Diagnostic Troubleshooting Repair

RTHD

RediStart Solid State Starter

Order No:**RTHD-SVD02A-EN** Date: May 2005

Pueblo Built Units Only

Introduction

The purpose of this bulletin is to provide set-up, operation, troubleshooting and replacement information for the "RediStart" solid state starter used on Trane RTHD units.

NOTICE: Warnings and Cautions appear at appropriate sections throughout this literature. Read these carefully.

⚠ **WARNING:** Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

⚠ **CAUTION:** Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury. It may also be used to alert against unsafe practices.

CAUTION: Indicates a situation that may result in equipment or property-damage only accidents.

General Overview

The RediStart MX motor starter is a microprocessor-controlled starter for three-phase induction motors. The starter can be custom designed for specific applications. A few of the features are:

- Solid state design.
- Reduced voltage starting.
- Closed-loop motor current control.
- Programmable motor protection.

- Programmable operating parameters.
- Programmable metering.

Each starter can operate within applied line voltage and frequency values of 100VAC to 600VAC (optional 1000VAC) and 23 to 72Hz.

The starter can be programmed for any motor FLA and all of the common motor service factors. It can also protect the motor and its load from damage that could be caused by incorrect phase order wiring.

The starter continually monitors the amount of current being delivered to the motor. This protects the motor from overheating or drawing excess current. The starter will automatically stop the motor if the Phase to Phase line current is not within acceptable ranges or if the current is lost in a line.

Features

The enhanced engineering features of the starter include:

- Multiple frame sizes
- Universal voltage operation
- Universal frequency operation
- Controlled acceleration and deceleration
- Phase rotation protection
- Regulated current control
- Electronic over/under current protection
- Single phase protection
- Line-to-line current imbalance protection
- Stalled motor protection
- Programmable metering
- Passcode protected
- Programmable Relays
- Analog output with digital offset and span adjustment
- Analog input with digital offset and span adjustment

Caution

Starter Damage!

To prevent damage to control board and possibly the SCRs, do not megger test the motor with the motor leads connected. Never hypot test the starter with the SCRs installed. Remove SCRs per recommended procedure on page 24. Failure to follow these recommendations may result in starter damage.

Meggering a Motor

If the motor needs to be meggered, remove the motor leads from the starter before conducting the test. **Failure to comply may damage the SCRs and WILL damage the control board, which will not be replaced under warranty.**

High Pot Testing

If the starter needs to be high pot tested, remove the SCR gate leads from the control board before conducting the test. **Failure to comply WILL damage the control board WHICH will not be replaced under warranty.**

Environmental Conditions

Operating Temperatures	0°C to +40°C (32°F to 104°F)
Storage Temperatures	-20°C to +70°C (-4°F to 155°F)
Humidity	0% to 95% non condensing
Altitude	1000m (3300ft) without derating
Maximum Vibration	5.9m/s2 (19.2ft/s2) [0.6G]
Cooling	Natural convection

Altitude Derating

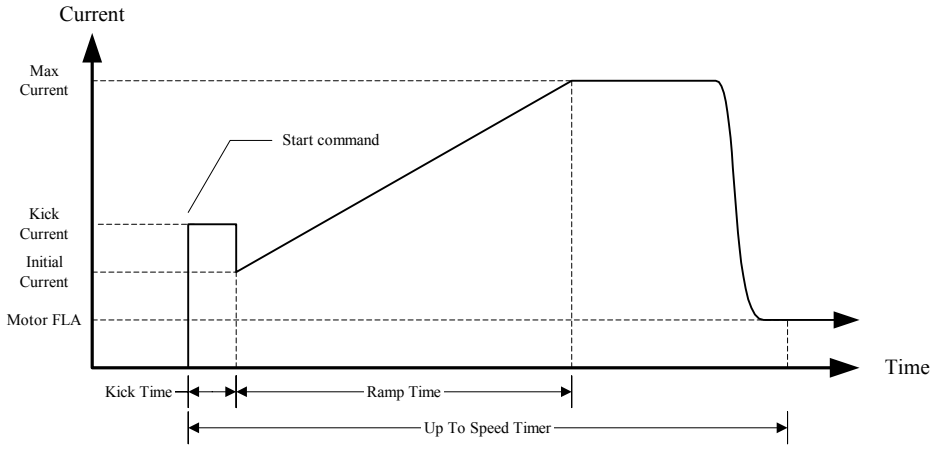
Benshaw's starters are capable of operating at altitudes up to 3,300 feet (1000 meters) without requiring altitude derating. provides the derating percentage to be considered when using a starter above 3,300 feet (1000 meters).

Altitude		Percent Derating (Amps)
3300 Feet	1006 meters	0.0%
4300 Feet	1311 meters	3.0%
5300 Feet	1615 meters	6.0%
6300 Feet	1920 meters	9.0%
7300 Feet	2225 meters	12.0%
8300 Feet	2530 meters	15.0%
9300 Feet	2835 meters	18.0%

Current Ramp Settings, Ramps and Times

The current ramp sets how the motor accelerates. The current ramp is a linear increase in current from the initial setting to the maximum setting. The ramp time sets the speed of this linear current increase. The following figure shows the relationships of these different ramp settings.

Figure 1: Current Ramp



Initial Current

The initial current should be set to the level that allows the motor to begin rotating within a couple of seconds of receiving a start command.

To adjust the initial current setting, give the starter a run command. Observe the motor to see how long it takes before it begins rotating and then stop the unit. For every second that the motor doesn't rotate, increase the initial current by 20%. Typical loads will require an initial current in the range of 50% to 175%.

Maximum Current

The maximum current can be left at 260%. This will ensure that enough current is applied to the motor to accelerate it to full speed.

The maximum current can also be set to a lower current limit. This is usually done to limit the voltage drop on the power system or to limit the torque the motor produces to help prevent damage to the driven load.

NOTE: The motor may achieve full speed at any time during the current ramp. This means that the maximum current setting may not be reached. Therefore, the maximum current setting is the most current that could ever reach the motor, and not necessarily the maximum current that will reach the motor.

NOTE: When setting a current limit, the motor must be monitored to ensure that the current is high enough to allow the motor to reach full speed under worst case load conditions.

Ramp Time

The ramp time is the time it takes for the current to go from the initial current to the maximum current. To make the motor accelerate faster, decrease the ramp time. To make the motor accelerate slower, increase the ramp time.

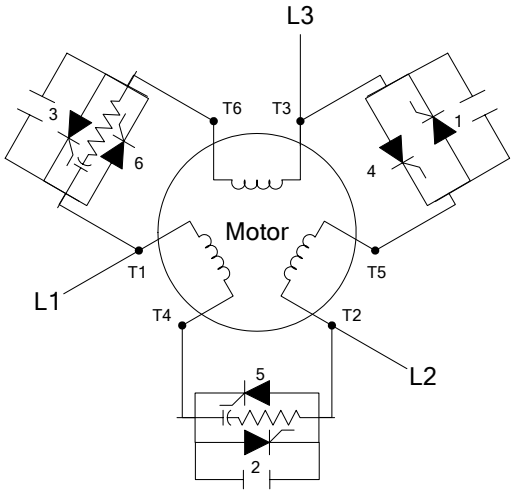
If the ramp time expires before the motor reaches full speed, the starter will maintain the set maximum current level until either the motor reaches full speed, the Up to Speed time expires, or the motor thermal overload trips.

NOTE: Setting the ramp time to a specific value does not necessarily mean that the motor will take this time to accelerate to full speed. The motor and load may achieve full speed before the ramp time expires if the application does not require the set ramp time and maximum current to reach full speed. Alternatively, the motor and load may take longer than the set ramp time to achieve full speed.

Typical Inside Delta Motor Connection

An inside delta soft starter is shown below, where the power poles are connected in series with the stator windings of a delta connected motor.

Figure 2: Typical Inside Delta Motor Connection



Integral Bypass

The RBX power stack has an integrated contactor that is used to bypass the SCR once the motor is up to speed. The contactor is sized to handle the current of the motor while running, but is NOT sized to start or stop the motor, this is the function of the solid state starter. **Any attempt to start the motor with the bypass contactor will damage the starter and/or the contactors.** The bypass contactor is used to reduce the heat that would be generated if the SCR's were not bypassed. While bypassed, the SCR's continue to fire even though the contactor is bypassing SCR.

Emergency Motor Overload Reset

The MX control has an emergency motor overload reset feature that allows the user to override the overload starter lockout.

To perform an emergency overload reset, simultaneously press the RESET and DOWN buttons on the keypad. An emergency overload reset may also be performed by applying 120 Volts to a digital input that is configured as an emergency overload reset input or by setting the emergency overload reset bit in the stator control modbus register

CAUTION

Motor Damage!

This feature should only be used in an emergency. Before an emergency reset is performed the cause of the motor overload should be investigated to ensure that the motor is capable of restarting without causing undesired motor or load damage. When the emergency motor overload reset is used, the accumulated motor overload content will be reset back to zero (0%). Therefore the MX's motor protection functions may not be able to fully protect the motor from damage during a restart after performing an emergency motor overload reset.

Power Factor Capacitors

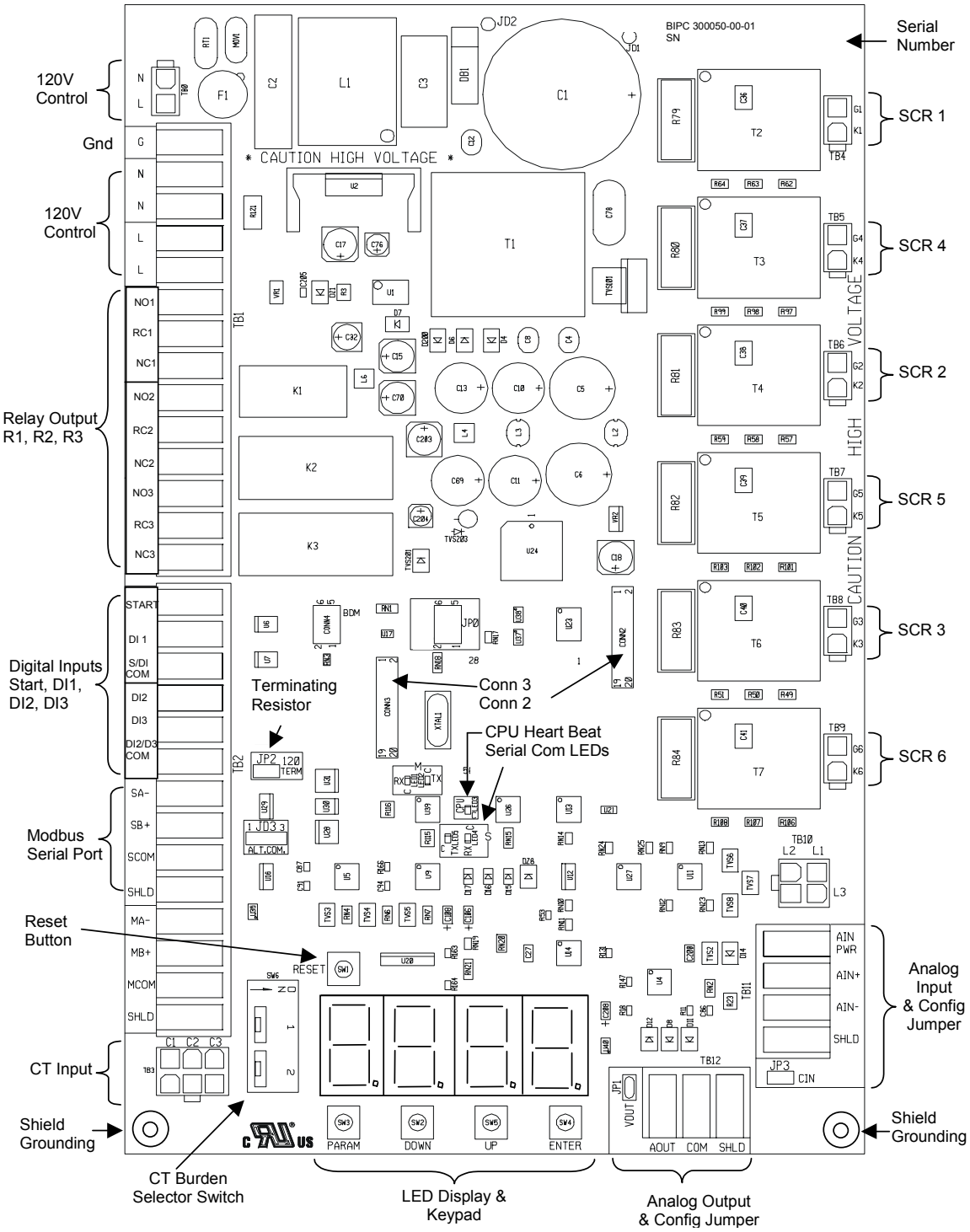
Power factor correction capacitors and surge capacitors CAN NOT be connected between the starter and the motor. These devices can damage the SCRs during ramping. These devices appear like a short circuit to the SCR when it turns on, which causes a di/dt (current surge) level greater than the SCR can handle. If used, power factor correction capacitors or surge capacitors must be connected ahead of the starter and sequenced into the power circuit after the start is completed. A programmable relay can be configured as an up-to-speed (UTS) relay and then used to pull-in a contactor to connect the capacitors after the motor has reached full speed.

CAUTION

Starter Damage!

Use of power factor correction or surge capacitors on the load side of the starter will result in serious damage to the starter that will not be covered by the starter warranty. The capacitors must be connected to the line side of the starter. The up-to-speed (UTS) contact can be used to energize the capacitors after the motor has reached full speed.

