YORK	AIR-COOLED SCREW LIQUID CHILLERS	
SERVICE INSTRUCTIONS	Supersedes: 201.28-M1 (616)	Form 201.28-M1 (1117)

MODEL YVAA STYLE A
AIR-COOLED SCREW LIQUID CHILLERS WITH VARIABLE SPEED DRIVE
FRAME SIZES 015 - 052

150 - 500 TONS
525 - 1750 KW
2 COMPRESSOR
50 AND 60 HZ

LD15045

HFC-134a or HFC-513A

Issue Date:
November 27, 2017

IMPORTANT!

READ BEFORE PROCEEDING!

GENERAL SAFETY GUIDELINES

This equipment is a relatively complicated apparatus. During rigging, installation, operation, maintenance, or service, individuals may be exposed to certain components or conditions including, but not limited to: heavy objects, refrigerants, materials under pressure, rotating components, and both high and low voltage. Each of these items has the potential, if misused or handled improperly, to cause bodily injury or death. It is the obligation and responsibility of rigging, installation, and operating/service personnel to identify and recognize these inherent hazards, protect themselves, and proceed safely in completing their tasks.

Failure to comply with any of these requirements could result in serious damage to the equipment and the property in which it is situated, as well as severe personal injury or death to themselves and people at the site.

This document is intended for use by owner-authorized rigging, installation, and operating/service personnel. It is expected that these individuals possess independent training that will enable them to perform their assigned tasks properly and safely. It is essential that, prior to performing any task on this equipment, this individual shall have read and understood the on-product labels, this document and any referenced materials. This individual shall also be familiar with and comply with all applicable industry and governmental standards and regulations pertaining to the task in question.

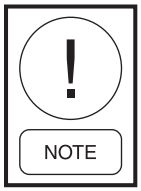
SAFETY SYMBOLS

The following symbols are used in this document to alert the reader to specific situations:

Indicates a possible hazardous situation which will result in death or serious injury if proper care is not taken.

Identifies a hazard which could lead to damage to the machine, damage to other equipment and/or environmental pollution if proper care is not taken or instructions and are not followed.

Indicates a potentially hazardous situation which will result in possible injuries or damage to equipment if proper care is not taken.



Highlights additional information useful to the technician in completing the work being performed properly.

External wiring, unless specified as an optional connection in the manufacturer's product line, is not to be connected inside the control cabinet. Devices such as relays, switches, transducers and controls and any external wiring must not be installed inside the micro panel. All wiring must be in accordance with Johnson Controls' published specifications and must be performed only by a qualified electrician. Johnson Controls will NOT be responsible for damage/problems resulting from improper connections to the controls or application of improper control signals. Failure to follow this warning will void the manufacturer's warranty and cause serious damage to property or personal injury.

CHANGEABILITY OF THIS DOCUMENT

In complying with Johnson Controls' policy for continuous product improvement, the information contained in this document is subject to change without notice. Johnson Controls makes no commitment to update or provide current information automatically to the manual or product owner. Updated manuals, if applicable, can be obtained by contacting the nearest Johnson Controls Service office or accessing the Johnson Controls QuickLIT website at http://cgproducts.johnsoncontrols.com.

It is the responsibility of rigging, lifting, and operating/service personnel to verify the applicability of these documents to the equipment.

If there is any question regarding the applicability of these documents, rigging, lifting, and operating/service personnel should verify whether the equipment has been modified and if current literature is available from the owner of the equipment prior to performing any work on the chiller.

CHANGE BARS

Revisions made to this document are indicated with a line along the left or right hand column in the area the revision was made. These revisions are to technical information and any other changes in spelling, grammar or formatting are not included.

The Control/VSD Cabinet contains lethal high AC and DC voltages. Before performing service inside the cabinet, remove the AC supply feeding the chiller and verify using a non-contact voltage sensor.

The DC voltage on the VSD DC Bus will take 5 minutes to bleed off, after AC power is removed. Always check the DC Bus Voltage with a Voltmeter to assure the capacitor charge has bled off before working on the system.

NEVER short out the DC Bus to discharge the filter capacitors.

NEVER place loose tools, debris, or any objects inside the Control Panel/VSD Cabinet.

NEVER allow the Control Panel VSD Cabinet doors to remain open if there is a potential for rain to enter the panel. Keep doors closed and assure all latches are engaged on each door unless the unit is being serviced.

ALWAYS lockout the disconnect supplying AC to the chiller.

The 1L Line Inductor will reach operating temperatures of over 150°C (300°F.) DO NOT open panel doors during operation. Assure the inductor is cool whenever working near the inductor with power OFF.

ASSOCIATED LITERATURE

MANUAL DESCRIPTION	FORM NUMBER
Equipment Pre-Startup and Startup Checklist	201.28-CL2
YVAA Style A Air-Cooled Screw Liquid Chillers With Variable Speed Drive Installation, Maintenance & Operation Manual (Form 201.28-NM1.1)	201.28-NM1.1
YVAA Style A Frame Size 015 - 027, 2 Compressor 60 Hz (150-350 Tons) YVAA Style A Frame Size 054 - 098, 2 Compressor 50 Hz (525-950 KW)	201.28-RP1
YVAA Style A Frame Size 015 - 052, 2 Compressor 50 & 60 Hz (150-500 Tons) (Manufactured After April 2012)	201.28-RP2
YVAA Style B Frame Size 015 - 052, 2 Compressor 50 & 60 Hz (150-500 Tons) (Manufactured After September 2014)	201.28-RP3

ABBREVATIONS

DSP	Digital Signal Processors
FIA	Full Load Amps
K	1,000
LED	Light Omitting Diode
MOD	Module
MTR	Motor
OL	Over Load
PWM	Pulse Width Modulator

RCV	Receive
RES	Resistor
SCR	Silicone Controlled Rectifier
TP	Test Point
VI	Variable Volume Index
VSD	Variable Speed Drive
XMT	Transmit
ZGBT	Insulator Gate Bipolar Transistor

TABLE OF CONTENTS

SECTION 1 - GENERAL CHILLER INFORMATION AND SAFETY 17
Introduction 17
Warranty 17
Certifications and Labels 17
Quality Assurance and Safety 18
Fluorinated Greenhouse Gases 18
Responsibility for Safety 18
About This Manual 19
Misuse of Equipment 19
Suitability for Application 19
Structural Support 19
Mechanical Strength 19
General Access 19
Pressure Systems 19
Electrical 19
Rotating Parts 19
Sharp Edges 19
Refrigerants and Oils 19
High Temperature and Pressure Cleaning 20
Emergency Shutdown 20
Safety Labels 20
MSDS Information 20

SECTION 2 - PRODUCT DESCRIPTION 21
General System Description 21
Compressor 23
Evaporator 24
2-Pass Evaporator 25
Condenser 26
Flash Tank / Receiver, Flash Tank Feed Valve and Economizer Valve 26
Liquid Line Pressure Transducer 27
Oil Separator/Oil System/Oil Cooling 27
Economizer 29
Relief Valves 30
Capacity Control 31
Power and Control Panel 31
Power Compartment 31
Microprocessor and VSD Controls 31
Keypad 32
Unit Switch 32
Variable Speed Drive (VSD) 32
Glycol Coil and VSD Cooling 34
Accessories and Options 34
Sound Reduction Options 34
Condenser Coil Protection 35
Protective Chiller Panels 35
Evaporator Options 35
Controls Options 36
General Options 36
Vibration Isolation 37
Building Automation System Option 38
Dimensions 49

TABLE OF CONTENTS (CONT'D)

