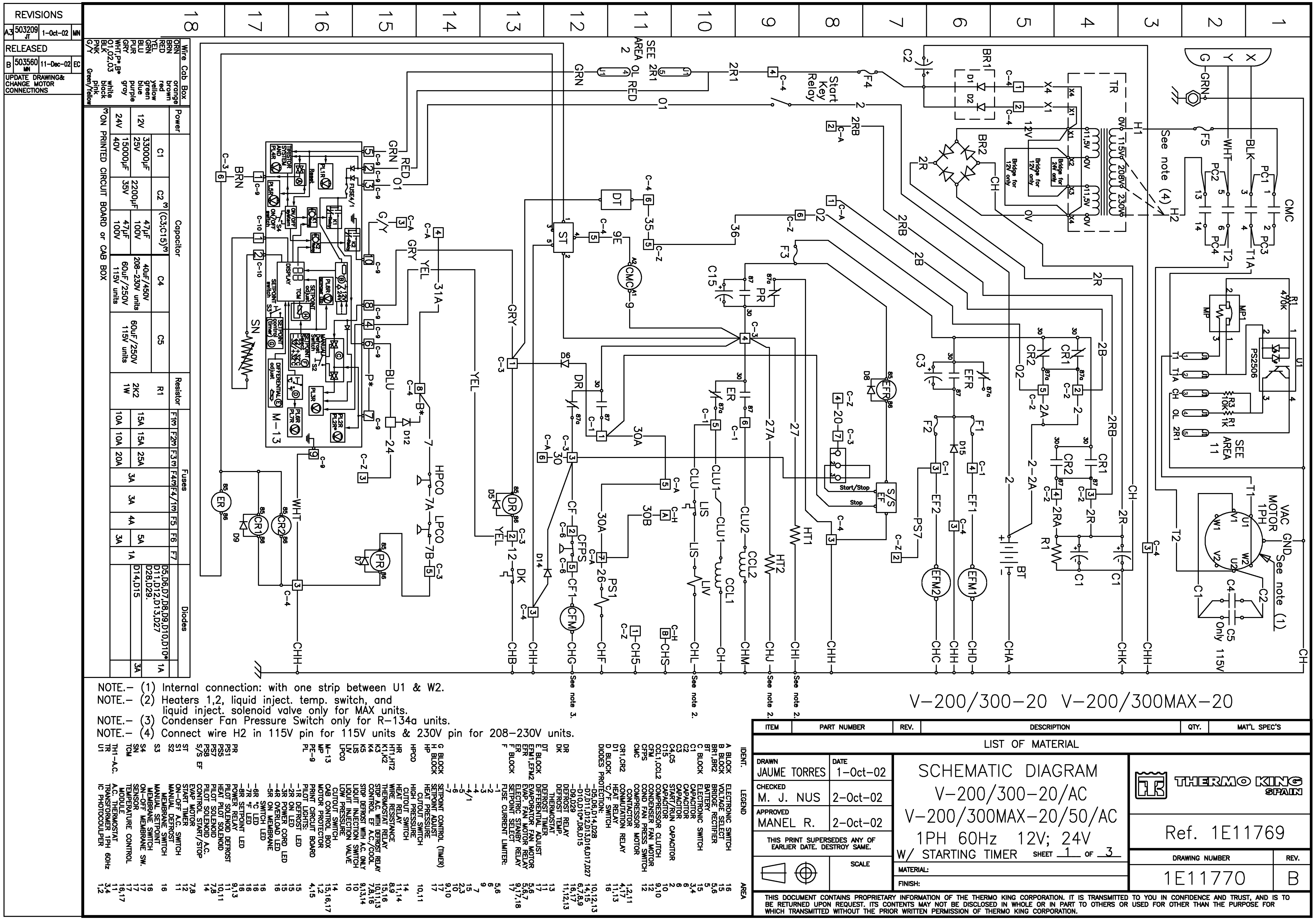
MATERIAL:
FINISH:

THERMO KING SPAIN

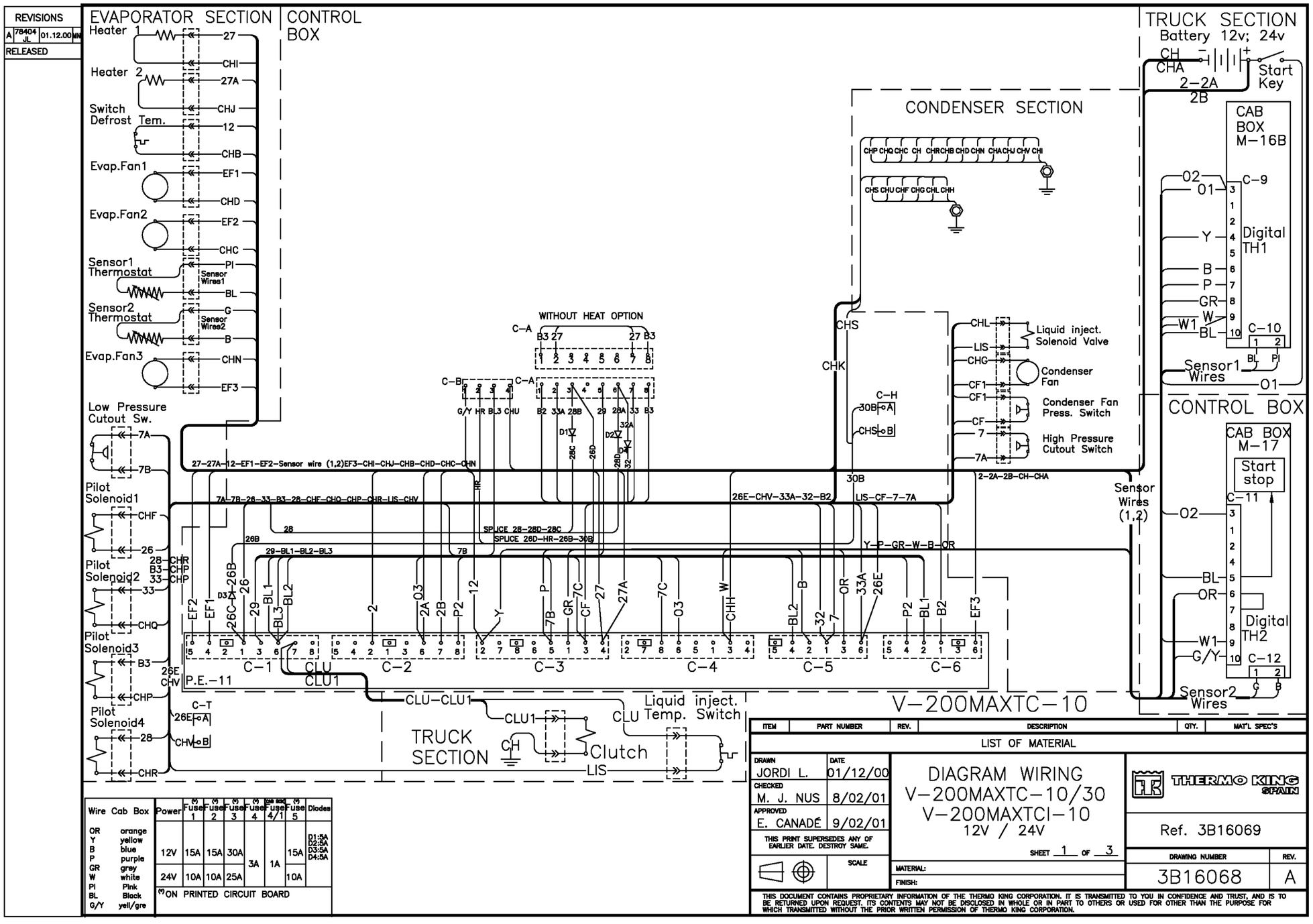
Ref. 1E11770

DRAWING NUMBER	REV.
1E11769	B

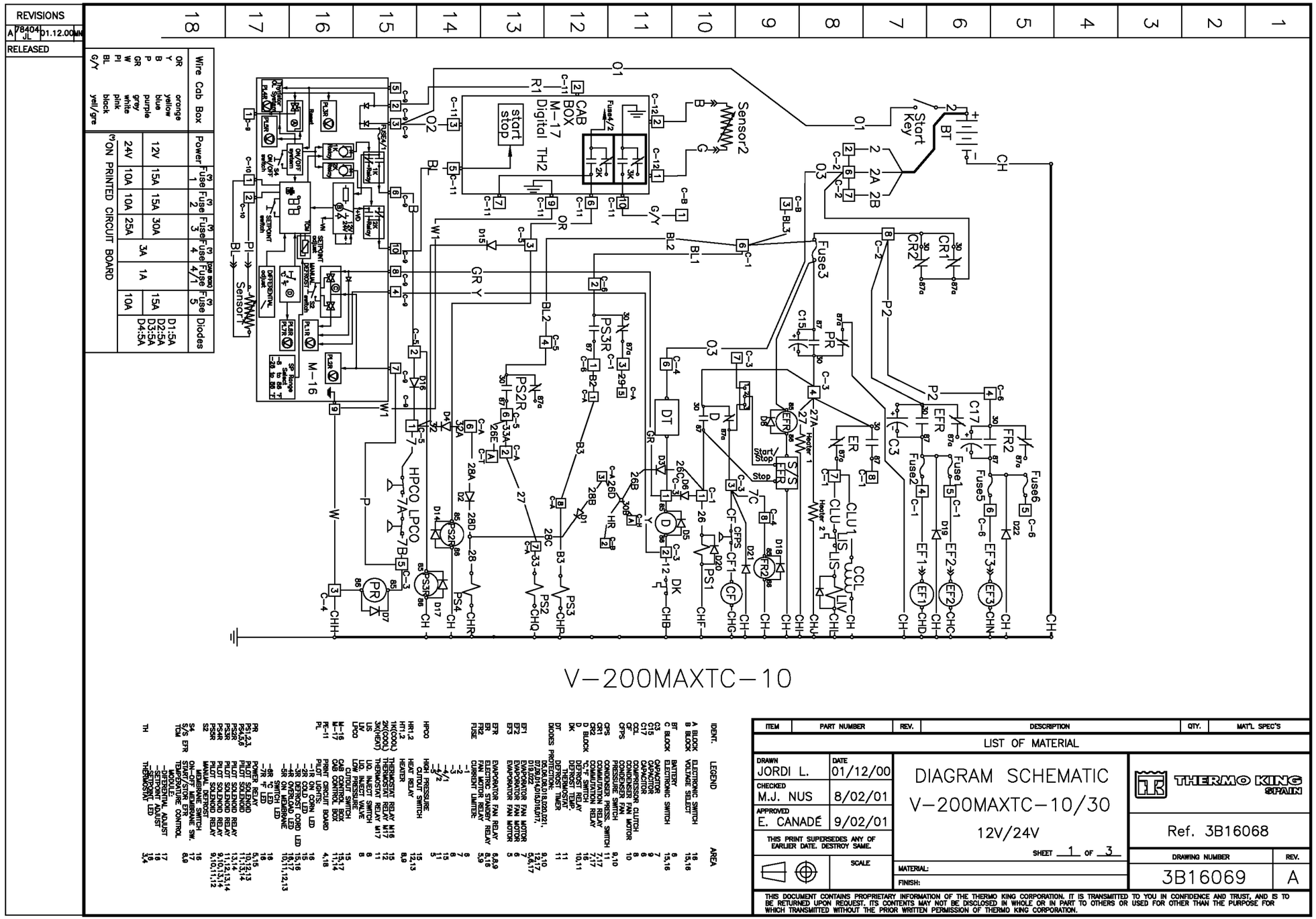
V-200/V-300-20/AC 1PH 60 Hz 12V; 24V Schematic Diagram



V-200 MAXTC-10/30 V-200 MAXTCI-10 12V/24V Wiring Diagram



V-200 MAXTC-10/30 12V/24V Schematic Diagram



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

LIST OF MATERIAL

DRAWN: JORDI L.	DATE: 01/12/00
CHECKED: M.J. NUS	8/02/01
APPROVED: E. CANADÉ	9/02/01

THIS PRINT SUPERSEDES ANY OF EARLIER DATE. DESTROY SAME.