Figure 3: MX Control Board Layout



Terminal Points

Function	Terminal Number	Description
TB1		
Control Power Input	N, neutral L, line G, ground	96 - 144V AC input 45VA current requirements Line Frequency, 23 to 72Hz
Relay Output R1	NC1: Normally Closed RC1:Common NO1:Normally Open	Relay Output, SPDT form C 5 Amp, 125VAC, resistive 1 Amp, 125VAC, 0.4PF 100VA Inrush
Relay Output R2 & R3	NC2, RC2, NO2 NC3, RC3, NO3	Relay Output, SPDT form C 16 Amp, 250VAC, resistive 8 Amp, 250VAC, 0.4PF 2000VA Inrush
TB2		
Digital Inputs Start & DI1	Start, DI1, S/DI1 Com	120V AC digital input, 2500V optical isolation, 4mA cur. draw Off = 0 to 35 VAC, On = 60 to 120VAC
Digital Inputs DI2 & DI3		
Serial Comm. (Slave)	SA-, SB+, SCOM, SHLD	
Serial Comm	MA-, MB+, MCOM, SHLD	Factory Use Only, not isolated
TB12		
Analog Output	AOUT, COM, SHLD	Voltage or Current Output, selectable by JP1 Voltage; 0-10VDC (20mA Maximum), Current; 0-20mA, Software scalable, 500ohm load max. Accuracy ±1.5% Full Scale Update rate: 25msec.
TB13		
Analog Input	AIN+, ANI-, SHLD	Voltage or Current Input, selectable by JP3 Voltage; 0-10VDC, 1 Meg. impedance Current; 0-20mA, 499 ohm impedance, Software scalable, Accuracy ± 3% of full scale
Reference Supply	AIN PWR	10V DC (4 mA Maximum) Reference Source
Jumpers		
JP1	Analog Output	Voltage output when installed, Current loop removed
JP3	Analog Input	Current input when installed, Voltage input removed
JP0, JP2,JD3		Factory Use Only

Connectors

Connectors		Description
Aux Power	TB0	120V AC, 5 amps, Aux. Connector for control voltage
Current Transformers (CT) Connection	TB3	CT connection for CT1, CT2 and CT3 Molex Connector: #39-01-2065 Molex Connector Pins: #39-00-0090 crimp
SCR Connection	TB4	Cathode and Gate for SCR # 1
SCR Connection	TB5	Cathode and Gate for SCR # 4
SCR Connection	TB6	Cathode and Gate for SCR # 2
SCR Connection	TB7	Cathode and Gate for SCR # 5
SCR Connection	TB8	Cathode and Gate for SCR # 3
SCR Connection	TB9	Cathode and Gate for SCR # 6
		Molex Connector for gates: #39-01-3028 Molex Connector pins: #39-00-0056 crimp,
Remote Display	Conn 3	Remote Display or Option Board Interface
	TB10, Conn 4	Factory Use Only

Terminal Torque rating

The terminals on the control board have a torque rating of 3.5-inch lb. or 0.4nm. This MUST be followed or damage will occur to the terminals.

Please refer to Trane wiring diagrams for complete connection diagrams. The following diagrams are in the back of this manuel.

Schematic, Sheet 1 of 4	2309-1360
Schematic, Sheet 2 of 4	2309-1361
Schematic, Sheet 3 of 4	2309-1362
Schematic, Sheet 4 of 4	2309-1363
Component Location	2309-7565
Field Layout Diagram	2309-4869
Field Wiring Diagram	2309-4870

CT Switch Settings

When the starter is shipped from the factory the CT setting are set to match the CT ratios supplied with the starter. If the MX control is changed the CT settings must be changed to match the CT ratios for that given current rating.

To verify or change the motor current signal scaling:

- Compare the CT ratio stamped on each CT to the CT ratio listed on the wiring diagram supplied with the starter to ensure the correct CTs are installed.
- Inspect the control card to ensure that the DIP switches are in the correct positions for the applicable CT ratio and the motor full-load current (FLA)

CT Ratio	Minimum FLA (A rms)	Maximum FLA (A rms)	Switch 6 Position 1	Switch 6 Position 2
2640	73	128	Off	Off
	128	151	Off	On
	151	330	On	Off
	330	590	On	On
5760	590	720	On	Off
	720	1280	On	On

CT Polarity

The CT has a polarity that must be correct for the starter to correctly measure Watts, kW Hours, Power Factor, and for the Power and TruTorque motor control functions to operate properly.

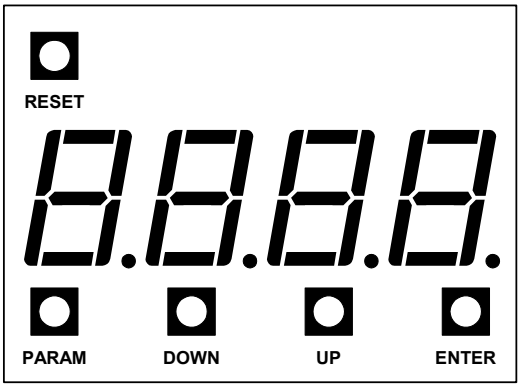
Each CT has a dot on one side of the flat surfaces. This dot, normally white in color, must be facing in the direction of the line.

The CT can be placed either before or after the starter. In specific applications, like Inside Delta, the CT's must be before the starter.

CT1 must be on Line L1 (R), CT2 must be on Line L2 (S), CT3 must be on Line L3 (T).

LED Display

Figure 4: Display



LED Display

1. View parameters, messages and faults.
2. Shows software revision on power up.

Programming

3. Press PARAM to enter the menu and then UP or DOWN to reach the desired parameter.
4. Press ENTER to show the present value of the parameter.
5. Press UP or DOWN to change the parameter value.
6. Press ENTER to store the new value or PARAM to abandon the change.

Quick Meters

7. Press DOWN to display the motor thermal overload content.
8. Press UP to display the incoming line phase order.
9. Press ENTER to display the status meter.Fault Log
10. Select P32 and press ENTER. The most recent fault will be displayed as "xFyy" where x will be 1 to indicate the most recent fault is being displayed and yy is the fault code.
11. Press DOWN to view older faults. Up to 9 faults may be stored in the log.

Resetting a Fault

12. Press RESET to reset from a fault.

Resetting Parameters

13. Press and hold PARAM and ENTER on power up to reset parameters to default values.

Emergency Thermal Reset

14. Press RESET and DOWN to perform an emergency thermal reset.

Messages

Figure 5: Messages

noL	No Line
rdY	Ready
Acc	Accelerating or Kicking
Acc2	Accelerating or Kicking with ramp 2
uES	Up to Speed
run	Run – Done with Accel ramp but not yet Up to Speed.
dcL	Decelerating Motor
A OL	Overload Alarm – The motor overload level is between 90% and 100%.
F OL	Overload Fault – The motor overload level has reached 100%.
L OL	Overload Lockout – A start is not allowed until the motor overload level cools below 60%.
L CP	Control Power Lockout – A start is not allowed because the control power is too low.
LOC	Lock out State
AbC	Phase order meter showing ABC
CbA	Phase order meter showing CBA
SPH	Phase order meter showing Single Phase
oxxx	xxx = overload content.
P xx	xx = Parameter code.
A xx	xx = Alarm code. If the condition persists, a fault will occur.
F xx	xx = Fault code.
ioc	Instantaneous Overcurrent
dFLt	Default – Flashes when parameter defaults are loaded.
HEAt	Heater/Anti-windmill Mode
ES	Energy Saver
FLSH	In reflash mode
Prog	In reflash mode, programming
rEAd	In reflash mode, verifying
donE	In reflash mode, complete

Viewing Parameter Values

Parameter view mode can be entered by:

1. At the default meter display, press the PARAM key to enter parameter mode. "P 1" will be displayed to indicate Parameter 1.
2. Use the UP and DOWN keys to scroll through the available parameters.
3. Pressing the UP key from "P 1" will advance to parameter "P 2".
4. Pressing the DOWN key from "P 1" will wrap around to the highest parameter.
5. The value of the parameter can be viewed by pressing the ENTER key.
6. To view another parameter without changing/saving the parameter, press the PARAM key to return to the parameter number display.

To return to the default meter display either:

1. Press the PARAM key while in the parameter number display mode.
2. Wait 60 seconds and the display will return to the default meter display

Changing Parameter Values

Parameter change mode can be entered by:

1. At the default meter display, press the PARAM key to enter parameter mode.
2. Use the UP and DOWN keys to scroll through the available parameters.
3. The value of the parameter can be viewed by pressing the ENTER key.
4. When viewing the parameter value, the parameter can be changed by using the UP and DOWN keys.
5. To store the new value, press the ENTER key. When the ENTER key is pressed the value will be saved and the display will go back to parameter # "P_"

To exit parameter change mode without saving the new parameter value either:

1. Press the PARAM key to return to the parameter number display.
2. Wait 60 seconds and the display will return to the default meter display.

Power Up

The software version will be displayed as a series of blinking digits once power has been applied to the MX control. If the parameters were being reset on power up, "dFLt" will be flashed on the display for three seconds, then the software version will be displayed.

Stopped

When the starter is not in the run mode, the display will show the status condition of the starter, such as "rdY" (ready), "L OL" (Overload Lockout), "noL" (No Line).

Running

When running, the display will show the user selected meter function. The following meters can be selected using the "Meter" display parameter.

Avg. RMS current	GF Current (% FLA)	Overload%	MWh	Running Time Days
Phase 1 RMS current	Avg. Voltage (RMS)	Power Factor	Phase Rotation	Running Time Hours
Phase 2 RMS current	L1-L2 Voltage (RMS)	KW	Line Frequency	Starts
Phase 3 RMS current	L2-L3 Voltage (RMS)	KVA	Analog Input%	TruTorque%
Current Imbalance%	L3-L1 Voltage (RMS)	KWh	Analog Output%	Power%

Alarm Condition

When an alarm condition exists, the display alternates between displaying the selected meter and the alarm code. The alarm code is displayed as "A XX", where XX is the alarm code.

- When a thermal overload alarm condition exists, "A OL" will be displayed.
- When a no line alarm condition exists, "noL" will be displayed.

When the starter is stopped, the selected meter is not included.

Lockout Condition

When a lockout condition exists, the display shows the lockout code. The lockout code is displayed as "L XX: where XX is the lockout code. Following are the defined lockout conditions and their codes:

- When a motor thermal overload lockout condition exists, "L OL" will be displayed.
- When a power stack thermal overload lockout condition exists, "L Ot" will be displayed.
- When a low control power lockout condition exists, "L CP" will be displayed.

When there are multiple lockout codes, each will be displayed for 2 seconds.

Faulted Condition

When a fault condition exists, the display shows the fault code. The exceptions to this are as follows:

- When the fault is thermal overload trip, "F OL" will be displayed.
- When the fault is I.O.C. (Instantaneous over current), will be displayed.

Quick Start, Initial Parameters

All parameters are factory set, no adjustments are required. In the event of a board replacement three parameters and the CT switch settings require adjustments.

In order for the starter to operate properly, there are 3 (P1, P4, P5) parameters that need to be validated before the starter can correctly start a motor. For the range of parameters, refer to the parameter table and the CT switch settings.

P1 Motor FLA

This parameter configures the motor full load amps, and is obtained from the nameplate on the attached motor.

If multiple motors are connected, the FLA of each motor must be added together for this value

NOTE: Incorrectly setting this parameter will affect proper operation of the motor overload protection, motor over current protection, motor undercurrent protection, ground fault protection and acceleration control.

P2 Maximum Motor Current

The maximum current 1 parameter is set as a percentage of the motor FLA parameter setting. The maximum current parameter performs two functions. It sets the current level for the end of the ramp profile. It also sets the maximum current that is allowed to reach the motor after the ramp is completed.

If the ramp time expires before the motor has reached full speed, the starter will hold the current at the maximum current level until the UTS timer expires, the motor reaches full speed, or the overload trips.

P3 Ramp Time

The ramp time is the time it takes for the starter to allow the current to go from the initial current to the maximum current. To make the motor accelerate faster, decrease the ramp time. To make the motor accelerate slower, increase the ramp time.

The ramp time is set for 1 second from the factory.

If the ramp time expires before the motor reaches full speed, the starter will maintain the set maximum current level until either the motor reaches full speed, the UTS timer expires, or the motor thermal overload trips.

NOTE: Setting the ramp time to a specific value does not necessarily mean that the motor will take this time to accelerate to full speed. The motor and load may achieve full speed before the ramp time expires if the application does not require the set ramp time and maximum current to reach full speed. Alternatively, the motor and load may take longer than the set ramp time to achieve full speed.

P4 Rated RMS Voltage

The Rated Voltage parameter sets the line voltage that is used when the starter performs Over and Under line voltage calculations. This value is the supply voltage; NOT the motor utilization voltage.

P5 CT Ratio

The CT ratio must be set to match the CTs (current transformers) supplied with the starter. This allows the starter to properly calculate the current supplied to the motor.

Only Benshaw supplied CTs can be used on the starter. The CTs are custom 0.2 amp secondary CTs specifically designed for use on the MX starter. The CT ratio is then normalized to a 1A secondary value. The supplied CT ratio can be confirmed by reading the part number on the CT label. The part number is of the form BICTxxx1M, where xxx is the CT primary and the 1 indicates the normalized 1 amp.

P6 Software Part Number

The software part number is useful for future service reasons. If calling Benshaw for service, this number should be recorded so it can be provided to the service technician.

On power up with an LED display, the software version is flashed one character at a time on the least significant digit. With an LCD display, the software PN is fully displayed on power up.

P7 Passcode

The MX control supports a 4-digit passcode. When the passcode is set, parameters may not be changed.

When a passcode is set and an attempt is made to change a parameter through the display/keypad, the UP and DOWN keys will simply have no effect. When a passcode is set and an attempt is made to change a parameter through Modbus, the control will return an error response with an exception code of 03 (Illegal Data Value) to indicate that the register may not be changed.

P8 Fault Log

When a fault occurs, the fault number is logged in non-volatile memory. The most recent fault will be in FL1 location and the oldest fault will be in FL9.

Refer to section 7, Troubleshooting or Appendix B for the fault codes and their descriptions.

Parameter Settings

Parameter	Description	Setting Range	Units	Default
P1	Motor FLA	1-6400	A_{rms}	10
P2	Maximum Motor Current	100-800	%FLA	260
P3	Ramp Time	0-300	Sec	1
P4	Rated RMS Voltage	200, 208, 220, 230, 240, 350, 380, 400, 415, 440, 460, 480, 500, 525, 575, 600	V_{rms}	480
P5	CT Ratio (x:1)	2640, 5760	-	2640
P6	Software Part Number	Display only	-	-
P7	Passcode	0-9999	-	-
P8	Fault Log	Display faults stored in Fault log	-	-

Troubleshooting

The troubleshooting section is divided into 4 sections.