SECTION 3 - RIGGING, HANDLING AND STORAGE 51
Lifting Weights 51
Delivery and Storage 51
Inspection 51
Unit Removal From Shipping Container 60
Lifting Using Lugs 60
Lifting Using Shackles 60

SECTION 4 - INSTALLATION 61
Location Requirements 61
Outdoor Installations 61
Location Clearances 61
Recommended Minimum Clearances 62
Vibration Isolators 63
Installation 63
Shipping Braces 63
Chilled Liquid Piping 63
General Requirements 63
Water Treatment 64
Pipework Arrangement 64
Minimum Water Volume 64
Leaving Water Temperature Out of Range 65
Thermal Storage 65
Variable Primary Flow 66
Connection Types and Sizes 66
Evaporator Connections 66
Refrigerant Relief Valve Piping 68
Electrical Connection 68
Power Wiring 68
Power Supply Wiring 69
115VAC Control Supply Transformer 69
Control Panel Wiring 69
Volts Free Contacts 69
Chilled Liquid Pump Starter 69
Run Contact 69
Alarm Contacts 69
System Inputs 70
Flow Switch 70
Remote Run / Stop 70
Remote Print 70
Optional Remote Setpoint Offset – Temperature 70
Optional Remote Setpoint Offset – Current 70
Optional Remote Setpoint Offset – Sound Limiting 70
Ductwork Connection 70
Removing Water/Glycol From The Evaporator 70
Before Applying Power To The Chiller, Assure The Chilled Liquid System Is Filled 71
Evaporator Freeze Damage 71
Remote Evaporator Piping 71

SECTION 5 - TECHNICAL DATA 73
Evaporator Pressure Drop 73
Glycol Correction Factors 74

TABLE OF CONTENTS (CONT'D)

Removing Water/Glycol From The Evaporator 74
Evaporator Freeze Damage 74
Before Applying Power To The Chiller, Assure The Chilled Liquid System Is Filled 74
Evaporator Options 86
One Inch Deflection Spring Isolators Installation Instructions 100
One Inch Deflection Spring Isolators 101
Installation Of Elastromeric Isolators 102
Elastomeric Isolator Cross Reference 103
Two Inch Deflection Isolator Installation and Adjustment 104
Two Inch Deflection Restrained Spring Isolator 105
Wiring Diagrams 126
Glycol System Components 170
Compressor Components 172
Chiller Electronic Components 173
Keypad 173
Keypad Data Entry Mode 174
Display 174
Chiller Control Board 174
Relay Output Boards 175
VSD (Variable Speed Drive) 176
AC to DC Rectifier 176
SCR Trigger Board 176
DC Link Filter 176
1L Line Inductor 177
DC to AC Inverter 177
Laminated Bus Structure 178
VSD Logic Board 178
Control Panel to VSD Communications 178
Current Transformers 179
DV/DT Output Suppression Network 179
Flash Tank Feed (Condenser Drain Valve) and Economizer Feed Stepper Motor Valve Controller 180
DC Bus Voltage Isolation Board 180
Chiller Circuit Breaker 181
Chiller Configuration Jumpers 181
VSD Logic to Chiller Microprocessor Board RS-485 Communication Configuration Jumpers 181

SECTION 6 - COMMISSIONING 183
Preparation 183
Inspection 183
Refrigerant Charge 183
Correct System Refrigerant Charge 183
Service and Oil Line Valves 183
Compressor Oil 183
Fans 184
Isolation / Protection 184
Control Panel 184
Power Connections 184
Grounding 184
Water System 184
Flow Switch 184
Temperature Sensor(s) 184
Programmed Options 184

TABLE OF CONTENTS (CONT'D)

Programmed Settings 184
Date and Time 184
Start/Stop Schedule 184
Setpoint and Remote Offset 184
First Time Start-up 185
Interlocks 185
Unit Switch 185
Startup 185
Oil Pressure 185
Loading 185
Condenser and Fan Rotation 185
System Charge 185
General Operation 185
Operation in Sub-freezing Conditions 186
Unit Maintenance and Shutdown in Sub-freezing Conditions 186

SECTION 7 - OPERATION 193
Operating Controls 193
Anti-recycle Timer 193
Evaporator Pump Control 193
Evaporator Heater Control 193
Pumpdown Control 193
Compressor Heater Control 193
Alarms 193
Chiller Run Contact 193
Flow Switch Control 193
Run Permissive Control 194
Unit Switch 194
Basic Operating Sequence 194
Start Sequence and Loading 194
Number of Compressors To Start 196
General 196
Minimum VSD Compressor Start/Run Frequency 196
Minimum VSD Start Frequency 196
Minimum VSD Run Frequency 196
Acceleration/Deceleration Rate When Starting/Stopping Compressors 197
VSD Acceleration and Deceleration Rates 197
Capacity Control 197
Loading/Unloading and Starting Additional Compressors 197
Fuzzy Logic Control 198
Hot Water Starts 199
Load Limiting Control 199
Load Limiting 199
Motor Current Load Limiting/Unloading 200
Discharge Pressure Load Limiting/Unloading 200
Suction Pressure Load Limiting/Unloading 200
VSD Internal Ambient Temperature Load Limiting 201
VSD Baseplate Temperature Load Limiting 201
Flash Tank Feed Valve (Condenser Drain Valve) and Economizer Valve Controller 201
Flash Tank Feed Valve (Condenser Drain Valve) Operation 202
Eductor Clog Protection 204

TABLE OF CONTENTS (CONT'D)

Optional VI Step Solenoids (Variable Volume Index Control) 205
Optimized Fan VSD Control 205
Checking the VSD Programming 207
Optimized IPLV Contactor Fan Control By Discharge Pressure 211
High VSD Cabinet Ambient Temperature Fan Operation 211
VSD Temperature Control, Operation of The Coolant Pump, and VSD Cabinet Cooling Fans 211
Remote Temperature Reset Control 212
Temperature Reset Control 212
Remote BAS Setpoint Control 212
Remote Temperature Reset 212
Local Current Limit Control 213
Pulldown Current Limit Setpoint 213
Remote Current Limit Reset Control 213
Remote ISN Current Limit Setpoint 213
Remote Current Limit Reset 213
Sound Limit Control 214
Sound Limiting and Local Sound Limit Setpoint 214
BAS Sound Limit Setpoint 215
Remote Sound Limit 215

SECTION 8 - MICROPANEL 217
VSD Operation and Controls 217
VSD Logic Board 217
VSD Start/run Initiation 217
PWM Generator Type and Carrier Frequency 217
Short Circuit Protection Minimum Output Pulse Width and Interlock Delay 217
Modulating Frequency 217
Maximum VSD Frequency 217
VSD % Modulation 218
VSD Cooling and Cooling Loop 218
IGBT Module Baseplate Temperature Sensing 219
VSD Internal Ambient Temperature Sensing 219
Pre-charge 219
Run Mode / Unit Restart 220
DC Bus Voltage Sensing and Scaling 220
Current Sensing and Scaling 220
VSD Transmitted Operating Parameters 220
VSD Safeties (Faults) 220
Pre-charge Low DC Bus Voltage (Software) Fault 222
Pre-charge DC Bus Voltage Imbalance (Software) Fault 222
High DC Bus Voltage (Hardware) Fault 222
Low DC Bus Voltage (Software) Fault 222
DC Bus Voltage Imbalance (Software) Fault 222
High Motor Current (Hardware) Fault 222
Motor Current Overload (Software) Fault 223
Motor Current Overload (Hardware) Fault 223
IGBT Gate Driver (Hardware) Fault 223
High Baseplate Temperature (Software) Fault 223
High VSD Internal Ambient Temperature (Software) Fault 224
Single Phase Input (Hardware) Fault 224

