

**THANK YOU FOR CHOOSING THE *KIRBY* TITAN CONDENSING UNIT WITH VSD.
TO ENSURE TROUBLE FREE INSTALLATION AND COMMISSIONING, PLEASE REFER TO THE
CONTENTS OF THIS HANDBOOK, AND IM-008A FOR GENERAL TITAN UNIT INSTALLATION
AND COMMISSIONING.**

**THIS HANDBOOK IS TO BE USED ONLY AS A GUIDE.
REFER TO DANFOSS VSD USER MANUAL FOR DETAILED INFORMATION RELATING TO THE
VSD OR CONTACT YOUR KIRBY REPRESENTATIVE ON 13 23 50..**

**Polar
Pack**



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1 INTRODUCTION

Please take a few minutes to read the section “How This Unit Works”. In order to get the most out of this information you need to have the wiring diagram available as you read this section. The diagram is located at the end of this document and on the inside of the VSD panel door.

2 SAFETY

Please refer to the Titan Handbook [IM-008A](#) and the Danfoss Operating Instruction.

3 HOW THIS UNIT WORKS

3.1 General Operation

This unit has been preconfigured to operate the compressor via a Variable Speed Drive (VSD) to maintain a fixed suction Temperature (SetPoint). The speed of the compressor is determined by the difference in the evaporating temperature and the desired setpoint. This VSD has been factory set to enable the refrigeration system to operate in a basic pump down system. The VSD will switch the compressor off once the suction temperature has reached a pre-set value (refer table below). If it is desirable to operate the unit directly via the thermostat, not on pumpdown, this can be done by connecting the thermostat directly between terminals 1 and 2, removing the customer control link.

3.2 Bypass Operation

The unit also has a bypass contactor (K1) fitted to allow fixed speed operation, 50Hz. This is activated if the VSD registers an internal fault. When operating on the bypass contactor K1 the “Blue Light” located on the compressors end of the unit will be lit.

3.3 Control / Safety Circuit

The unit includes the standard compressor protection devices such as MP15, HP/LP, and compressor thermistors protection.

These components are all connected in series and form the control circuit loop. When a control loop component changes to the OPEN state the VSD display will indicate “Auto Remote Standby” and the compressor will stop.

4 COMPONENT FUNCTION

4.1 VSD

[This](#) is used to change the operating speed of the compressor.

4.2 K1 Main contactor used for FIXED SPEED operation.

This contactor is energized when the VSD detects an internal fault. VSD relay no. 1 closes providing power to K1 coil.

4.3 K2 Fan Motor contactor.

This contactor is used to control the operation of the condenser fan motors. It also controls the crankcase heater through the normally closed auxiliary contact.

4.4 External Relay No.1

This is used to provide a signal to the VSD that the compressor safety circuit is closed and the compressor is ready to run as required.

4.5 VSD Relay No. 1

Toggles between VSD operation (no internal alarm in VSD) and fixed speed operation (VSD internal alarm).

4.6 VSD Relay No. 2

This is used to control K2 condenser fan/crankcase heater contactor. Whilst the VSD is outputting a frequency to the compressors relay 2 will be powering K2.

4.7 MP15

This is used to protect the compressors from power supply abnormalities.

4.8 Mechanical HP/LP

Used to protect the compressor from either high or low pressure.

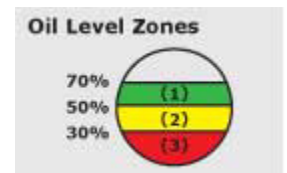
4.9 Int69

This thermistor module is used to protect the compressor motor. If the temperature in one of the areas monitored exceeds the nominal response temperature of the respective PTC-sensor, the sensor resistance increases and the INT69 module control contact will change state causing the motor contact to open.. Once the motor has cooled the sensor resistance will reduce and the INT69 control module contact will change state again allowing the motor contact to close. The relay switch output is designed as a potential free change-over contact.

4.10 TraxOil

This is used for oil management/control to the compressor. The unit is mounted in place of the oil level sight glass at the compressor's crankcase. A mechanical level detector (float and hall sensor) monitors the oil level and transmits information to the control logic.

The integrated solenoid valve feeds oil directly into the compressor sump when the compressor oil level is low. If the correct oil level cannot be reached and goes into the red zone area, the unit emits an alarm signal. The alarm contacts are used to shut down the compressor, thus opening the control circuit, signalling the VSD to stop



4.11 External Blue Light

This indicates the VSD has experienced an internal fault forcing the VSD to stop. The unit is now operating on fixed speed running bypassing the VSD. All the safety controls are still active and able to protect the compressor.

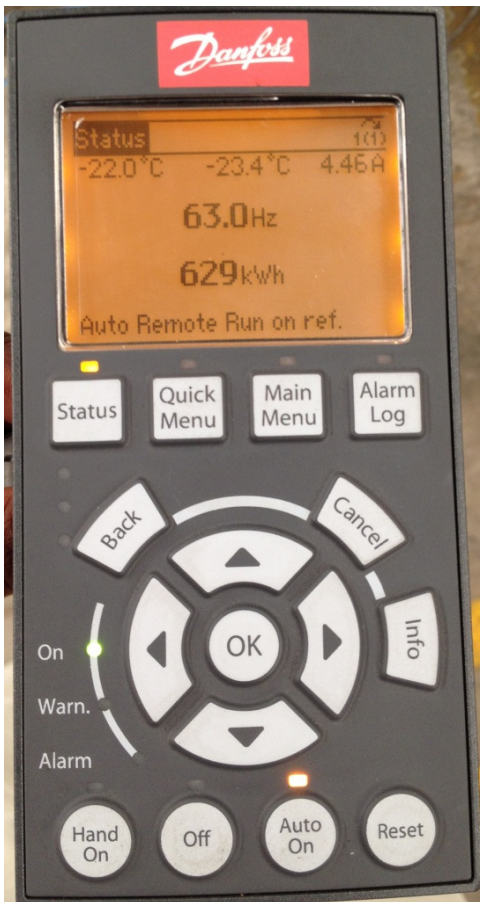
5 OPERATING LIMITS FOR VSD UNITS

Titan VSD units are designed to operate within the following application envelope