- CH530 Diagnostics and Settings
- MX Control; General Troubleshooting when MX controlled is installed
- SCR Testing
- SCR Replacement

CH530 Diagnostics and Settings

The following troubleshooting chart can be used to help solve many of the diagnostics that may occur.

CH530 Diagnostic	Possible Cause/Solution
Phase Reversal	Phase Reversal must be disabled if using a Solid State Starter
Solid State Starter Fault	See Starter Fault Code
Compressor Did Not Accelerate Fully	Wiring Problem, Compressor Starting Loaded
Compressor Did Not Accelerate: Shutdown	Wiring Problem, Compressor Starting Loaded
At Speed Input Shorted	Wiring Problem, Welded Contactor
At Speed Input Open	Wiring Problem

CMX Control Trouble Shooting

The following troubleshooting charts can be used to help solve many of the more common problems that may occur when the MX control is installed.

⚠ WARNING

Live Electrical Components!

During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.

Condition	Cause	Solution
Motor does not start, no output to motor		
Display Blank, CPU Heartbeat LED on MX board not blinking.	Control voltage absent.	Check for proper control voltage input. Verify fuses and wiring.
	MX control board problem.	Consult factory.
Fault Displayed.	Fault Occurred.	See fault code troubleshooting table for more details.
Start command given but nothing happens.	Start/Stop control input problems.	Verify that the start/stop wiring and start input voltage levels are correct.
NOL or No Line is displayed and a start command is given, it will fault in F28.	No line voltage has been detected by the MX when a start command is given.	Check input supply for inline contactor, open disconnects, open fuses, open circuit breakers, or disconnected wiring.
		Verify that the SCR gate wires are properly connected to the MX control board.
		See fault code troubleshooting table for more details.

Condition	Cause	Solution
During starting, motor rotates but does not reach full speed		
Fault Displayed.	Fault Occurred.	See fault code troubleshooting table for more details.
Display shows Accel or Run.	Maximum Motor Current setting (P2) set too low.	Review acceleration ramp settings.
	Motor loading too high and/or current not dropping below 175% FLA indicating that the motor has not come up to speed.	Reduce load on motor during starting.
	Motor FLA (P1) or CT ratio (P5) parameter set incorrectly.	Verify that Motor FLA and CT ratio parameters are set correctly.
	Abnormally low line voltage.	Fix cause of low line voltage.
	A mechanical jam has occurred.	Verify that motor and load are free to rotate.
Motor Hums before turning	Initial current to low	Increase initial current
	FLA or CT incorrect	Verify FLA or CT's
Acceleration not operating as desired		
Motor accelerates too quickly.	Ramp time (P3) too short.	Increase ramp time.
	Initial current (H3) set too high.	Decrease Initial current.
	Maximum current (P2) set too high.	Decrease Maximum current.
	Motor FLA (P1) or CT ratio (P68) parameter set incorrectly.	Verify that Motor FLA and CT ratio parameters are set correctly.
Motor accelerates too slowly	Maximum Motor Current setting (P2) set too low.	Review acceleration ramp settings. Increase max current
	Motor loading too high.	Reduce load on motor during starting.
	Motor FLA (P1) or CT ratio (P5) parameter set incorrectly.	Verify that Motor FLA and CT ratio parameters are set correctly.
	Abnormally low line voltage.	Fix cause of low line voltage.
	Ramp time to long	Decrease ramp time
Motor stops unexpectedly while running		
Fault Displayed.	Fault Occurred.	See fault code troubleshooting table for more details.
Ready Displayed.	Start command lost.	Verify start command input signal is present or serial communications start command is present.
		Check any permissives that may be wired into the run command (Start/Stop)
Display Blank, Heartbeat LED on MX board not blinking.	Control voltage absent.	Check for proper control voltage input. Verify wiring and fuses.
	MX control board problem.	Consult factory.
Metering incorrect		
Power Metering not reading correctly.	CTs installed or wired incorrectly.	Verify correct CT wiring and verify that the CTs are installed with all the White dots towards the input line side.
	CT ratio parameter (P5) set incorrectly.	Verify that the CT ratio parameter is set correctly.
	Burden switches set incorrectly.	Verify that the burden switches are set correctly.
PF Meter not reading correctly.	CTs installed or wired incorrectly.	Verify correct CT wiring and verify that the CTs are installed with all the White dots towards the input line side.
Motor Current or Voltage meters fluctuating with steady load.	Loose connections.	Shut off all power and check all connections.
	SCR fault.	Verify that the SCRs gate leads are connected properly and the SCRs are ok.
	Load actually not steady.	Verify that the load is actually steady and that there are not mechanical issues.
	Other equipment on same power feed causing power fluctuations and/or distortion.	Fix cause of power fluctuations and/or distortion.
Voltage Metering not reading correctly.	Rated Voltage parameter (P4) set incorrectly.	Verify that Rated Voltage parameter is set correctly.

Condition	Cause	Solution
Current Metering not reading correctly.	CT ratio parameter (P5) set incorrectly.	Verify that the CT ratio parameter is set correctly.
	Burden switches set incorrectly.	Verify that the burden switches are set correctly.
	CTs installed or wired incorrectly.	Verify correct CT wiring and verify that the CTs are installed with all the White dots towards the input line side.
Ground Fault Current Metering not reading correctly.	CT ratio parameter (P5) set incorrectly.	Verify that the CT ratio parameter is set correctly.
	Burden switches set incorrectly.	Verify that the burden switches are set correctly.
	CTs installed or wired incorrectly.	Verify correct CT wiring and verify that the CTs are installed with all the White dots towards the input line side.
Other Situations		
Motor Rotates in Wrong Direction	Phasing incorrect	If input phasing correct, exchange any two output wires.
		If input phasing incorrect, exchange any two input wires.
Erratic Operation	Loose connections	Shut off all power and check all connections.
Motor Overheats	Motor overloaded	Reduce motor load.
	Too many starts per hour	Allow for adequate motor cooling between starts. Set Hot/Cold ratio higher or lengthen cooling time.
	High ambient temperature	Reduce ambient temperature or provide for better cooling. Set OL class lower to compensate for ambient temperature.
	Acceleration time too long	Reduce starting load and/or review acceleration ramp settings.
	Incorrect motor OL settings	Review and correct if necessary motor OL settings.
	Motor cooling obstructed/damaged	Remove cooling air obstructions. Check motor cooling fan.
Starter cooling fans do not operate (When Present)	Fan power supply lost	Verify fan power supply, check fuses.
	Fan wiring problem	Check fan wiring.
	Fan failure	Replace fan
Analog Output not functioning properly	Voltage/Current output jumper (JP1) not set correctly.	Set jumper to give correct output.
	Wiring problem	Verify output wiring.
	Analog Output Function parameter (A19) set incorrectly.	Verify that the Analog Output Function parameter is set correctly.
	Analog Output Offset and/or Span parameters (H20-21) set incorrectly.	Verify that the Analog Output Span and Offset parameters are set correctly.
	Load on analog output too high.	Verify that load on analog output meets MX control analog output specifications.
	Ground loop or noise problems.	Verify correct grounding of analog output connection to prevent noise and/or ground loops from affecting output.

Fault Code Troubleshooting

The following is a list of possible faults that can be generated by the MX starter control.

Fault Code	Description	Detailed Description of Fault / Possible Solutions
F01	UTS Time Limit Expired	Motor did not achieve full speed before the UTS timer (H4) expired.
		Check motor for jammed or overloaded condition.
		Verify that the acceleration ramp time (P3) is shorter than the UTS timer setting.
		Evaluate acceleration ramp settings. The acceleration ramp settings may be too low to permit the motor to start and achieve full speed. If so, revise acceleration ramp settings to provide more motor torque during starting.
		Evaluate UTS timer setting and, if acceptable, increase UTS timer setting (H4).

Fault Code	Description	Detailed Description of Fault / Possible Solutions
F02 (F OL)	Motor Thermal Overload Trip	The MX motor thermal overload protection has tripped.
		Check motor for mechanical failure, jammed, or overloaded condition.
		Verify the motor thermal overload parameter settings (H2, H16-18) and motor service factor setting (H1).
		Verify that the motor FLA (P1), CT ratio (P5), and burden switch settings are correct.
		If motor OL trip occurs during starting, review acceleration ramp profile settings.
		Verify that there is not an input line power quality problem or excessive line distortion present.
		Verify that PF caps, if installed, are ahead of CT's and starter.
		Reset overload when content falls below 15%.
F10	Phase Rotation Error, not ABC	Verify correct phase rotation of input power. Correct wiring if necessary.
F12	Low Line Frequency	Line frequency below 23 Hz was detected.
		Verify input line frequency.
		If operating on a generator, check generator speed governor for malfunctions.
		Check input supply for open fuses or open connections
		Line power quality problem / excessive line distortion.
F13	High Line Frequency	Line frequency above 72 Hz was detected.
		Verify input line frequency.
		If operating on a generator, check generator speed governor for malfunctions.
		Line power quality problem / excessive line distortion.
F15	Input power not three phase	Single-phase power has been detected when the starter is expecting three-phase power.
		Verify that input power is three phase. Correct wiring if necessary.
		Verify that the SCR gate wires are properly connected to the MX control board.
F21	Low Line L1-L2	Low voltage below the Undervoltage Trip Level parameter setting (H12) was detected for longer than the Over/Under Voltage Trip delay time (H13).
		Verify that the actual input voltage level is correct.
		Verify that the Rated Voltage parameter (P4) is set correctly.
		Check input supply for open fuses or open connections.
		On medium voltage systems, verify wiring of the voltage measurement circuit.
F22	Low Line L2-L3	Low voltage below the Undervoltage Trip Level parameter setting (H12) was detected for longer than the Over/Under Voltage Trip delay time (H13).
		Verify that the actual input voltage level is correct.
		Verify that the Rated Voltage parameter (P4) is set correctly.
		Check input supply for open fuses or open connections.
		On medium voltage systems, verify wiring of the voltage feedback measurement circuit.
F23	Low Line L3-L1	Low voltage below the Undervoltage Trip Level parameter setting (H12) was detected for longer than the Over/Under Voltage Trip delay time (H13).
		Verify that the actual input voltage level is correct.
		Verify that the Rated Voltage parameter (P4) is set correctly.
		Check input supply for open fuses or open connections.
		On medium voltage systems, verify wiring of the voltage feedback measurement circuit.

Fault Code	Description	Detailed Description of Fault / Possible Solutions
F24	High Line L1-L2	High voltage above the Over voltage Trip Level parameter setting (H11) was detected for longer than the Over/Under Voltage Trip delay time (H13).
		Verify that the actual input voltage level is correct.
		Verify that the Rated Voltage parameter (FUN 05, P66) is set correctly.
		Line power quality problems/ excessive line distortions.
F25	High Line L2-L3	High voltage above the Over voltage Trip Level parameter setting (H11) was detected for longer than the Over/Under Voltage Trip delay time (H13).
		Verify that the actual input voltage level is correct.
		Verify that the Rated Voltage parameter (P4) is set correctly.
		Line power quality problems/ excessive line distortions.
F26	High Line L3-L1	High voltage above the Over voltage Trip Level parameter setting (H11) was detected for longer than the Over/Under Voltage Trip delay time (H13).
		Verify that the actual input voltage level is correct.
		Verify that the Rated Voltage parameter (P4) is set correctly.
		Line power quality problems/ excessive line distortions.
F27	Phase Loss	The MX control has detected the loss of one or more input or output phases when the starter was running. Can also be caused by line power dropouts.
		Check input supply for open fuses.
		Check power supply wiring for open or intermittent connections.
		Check motor wiring for open or intermittent connections.
		On medium voltage systems, verify wiring of the voltage feedback measurement circuit.
		Check Gate and Cathode connections to MX board
F28	No Line	Check input supply for open disconnects, open fuses, open circuit breakers, or disconnected wiring.
		Verify that the SCR gate wires are properly connected to the MX control board.
		On medium voltage systems, verify wiring of the voltage feedback measurement circuit.
F30	I.O.C. (Instantaneous Overcurrent Current)	During operation, the MX controller detected a very high level of current in one or more phases.
		Check motor wiring for short circuits or ground faults.
		Check motor for short circuits or ground faults.
		Check if power factor or surge capacitors are installed on the motor side of the starter.
		Verify that the motor FLA (P1), CT ratio (P5), and burden switch settings are correct.
F31	Overcurrent	Motor current exceeded the Over Current Trip Level setting (H5) for longer than the Over Current Trip Delay Time setting (H6).
		Check motor for a jammed or an overload condition.
F34	Undercurrent	Motor current dropped under the Under Current Trip Level setting (H7) for longer than the Under Current Trip Delay time setting (H8).
		Check system for cause of under current condition.
F37	Current Imbalance	A current imbalance larger than the Current Imbalance Trip Level parameter setting (H9) was present for longer than ten (10) seconds.
		Check motor wiring for cause of imbalance. (Verify dual voltage and 6 lead motors for correct wiring configuration).
		Check for large input voltage imbalances that can result in large current imbalances.
		Check motor for internal problems.