TABLE OF CONTENTS (CONT'D)

Power Supply (Hardware) Fault 224
Run Relay (Software) Fault 224
VSD Logic Board Failure (Software) Fault 224
VSD CT Plug (Hardware) Fault 225
VSD Fault Data 225
Fault Relay/Fault Acknowledge Bit 225
VSD Fault Compressor Start Inhibit 225
VSD Logic Board Test Mode 225
Unit Warnings 226
Unit Warning Operation 226
Low Battery Warning 226
Microboard (331-03478-xxx) 227
Power Supplies and LEDs 227
Power Supply Test Points 227
Configuration Jumpers 227
Building Automation System (BAS) Communications 227
Using Communications Protocol 227
E-Link or SC-EQ Interface 230
Communication Ports 230
E-Link 230
VSD 230
Program Update 230
Data Logging 231
Invalid Number of Compressors Warning 232
Invalid Serial Number Warning 232
Unit Safeties 232
Unit Safety Operation 232
High Ambient Temp Fault 233
Low Ambient Temp Fault 233
Low Leaving Chilled Liquid Temp Fault 233
VSD Communications Failure Fault 233
System Safeties (Faults) 234
System Safety (Fault) Operation 234
High Discharge Pressure Cutout (Software) Fault 234
High Discharge Pressure Cutout (HPCO) (Hardware) Fault 235
Low Suction Pressure Cutout (Software) Fault 235
Low Motor Current Cutout Fault 235
High Differential Oil Pressure Cutout Fault 235
Low Differential Oil Pressure Cutout Fault 236
High Discharge Temperature Cutout Fault 236
Low Discharge Superheat Cutout Fault 236
Sensor Failure Cutout Fault 237
High Motor Temperature Cutout Fault 237
System Control Voltage Cutout Fault 237
Eductor Clog Fault 238
Status Key Operation 239
General Status Messages 239
Unit Safety (Fault) Status Messages 241
System Safety (Fault) Status Messages 241
VSD Safety (Fault) Status Messages 241
Unit Warning Messages 241

TABLE OF CONTENTS (CONT'D)

General....242
Unit Data Key Operation....242
General....244
System 1 Data Key Operation....244
System 2 Data Key Operation....245
Sensor Displays....246
General....247
VSD Data Key Operation....247
History Key Operation....250
Normal Shutdowns History....250
Fault Shutdowns History....250
Status Fault Type....251
Unit Fault Type....251
All Fault Data....251
Unit Data....251
VSD Data....252
System Data....253
Compressor Speed and Heater Status....253
System #1 Motor Temperatures....253
Flash Tank Level and Economizer Position....253
Condenser Sub-cooling and Condenser Drain Valve Position....253
Condenser Fans....253
VI Step Solenoid....253
Compressor Operating Hours and Starts....254
Chilled Liquid Setpoint Cooling Setpoints....254
Options....254
Remote Temperature Reset....255
Remote Current Reset....255
Remote Sound Limit Selection....255
Program Values....255
Pulldown Current Limit....255
Eductor Differential Temperature....256
Eductor Safety Time....256
Motor Temperature Unload....256
Setpoints Key....257
Setpoints Key Operation....257
Program Key Operation....259
Suction Pressure Cutout....259
Low Ambient Cutout....260
Low Leaving Liquid Temp Cutout....260
Motor Current Limit....260
Pulldown Current Limit....260
Pulldown Current Limit Time....260
Sub-cooling Setpoint....260
Unit ID Number....260
Sound Limit Setpoint....260
Eductor Differential....261
Eductor Safety Time....261
Motor Temperature Unload....261
Default Values....261
Options Key Operation....263

TABLE OF CONTENTS (CONT'D)

Display Language Selection....263
Chilled Liquid Cooling Mode Selection....263
Local / Remote Control Mode Selection....263
Display Units Selection....264
System Lead/Lag Control Mode Selection....264
Remote Temperature Reset Selection....264
Remote Current Limit Input Selection....264
Remote Sound Limit Selection....265
Low Ambient Cutout Enable/Disable....265
Date/Time And Schedule Keys....266
Date/Time Key Operation....266
Schedule Key Operation....267
Unit Operating Schedule....267
Sound Limit Schedule....268
Manual Overrride Key Operation....269
Print Key Operation....270
Operating Data Printout....271
History Data Printout....272
Service Key....273
Service Key Operation....273
Software Version / Unit Serial Number....274
Analog Inputs....274
Digital Inputs....275
Digital Outputs....276
Analog Outputs....277
VSD Digital Outputs....277
System Switches Key Operation....278
Serial Number Programming....279
Unit Setup Mode....280
Default Programmable Values....282
Serial Port Connections....282
Analog Input Connections....282
Digital Input Connections....284
Analog Output Connections....285
Digital Output Connections....285
BAS Communications....287
SE-EQ or E-Link BAS Communications Card....287

SECTION 9 - MAINTENANCE....293
General Requirements....293
Weekly Maintenance....293
Unit Status....293
Refrigerant Leaks....293
Operating Conditions....293
Compressor Oil Level....293
Refrigerant Charge....293
Refrigerant Removal, Evacuation And Charging YVAA Chiller....294
Refrigerant Removal....294
Evacuating a System....294
Charging Refrigerant into a System....294

TABLE OF CONTENTS (CONT'D)

Microchannel Coil Cleaning....295
Chilled Liquid System Maintenance....295
Scheduled Maintenance....295
Chiller / Compressor Operating Log....295
Before Applying Power To The Chiller, Assure The Chilled Liquid System Is Filled....295
Removing Water/Glycol From The Evaporator....296
Evaporator Freeze Damage....296
Glycol Concentration....296
Winterization....296
Maintenance Requirements for YVAA Chillers....297
Refrigerant Conversion Tables....298
R-513A Conversion Table....302
R-513A Conversion Table....303
Printer Wiring....308
Printer Cables....309
Printer Setup....309
Okidata 184....309
Weigh-tronix IMP 24 Model 2600....309
Seiko....309
Operating Log Sheet Site And Chiller Information....310

LIST OF FIGURES

FIGURE 1 - YVAA Air-Cooled Screw Liquid Chiller with Variable Speed Drive....21
FIGURE 2 - Chiller Control System....22
FIGURE 3 - CTS Compressor....23
FIGURE 4 - Compressor Models....24
FIGURE 5 - Optional Compressor VI Step Solenoids (Variable Volume Index Control)....24
FIGURE 6 - Hybrid Falling Film Evaporator....25
FIGURE 7 - 2-Pass Evaporator With Optional Immersion Heater....25
FIGURE 8 - Evaporator Sight Glass....25
FIGURE 9 - 2-Pass Evaporator Standard Arrangement....25
FIGURE 10 - 2-Pass Evaporator Optional Arrangement....26
FIGURE 11 - Suction Piping....26
FIGURE 12 - VSD Enclosure....26
FIGURE 13 - Eductor Oil Management....27
FIGURE 15 - Oil Level....28
FIGURE 16 - Eductor Filter Drier....28
FIGURE 14 - Eductor - Jet Pump....28
FIGURE 17 - Eductor....29
FIGURE 18 - Economizer Circuit....30
FIGURE 19 - Economizer Stepper Control Valve....30
FIGURE 20 - Check Valve....30
FIGURE 21 - Flash Tank Level Switch (High Level Switch)....30
FIGURE 22 - PWM Current Waveform....32
FIGURE 23 - PWM Voltage Waveform....33
FIGURE 24 - Glycol Cooling Coil....34
FIGURE 25 - Unit Model Number Nomenclature....38
FIGURE 26 - YVAA0153 Dimensions....49
FIGURE 27 - Lift lug to remove unit from shipping container....60
FIGURE 28 - Accessory lifting lugs....60