REFRIGERANT	MINIMUM EVAPORATING TEMPERATURE	MAXIMUM EVAPORATING TEMPERATURE	MAXIMUM AMBIENT	FREQUENCY RANGE
R134a	-20	+10	45 °C	30-65 Hz
R404A	-40	-5 (refer note)	45 °C	30-65 Hz

Note- -5°C for CS compressors, CC compressors with limited operation above -5°C for pull-down operation.

6 VSD DISPLAY INFORMATION



The VSD LCP display is basically divided into 3 areas, Top Line, Middle Section and Bottom Line. Each of these areas can be configured to display various information. However, the factory configuration is as follows

6.1 Top Line

There are three pieces of information available on this line.

6.1.1 Top Left

The setpoint temperature in the evaporator.

6.1.2 Top Middle

The current evaporator temperature.

6.1.3 Top Right

The current drawn by the compressor from the VSD.

6.2 Middle Line

The VSD output frequency in Hz.

6.3 Bottom Line

6.3.1 Bottom Left

Mode of operation whether the VSD is in AUTO or HAND (manual mode).

6.3.2 Bottom Middle

Indicates where the setpoint reference is coming from. Remote means it is from parameter 2021, Local means the reference is from the display screen.

6.3.3 Bottom Right

Status of VSD Input/Outputs.

If this value is

- STANDBY - the compressor control circuit has opened, either the HP/LP, Int69 or TraxOil or Customer Control has tripped. No power to the compressor.
- CUT OUT - the suction pressure measured by the VSD has reached the low limit cut out pressure and the VSD has stopped. No power to the compressor.
- RUNNING ON REF - the compressor is operating.

7 TROUBLE SHOOTING

7.1 Room Thermostat calls for cooling but VSD has 0 Hz output

- Check for “Standby” status on VSD screen refer to section 8.3.1.
- Check for Warning or Alarm messages on the VSD screen and refer to Danfoss VSD booklet.
- The delayed start may be activated, anti-short cycle timer in operation.

7.2 VSD has 30 Hz or constant Hz output.

- Check if the VSD is in HAND or AUTO mode of operation.
- Check if the suction temperature/pressure is lower than the setpoint but above Cut-out.

7.3 External Blue Light Is On

The VSD has experienced an internal fault, excessive current, overheating etc. Identify and correct the problem. To reactivate the VSD press the “RESET” button on the VSD control panel.

7.4 Total VSD Failure

In the event of a complete VSD failure the system can be made to operate in fixed speed operation by

- Pressing the OFF button on the LCP.
- Insert a WAGO jumper between terminal 6 and 7 on the WAGO terminal strip (located in the main electrical panel).
- On the VSD unplug relay no. 1 and 2, insulating the plug.

The system will now operate on fix speed running and cycle off on the LP control. When the unit cycles off on the LP a 15 minute delay will be initiated by the MP15. The delay can be avoided by removing the wire between the LP and the MP15 (terminal no 5 on MP15).

8 FACTORY SET PARAMETERS

LCP – Operating Instructions.

Table 1 - Parameter list for R134a.

Table 2 - Parameter list for R404a.

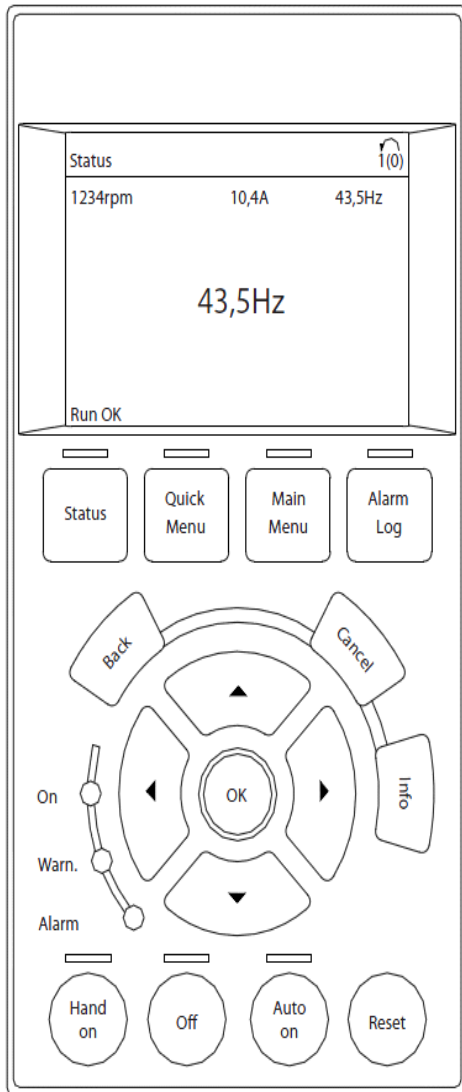
Table 1 and 2 list the factory set parameters. If the need should arise the VSD can be reset to these values by

- Switching off the VSD (open the 3 phase circuit breaker).
- Holding down the STATUS, MAIN MENU and OK button while closing the circuit breaker.
- Release the 3 buttons after 5 seconds.