Fault Code	Description	Detailed Description of Fault / Possible Solutions
F38	Ground Fault	Ground current above the Ground Fault Trip level setting (H10) has been detected for longer than 3 seconds.
		Check motor wiring for ground faults.
		Check motor for ground faults.
		Megger motor and cabling (disconnect from starter before testing).
		Verify that the motor FLA (P1), CT ratio (P5), and burden switch settings are correct.
		Verify that the CTs are installed with all the White dots towards the input line.
		In Single phase applications, verify that only two CTs are being used; that they are installed with all the White dots or Xs in the correct direction; and that the CTs are connected to the L1 and L3 CT inputs on the MX control card.
F39	No Current at Run	Motor current went below 10% of FLA while the starter was running.
		Verify Motor Connections.
		Verify the CT wiring to the MX control board.
		Verify that the motor FLA (P1), CT ratio (P5), and burden switch settings are correct.
		Check if load is still connected to starter
		Check if motor may have been driven by the load (a regeneration condition)
		Check Gate and Cathode connections to MX for loose connections.
		Check for inline contactor or disconnect.
F40	Shorted / Open SCR	A shorted or open SCR condition has been detected.
		Verify that all SCR gate leads wires are properly connected at the SCR devices and the MX control board.
		Check all SCRs with ohmmeter for shorts.
		Verify the motor wiring. (Verify dual voltage motors for correct wiring configuration).
F41	Current at Stop	Motor current was detected while the starter was not running.
		Examine starter for shorted SCRs.
		Examine bypass contactor (if present) to verify that it is open when starter is stopped.
		Verify that the motor FLA (P1), CT ratio (P5), and burden switch settings are correct.
F47	Stack Protection Fault (stack thermal overload)	The MX electronic power stack OL protection has detected an overload condition.
		Check motor for jammed or overloaded condition.
		Verify that the CT ratio (P5) and burden switch settings are correct.
		Motor load exceeds power stack rating. Consult factory
F48	Bypass /2M Contactor Fault	A digital input has been programmed as a Bypass/2M Contactor Feedback input and an incorrect bypass feedback has been detected for longer than the Bypass Confirm time parameter setting.
		Verify that the bypass/2M contactor coil and feedback wiring is correct.
		Verify that the relay output that is connected to the bypass/2M contactor(s) is programmed to the UTS function.
		Verify that the bypass/2M contactor power supply is present.
		Verify that the appropriate Digital Input Configuration parameter has been programmed correctly.
		Verify that the bypass contactor(s) are actually not damaged or faulty.

Fault Code	Description	Detailed Description of Fault / Possible Solutions
F50	Control Power Low	Low control power (below 90V) has been detected while running, by the MX controller.
		Verify that the control power input level is correct especially during starting when there may be significant line voltage drop.
		Check control power transformer tap setting (if available).
		Check control power transformer fuses (if present).
		Check wiring between control power source and starter.
F51	Current Sensor Offset Error	Indicates that the MX control board self-diagnostics have detected a problem with one or more of the current sensor inputs.
		Verify that the motor FLA (P1), CT ratio (P5), and burden switch settings are correct.
		Verify that no actual current is flowing through any of the starter's CTs when the starter is not running.
		Consult factory if fault persists.
F52	Burden Switch Error	The burden switch settings were changed when starter was running. Only change burden switches when starter is not running.
F60	External Fault on DI#1 Input	DI#1 has been programmed as a fault type digital input and the input indicates a fault condition is present.
		Verify that the appropriate Digital Input Configuration parameter has been programmed correctly.
		Verify wiring and level of input.
F61	External Fault on DI#2 Input	DI#2 has been programmed as a fault type digital input and input indicates a fault condition is present.
		Verify that the appropriate Digital Input Configuration parameter has been programmed correctly.
		Verify wiring and level of input.
F62	External Fault on DI#3 input	DI#3 input has been programmed as a fault type digital input and input indicates a fault condition is present.
		Verify that the appropriate Digital Input Configuration parameter has been programmed correctly.
		Verify wiring and level of input.
F71	Analog Input Level Fault Trip.	Contact Technical Service
F81	SPI Communication Fault	Indicates that communication has been lost with a remote device such as a remote keypad. (This fault will normally occur if the remote keypad is disconnected while the MX control board is powered up. Only connect and disconnect a remote keypad when the control power is off.)
		Verify that the remote keypad cable has not been damaged and that its connectors are firmly seated at both the keypad and the MX Control board.
		Verify that the display interface board (when present) is firmly attached to MX control card.
		Route keypad cables away from high power and/or high noise areas to reduce possible electrical noise pickup.
F82	Modbus Timeout Fault	Contact Technical Service
F94	CPU Error - SW fault	Typically occurs when attempting to run a version of control software that is incompatible with the MX control board hardware being used. Verify that the software is a correct version for the MX control board being used. Consult factory for more details.
		Fault can also occur if the MX control has detected an internal software problem. Consult factory.
F95	CPU Error - Parameter EEPROM Checksum Fault	The non-volatile user parameter values have been found to be corrupted. Typically occurs when the MX control is re-flashed with new software.
		Perform a Factory Parameter reset and then properly set all user parameters before resuming normal operation.
		If fault persists after performing a Factory Parameter reset, consult factory.
F96	CPU Error	The MX control has detected an internal CPU problem. Consult factory.
F97	CPU Error - SW Watchdog Fault	The MX control has detected an internal software problem. Consult factory.
F98	CPU Error	The MX control has detected an internal CPU problem. Consult factory.

Fault Code	Description	Detailed Description of Fault / Possible Solutions
F99	CPU Error - Program EPROM Checksum Fault	The non-volatile program memory has been corrupted.
		Consult factory. Control software will need to be reloaded in to the MX control card before normal operation can resume.

SCR Testing

Resistance

The SCR in the starter can be checked with a standard ohmmeter to determine their condition.

⚠ WARNING

Hazardous Voltage w/Capacitors!

Disconnect all electric power, including remote disconnects before servicing. Follow proper lockout/tagout procedures to ensure the power cannot be inadvertently energized. For variable frequency drives or other energy storing components provided by Trane or others, refer to the appropriate manufacturer's literature for allowable waiting periods for discharge of capacitors. Verify with an appropriate voltmeter that all capacitors have discharged. Failure to disconnect power and discharge capacitors before servicing could result in death or serious injury.

1. Remove power from the starter before performing these checks
2. Check from L to T on each phase. The resistance should be over 50k ohms.

NOTE: The resistance measurements may not be within these values and the SCR may still be good. The checks are to determine if an SCR is shorted "L" to "T" of if the gate in an SCR is shorted or open. An SCR could also still be damaged even though the measurements are within the above specifications.

Voltage

⚠ WARNING

Live Electrical Components!

During installation, testing, servicing and troubleshooting of this product, it may be necessary to work with live electrical components. Have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks. Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.

1. When the starter is running, the operation of SCR can be confirmed with a voltmeter.
2. While the starter is running and up to speed, use an AC voltmeter, check the voltage from "L" to "T" of each phase. The voltage should be less that 1.5 Volts. If the starter has a bypass contactor, the voltage drop should be less that 0.3 volts.
3. Using a DC voltmeter, check between the gate leads for each SCR (red and white twisted pair). The voltage should between 0.5 and 2.0 volts.

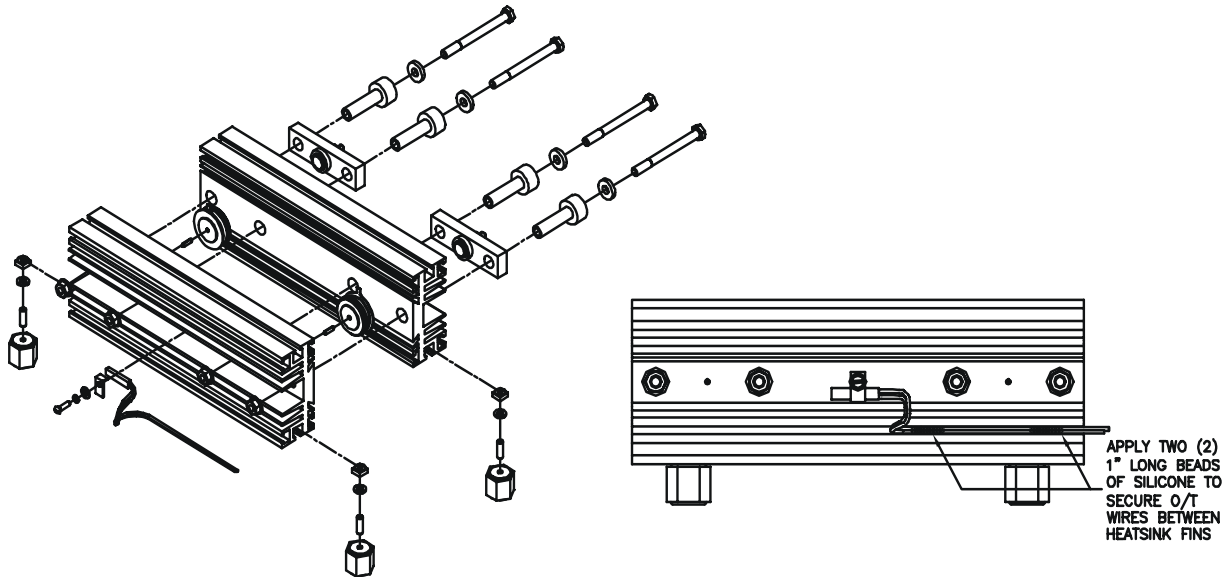
Integral Bypass

1. A voltage check from "L" to "T" of each phase of the RediStart starter should be preformed every 6 months to confirm the bypass contactors are operating correctly.
2. While the starter is running and Up to Speed, use an AC voltmeter; check the voltage from "L" to "T" of each phase. The voltage drop across the contactor contacts should be less than 300mV. If greater that 300mV the integral bypass should be disassembled. It may be necessary to clean the contact tips or replace the contactor.

SCR Replacement

This section is to help with SCR replacements on stack assemblies. Please read prior to installation.

Figure 6: Typical Stack Assembly



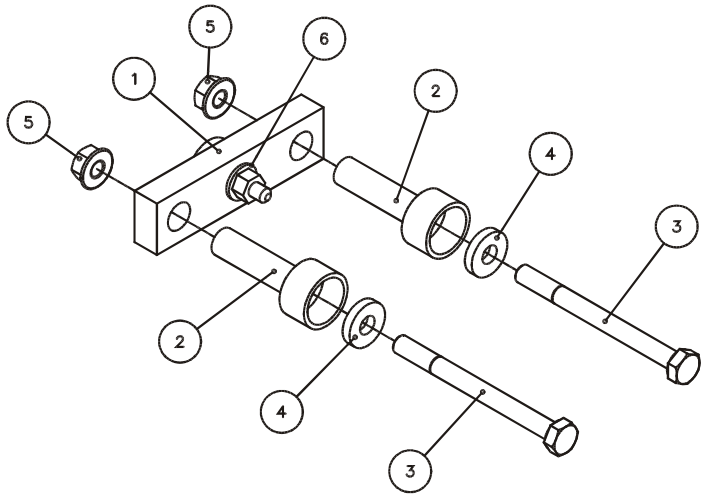
SCR Clamp Parts

Item #	Quantity	Description
1	1	Loader Bar
2	2	Insulator cup
3	2	Bolt
4	2	Washer
5	2	Serrated nut (larger style clamp has 1 support bar)
6	1 or 2	Indicator Washer - Quantity dependant on style of clamp

SCR Clamp

Below is an exploded view of a typical SCR clamp. Refer to the Clamp Parts List for names of the parts being used

Figure 7: SCR Clam



Removal

⚠ WARNING

Hazardous Voltage w/Capacitors!

Disconnect all electric power, including remote disconnects before servicing. Follow proper lockout/tagout procedures to ensure the power cannot be inadvertently energized. For variable frequency drives or other energy storing components provided by Trane or others, refer to the appropriate manufacturer's literature for allowable waiting periods for discharge of capacitors. Verify with an appropriate voltmeter that all capacitors have discharged. Failure to disconnect power and discharge capacitors before servicing could result in death or serious injury.

To remove the SCR from the heatsink, loosen the two bolts (3) on the loader bar side of the clamp. Do not turn on the nuts (5). The nuts have a locking ridge that sink into the aluminum heatsink. Do ¼ turns until the SCR comes loose. Remove the SCRs from the heatsink.

Note: Do not loosen nut on indicator washer (6). This will change the clamping pressure of the clamp and the clamp will be defective.

SCR INSTALLATION

Coat the faces of the SCRs to be installed with a thin layer of EJC (electrical joint compound).

Place the SCRs onto the dowel pins. The top SCR will have the cathode to the left and the bottom SCR will have the cathode to the right. The SCR symbol has a triangle that points to the cathode.

Finger tighten nuts on the bolts.

Tightening Clamp

Finger tighten the clamp. Ensure both bolts are tightened an equal amount so that the loader bar (item 1) is square in the heatsink. Tighten the bolts equally in 1/8 turn increments until the indicator washer(s) (item 6), which are under the nut(s) in the center of the loader bar, becomes loose indicating the clamp is tight. On the loader bars with two indicator washers, it may be necessary to tighten or loosen one side of the clamp to get both indicator washers free.

Appendix

The appendix contains the following.