SCALE

DIAGRAM SCHEMATIC
V-200MAXTC-10/30
12V/24V

SHEET 1 OF 3

MATERIAL:

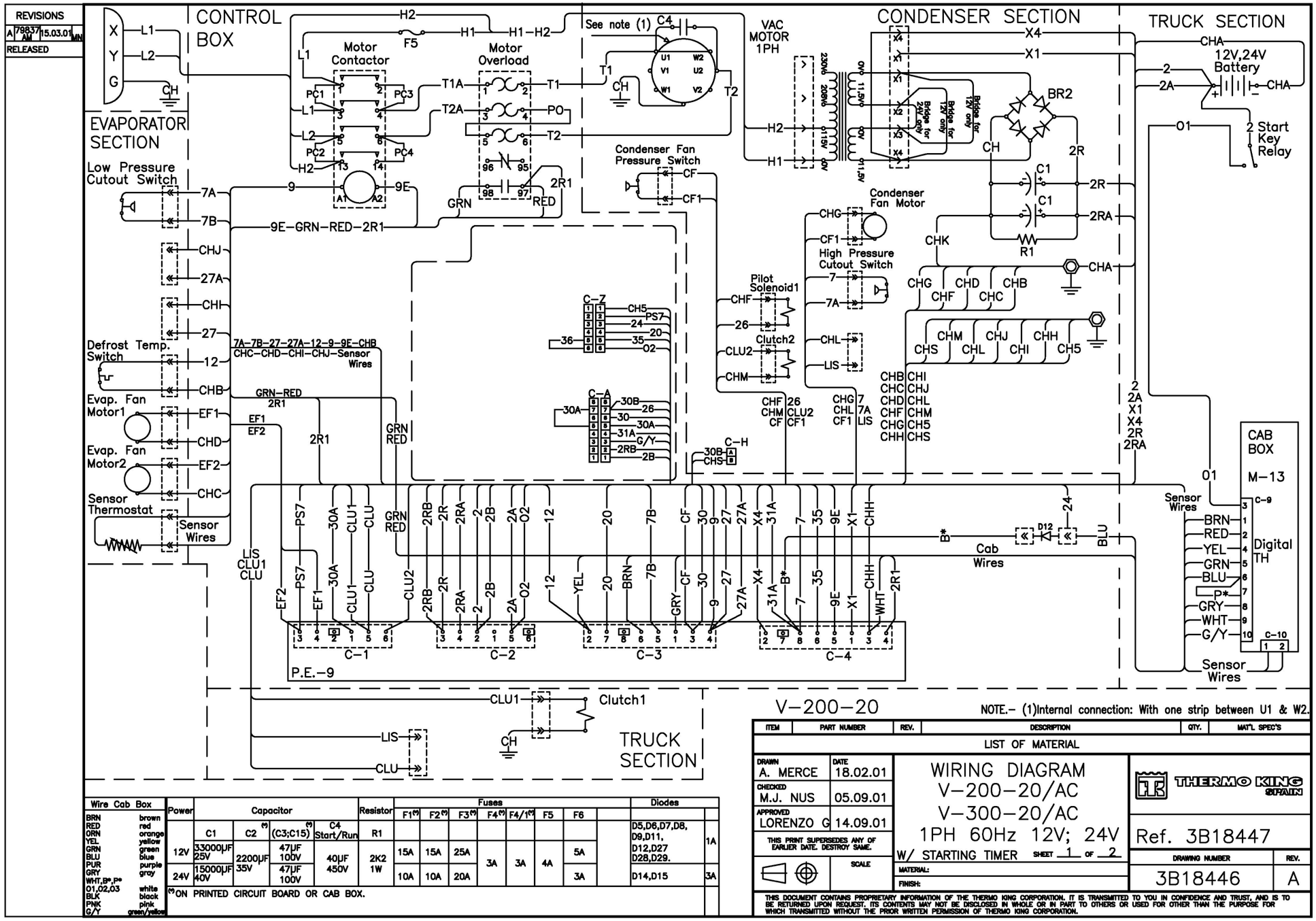
FINISH:

THERMO KING SPAIN

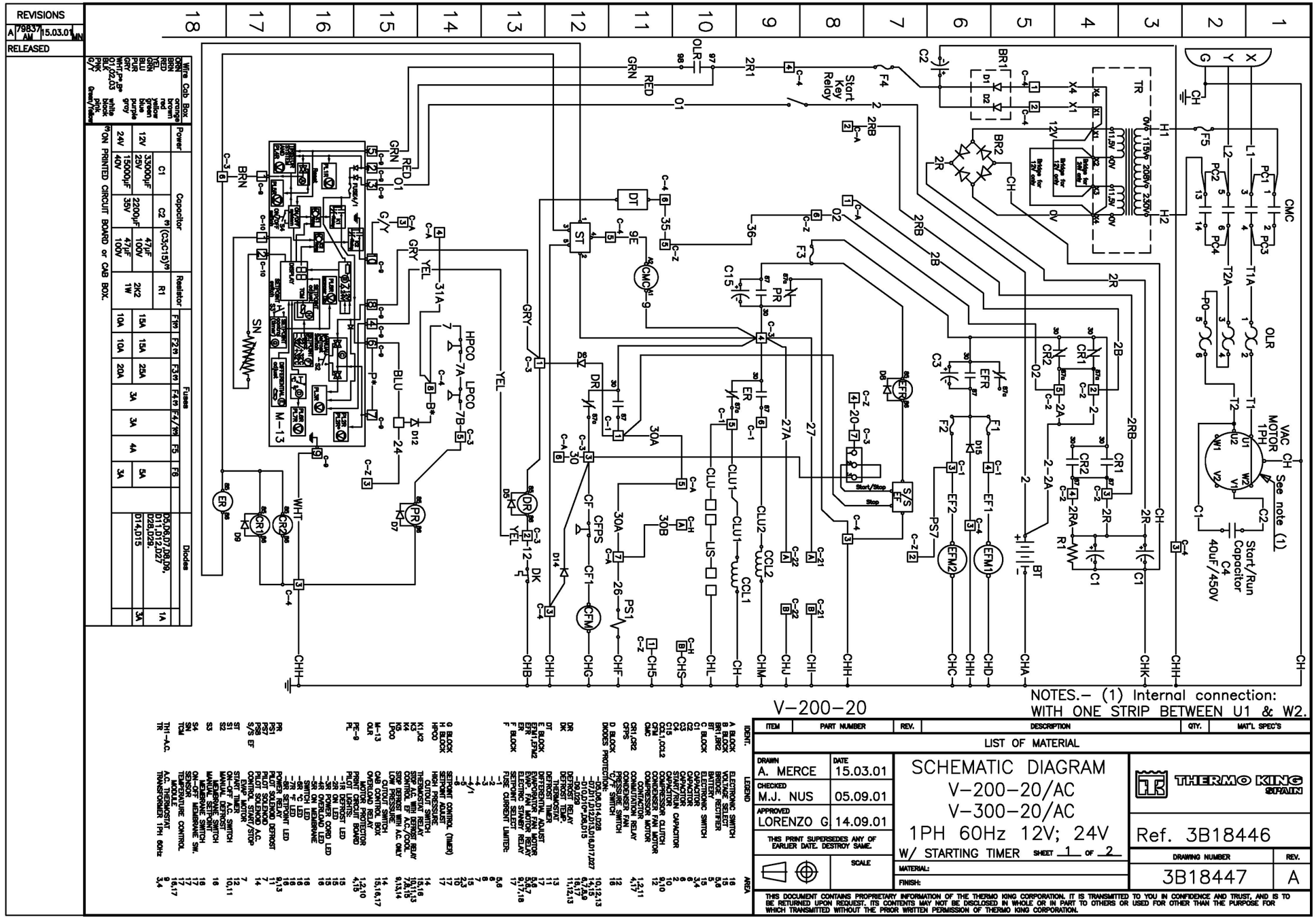
Ref. 3B16068

DRAWING NUMBER	REV.
3B16069	A

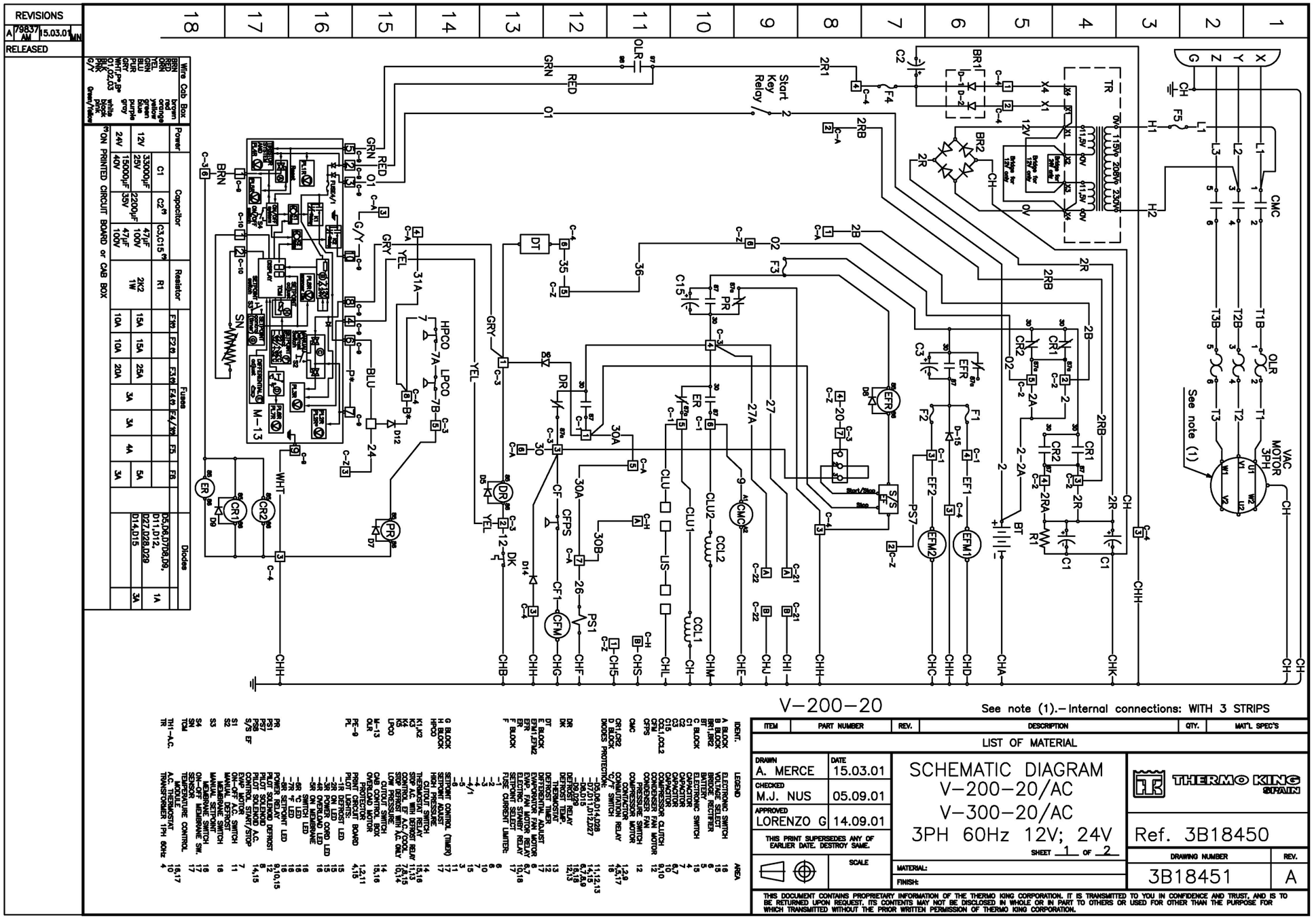
V-200-20/AC V-300-20/AC 1 PH 60Hz 12V; 24V Wiring Diagram