The VSD will ask if you want to run the ADAP COOL Wizard, please select “CANCEL” and proceed to the Main Menu and enter the parameters as per the parameter list. This information is also located on the inside of the Titan side panel covering the VSD.

FOR R407F/R448A/R449A, and R450A/R513A PLEASE REFER TO KIRBY

**THESE REFRIGERANTS MUST BE SPECIFIED WHEN ORDERING UNITS TO FACILLITATE
PROGRAMMING CHANGES**



LCP DISPLAY (LCP 102)

MS804-40
ISSUE-A
04 / 12 / 12

DIP SWITCH 54 ON THE VSD SET TO " I " AND NOT TO " U " MODE
[DIP SWITCH 54 LOCATED ON THE VSD WHERE THE LCP IS MOUNTED]

RESET THE VSD:

1. DISCONNECT FROM MAINS AND WAIT UNTIL THE DISPLAY TURNS OFF
2. PRESS [STATUS]--[MAIN MENU]--[OK] KEYS ON THE LCP DISPLAY AT THE SAME TIME WHILE POWER UP THE LCP
3. RELEASE THE KEYS AFTER 5 SECONDS
4. THE VSD IS NOW PROGRAMMED ACCORDING TO DEFAULT SETTINGS

HOW TO OPERATE THE LCP DISPLAY:

THE LCP DISPLAY DIVIDED TO FOUR FUNCTIONAL GROUPS

1. GRAPHICAL DISPLAY WITH STATUS LINES
2. MENU KEYS AND INDICATOR LEDS--SELECTING MODE, CHANGING PARAMETERS AND SWITCHING BETWEEN DISPLAY FUNCTIONS.
3. NAVIGATION KEYS AND INDICATOR LEDS
4. OPERATION KEYS AND INDICATOR LEDS

PRESS [MAIN MENU] TO GO THE MAIN PARAMETERS LIST

USE UP AND DOWN KEYS TO SWITCH BETWEEN PARAMETERS

USE [OK] KEY TO SELECT AN OPTION

TO CHANGE A PARAMETER USE [UP] / [DOWN] ARROW KEYS AND TO MOVE THE CURSOR USE [LEFT] / [RIGHT] KEYS

* USE THE ATTACHED TABLES TO PROGRAM THE VSD ACCORDINGLY

** SELECT SUITABLE LIST ACCORDING TO THE MCC OF THE COMPRESSOR AND THE TYPE OF REFRIGERANT USED

*** REFER TO DANFOSS VSD MANUAL FOR MORE INFORMATION ON THE VSD

Figure 1 – LCP Operating Instructions

Par No	R134a	DRIVE CAPACITY [kW]	4	5.5	7.5	11	15	22	USER
0.20	Parameters	Display line 1.1	Reference [Unit]	Reference [Unit]	Reference [Unit]	Reference [Unit]	Reference [Unit]	Reference [Unit]	
0.21	Operation/Display	Display line 1.2	Feedback [Unit]	Feedback [Unit]	Feedback [Unit]	Feedback [Unit]	Feedback [Unit]	Feedback [Unit]	
1.00	Load and Motor	Configuration Mode	Process closed loop	Process closed loop	Process closed loop	Process closed loop	Process closed loop	Process closed loop	
1.22	Load and Motor	Motor Voltage [V]	415	415	415	415	415	415	
1.24	Load and Motor	** Motor Current [A]	13.5	17.5	17.5	25	30.84	34	
3.02	Reference/Ramps	Minimum Reference [°C]	-25	-25	-25	-25	-25	-25	
3.03	Reference/Ramps	Maximum Reference [°C]	10	10	10	10	10	10	
3.15	Reference/Ramps	Reference 1 source	No Function	No Function	No Function	No Function	No Function	No Function	
3.41	Reference/Ramps	Ramp Up time [s]	3	3	3	3	3	3	
3.42	Reference/Ramps	Ramp Down time [s]	3	3	3	3	3	3	
4.12	Limits/Warnings	Motor speed low limit [Hz]	30	30	30	30	30	30	
4.14	Limits/Warnings	Motor speed high limit [Hz]	65	65	65	65	65	65	
5.10	Digital In/Out	Terminal 18 DI	Start	Start	Start	Start	Start	Start	
5.11	Digital In/Out	Terminal 19 DI	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	
5.12	Digital In/Out	Terminal 27 DI	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	
5.13	Digital In/Out	Terminal 29 DI	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	
5.14	Digital In/Out	Terminal 32 DI	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	
5.15	Digital In/Out	Terminal 33 DI	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	
5.40	Digital In/Out	Relay 1	Alarm	Alarm	Alarm	Alarm	Alarm	Alarm	
5.40.1	Digital In/Out	Relay 2	Running	Running	Running	Running	Running	Running	
6.24	Analog In/Out	Terminal 54 Low ref [mA]	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	
6.25	Analog In/Out	Terminal 54 High ref [mA]	11	11	11	11	11	11	
14.00	Special Functions	Switching Pattern	60AVM	60AVM	60AVM	60AVM	60AVM	60AVM	
14.01	Special Functions	Switching Frequency [Hz]	8kHz	8kHz	8kHz	8kHz	8kHz	8kHz	
20.00	Drive closed loop	Feedback 1 source	Analog Input 54	Analog Input 54	Analog Input 54	Analog Input 54	Analog Input 54	Analog Input 54	
20.01	Drive closed loop	Feedback 1 conversion	Pressure to Temp	Pressure to Temp	Pressure to Temp	Pressure to Temp	Pressure to Temp	Pressure to Temp	
20.21	Drive closed loop	Setpoint 1 [°C]	-5	-5	-5	-5	-5	-5	
20.30	Drive closed loop	Refrigerant	R134a	R134a	R134a	R134a	R134a	R134a	
20.40	Drive closed loop	Thermostat/Pressostat Fn	Relative	Relative	Relative	Relative	Relative	Relative	
20.41	Drive closed loop	Cutout Value [°C]	-10	-10	-10	-10	-10	-10	
20.42	Drive closed loop	Cutin Value [°C]	10	10	10	10	10	10	
20.81	Drive closed loop	PID Normal inverse control	Inverse	Inverse	Inverse	Inverse	Inverse	Inverse	
22.76	Appl. Functions	Interval between starts	60 s	60 s	60 s	60 s	60 s	60 s	