- Alarm Codes List
- Fault Codes List
- Wiring Schematics

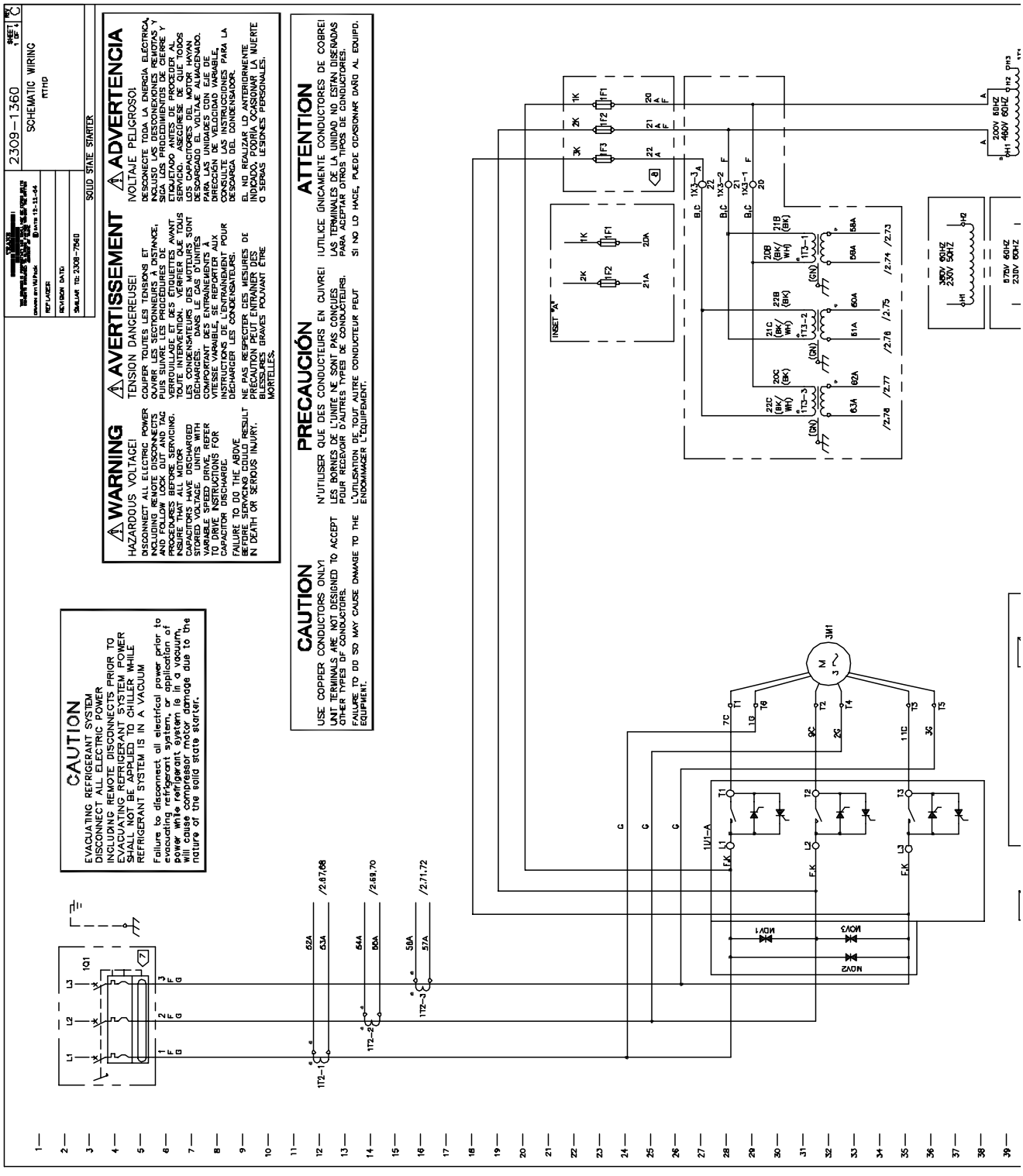
Fault Codes

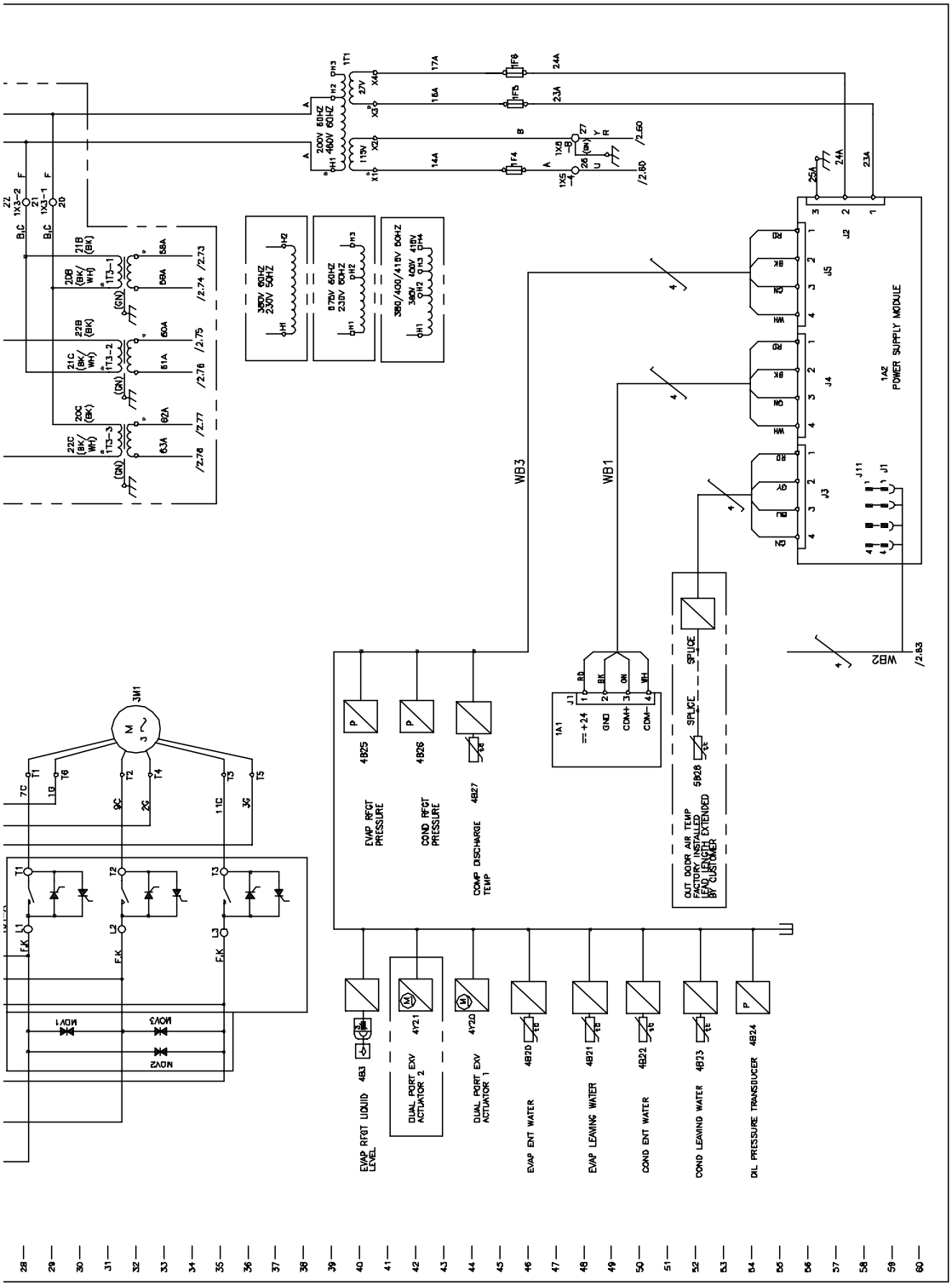
Fault Code	Description	Controlled Fault Stop	Shunt Trip Fault	Auto-Reset Allowed
F01	UTS Time Limit Expired	Y	N	Y
F02	Motor Thermal Overload Trip	Y	N	Y
F10	Phase Rotation Error, not ABC	N	N	Y
F12	Low Line Frequency	N	N	Y
F13	High Line Frequency	N	N	Y
F15	Input power not three phase	N	N	Y
F21	Low Line L1-L2	Y	N	Y
F22	Low Line L2-L3	Y	N	Y
F23	Low Line L3-L1	Y	N	Y
F24	High Line L1-L2	Y	N	Y
F25	High Line L2-L3	Y	N	Y
F26	High Line L3-L1	Y	N	Y
F27	Phase Loss	N	N	Y
F28	No Line	N	N	Y
F30	I.O.C.	N	Y	N
F31	Overcurrent	Y	N	Y
F34	Undercurrent	Y	N	Y
F37	Current Imbalance	Y	N	Y
F38	Ground Fault	N	Y	Y
F39	No Current at Run	N	N	Y
F40	Shorted / Open SCR	N	Y	N
F41	Current at Stop	N	Y	N
F47	Stack Protection Fault (stack thermal overload)	N	N	Y
F48	Bypass Contactor Fault	Y	N	N
F50	Control Power Low	N	N	Y
F51	Current Sensor Offset Error	-	Y	N
F52	Burden Switch Error	N	N	N
F60	External Fault on DI 1 Input	N	N	Y
F61	External Fault on DI 2 Input	N	N	Y
F62	External Fault on DI 3 Input	N	N	Y
F81	SPI Communication Fault	Y	N	N
F82	Modbus Timeout Fault	Y	N	Y
F94	CPU Error - SW fault	N	N	N
F95	CPU Error - Parameter EEPROM Checksum Fault	N		N
F96	CPU Error	N	Y	N
F97	CPU Error - SW Watchdog	N	Y	N
F98	CPU Error	N	N	N
F99	CPU Error - Program EPROM Checksum Fault	N	N	N

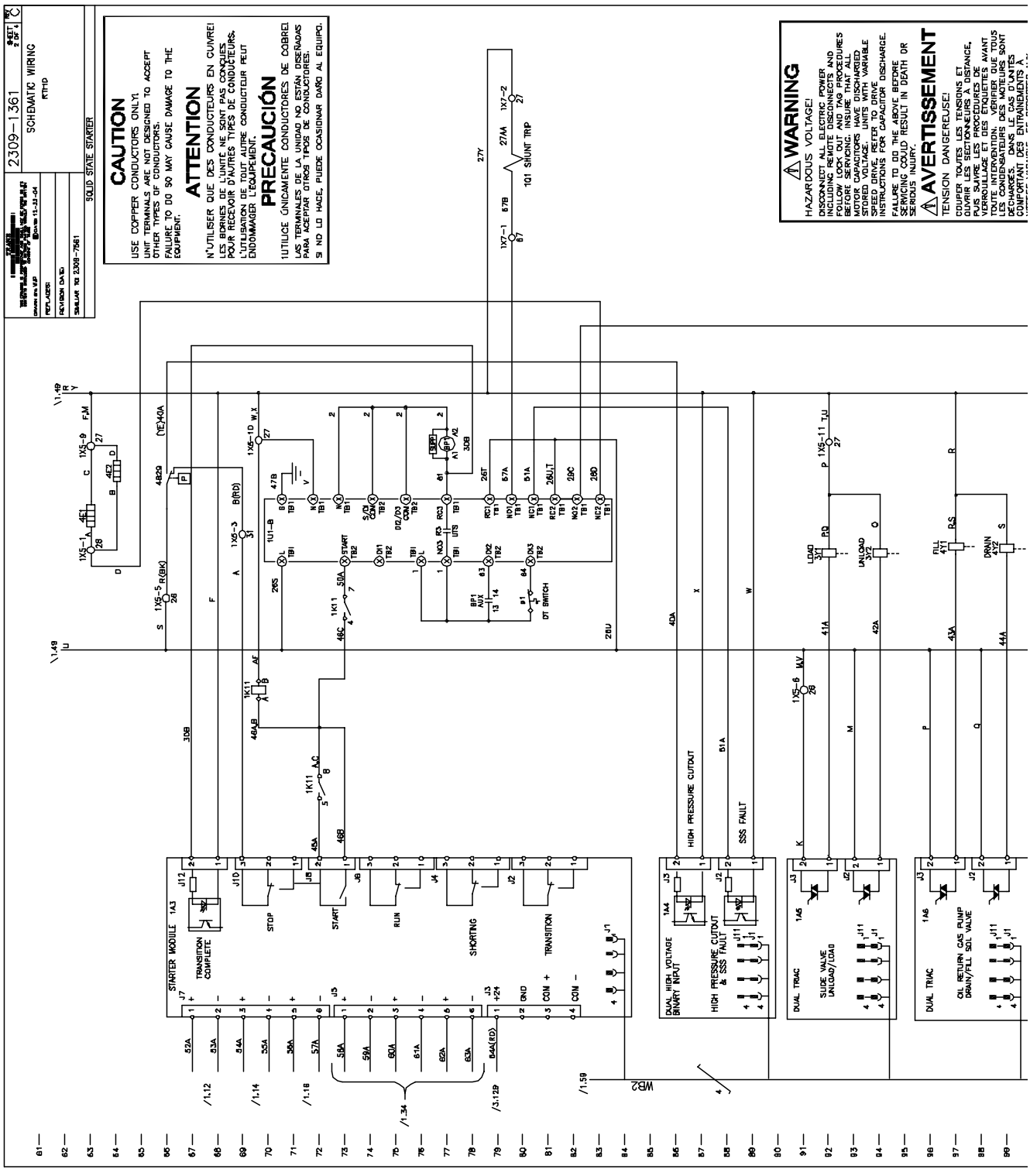
Alarm Codes

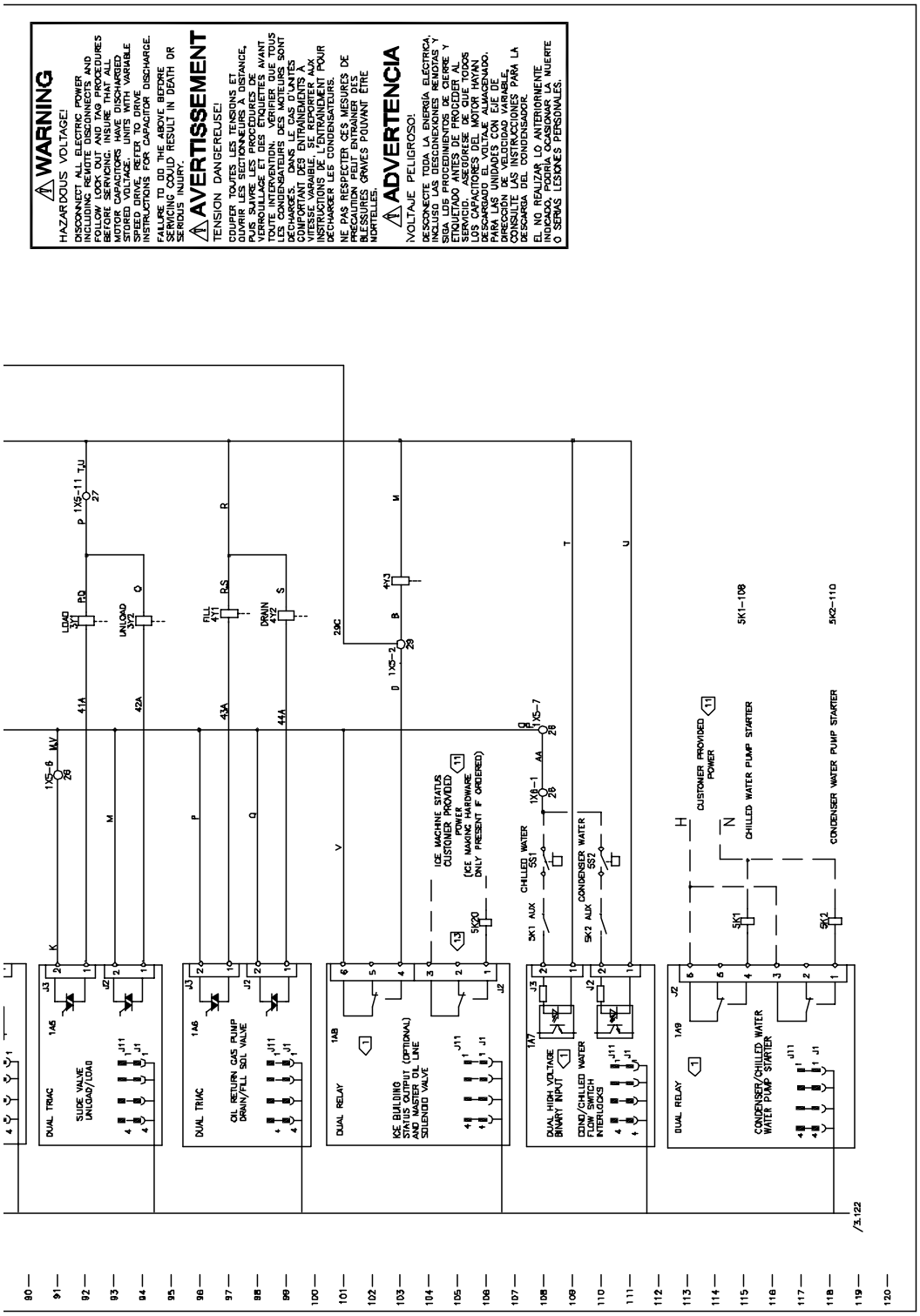
The following is a list of all MX alarm codes. The alarm codes correspond to associated fault codes. In general, an alarm indicates a condition that if continued, will result in the associated fault.