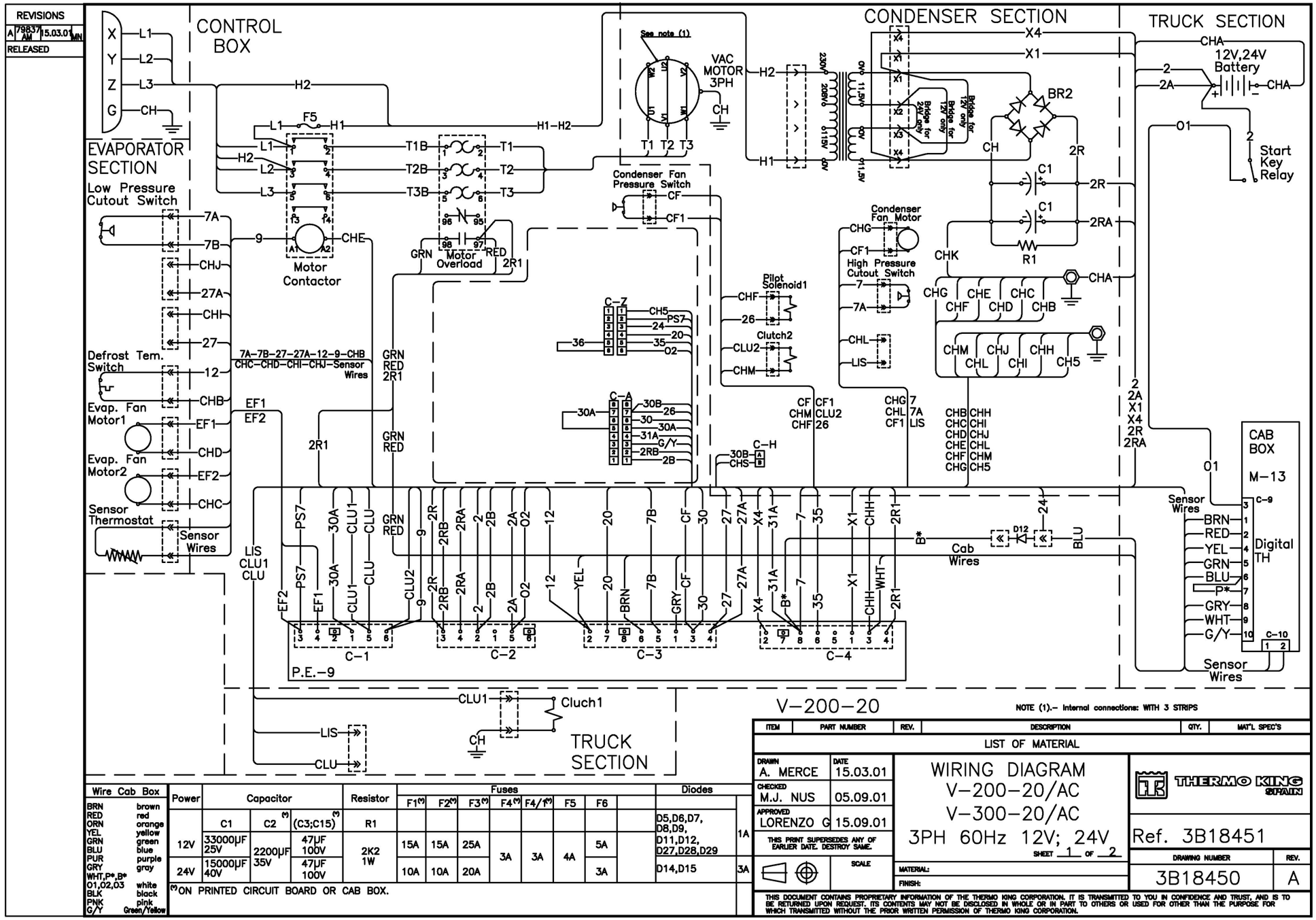
V-200-20/AC V-300-20/AC 1 PH 60Hz 12V; 24V Schematic Diagram



V-200-20/AC V-300-20/AC 3PH 60Hz 12V; 24V Schematic Diagram



V-200-20/AC V-300-20/AC 3PH 60Hz 12V; 24V Wiring Diagram



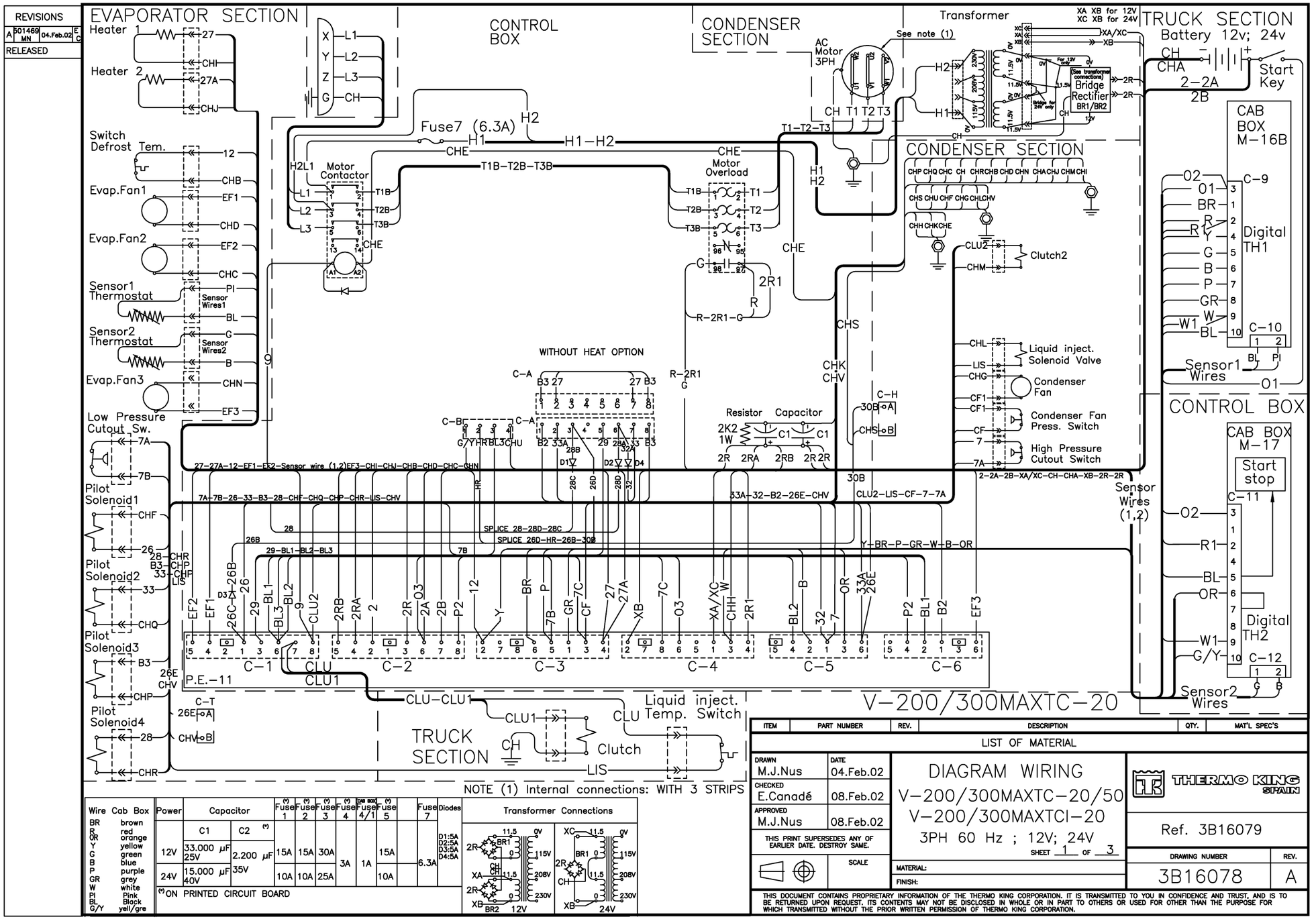
Wire	Cab Box
BRN	brown
RED	red
ORN	orange
YEL	yellow
GRN	green
BLU	blue
PUR	purple
GRY	gray
WHT,P*,B*	white
01,02,03	white
BLK	black
PNK	pink
G/Y	Green/Yellow