LIST OF FIGURES (CONT'D)

FIGURE 29 - Acceptable Minimum Clearances Around/Between Unit(s) 62
FIGURE 30 - Pipework Arrangement 64
FIGURE 31 - Leaving Water Temperature Out of Range Suggested Layout 65
FIGURE 32 - Suggested Layout For Applications With A Flow Rate Less Than The Evaporator Minimum Allowable Flow Rate 65
FIGURE 33 - Suggested Layout For Applications With A Flow Rate Greater Than The Evaporator Maximum Allowable Flow Rate 65
FIGURE 34 - Victaulic Groove 66
FIGURE 35 - Flange For GB Vessels 67
FIGURE 36 - Flange Attachment 68
FIGURE 37 - Two Pass Water Pressure Drop, English Units 73
FIGURE 38 - Three Pass Water Pressure Drop, english units 73
FIGURE 39 - Two Pass Water Pressure Drop, SI Units 74
FIGURE 40 - Glycol Correction Factors 74
FIGURE 41 - Cross Sectional View of One Inch Deflection Spring Isolator 100
FIGURE 42 - Elastomeric Isolator Cross Sectional View 102
FIGURE 43 - Elastomeric Isolator Data 103
FIGURE 44 - Two Inch Deflection Isolator 104
FIGURE 45 - Seismic Isolator Data 105
FIGURE 46 - Power Wiring - 2 Compressor Connections 122
FIGURE 47 - Single Point Connections For Vsd Control Panel 124
FIGURE 48 - Multipoint Connections For VSD Control Panel 125
FIGURE 49 - 2 Compressor Control Wiring 126
FIGURE 50 - 2 Compressor Power Wiring 128
FIGURE 51 - 2 Compressor Connection Diagram 130
FIGURE 52 - 2 Compressor Connection Diagram 132
FIGURE 53 - 2 Compressor Panel Layout 134
FIGURE 54 - 2 Fan Systems 1 and 2 Fan Wiring 135
FIGURE 55 - System 1 Fan Wiring 136
FIGURE 56 - System 2 Fan Wiring 138
FIGURE 57 - Fan Wiring 4 Fans, System 1 140
FIGURE 58 - Fan Wiring 4 Fans, System 2 141
FIGURE 59 - Fan Wiring 5 Fans, System 1 142
FIGURE 60 - Fan Wiring 5 Fans, System 2 143
FIGURE 61 - Fan Wiring 6 Fans, System 1 144
FIGURE 62 - Fan Wiring 6 Fans, System 2 145
FIGURE 63 - Fan Wiring 7 Fans, System 1 146
FIGURE 64 - Fan Wiring 7 Fans, System 2 147
FIGURE 65 - Fan Wiring 8 Fans, System 1 148
FIGURE 66 - Fan Wiring 8 Fans, System 2 149
FIGURE 67 - 2 Compressor Connection Diagrams 150
FIGURE 68 - Water Boxes / Heater Kit 152
FIGURE 69 - Refrigerant Flow Diagram 153
FIGURE 70 - Process And Instrumentation Diagram 154
FIGURE 71 - Component Locations 155
FIGURE 72 - Control and VSD Cabinet Components 156
FIGURE 73 - Chiller Control Board, Relay Boards, E-Link Gateway, and Optional Circuit Breaker 157
FIGURE 74 - Chiller Control Board, Relay Boards, and E-Link Gateway, 2 Compressor 158
FIGURE 75 - VSD Logic Board 159
FIGURE 76 - VSD Logic Board, P/N 031-02507-XXX 160
FIGURE 77 - User Control and Power Cable Connections 161
FIGURE 78 - User Control and Power Cable Connections 162
FIGURE 79 - Fan Contactors and 3T Transformer, 2 Compressor 163
FIGURE 80 - VSD Components 164

LIST OF FIGURES (CONT'D)

FIGURE 81 - VSD Components, 2 Compressor 165
FIGURE 82 - VSD Components, 2 Compressor 166
FIGURE 83 - Inverter Power Components, 2 Compressor 167
FIGURE 84 - Inverter Power Components 168
FIGURE 85 - Inverter Power Components 169
FIGURE 86 - Glycol Pump and Fill Tube Locations 170
FIGURE 87 - Glycol Piping and Fill Tube Location 171
FIGURE 88 - Standard Compressor Components (Without Variable VI) 172
FIGURE 89 - Keypad 173
FIGURE 90 - Keyboard and Display 174
FIGURE 91 - VSD Logic Board P/N 031-02507-000 178
FIGURE 92 - Chiller Control (Cooling) Range 195
FIGURE 93 - Number of Compressors To Start 195
FIGURE 94 - Minimum VSD Start Frequency 196
FIGURE 95 - Minimum VSD Run Frequency 197
FIGURE 96 - Flash Tank Feed Valve (Condenser Drain Valve) and Economizer Valve Controller 202
FIGURE 97 - LED Locations 202
FIGURE 98 - Power and Comms LED's 203
FIGURE 99 - Power, Comms and System Open/Close LED's 203
FIGURE 100 - SAT Discharge Temperature - SAT Suction Temperature 205
FIGURE 101 - Optimized Fan Speed Control 206
FIGURE 102 - Fan Speed Equation 206
FIGURE 103 - Inverter With Keypad and Display Installed 207
FIGURE 104 - Inverter Keypad 207
FIGURE 105 - Optimized IPLV Fan Control Pressure 211
FIGURE 106 - VSD Glycol Pump 219
FIGURE 107 - New Board - P/N 031-02507-XXX 219
FIGURE 108 - VSD Logic Board 225
FIGURE 109 - New 331-03478-xxx Microboard 228
FIGURE 110 - LON E-LINK Gateway option 287
FIGURE 111 - Print Cable - Chiller To Serial Printer 308