Parameter list for R134a

Par No	R404a	DRIVE CAPACITY [kW]	4	5.5	7.5	11	15	22	USER
0.20	Parameters	Display line 1.1	Reference [Unit]	Reference [Unit]	Reference [Unit]	Reference [Unit]	Reference [Unit]	Reference [Unit]	
0.21	Operation/Display	Display line 1.2	Feedback [Unit]	Feedback [Unit]	Feedback [Unit]	Feedback [Unit]	Feedback [Unit]	Feedback [Unit]	
1.00	Load and Motor	Configuration Mode	Process closed loop	Process closed loop	Process closed loop	Process closed loop	Process closed loop	Process closed loop	
1.22	Load and Motor	Motor Voltage [V]	415	415	415	415	415	415	
1.24	Load and Motor	** Motor Current [A]	13.5	17.5	17.5	25	30.84	34	
3.02	Reference/Ramps	Minimum Reference [°C]	-40	-40	-40	-40	-40	-40	
3.03	Reference/Ramps	Maximum Reference [°C]	0	0	0	0	0	0	
3.15	Reference/Ramps	Reference 1 source	No Function	No Function	No Function	No Function	No Function	No Function	
3.41	Reference/Ramps	Ramp Up time [s]	3	3	3	3	3	3	
3.42	Reference/Ramps	Ramp Down time [s]	3	3	3	3	3	3	
4.12	Limits/Warnings	Motor speed low limit [Hz]	30	30	30	30	30	30	
4.14	Limits/Warnings	Motor speed high limit [Hz]	65	65	65	65	65	65	
5.10	Digital In/Out	Terminal 18 DI	Start	Start	Start	Start	Start	Start	
5.11	Digital In/Out	Terminal 19 DI	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	
5.12	Digital In/Out	Terminal 27 DI	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	
5.13	Digital In/Out	Terminal 29 DI	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	
5.14	Digital In/Out	Terminal 32 DI	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	
5.15	Digital In/Out	Terminal 33 DI	No Operation	No Operation	No Operation	No Operation	No Operation	No Operation	
5.40	Digital In/Out	Relay 1	Alarm	Alarm	Alarm	Alarm	Alarm	Alarm	
5.40.1	Digital In/Out	Relay 2	Running	Running	Running	Running	Running	Running	
6.24	Analog In/Out	Terminal 54 Low ref [mA]	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	
6.25	Analog In/Out	Terminal 54 High ref [mA]	11	11	11	11	11	11	
14.00	Special Functions	Switching Pattern	60AVM	60AVM	60AVM	60AVM	60AVM	60AVM	
14.01	Special Functions	Switching Frequency [Hz]	8kHz	8kHz	8kHz	8kHz	8kHz	8kHz	
20.00	Drive closed loop	Feedback 1 source	Analog Input 54	Analog Input 54	Analog Input 54	Analog Input 54	Analog Input 54	Analog Input 54	
20.01	Drive closed loop	Feedback 1 conversion	Pressure to Temp	Pressure to Temp	Pressure to Temp	Pressure to Temp	Pressure to Temp	Pressure to Temp	
20.21	Drive closed loop	Setpoint 1 [°C]	-25	-25	-25	-25	-25	-25	
20.30	Drive closed loop	Refrigerant	R404a	R404a	R404a	R404a	R404a	R404a	
20.40	Drive closed loop	Thermostat/Pressostat Fn	Relative	Relative	Relative	Relative	Relative	Relative	
20.41	Drive closed loop	Cutout Value [°C]	-10	-10	-10	-10	-10	-10	
20.42	Drive closed loop	Cutin Value [°C]	10	10	10	10	10	10	
20.81	Drive closed loop	PID Normal inverse control	Inverse	Inverse	Inverse	Inverse	Inverse	Inverse	
22.76	Appl. Functions	Interval between starts	60 s	60 s	60 s	60 s	60 s	60 s	