Power	Capacitor C1	Capacitor C2 (*)	Capacitor (C3;C15) (*)	Resistor
12V	33000µF 25V	2200µF 35V	47µF 100V	2K2 1W
24V	15000µF 40V		47µF 100V	

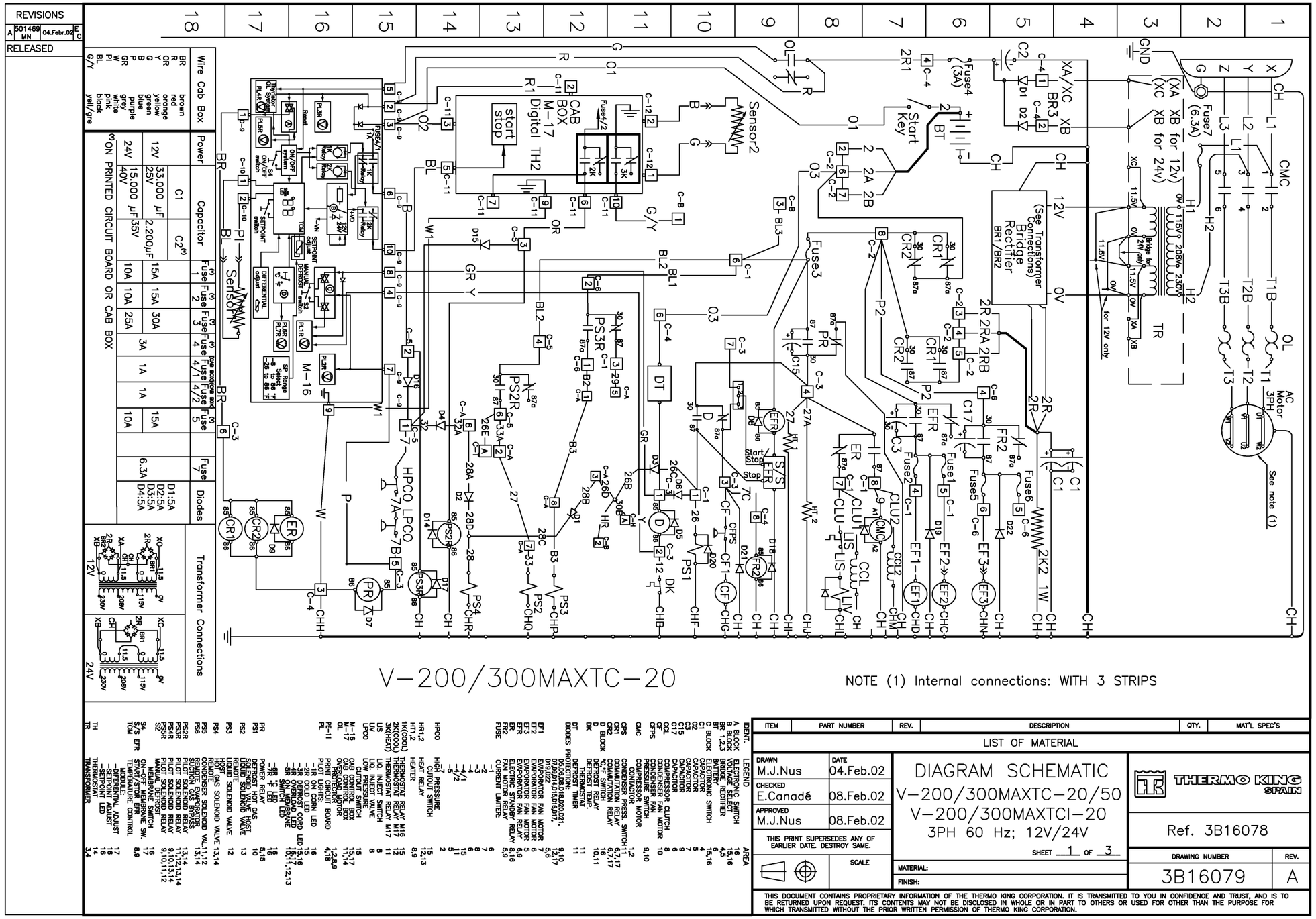
(*) ON PRINTED CIRCUIT BOARD OR CAB BOX.