LIST OF TABLES

TABLE 1 - Complete PIN Number Description 40
TABLE 2 - Unit Rigging 52
TABLE 3 - Minimum Evaporator Tube Removal Clearance 62
TABLE 4 - Evaporator Connections Dimensions 66
TABLE 5 - Remote Evaporator Piping 71
TABLE 6 - Water Temperature and Flows 75
TABLE 7 - Physical Data - Microchannel Coil 76
TABLE 8 - Physical Data - Round Tube Coil 80
TABLE 9 - Fan Data 82
TABLE 10 - Standard (Two-Pass, Rear Inlet/Outlet) Evaporator 86
TABLE 11 - Optional Three-Pass Rear Inlet/Front Outlet Evaporator 90
TABLE 12 - Isolator Selection and Mounting Locations 94
TABLE 13 - One Inch Deflection Spring Isolators Cross-reference 101
TABLE 14 - Electrical Lug Data 112
TABLE 15 - Compressors and The Appropriate Jumper Positions 181
TABLE 16 - VSD Logic Board Address Jumper 181
TABLE 17 - Fuzzy Logic Loading/Unloading vs. Error 199
TABLE 18 - Current Limit Load Limiting/Unloading 200
TABLE 19 - Discharge Pressure Load Limiting/Unloading 200
TABLE 20 - Suction Pressure Load Limiting/Unloading 201
TABLE 21 - VSD Internal Ambient Load Limiting/Unloading 201
TABLE 22 - VSD Baseplate Temperature Load Limiting/Unloading 201
TABLE 23 - Fan Speed Multiplier 206
TABLE 24 - Compressor Relative Displacement 206
TABLE 25 - Programmed Values 209
TABLE 26 - 9906, 9909 and 2003 Parameter Programming 210
TABLE 27 - Fan Staging 210
TABLE 28 - VSD Operating Display Parameters 221
TABLE 29 - Flash Card Update Error XXXXX 231
TABLE 32 - Data Logging 232
TABLE 30 - Low Differential Oil Pressure Cutout 236
TABLE 31 - Start Inhibit Sensor Thresholds 237
TABLE 33 - Sensor Min/Max Outputs 246
TABLE 34 - Compressor Motor Overload Settings 248
TABLE 35 - Setpoint Limits 258
TABLE 36 - Programmable Operating Parameters 262
TABLE 37 - Printout Types 270
TABLE 38 - Unit Setup Programmable Values 280
TABLE 39 - Serial Port Connections 282
TABLE 40 - Analog Input Connections 283
TABLE 41 - Digital Input Connections 284
TABLE 42 - Analog Outputs Connections 285
TABLE 43 - Digital Outputs Connections 285
TABLE 44 - Real Time Error Numbers 288
TABLE 45 - YVAA Communications Data Map 289
TABLE 46 - Refrigerant Pressure To Saturated Temperature Conversion 298
TABLE 47 - Troubleshooting Guide 299
TABLE 48 - R-513A Refrigerant pressure to saturated temperature 302
TABLE 49 - R-513A Refrigerant Saturated Temperature to Pressure 303
TABLE 50 - Temperature Input Voltage Sensor (Measured Signal To Shield At The Sensor) 304
TABLE 51 - Outside Air Temperature Sensor Input Voltage 305
TABLE 52 - Pressure Transducer Output Voltage 306
TABLE 53 - Motor Temperature Sensor Resistance (Check At The Motor) 307

SECTION 1 - GENERAL CHILLER INFORMATION AND SAFETY

INTRODUCTION

YORK YVAA chillers are manufactured to the highest design and construction standards to ensure high performance, reliability and adaptability to all types of air conditioning installations.

The unit is intended for cooling water or glycol solutions and is not suitable for purposes other than those specified in this manual.

Rigging and lifting should only be done by a professional rigger in accordance with a written rigging and lifting plan. The most appropriate rigging and lifting method will depend on job specific factors, such as the rigging equipment available and site needs. Therefore, a professional rigger must determine the rigging and lifting method to be used, and it is beyond the scope of this manual to specify rigging and lifting details.

This manual contains all the information required for correct installation and commissioning of the unit, together with operating and maintenance instructions. The manual should be read thoroughly before attempting to operate or service the unit.

All procedures detailed in the manual, including installation, commissioning and maintenance tasks must only be performed by suitably trained and qualified personnel.

The manufacturer will not be liable for any injury or damage caused by incorrect installation, commissioning, operation or maintenance resulting from a failure to follow the procedures and instructions detailed in the manual.

WARRANTY

Johnson Controls warrants YVAA chillers in accordance with the Limited Warranty Engineered Systems Equipment (*Form 50.05-NM2*).

Johnson Controls warrants all equipment and materials against defects in workmanship and materials for a period of eighteen months from date of shipment or 12 months from date of startup, whichever comes first, unless labor or extended warranty has been purchased as part of the contract.

The warranty is limited to parts only replacement and shipping of any faulty part, or sub-assembly, which has failed due to poor quality or manufacturing errors. All claims must be supported by evidence that the failure has occurred within the warranty period, and that the unit has been operated within the designed parameters specified.

All warranty claims must specify the unit model, serial number, order number and run hours/starts. Model and serial number information is printed on the unit identification plate.

The unit warranty will be void if any modification to the unit is carried out without prior written approval from Johnson Controls. For warranty purposes, the following conditions must be satisfied:

- The initial start of the unit must be carried out by trained personnel from an authorized Johnson Controls Service Center. See *SECTION 6 - COMMISSIONING on page 183*, for more information.
- Only genuine YORK approved spare parts, oils, coolants, and refrigerants must be used.
- All the scheduled maintenance operations detailed in this manual must be performed at the specified times by suitably trained and qualified personnel. See *SECTION 9 - MAINTENANCE,* for more information.
- Failure to satisfy any of these conditions will automatically void the warranty. Refer to *Form 50.05-NM2*, for complete details.

CERTIFICATIONS AND LABELS

The following certifications and labels are applicable to YVAA chillers:

- AHRI certified (60Hz models up to 200 tons)
- Eurovent certified (50Hz models up to 600KW)
- ETL/cETL GB, CE
- ASHRAE 90.1 compliant
- ISO9001
- LEED USGBC member

QUALITY ASSURANCE AND SAFETY

Products are Designed, Tested, Rated and Certified IAW, and installed in compliance with applicable sections of the following Standards and Codes:

- AHRI 550/590 – Water Chilling Packages Using the Vapor Compression Cycle
- AHRI 70 – Sound Rating of Large Outdoor Refrigerating and Air Conditioning Equipment
- ANSI/ASHRAE Standard 15 – Safety Code for Mechanical Refrigeration
- ASHRAE 34 – Number Designation and Safety Classification of Refrigerants
- ASHRAE 90.1 – Energy Standard for Buildings Except Low-Rise Residential Buildings
- ANSI/NFPA Standard 70 – National Electrical Code (N.E.C).
- ASME Boiler and Pressure Vessel Code, Section VIII, Division 1.
- ASTM A48 – Gray Iron Castings
- OSHA – Occupational Safety and Health Act
- YVAA chillers are designed within EN ISO 9001 and built within an EN ISO 9002 accredited manufacturing organization.
- Conform to Intertek (ETL) and provide ETL listing label.
- Units are Rated (all) and Certified (140 - 200 tons) IAW AHRI Standard 550/590.

When required, chillers (50 Hz only) have the option available to conform with the following European Directives.

CE/PED marked units conform to the following standards:

- Machinery Directive (2006/42/EC).
- EMC Directive (2004/108/EC).
- Pressure Equipment Directive (97/23/EC).
- Low Voltage Directive (2006/95/EC).
- Safety Code for Mechanical Refrigeration (EN378-2(2008)).

ETL/ASME marked units conform to the following standards:

- ANSI/ASHRAE 15 – Safety Code for Mechanical Refrigeration.
- ANSI/ASHRAE 34 – Number Designation and Safety Classification of Refrigerants.
- ANSI/NFPA 70 – National Electrical Code (N.E.C.).
- ASME Boiler and Pressure Vessel Code, Section VIII, Division 1.

GB marked units conform to the following standards:

- GB5226.1 Safety of machinery- Electrical equipment of machines – Part 1: General requirements.
- GB25131 Safety requirements for water chiller (heat pump) using the vapor compression cycle.

FLUORINATED GREENHOUSE GASES

- This equipment contains fluorinated greenhouse gases covered by the Kyoto Protocol.
- The global warming potential of the refrigerant R-134a used in this unit is 1300, R-513A is 630.
- The refrigerant quantity is stated in the Physical Data table in Section 5 of this document.
- The fluorinated greenhouse gases in this equipment may not be vented to the atmosphere.
- This equipment should only be serviced by qualified technicians

RESPONSIBILITY FOR SAFETY

Every care has been taken in the design and manufacture of the unit to ensure compliance with the safety requirements listed above. However, the individual rigging, lifting, maintaining, operating or working on any machinery is primarily responsible for:

- Personal safety, safety of other personnel, and the machinery.
- Correct utilization of the machinery in accordance with the procedures detailed in the manual.