Parameter list for R404a

9 WIRING DIAGRAMS

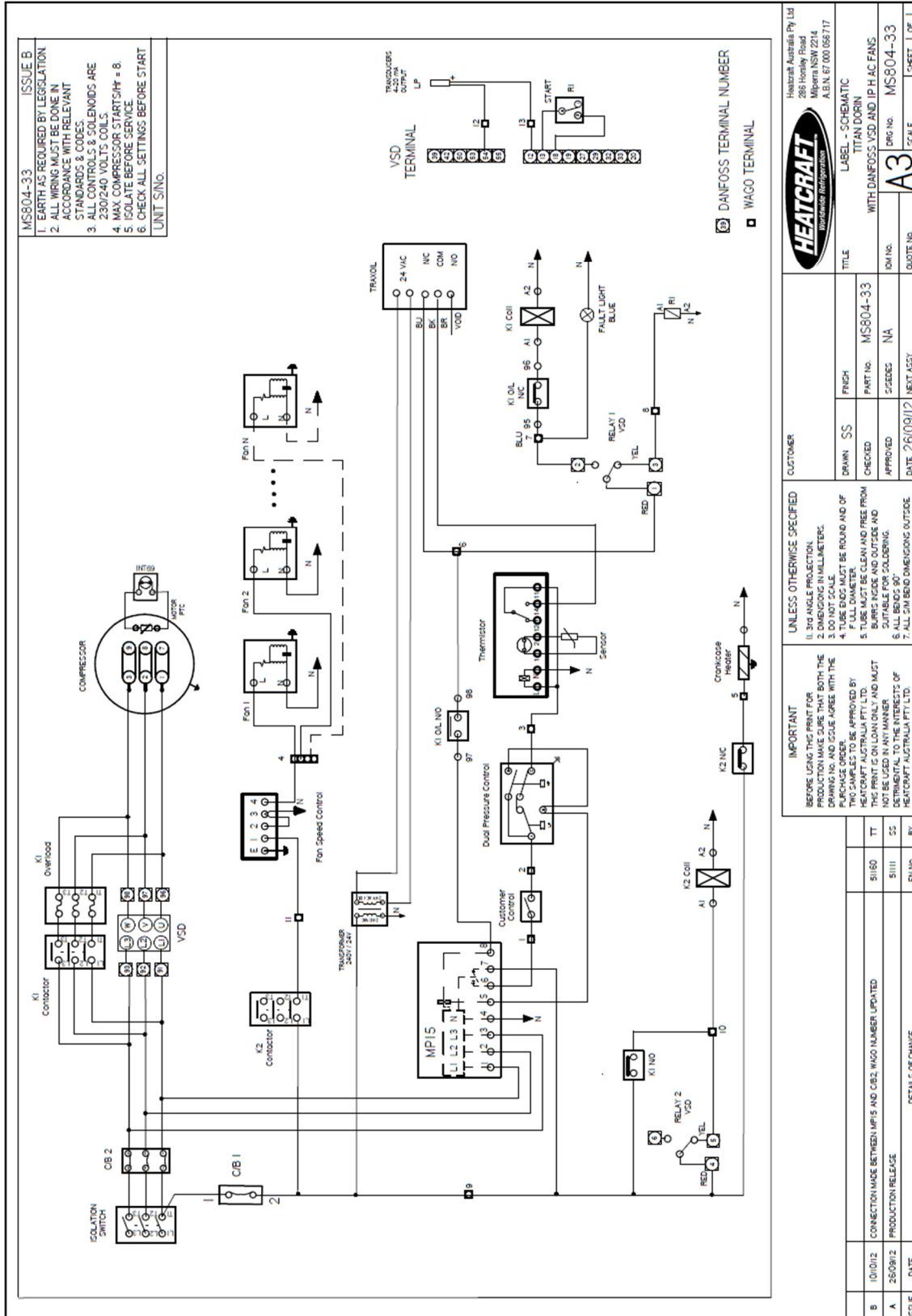
Please refer to the attached wiring schematic diagrams