Fuses	F1(*)	F2(*)	F3(*)	F4(*)	F4/1(*)	F5	F6		Diodes	
									D5,D6,D7, D8,D9, D11,D12, D27,D28,D29	1A
12V	15A	15A	25A	3A	3A	4A	5A			
24V	10A	10A	20A				3A		D14,D15	3A

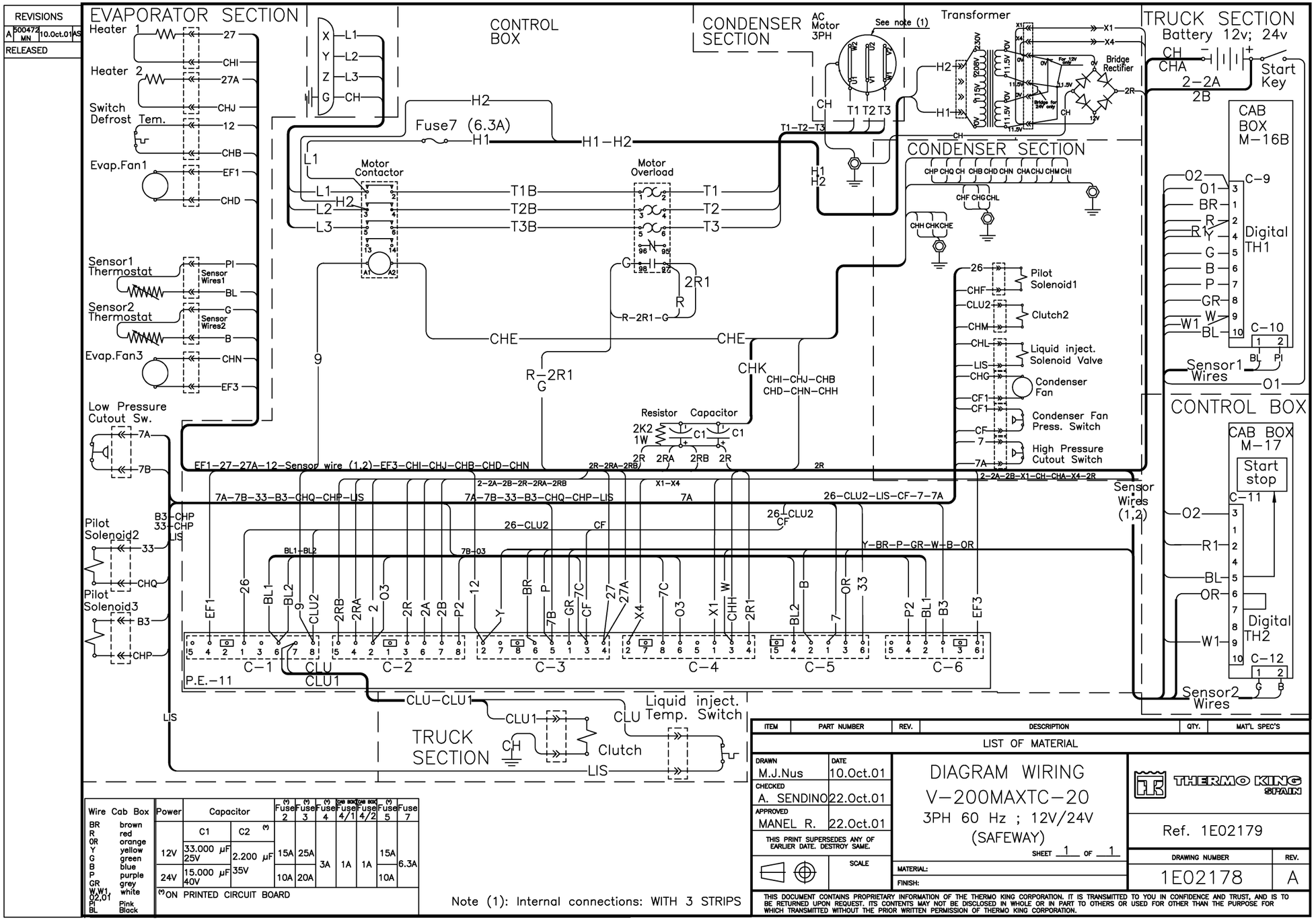
V-200/V-300 MAXTC-20, 3PH 60Hz; 12V; 24V Wiring Diagram



V-200/V-300 MAXTC-20, 3PH 60Hz; 12V/24V Schematic Diagram



V-200 MAXTC-20 3PH 60Hz; 12V/24V (Safeway) Wiring Diagram



Wire	Cab Box
BR	brown
R	red
OR	orange
Y	yellow
G	green
B	blue
P	purple
GR	grey
W,W1, O2,01	white
PI	Pink
BL	Black

Power	Capacitor C1	Capacitor C2 (*)	Fuse 2 (*)	Fuse 3 (*)	Fuse 4 (*)	Fuse 4/1 (cle box)	Fuse 4/2 (cle box)	Fuse 5 (*)	Fuse 7
12V	33.000 µF 25V	2.200 µF 35V	15A	25A	3A	1A	1A	15A	6.3A
24V	15.000 µF 40V		10A	20A				10A	

(*) ON PRINTED CIRCUIT BOARD

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

LIST OF MATERIAL

DRAWN	M.J.Nus
DATE	10.Oct.01
CHECKED	A. SENDINO
	22.Oct.01
APPROVED	MANEL R.
	22.Oct.01

THIS PRINT SUPERSEDES ANY OF EARLIER DATE. DESTROY SAME.

SCALE

DIAGRAM WIRING
V-200MAXTC-20
3PH 60 Hz ; 12V/24V
(SAFEWAY)

SHEET 1 OF 1

MATERIAL:

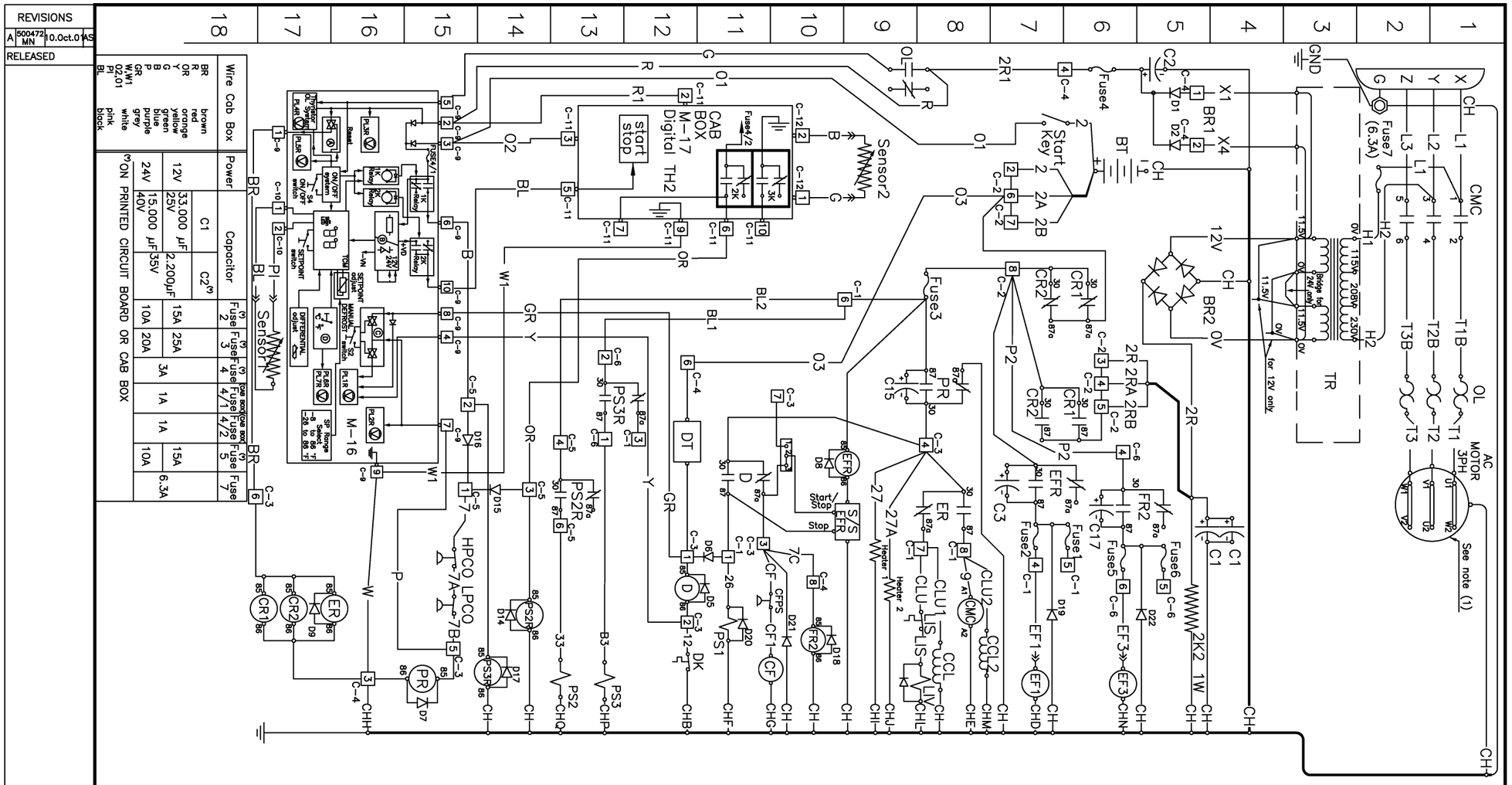
FINISH:

THERMO KING SPAIN

Ref. 1E02179

DRAWING NUMBER	REV.
1E02178	A

V-200 MAXTC-20 3PH 60Hz 12V/24V (Safeway) Schematic Diagram



IDENT.	LEGEND	AREA
A	BLOCK ELECTRIC SELECT	16,17
B	BLOCK BRIDGE RECTIFIER	4,5,18
BR 1,2	BATTERY	6
C	BLOCK CONTROL SWITCH	15,16
C1	CAPACITOR	4,5
C2	CAPACITOR	5
C5	CAPACITOR	7
C17	CAPACITOR	6
CCL	COMPRESSOR CLUTCH	8
CF	CONDENSER FAN MOTOR	10
CFPS	CONDENSER FAN MOTOR PRESSURE SWITCH	10
CMC	COMPRESSOR MOTOR CONTACTOR	10
CR1	COMMUTATION RELAY	12,8
CR2	COMMUTATION RELAY	6,7,17
D	BLOCK DEFROST RELAY	16
D	DEFROST THERMOSTAT	11,12
DK	DEFROST TIMER	11,12
DT	DEFROST TIMER	11,18
DIODES	PROTECTION: D1,D2,D3,D4,D20,D21, D7,D8,D14,D15,D16,D17, D18,D19,D22	9,10,11 12,13,14,17
EF1	EVAPORATOR FAN MOTOR	5,7
EF2	EVAPORATOR FAN MOTOR	7
EF3	EVAPORATOR FAN MOTOR	7
EFR	ELECTRIC STANDBY RELAY	7,9
FR2	FAN MOTOR RELAY	16
FUSE	CURRENT LIMITER:	5,6,10
	-2	7
	-3	8
	-4/1	15
	-4/2	11
	-5	2
HPCO	HIGH PRESSURE CUTOUT SWITCH	15
	HEATER	8,9
HT1,2	THERMOSTAT RELAY M16	15
1K(COOL)	THERMOSTAT RELAY M17	11
2K(COOL)	THERMOSTAT RELAY M17	10
SK(HEAT)	LOW PRESSURE SWITCH M17	9
LIS	LIQ. INJECT VALVE	9
LIV	LOW PRESSURE	15
LPCO	CUTOUT SWITCH	15,17
M-16	CAB CONTROL BOX	10,18
M-17	CAB CONTROL BOX	
OL	OVERLOAD MOTOR PROTECTOR	12,8,9
PC-11	PRINT CIRCUIT BOARD	4,18
PL	PILOT LIGHTS:	
	-1R ON LED	16
	-2R COLD LED	15
	-3R DEFROST CORD LED	15,16
	-4R OVERLOAD LED	16,17
	-5R LOW REFRIGERANT SWITCH LED	16,17,12,13
	-6R °F LED	16
	-7R °C LED	16
PR	POWER RELAY	8,9
PS1,2,3	PILOT SOLENOID	11,12,13
PS2R	PILOT SOLENOID RELAY	13,14
PS3R	PILOT SOLENOID RELAY	12,13,14
S2	MANUAL DEFROST SWITCH	16
S4	ON-OFF MEMBRANE SW.	17
S/S	START/STOP RELAY	8,9
EFR	TEMPERATURE CONTROL MODULE:	
TCM	-DIFFERENTIAL ADJUST	17
	-SETPOINT ADJUST	16
	-SETPOINT LED	14
TH	THERMOSTAT	3,4,18
TR	TRANSFORMER	