ABOUT THIS MANUAL

The contents of this manual include suggested best working practices and procedures. These are issued for guidance only, and they do not take precedence over the above stated individual responsibility and/or local safety regulations.

This manual and any other document supplied with the unit are the property of Johnson Controls which reserves all rights. They may not be reproduced, in whole or in part, without prior written authorization from an authorized Johnson Controls representative.

MISUSE OF EQUIPMENT

Suitability for Application

The unit is intended for cooling water or glycol solutions and is not suitable for purposes other than those specified in these instructions. Any use of the equipment other than its intended use, or operation of the equipment contrary to the relevant procedures may result in injury to the operator, or damage to the equipment.

The unit must not be operated outside the design parameters specified in this manual.

Structural Support

Structural support of the unit must be provided as indicated in these instructions. Failure to provide proper support may result in injury to the operator, or damage to the equipment and/or building.

Mechanical Strength

The unit is not designed to withstand loads or stresses from adjacent equipment, pipework or structures. Additional components must not be mounted on the unit. Any such extraneous loads may cause structural failure and may result in injury to the operator, or damage to the equipment.

General Access

There are a number of areas and features, which may be a hazard and potentially cause injury when working on the unit unless suitable safety precautions are taken. It is important to ensure access to the unit is restricted to suitably qualified persons who are familiar with the potential hazards and precautions necessary for safe operation and maintenance of equipment containing high temperatures, pressures and voltages.

Pressure Systems

The unit contains refrigerant vapor and liquid under pressure, release of which can be a danger and cause injury. The user should ensure that care is taken during installation, operation and maintenance to avoid damage to the pressure system. No attempt should be made to gain access to the component parts of the pressure system other than by suitably trained and qualified personnel.

Electrical

The unit must be grounded. No installation or maintenance work should be attempted on the electrical equipment without first switching power OFF, isolating and locking-off the power supply. Servicing and maintenance on live equipment must not be attempted. No attempt should be made to gain access to the control panel or electrical enclosures during normal operation of the unit.

Rotating Parts

Fan guards must be fitted at all times and not removed unless the power supply has been isolated. If ductwork is to be fitted, requiring the wire fan guards to be removed, alternative safety measures must be taken to protect against the risk of injury from rotating fans.

Sharp Edges

The fins on the air-cooled condenser coils have sharp metal edges. Reasonable care should be taken when working in contact with the coils to avoid the risk of minor abrasions and lacerations. The use of gloves is recommended.

Frame rails, brakes, and other components may also have sharp edges. Reasonable care should be taken when working in contact with any components to avoid risk of minor abrasions and lacerations.

Refrigerants and Oils

Refrigerants and oils used in the unit are generally non-toxic, non-flammable and non-corrosive, and pose no special safety hazards. Use of gloves and safety glasses is, however, recommended when working on the unit. The buildup of refrigerant vapor, from a leak for example, does pose a risk of asphyxiation in confined or enclosed spaces and attention should be given to good ventilation. Use only the refrigerant specifically designated for the unit. Any other type of refrigerant may cause damage to the equipment and will void the warranty.

High Temperature and Pressure Cleaning

High temperature and pressure cleaning methods (e.g. steam cleaning) should not be used on any part of the pressure system as this may cause operation of the pressure relief device(s). Detergents and solvents, which may cause corrosion, should also be avoided.

Emergency Shutdown

In case of emergency, the control panel is fitted with a UNIT switch to stop the unit. When operated, it removes the low voltage 120VAC electrical supply from the inverter system, thus shutting down the unit. CE certified units use a circuit breaker/non-fused disconnect to remove all power to the unit.

Safety Labels

White symbol on blue background.

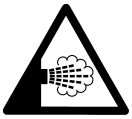
For safe operation, read the Instructions first.

Black symbol on yellow background.

Warning: This machine may start automatically without prior warning.

Black symbol on yellow background.

Warning: Hot surface.



Black symbol on yellow background.

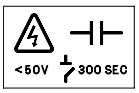
Warning: Safety relief valve may discharge gas or liquid without prior warning.

Black symbol on yellow background.

Warning: Isolate all electrical sources of supply before opening or removing the cover, as lethal voltages may exist.

Black symbol on yellow background.

General attention symbol.



Black symbol on yellow background.

Warning: On isolating the supply it may take up to 300 seconds for the capacitor voltage to fall below 50 volts.

MSDS Information

Manufacturer Safety Data Sheets (MSDS) information can be obtained by calling (800) 451-8346 in the U.S. or e-mail to MSDS@3Ecompany.com. Please provide the product name, manufacturer, part number, and the specific language required.

SECTION 2 - PRODUCT DESCRIPTION

YORK YVAA chillers are designed for water or glycol cooling. All units are designed to be located outside on the roof of a building or at ground level.

The units are completely assembled with all interconnecting refrigerant piping and internal wiring, ready for field installation.

Prior to delivery, the unit is pressure tested, evacuated, and fully charged with refrigerant and oil in each of the two independent refrigerant circuits. After assembly, an operational test is performed with water flowing through the evaporator to ensure that each refrigerant circuit operates correctly.

The unit structure is manufactured from heavy gauge, galvanized steel. Many external structural parts are coated with baked-on enamel powder "Champagne" paint color ((RAL 7006), (Munsel No. 9.8YR4.36/1.2)). This provides a finish which, when subjected to ASTM B117, 1000 hour, 5% salt spray conditions, shows breakdown of less than 1/8 inches on either side of a scribed line (equivalent to ASTM D1654 rating of "6").

All exposed power wiring is routed through liquid-tight, non-metallic conduit.

GENERAL SYSTEM DESCRIPTION

The YVAA Chiller combines the best of modern screw compressor design with the latest technology in variable speed drives. The result is superior control and efficiency in real world conditions. The VSD enables slowing the speed of the compressor to match the load on the system resulting in precise chilled liquid control, minimized sound, maximum energy efficiency, and reduced cost of ownership. The VSD also provides soft starts with no electrical inrush. The lack of heat build-up on start also enables required off time between starts to be reduced to a period of two minutes.

The YVAA Air-Cooled Screw Chiller utilizes many components, which are the same or nearly the same as a standard screw chiller of a similar size. This includes modular frame rails, condenser, fans, compressors and evaporator. The chiller consists of two screw compressors in a corresponding number of separate refrigerant circuits, a hybrid falling film evaporator, an air-cooled condenser, receiver/flash tanks, feed valves, oil separators, and compressor mufflers. Oil separators utilize no moving parts. Oil cooling is accomplished by refrigerant leaving the eductor flashing in the suction line which cools the oil, motor and compressor.