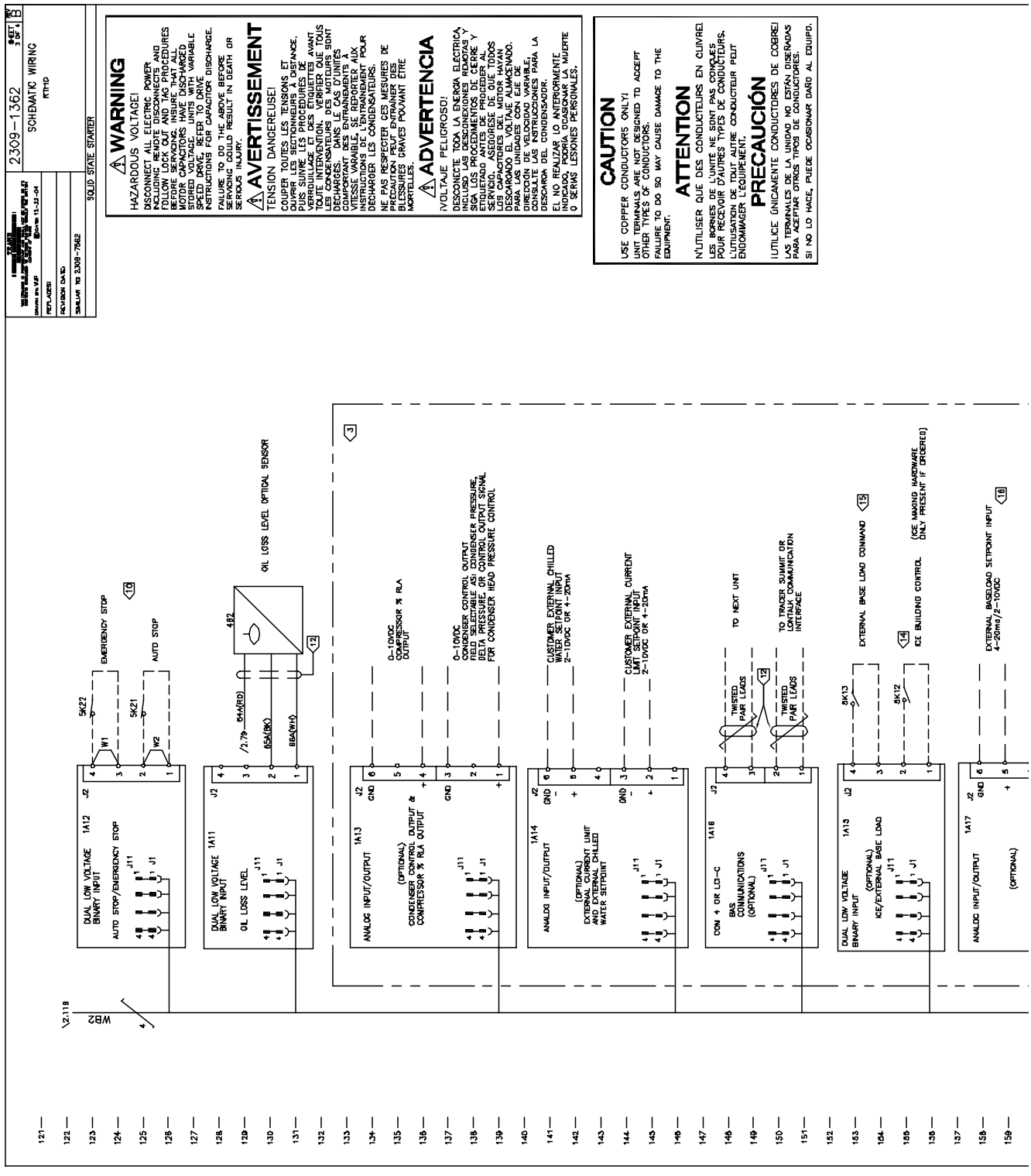
Alarm Code	Description	Notes
A02	Motor Overload Alarm	This occurs when the motor thermal content reaches the 90%. The MX will trip when it reaches 100%. The alarm will continue until the overload trip lockout is reset.
A10	Phase Rotation not ABC	This alarm exists while the MX is stopped and line voltage is detected and phase sensitivity parameter is set to ABC. If a start is commanded, a Fault 10 will occur.
A12	Low Line Frequency	This alarm exists when the MX has detected a line frequency below the user defined low line frequency level. The alarm will continue until either the line frequency changes to be in range or the fault delay timer has expired.
A13	High Line Frequency	This alarm exists when the MX has detected a line frequency above the user defined high line frequency level. The alarm will continue until either the line frequency changes to a valid frequency or the fault delay timer has expired.
A15	Input power not three phase	This alarm exists while the MX is stopped, set to a three-phase mode, and single-phase line voltage is detected. If a start is commanded, a Fault 15 will occur.
A21	Low Line L1-L2	This alarm exists while the MX is stopped and low line voltage is detected. If a start is commanded, a Fault 21 may occur.
A22	Low Line L2-L3	This alarm exists while the MX is stopped and low line voltage is detected. If a start is commanded, a Fault 22 may occur.
A23	Low Line L3-L1	This alarm exists while the MX is stopped and low line voltage is detected. If a start is commanded, a Fault 23 may occur.
A24	High Line L1-L2	This alarm exists while the MX is stopped and high line voltage is detected. If a start is commanded, a Fault 24 may occur.
A25	High Line L2-L3	This alarm exists while the MX is stopped and high line voltage is detected. If a start is commanded, a Fault 25 may occur.
A26	High Line L3-L1	This alarm exists while the MX is stopped and high line voltage is detected. If a start is commanded, a Fault 26 may occur.
A27	Phase Loss	This alarm exists while the MX is running and a phase loss condition is detected, but the delay for the fault has not yet expired. When the delay expires, a Fault 27 will occur.
A28	No Line	This alarm exists while the MX needs to be synced or is trying to sync to the line and no line is detected.
A31	Overcurrent	This alarm exists while the MX is running and the average current is above the defined threshold, but the delay for the fault has not yet expired. When the delay expires, a Fault 31 will occur.
A34	Undercurrent	This alarm exists while the MX is running and the average current is below the defined threshold, but the delay for the fault has not yet expired. When the delay expires, a Fault 34 will occur.
A37	Current Imbalance	This alarm exists while the MX is running and a current imbalance above the defined threshold is detected, but the delay for the fault has not yet expired. When the delay expires, a Fault 37 will occur.
A38	Ground Fault	This alarm exists while the MX is running and a ground current above the defined threshold is detected, but the delay for the fault has not yet expired. When the delay expires, a Fault 38 will occur.
A47	Stack Overload Alarm	This occurs when the stack thermal rises above 105%.

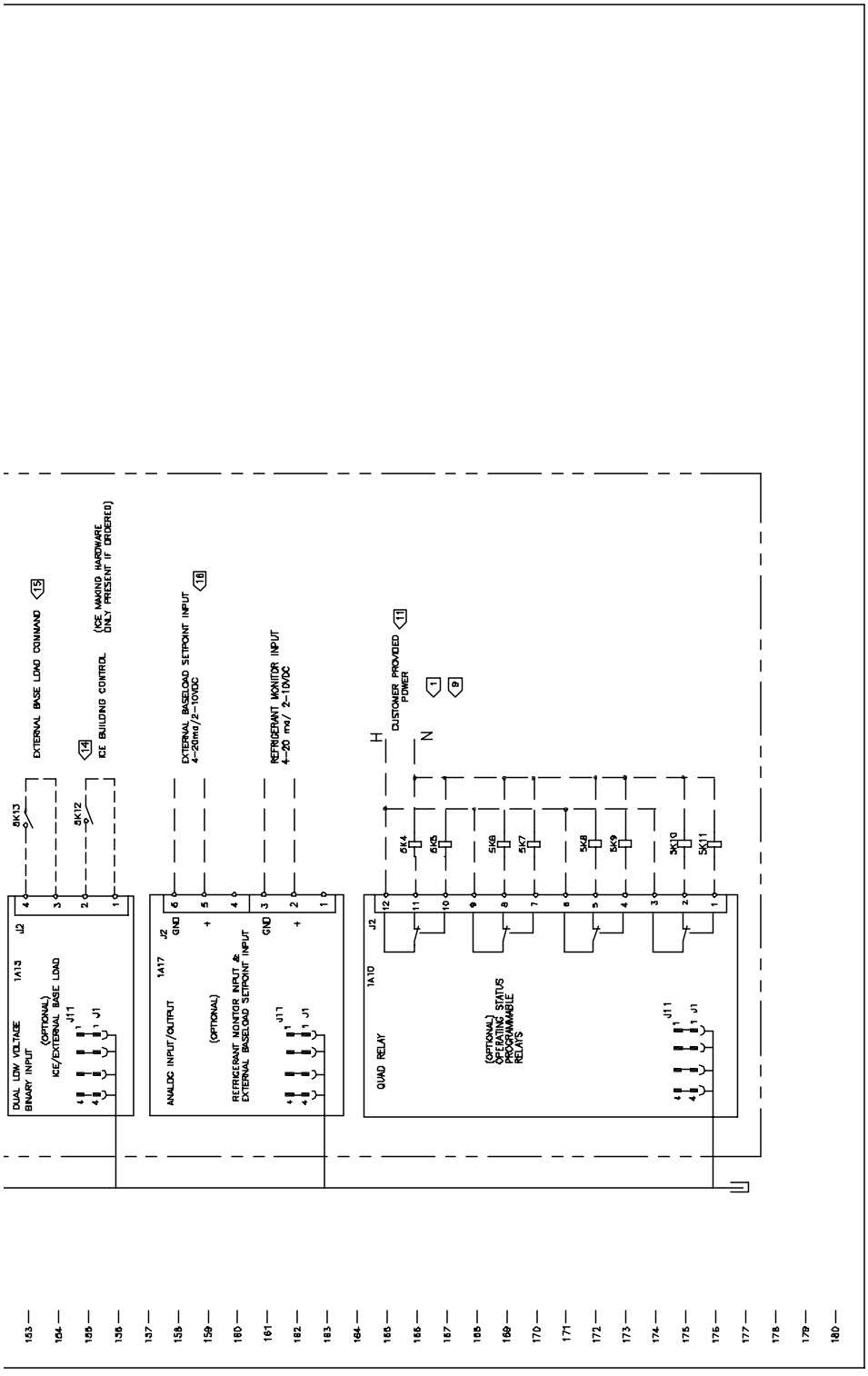

2309-1360
SCHEMATIC WIRING
RTHD
SOLID STATE STARTER
CAUTION
EVACUATING REFRIGERANT SYSTEM
DISCONNECT ALL ELECTRIC POWER
INCLUDING REMOTE DISCONNECTS PRIOR TO
EVACUATING REFRIGERANT SYSTEM POWER
SHALL NOT BE APPLIED TO CHILLER WHILE
REFRIGERANT SYSTEM IS IN A VACUUM
Failure to disconnect all electrical power prior to evacuating refrigerant system or application of power while refrigerant system is in a vacuum, will cause compressor motor damage due to the nature of the solid state starter.
⚠ WARNING
HAZARDOUS VOLTAGE!
DISCONNECT ALL ELECTRIC POWER INCLUDING REMOTE DISCONNECTS AND FOLLOW LOCK OUT AND TAG PROCEDURES BEFORE SERVICING. ENSURE THAT ALL MOTOR CAPACITORS HAVE DISCHARGED AND ALL STORED VOLTAGE IN UNITS WITH VARIABLE SPEED DRIVE, REFER TO DRIVE INSTRUCTIONS FOR CAPACITOR DISCHARGE. FAILURE TO DO THE ABOVE BEFORE SERVICING COULD RESULT IN DEATH OR SERIOUS INJURY.
⚠ AVERTISSEMENT
TENSION DANGEREUSE!
COUPER TOUTES LES TENSIONS ET OUVRIR LES SECTIONNEURS À DISTANCE, PUIS SUIVRE LES PROCÉDURES DE VERROUILLAGE ET DES ÉTIQUETTES AVANT TOUTE INTERVENTION. VÉRIFIER QUE TOUS LES CONDENSATEURS DES MOTEURS SONT DÉCHARGÉS. DANS LE CAS D'UNITÉS COMPORTANT DES ENTRAÎNEMENTS À VITESSE VARIABLE, SE REPORTER AUX INSTRUCTIONS DE L'ENTRAÎNEMENT POUR DÉCHARGER LES CONDENSATEURS. NE PAS RESPECTER CES MESURES DE PRÉCAUTION PEUT ENTRAÎNER DES BLESSURES GRAVES POUVANT ÊTRE MORTELLES.
⚠ ADVERTENCIA
VOLTAJE PELIGROSO!
DESCONECTE TODA LA ENERGÍA ELÉCTRICA, INCLUSO LAS DESCONEXIONES REMOTAS Y SIGA LOS PROCEDIMIENTOS DE CIERRE Y ETIQUETADO ANTES DE PROCEDER AL SERVICIO. ASEGÚRESE DE QUE TODOS LOS CONDENSADORES DEL MOTOR HAYAN DESCARGADO EL VOLTAJE ALMACENADO. PARA LAS UNIDADES CON EJE DE DIRECCIÓN DE VELOCIDAD VARIABLE, CONSULTE LAS INSTRUCCIONES PARA LA DESCARGA DEL CONDENSADOR. EL NO REALIZAR LO ANTERIORMENTE INDICADO PODRÍA OCASIONAR LA MUERTE O SERIAS LESIONES PERSONALES.
CAUTION
USE COPPER CONDUCTORS ONLY! UNIT TERMINALS ARE NOT DESIGNED TO ACCEPT OTHER TYPES OF CONDUCTORS. FAILURE TO DO SO MAY CAUSE DAMAGE TO THE EQUIPMENT.
PRECAUCIÓN
N'UTILISER QUE DES CONDUCTEURS EN CUIVRE! LES BORNES DE L'UNITÉ NE SONT PAS CONÇUES POUR RECEVOIR D'AUTRES TYPES DE CONDUCTEURS. L'UTILISATION DE TOUT AUTRE CONDUCTEUR PEUT ENDOMMAGER L'ÉQUIPEMENT.
ATTENTION
¡UTILICE ÚNICAMENTE CONDUCTORES DE COBRE! LAS TERMINALES DE LA UNIDAD NO ESTAN DISEÑADAS PARA ACEPTAR OTROS TIPOS DE CONDUCTORES. SI NO LO HACE, PUEDE OCASIONAR DAÑO AL EQUIPO.
INSET "A"
1U1-A
1U1
3M1
MOV1
MOV2
MOV3
200V 60HZ
460V 60HZ
380V 50HZ
230V 50HZ
575V 60HZ
230V 60HZ