MS804-33, Wiring Schematic Titan with VSD, 1 Ph AC Fan Motors

MS804-34, Wiring Schematic Titan with VSD, 2 or 3, 450 mm EC Fan Motors

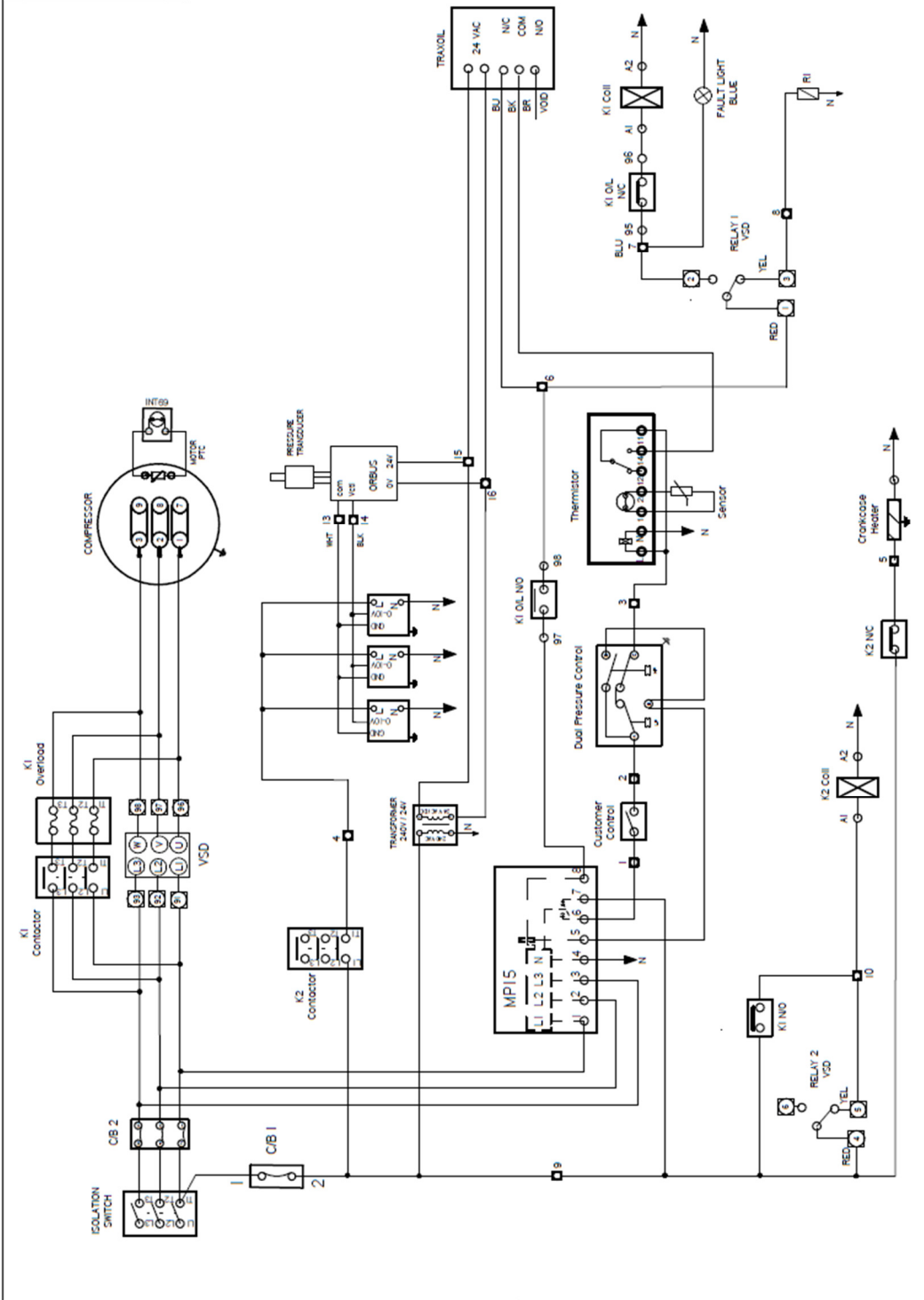
MS804-35, Wiring Schematic Titan with VSD, 3 Ph AC Fan Motors

MS804-39, Wiring Schematic Titan with VSD, 500 mm EC Fan Motors



MS804-33 - Wiring Schematic Titan with VSD, 1 Ph AC Fan Motors

- MS804-34
 ISSUE B
- EARTH AS REQUIRED BY LEGISLATION
 - ALL WIRING MUST BE DONE IN ACCORDANCE WITH RELEVANT STANDARDS & CODES
 - ALL CONTROLS & SOLENOIDS ARE 230/240 VOLTS COILS.
 - MAX COMPRESSOR STARTS: Ht = 8.
 - ISOLATE BEFORE SERVICE.
 - CHECK ALL SETTINGS BEFORE START.
- UNIT S/NO.



HEATCRAFT
 Residential Refrigeration

Heatcraft Australia Pty Ltd
 286 Honeily Road
 Milperra NSW 2214
 A.B.N. 61 000 66717