FIGURE 1 - YVAA AIR-COOLED SCREW LIQUID CHILLER WITH VARIABLE SPEED DRIVE

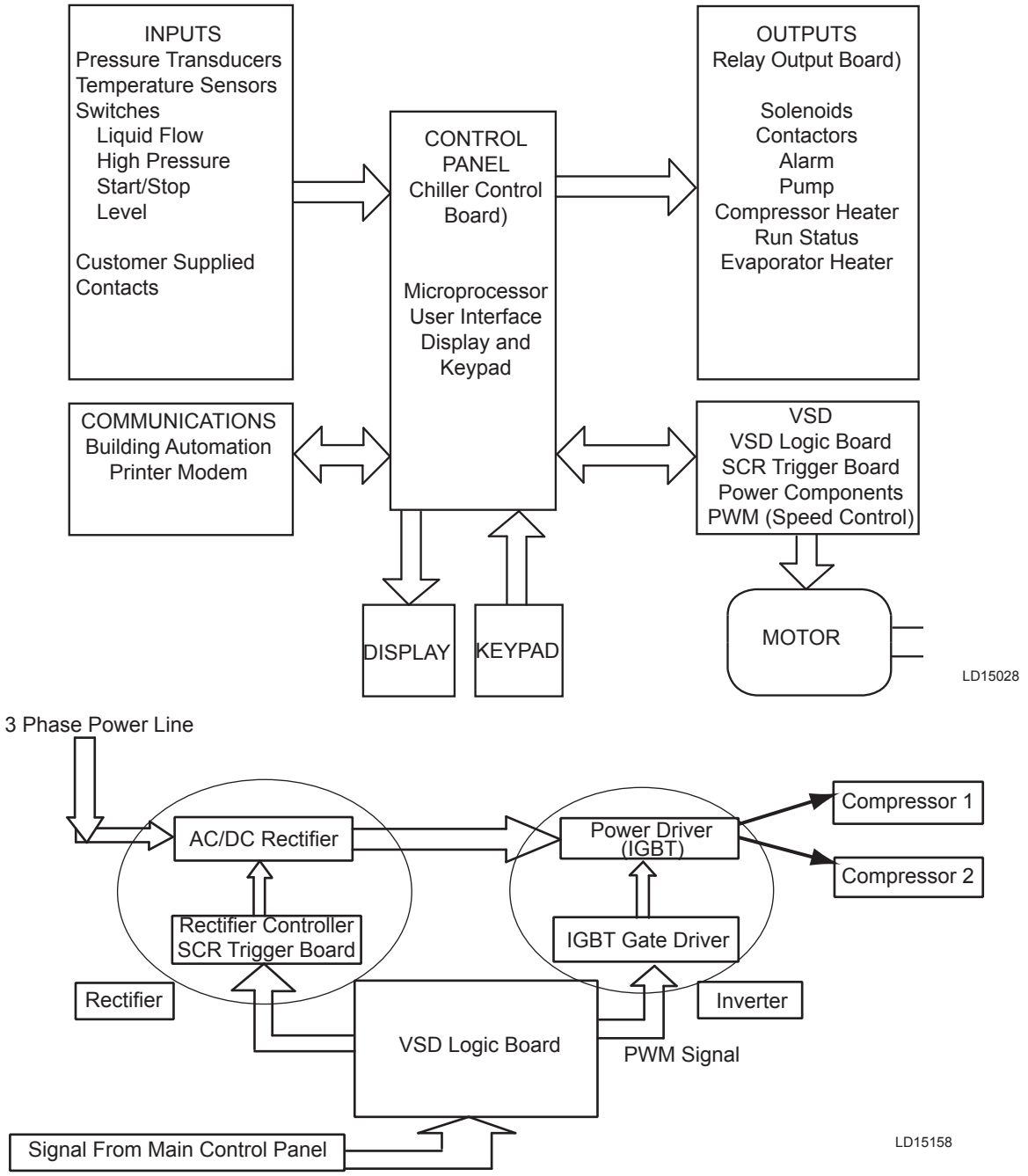


FIGURE 2 - CHILLER CONTROL SYSTEM

An integral liquid cooled, transistorized, PWM, Variable Speed Drive (VSD) is controlled by the chiller microprocessor control panel to start/stop, select compressors to run, and select compressor speed. Displacement Power Factor is 0.95 at part or full load.

The standard VSD uses existing VSD technology, long proven in prior chiller products. The chiller microprocessor communicates with the VSD Logic Board via a 3-wire RS-485 opto coupled data link.

The VSD Logic Board runs the number of compressors required to meet the load and the compressors to the speed requested by the chiller microprocessor. The basic system control and VSD system architecture is shown in *Figure 2 on page 22* above.

The chiller is designed to operate in ambient temperatures of 0°F to 125°F (-18°C to 52°C). Capacity control is capable of reducing chiller capacity to 10% of full load without the need for Hot Gas Bypass.

Compressor

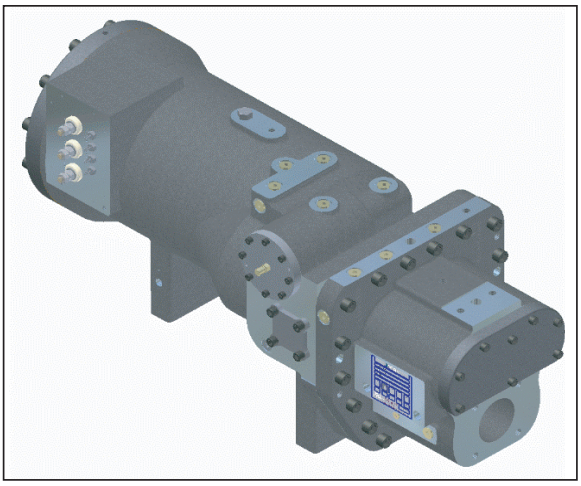
The direct drive semi-hermetic rotary twin-screw CTS compressor is designed for industrial refrigeration applications and ensures high operational efficiencies and reliable performance. Capacity control is achieved by stepless VSD speed changes. No slide valve is required. Smooth capacity control is achieved between 10% and 100% of the chiller capacity in most operating conditions. The compressor is a positive displacement type characterized by two helically grooved rotors, which are manufactured from forged steel. The four pole motor operates at speeds over 6000 RPM to direct drive the male rotor, which in turn drives the female rotor on a light film of oil.

Refrigerant gas is injected into the void created by the unmeshing of the five lobed male and seven lobed female rotors. Further meshing of the rotors closes the rotor threads to the suction port and progressively compresses the gas in an axial direction to the discharge port. The gas is compressed in volume and increased in pressure before exiting in a designed volume at the discharge end of the rotor casing. Since the intake and discharge cycles overlap, a resulting smooth flow of gas is maintained.

The rotors are housed in a cast iron compressor housing precision that is machined to provide optimal clearances for the rotors. Contact between the male and female rotor is primarily rolling on a contact band on each of the rotor's pitch circle. This results in virtually no rotor wear and increased reliability, a trademark of the screw compressor.

The CTS compressor incorporates a complete anti-friction bearing design for reduced power input and increased reliability. Separated, cylindrical, roller bearings handle radial loads. Angular-contact ball bearings handle axial loads. Together they maintain accurate rotor positioning at all pressure ratios, thereby minimizing leakage and maintaining efficiency (See *Figure 3 on page 23*).

Motor cooling is provided by suction gas from the evaporator flowing across the motor. Redundant overload protection is provided using both internal thermistor and current overload protection on all three phases. The CTS compressor is lubricated by removing oil from the refrigerant using an external oil separator. The oil is piped back to the compressor through a removable 0.005 inch mesh screen oil filter to provide compressor lubrication. The cast iron compressor housing design working pressure is 350 PSIG (24 barg) higher.



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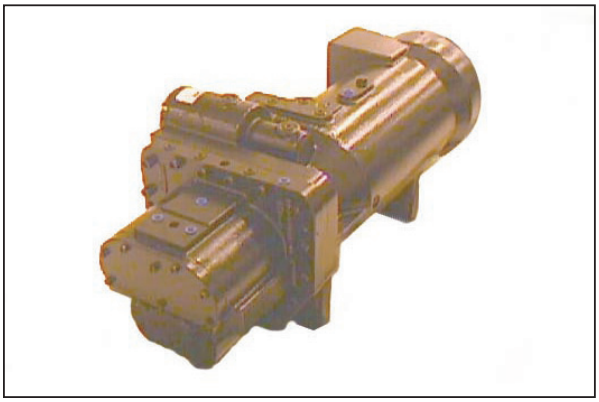

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FIGURE 3 - CTS COMPRESSOR

Each chiller receives a 300 PSIG (21 barg) low side and a 450 PSIG (31 barg) high side factory test. A 350 Watt (115-1-60 Hz) cartridge heater is located in the compressor. The heater is temperature activated to prevent refrigerant condensation.