1A2
POWER SUPPLY MODULE
WB1
WB2
WB3
EVAP RFGT PRESSURE
COND RFGT PRESSURE
COMP DISCHARGE TEMP
OUT DOOR AIR TEMP FACTORY INSTALLED FIELD INSTALLED EXTENDED BY CUSTOMER
EVAP RFGT LIQUID LEVEL
DUAL PORT EXV ACTUATOR 2
DUAL PORT EXV ACTUATOR 1
EVAP ENT WATER
EVAP LEAVING WATER
COND ENT WATER
COND LEAVING WATER
DIL PRESSURE TRANSDUCER
GND
COM+
COM-
SPLICE


2309-1361
SCHEMATIC WIRING
RTHD
SOLID STATE STARTER
CAUTION
USE COPPER CONDUCTORS ONLY!
UNIT TERMINALS ARE NOT DESIGNED TO ACCEPT OTHER TYPES OF CONDUCTORS.
FAILURE TO DO SO MAY CAUSE DAMAGE TO THE EQUIPMENT.
ATTENTION
N'UTILISER QUE DES CONDUCTEURS EN CUIVRE!
LES BORNES DE L'UNITÉ NE SONT PAS CONÇUES POUR RECEVOIR D'AUTRES TYPES DE CONDUCTEURS.
L'UTILISATION DE TOUT AUTRE CONDUCTEUR PEUT ENDOMMAGER L'EQUIPEMENT.
PRECAUCIÓN
¡UTILICE ÚNICAMENTE CONDUCTORES DE COBRE!
LAS TERMINALES DE LA UNIDAD NO ESTÁN DISEÑADAS PARA ACEPTAR OTROS TIPOS DE CONDUCTORES.
SI NO LO HACE, PUEDE OCASIONAR DAÑO AL EQUIPO.
WARNING
HAZARDOUS VOLTAGE!
DISCONNECT ALL ELECTRIC POWER INCLUDING REMOTE DISCONNECTS AND FOLLOW LOCK OUT AND TAG PROCEDURES BEFORE SERVICING. WAIT FIVE MINUTES AFTER MOTOR CAPACITORS HAVE BEEN DISCHARGED. STORED VOLTAGE. UNITS WITH VARIABLE SPEED DRIVE, REFER TO DRIVE INSTRUCTIONS FOR CAPACITOR DISCHARGE.
FAILURE TO DO THE ABOVE BEFORE SERVICING COULD RESULT IN DEATH OR SERIOUS INJURY.
AVERTISSEMENT
TENSION DANGEREUSE!
COUPER TOUTES LES TENSIONS ET OUVRIR LES SECTIONNEURS À DISTANCE, AVEC VERROUILLAGE ET ÉTIQUETTES AVANT TOUTE INTERVENTION. VÉRIFIER QUE TOUS LES CONDENSATEURS DES MOTEURS SONT DÉCHARGÉS. DANS LE CAS D'UNITÉS
STARTER MODULE 1A3
TRANSITION COMPLETE
STOP
START
RUN
SHORTING
TRANSITION
DUAL HIGH VOLTAGE BINARY INPUT
HIGH PRESSURE CUTOUT
HIGH PRESSURE CUTOUT & SSS FAULT
SSS FAULT
DUAL TRIAC
SLIDE VALVE UNLOAD/LOAD
DUAL TRIAC
OIL RETURN GAS PUMP DRAIN/FILL SOL VALVE
LOAD
UNLOAD
FILL
DRAIN
DT SWITCH
SHUNT TRIP


WARNING
HAZARDOUS VOLTAGE!
DISCONNECT ALL ELECTRIC POWER INCLUDING REMOTE DISCONNECTS AND FOLLOW PROPER LOCKOUT/TAGOUT PROCEDURES BEFORE SERVICING. INSURE THAT ALL MOTOR CAPACITORS HAVE DISCHARGED STORED VOLTAGE. UNITS WITH VARIABLE SPEED DRIVE, REFER TO DRIVE DISCHARGE INSTRUCTIONS FOR CAPACITOR DISCHARGE.
FAILURE TO DO THE ABOVE BEFORE SERVICING COULD RESULT IN DEATH OR SERIOUS INJURY.
AVERTISSEMENT
TENSION DANGEREUSE!
COUPER TOUTES LES TENSIONS ET, OUVRIR LES SECTIONNEURS À DISTANCE, PUIS SUIVRE LES PROCÉDURES DE VERROUILLAGE ET DES ÉTIQUETTES AVANT TOUTE INTERVENTION. VÉRIFIER QUE TOUS LES CONDENSATEURS DES MOTEURS SONT DÉCHARGÉS. DANS LES UNITÉS ÉQUIPÉES D'UN ENTRAÎNEMENT À VITESSE VARIABLE, SE REPORTER AUX INSTRUCTIONS DE L'ENTRAÎNEMENT POUR DÉCHARGER LES CONDENSATEURS.
NE PAS RESPECTER CES MESURES DE PRÉCAUTION PEUT OCCASIONNER DES BLESSURES GRAVES POUVANT ÊTRE MORTELLES.
ADVERTENCIA
VOLTAJE PELIGROSO!
DESCONECTE TODA LA ENERGÍA ELÉCTRICA, INCLUSO LAS DESCONEXIONES REMOTAS Y SIGA LOS PROCEDIMIENTOS DE CIERRE Y ETIQUETADO ANTES DE PROCEDER AL SERVICIO. ASEGÚRESE DE QUE TODOS LOS CAPACITORES DEL MOTOR HAYAN SE DESCARGADO EL VOLTAJE ALMACENADO. PARA LAS UNIDADES CON EJE DE DIRECCIÓN DE VELOCIDAD VARIABLE, CONSULTE LAS INSTRUCCIONES PARA LA DESCARGA DEL CONDENSADOR.
EL NO REALIZAR LO ANTERIORMENTE INDICADO PUEDE CAUSAR LA MUERTE O SERIAS LESIONES PERSONALES.
DUAL TRIAC
SLIDE VALVE UNLOAD/LOAD
DUAL TRIAC
OIL RETURN GAS PUMP DRAIN/FILL SOL VALVE
DUAL RELAY
ICE BUILDING STATUS OUTPUT (OPTIONAL) AND HOT GAS BYPASS SOLENOID VALVE
DUAL HIGH VOLTAGE BINARY INPUT
COND/CHILLED WATER FLOW SWITCH INTERLOCKS
DUAL RELAY
CONDENSER/CHILLED WATER WATER PUMP STARTER
ICE MACHINE STATUS CUSTOMER PROVIDED POWER
(ICE MAKING HARDWARE ONLY PRESENT IF ORDERED)
CHILLED WATER
CONDENSER WATER
CUSTOMER PROVIDED POWER
CHILLED WATER PUMP STARTER
CONDENSER WATER PUMP STARTER
5K1-10B
5K2-11D
/3.122


2309-1362
SCHEMATIC WIRING
RTHD
SOLID STATE STARTER
WARNING
HAZARDOUS VOLTAGE!
AVERTISSEMENT
TENSION DANGEREUSE!
ADVERTENCIA
¡VOLTAJE PELIGROSO!
CAUTION
USE COPPER CONDUCTORS ONLY!
ATTENTION
PRÉCAUCIÓN
DUAL LOW VOLTAGE BINARY INPUT
AUTO STOP/EMERGENCY STOP
OIL LOSS LEVEL
ANALOG INPUT/OUTPUT
CONDENSER CONTROL OUTPUT & COMPRESSOR % RLA OUTPUT
EXTERNAL CURRENT LIMIT AND EXTERNAL CHILLED WATER SETPOINT
DCN 4 OR LCI-C
BAS COMMUNICATIONS (OPTIONAL)
ICE/EXTERNAL BASE LOAD
EMERGENCY STOP
AUTO STOP
OIL LOSS LEVEL OPTIONAL SENSOR
0-10VDC COMPRESSOR % RLA OUTPUT
0-10VDC CONDENSER CONTROL OUTPUT FIELD SELECTABLE ΔSi CONDENSER PRESSURE, DELTA PRESSURE, OR CONTROL OUTPUT SIGNAL FOR CONDENSER HEAD PRESSURE CONTROL
CUSTOMER EXTERNAL CHILLED WATER SETPOINT INPUT 2-10VDC OR 4-20mA
CUSTOMER EXTERNAL CURRENT LIMIT SETPOINT INPUT 2-10VDC OR 4-20mA
TWISTED PAIR LEADS
TO NEXT UNIT
TO TRACER SUMMIT OR LONTALK COMMUNICATION INTERFACE
EXTERNAL BASE LOAD COMMAND
ICE BUILDING CONTROL
(ICE MAKING HARDWARE ONLY PRESENT IF ORDERED)
EXTERNAL BASELOAD SETPOINT INPUT 4-20ma/2-10VDC
(OPTIONAL)


DUAL LOW VOLTAGE BINARY INPUT
1A13
J2
(OPTIONAL) ICE/EXTERNAL BASE LOAD
J11
J1
ANALOG INPUT/OUTPUT
1A17
J2
GND
+
(OPTIONAL) REFRIGERANT MONITOR INPUT & EXTERNAL BASELOAD SETPOINT INPUT
QUAD RELAY
1A10
(OPTIONAL) OPERATING STATUS PROGRAMMABLE RELAYS
5K13
5K12
EXTERNAL BASE LOAD COMMAND
13
ICE BUILDING CONTROL
14
(ICE MAKING HARDWARE ONLY PRESENT IF ORDERED)
EXTERNAL BASELOAD SETPOINT INPUT 4-20ma/2-10VDC
16
REFRIGERANT MONITOR INPUT 4-20 ma/ 2-10VDC
H
CUSTOMER PROVIDED POWER
11
N
1
9
5K4
5K5
5K6
5K7
5K8
5K9
5K10
5K11
L1
153
154
155
156
157
158
159
160
161
162
163
164
165
166
167
168
169
170
171
172
173
174
175
176
177
178
179
180