TITLE: TITAN DORIN WITH DANFOSS VSD EC FANS AND ORBUS

DRAWN: SS
 CHECKED: MS804-34
 APPROVED: PREV. ISSUE

DATE: 26/09/12
 NEXT ASSY

SCALE: A3
 SHEET: 12 OF 15

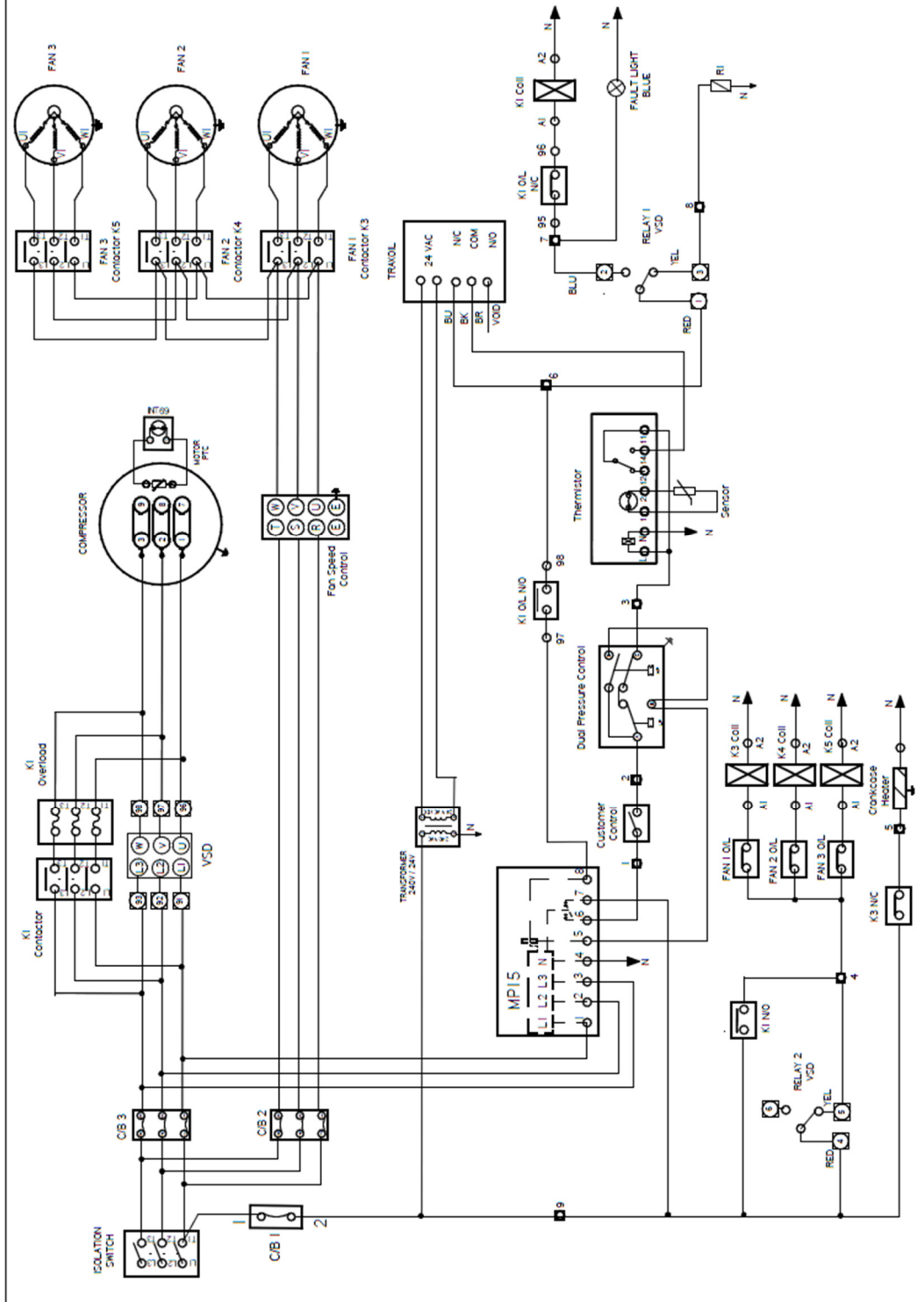
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- UNLESS OTHERWISE SPECIFIED**
 1. 3/16 INCH PROJECTION.
 2. DIMENSIONS IN MILLIMETERS.
 3. DO NOT SCALE.
 4. TUBE ENDS MUST BE ROUND AND OF FULL DIAMETER.
 5. TUBE MUST BE CLEAN AND FREE FROM BURRS INSIDE AND OUTSIDE AND SUITABLE FOR COLDERING.
 6. ALL BENDS 90°.
 7. ALL 5/16 INCH DIMENSIONS OUTSIDE.

ISSUE	DATE	BY	DETAILS OF CHANGE
B	15/01/12	SI78	FUSE DELETED WAGO NUMBER UPDATED
A	26/09/12	SS	PRODUCTION RELEASE

MS804-34 - Wiring Schematic Titan with VSD, 2 or 3, 450 mm EC Fan Motors

MS804-35 ISSUE D
 1. EARTH AS REQUIRED BY LEGISLATION.
 2. ALL WIRING MUST BE DONE IN ACCORDANCE WITH RELEVANT STANDARDS & CODES.
 3. ALL CONTROLS & SOLENOIDS ARE 230/240 VOLT'S COILS.
 4. MAX COMPRESSOR START/SHF = 8.
 5. ISOLATE BEFORE SERVICE.
 6. CHECK ALL SETTINGS BEFORE START

UNIT S/NO.



HEATCRAFT
 Refrigeration

Heatcraft Australia Pty Ltd
 286 Honsley Road
 Mibleira NSW 2214
 A.B.N. 67 000 068717

TITLE: TITAN DORIN WITH DANFOSS VSD
 3 PH AC FANS

DRAWN: SS
 CHECKED: TT
 APPROVED: RH
 DATE: 26/09/12

FINISH: SS
 PART NO.: MS804-35
 S/SEDES: PREV. ISSUE

QUOTE NO.: A3
 SCALE: MS804-35
 SHEET: 1 OF 1

UNLESS OTHERWISE SPECIFIED

- 3/16 ANGLE PROJECTION.
- DIMENSIONS IN MILLIMETERS.
- DO NOT SCALE.
- TUBE ENDS MUST BE ROUND AND OF FULL DIAMETER.
- TUBES MUST BE CLEAN AND FREE FROM BURRS INSIDE AND OUTSIDE AND SUITABLE FOR COLDERING.
- ALL BENDS 90°.
- ALL 5/8" BEND DIMENSIONS OUTSIDE.