COLOR CODE	
BK	BLACK
BN	BROWN
BU	BLUE
GY	GRAY
RD	RED
WH	WHITE
GN	GREEN
OG	ORANGE
YE	YELLOW

1K20
- IDENTIFICATION
- CLASSIFICATION
- LOCATION CODE

LOCATION

1	CONTROL PANEL
2	NOT USED
3	COMPRESSOR
4	UNIT MTD
5	CUSTOMER PROVIDED

———	TRANE WIRING
— — —	CUSTOMER WIRING
———	OPTIONS

LINE #	ITEM	DESCRIPTION
47	1A1	DYNA VIEW DISPLAY AND INTERFACE
58	1A2	POWER SUPPLY MODULE
66	1A3	STARTER MODULE
88	1A4	SOLID STATE STARTER FAULT AND HIGH PRESSURE CUTOUT SWITCH
91	1A5	SLIDE VALVE UNLOAD AND LOAD CONTROL SOLENOID VALVE
96	1A6	OIL RETURN GAS PUMP DRAIN AND FILL SOLENOID VALVE
108	1A7	CONDENSER AND CHILLED WATER FLOW SWITCH INTERLOCKS
101	1A8	ICE BUILDING STATUS OUTPUT AND MASTER OIL LINE SOLENOID VALVE
113	1A9	CONDENSER AND CHILLED WATER PUMP STARTER
164	1A10	OPERATING STATUS PROGRAMMABLE RELAYS
128	1A11	OIL LOSS LEVEL SENSOR AND UNUSED INPUTS
123	1A12	EXTERNAL AUTO/STOP AND EMERGENCY STOP INPUT
134	1A13	CONDENSER CONTROL AND % RLA OUTPUT
141	1A14	EXTERNAL CURRENT LIMIT AND CHILLED WATER
152	1A15	ICE BUILDING CONTROL AND EXTERNAL BASE LOADING COMMAND
147	1A16	COMM 4 OR LCI-C (COMM 5)
167	1A17	REFRIGERANT MONITOR INPUT AND EXTERNAL BASE LOADING SETPOINT
4, 80	1Q1	MAIN CIRCUIT BREAKER
23	1F1, 1F2, 1F3	PRIMARY FUSES - CPT, UOVM
44	1F4	SECONDARY FUSE 115V
44	1F5, 1F6	SECONDARY FUSES 27V
39	1T1	TRANSFORMER
12,14,18	1T2-1,2,3	CURRENT TRANSFORMERS
32	1T3-1,2,3	UNDER OVER VOLTAGE TRANSFORMERS
28,77	1U1	SOLID STATE STARTER
27,28,29	1X3	UNDER OVER VOLTAGE TERMINAL BLOCK
	1X5	CONTROL TERMINAL BLOCK 115V
106	1X6	FIELD FLOW SWITCH TERMINAL BLOCK
80	1X7	CIRCUIT BREAKER SHUNT TRIP TERMINAL BLOCK
82	JY1	LOAD SOLENOID VALVE
94	3Y2	UNLOAD SOLENOID VALVE
32	3M1	COMPRESSOR MOTOR
63,64	4E1-2	OIL SUMP HEATERS
97	4Y1	FILL SOLENOID VALVE
98	4Y2	DRAIN SOLENOID VALVE
103	4Y3	MASTER OIL LINE SOLENOID
129	4B2	OIL LOSS LEVEL SWITCH
40	4B3	EVAPORATOR REFRIGERANT LIQUID LEVEL SENSOR
46	4B20	EVAPORATOR ENTERING WATER TEMP. SENSOR
48	4B21	EVAPORATOR LEAVING WATER TEMP. SENSOR
50	4B22	CONDENSER ENTERING WATER TEMP. SENSOR
52	4B23	CONDENSER LEAVING WATER TEMP. SENSOR
54	4B24	OIL PRESSURE TRANSDUCER
40	4B25	EVAPORATOR REFIGERANT PRESSURE TRANSDUCER
42	4B26	CONDENSER REFRIGERANT PRESSURE TRANSDUCER
44	4B27	COMPRESSOR DISCHARGE TEMP. SENSOR
66	4B29	HIGH PRESSURE CUTOUT SWITCH
44,42	4Y20-21	DUAL PORT EXV ACTUATOR
62	8B28	OUTDOOR AIR TEMP. SENSOR
115	5K1	CHILLED WATER PUMP STARTER
118	5K2	CONDENSER WATER PUMP STARTER
166-176	5K4-11	UNIT STATUS RELAYS
155	5K12	ICE BUILDING CONTROL
153	5K13	EXTERNAL BASE LOAD ENABLE
108	5K20	ICE BUILDING STATUS
123	5K22	EXTERNAL EMERGENCY STOP
128	5K21	EXTERNAL AUTO STOP
108	5S1	CHILLED WATER FLOW SWITCH

TRANE
[redacted]
DRAWN BY: VJP | DATE: 11-22-04
REPLACES:
REVISION DATE:
SIMILAR TO: 2309-7584

2309-1363 | SHEET 4 OF 4 | REV B

SCHEMATIC WIRING

RTHD

SOLID STATE STARTER

⚠ WARNING

HAZARDOUS VOLTAGE!

DISCONNECT ALL ELECTRIC POWER INCLUDING REMOTE DISCONNECTS AND FOLLOW LOCK OUT AND TAG PROCEDURES BEFORE SERVICING. INSURE THAT ALL MOTOR CAPACITORS HAVE DISCHARGED STORED VOLTAGE. UNITS WITH VARIABLE SPEED DRIVE, REFER TO DRIVE INSTRUCTIONS FOR CAPACITOR DISCHARGE.

FAILURE TO DO THE ABOVE BEFORE SERVICING COULD RESULT IN DEATH OR SERIOUS INJURY.

⚠ AVERTISSEMENT

TENSION DANGEREUSE!

COUPER TOUTES LES TENSIONS ET OUVRIR LES SECTIONNEURS À DISTANCE, PUIS SUIVRE LES PROCEDURES DE VERROUILLAGE ET DES ETIQUETTES AVANT TOUTE INTERVENTION. VERIFIER QUE TOUS LES CONDENSATEURS DES MOTEURS SONT DÉCHARGES. DANS LE CAS D'UNITES COMPORTANT DES ENTRAINEMENTS À VITESSE VARAIBLE, SE REPORTER AUX INSTRUCTIONS DE L'ENTRAINEMENT POUR DÉCHARGER LES CONDENSATEURS.

NE PAS RESPECTER CES MESURES DE PRECAUTION PEUT ENTRAINER DES BLESSURES GRAVES POUVANT ÊTRE MORTELLES.

⚠ ADVERTENCIA

¡VOLTAJE PELIGROSO!

DESCONECTE TODA LA ENERGIA ELECTRICA, INCLUSO LAS DESCONEXIONES REMOTAS Y SIGA LOS PROCEDIMIENTOS DE CIERRE Y ETIQUETADO ANTES DE PROCEDER AL SERVICIO. ASEGÚRESE DE QUE TODOS LOS CAPACITORES DEL MOTOR HAYAN DESCARGADO EL VOLTAJE ALMACENADO. PARA LAS UNIDADES CON EJE DE DIRECCIÓN DE VELOCIDAD VARIABLE, CONSULTE LAS INSTRUCCIONES PARA LA DESCARGA DEL CONDENSADOR.

EL NO REALIZAR LO ANTERIORMENTE INDICADO, PODRÍA OCASIONAR LA MUERTE O SERIAS LESIONES PERSONALES.

CAUTION

USE COPPER CONDUCTORS ONLY!

UNIT TERMINALS ARE NOT DESIGNED TO ACCEPT OTHER TYPES OF CONDUCTORS.

FAILURE TO DO SO MAY CAUSE DAMAGE TO THE EQUIPMENT.

ATTENTION

N'UTILISER QUE DES CONDUCTEURS EN CUIVRE!

LES BORNES DE L'UNITÉ NE SONT PAS CONÇUES POUR RECEVOIR D'AUTRES TYPES DE CONDUCTEURS.

L'UTILISATION DE TOUT AUTRE CONDUCTEUR PEUT ENDOMMAGER L'EQUIPEMENT.

PRECAUCIÓN

¡UTILICE ÚNICAMENTE CONDUCTORES DE COBRE!

LAS TERMINALES DE LA UNIDAD NO ESTAN DISEÑADAS PARA ACEPTAR OTROS TIPOS DE CONDUCTORES.

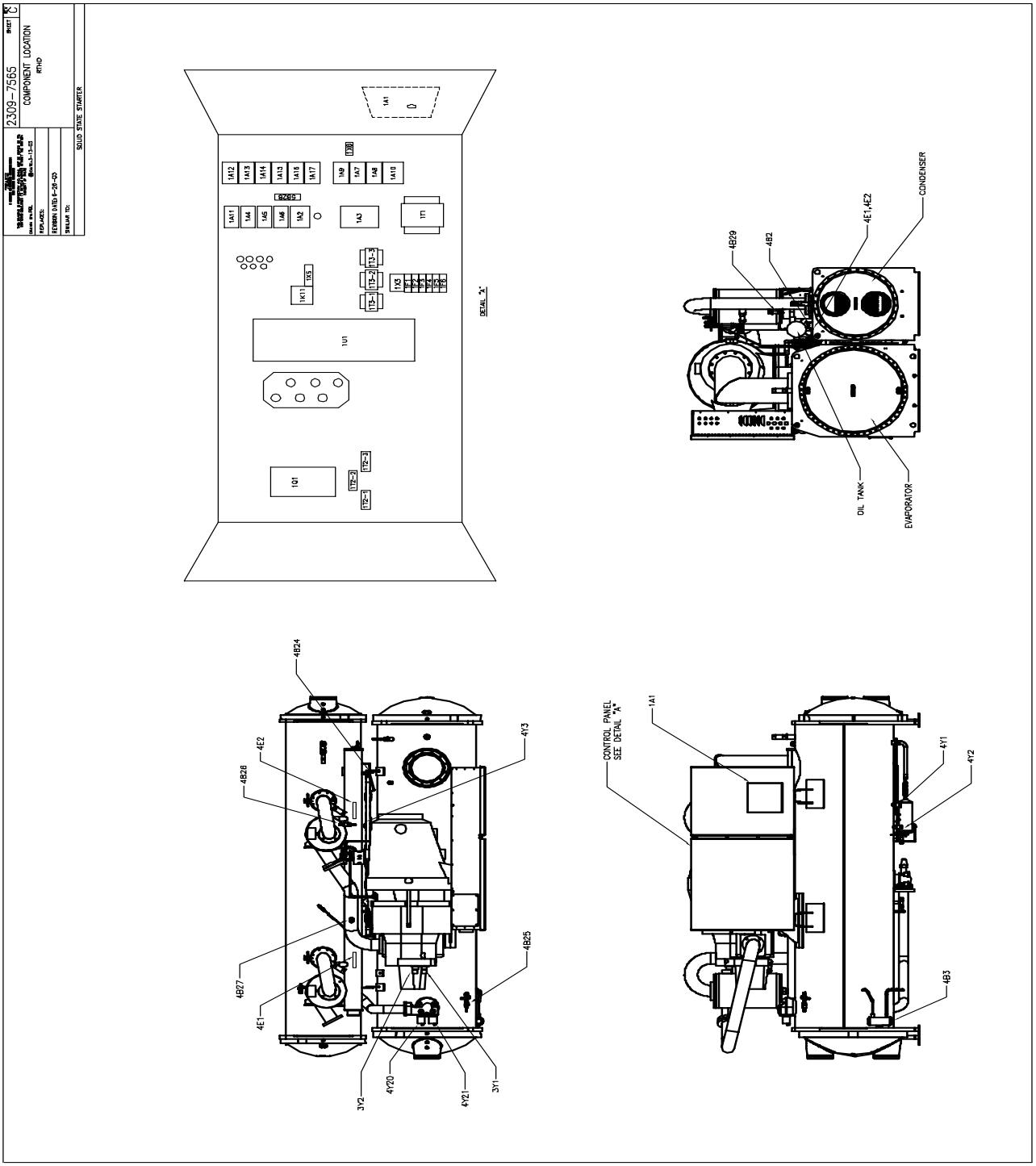
SI NO LO HACE, PUEDE OCASIONAR DAÑO AL EQUIPO.

129	4B2	OIL LOSS LEVEL SWITCH
4D	4B3	EVAPORATOR REFRIGERANT LIQUID LEVEL SENSOR
4B	4B20	EVAPORATOR ENTERING WATER TEMP. SENSOR
4B	4B21	EVAPORATOR LEAVING WATER TEMP. SENSOR
8D	4B22	CONDENSER ENTERING WATER TEMP. SENSOR
82	4B23	CONDENSER LEAVING WATER TEMP. SENSOR
54	4B24	OIL PRESSURE TRANSDUCER
4D	4B25	EVAPORATOR REFRIGERANT PRESSURE TRANSDUCER
42	4B26	CONDENSER REFRIGERANT PRESSURE TRANSDUCER
44	4B27	COMPRESSOR DISCHARGE TEMP. SENSOR
66	4B29	HIGH PRESSURE CUTOUT SWITCH
44,42	4Y20-21	DUAL PORT EXV ACTUATOR
52	8B28	OUTDOOR AIR TEMP. SENSOR
115	5K1	CHILLED WATER PUMP STARTER
118	5K2	CONDENSER WATER PUMP STARTER
185-175	5K4-11	UNIT STATUS RELAYS
155	5K12	ICE BUILDING CONTROL
153	5K13	EXTERNAL BASE LOAD ENABLE
106	5K20	ICE BUILDING STATUS
123	5K22	EXTERNAL EMERGENCY STOP
125	5K21	EXTERNAL AUTO STOP
108	5S1	CHILLED WATER FLOW SWITCH
110	5S2	CONDENSER WAQTER FLOW SWITCH

¡UTILICE ÚNICAMENTE CONDUCTORES DE COBRE!
LAS TERMINALES DE LA UNIDAD NO ESTÁN DISEÑADAS PARA ACEPTAR OTROS TIPOS DE CONDUCTORES.
SI NO LO HACE, PUEDE OCASIONAR DAÑO AL EQUIPO.

NOTES:

1. CLASS 1 FIELD WIRED MODULE
2. CLASS 1 FIELD WIRING INSULATION RATING IS REQUIRED TO BE EQUAL TO OR GREATER THAN THE EQUIPMENT SUPPLY VOLTAGE RATING. CLASS 2 FIELD WIRE INSULATION TO BE RATED AT 300V MINIMUN.
3. OPTIONAL MODULES. REFER TO FIELD WIRING DIAGRAM FOR SUGGESTED WIRING.
7. OPTIONAL GROUND FAULT CIRCUIT BREAKER.
8. SEE INSET "A" FOR WIRING OF 1F1, 1F2 WHEN UNDER/OVER VOLTAGE OPTION IS NOT USED.
9. FIELD ASSIGNED PROGRAMMABLE RELAYS.
10. AUTO/STOP, EMERGENCY STOP THE CONTACTS ARE JUMPED AT THE FACTORY BY JUMPERS W1 & W2 TO ENABLE UNIT OPERATION. IF REMOTE CONTROL IS DESIRED REMOVE THE JUMPERS AND CONNECT TO THE DESIRED CONTROL CIRCUIT.
11. RELAY AT 120VAC: 7.2 AMPS RESISTIVE, 2.88 AMPS PILOT DUTY, 1/3 HP, 7.2 FLA AT 240VAC: 5 AMPS GENERAL PURPOSE.
12. IF SHIELD IS PRESENT, DO NOT WIRE SHIELD TO GROUND IN CONTROL PANEL. IF USED, SHIELD IS TO BE GROUNDED EXTERNALLY TO CONTROL PANEL. REFERENCE FIELD WIRING DIADRAM FOR RECOMMENDED WIRE TYPE.
13. RELAY ENERGIZED WHILE MAKING ICE.
14. CONTACT CLOSURE ENABLES ICE MAKING.
15. CLOSED CONTACT COMMANDS BASE LOADING OPERATION.
16. ACTUAL BASE LOADING SETPOINT USED IS SETABLE AT FRONT PANEL. REFER TO IOM FOR DETAILS.


2309-7565
COMPONENT LOCATION
RTHD
SOLID STATE STARTER
DETAIL "A"
CONDENSER
OIL TANK
EVAPORATOR
CONTROL PANEL
SEE DETAIL "A"

Trane
A business of American Standard Companies
www.trane.com

For more information contact your local district office or e-mail us at comfort@trane.com

Literature Order Number	RTHD-SVD02A-EN
File Number	SL-RF-RLC-RTHD-SVD02A-EN-0505
Supersedes	New
Stocking Location	Electronic Only