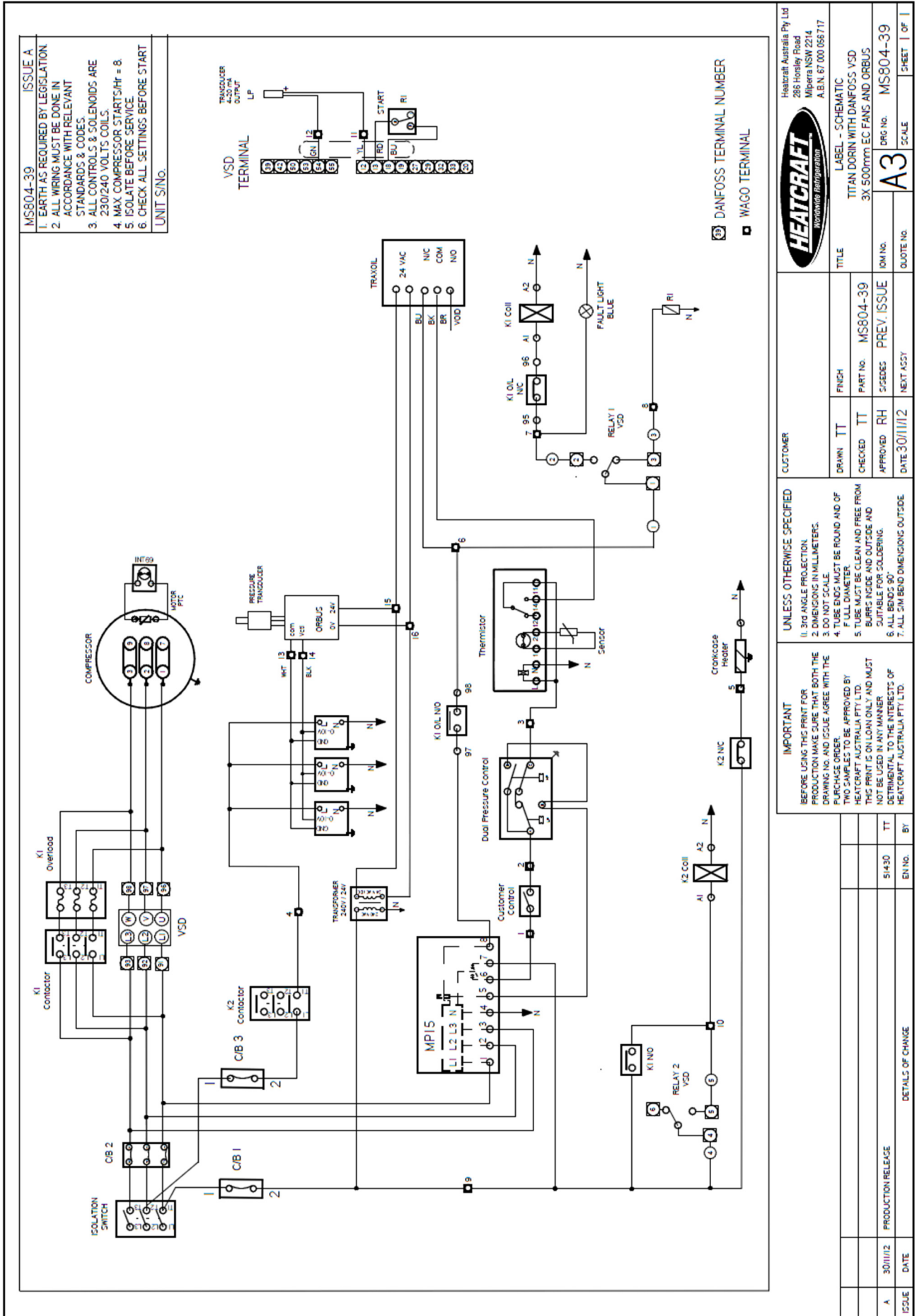
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ISSUE	DATE	DETAILS OF CHANGE	EN. NO.	BY:
D	22/01/12	FAN MOTORS AND CIRCUIT BREAKERS NUMBER UPDATED	51208	TT
C	15/01/12	FAN 1 OIL WAS CALLED K2 OIL. N.C. SAME AS FOR FAN 2 OIL AND FAN 3 OIL.	51177	TT
B	11/01/12	CONNECTION MADE BETWEEN MPIS AND CB2. WAGO NUMBER UPDATED	51168	TT

MS804-35 - Wiring Schematic Titan with VSD, 3 Ph AC Fan Motors



MS804-39 - Wiring Schematic Titan with VSD, 500 mm EC Fan Motors

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DRAWN	TT	FINISH	TITLE
CHECKED	TT	MS804-39	TITAN DORIN WITH DANFOSS VSD
APPROVED	RH	PREV. ISSUE	3X 500mm EC FANS AND ORBUS
DATE	30/11/12	DWG No.	MS804-39
ISSUE	A	QUOTE No.	SCALE
BY	51430	ISSUE No.	SHEET OF
DETAILS OF CHANGE		NEXT ASSY	

IMPORTANT

BEFORE USING THIS PRINT FOR PRODUCTION MAKE SURE THAT BOTH THE DRAWING NO. AND ISSUE AGREE WITH THE TWO COPIES TO BE APPROVED BY HEATCRAFT AUSTRALIA PTY LTD. THIS PRINT IS ON LOAN ONLY AND MUST NOT BE USED IN ANY MANNER DETRIMENTAL TO THE INTERESTS OF HEATCRAFT AUSTRALIA PTY LTD.

UNLESS OTHERWISE SPECIFIED

1. 3/8" ANGLE PROJECTION
2. DIMENSIONS IN MILLIMETERS.
3. DO NOT SCALE.
4. ALL DIMENSIONS MUST BE ROUND AND OF FULL DIMETER.
5. TUBES MUST BE CLEAN AND FREE FROM BURRS INSIDE AND OUTSIDE AND SUITABLE FOR COLLECTING.
6. ALL BENDS 90°
7. ALL SIM BEND DIMENSIONS OUTSIDE.

10 INSTALLATION NOTES

UNIT SERIAL NUMBER

INSTALLATION/COMMISSIONING DATE(S)



KIRBY HVAC&R PTY LTD (TRADING AS KIRBY)

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