The following items are also included:

- An external discharge muffler, accoustically tuned to minimize noise, while optimizing flow for maximum performance.
- Discharge shutoff valve.
- Rain-tight terminal box.
- Suction gas screen within the compressor housing.

There are five sizes of compressors that are utilized throughout the product line. The sizes are based on rotor diameter and include 124mm, 136mm, 145mm, 151mm and 170mm. The 124mm-145mm CTS design is the same design used in the YVAA product line. The 151 compressor is also designated as the CTS design and the 170 mm as the WTS design.

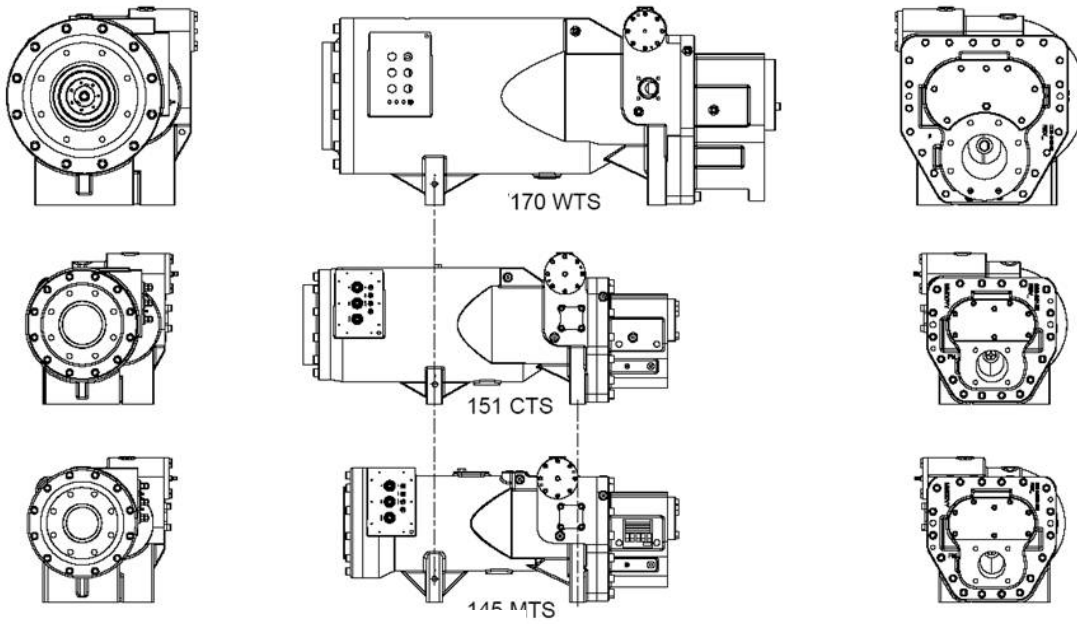

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FIGURE 4 - COMPRESSOR MODELS

These compressors are very similar to the MTS design, but utilize larger rotors and a larger economizer port diameter for increased capacity. See *Figure 4 on page 24* above. Optional internal stepped Variable Index Solenoids are available for additional part-load performance. See *Figure 5 on page 24*.

Optional Compressor VI Step Solenoids (Variable Volume Index Control)

Compressors may be optionally equipped with two Variable Volume Index Control (VI) solenoids to improve part and full load efficiency at low condenser pressures. These solenoids will be activated as step 1 and step 2 on each compressor.

The purpose of these solenoids is to match the gas pressure leaving the compressor (determined by the compression ratio) to the system discharge pressure (determined by the ambient temperature and condenser size). The controls will monitor the saturated discharge temperature and adjust the VI of the compressor as needed for optimum operation at all speeds of compressor operation.

Evaporator

A hybrid falling film evaporator is utilized in the design which incorporates benefits from both falling film and flooded technology. Water flows through the tubes and refrigerant is on the outside. High pressure liquid from the flash/storage tank is metered into the top of the evaporator from a fixed orifice where some of the liquid flashes into vapor. This two phase mixture is fed into a spray header and uniformly dispersed through spray nozzles over the tubes. Refrigerant flow across the tubes is contained with baffles around the outside of the tube bundle.

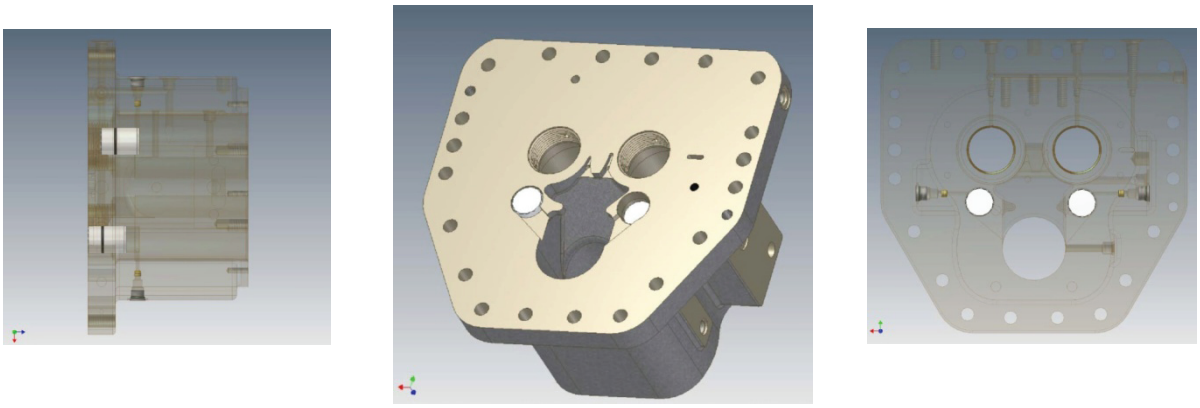

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FIGURE 5 - OPTIONAL COMPRESSOR VI STEP SOLENOIDS (VARIABLE VOLUME INDEX CONTROL)

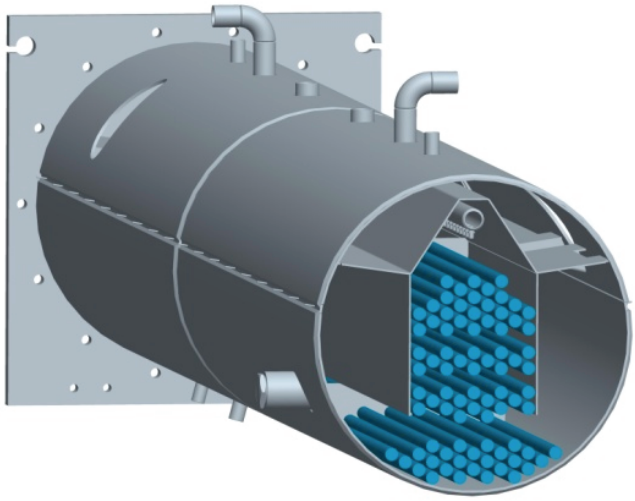

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FIGURE 6 - HYBRID FALLING FILM EVAPORATOR

As the liquid refrigerant falls down across individual tubes in the tube bundle, it is efficiently boiled off as it absorbs heat from the return chilled liquid. Liquid refrigerant collects at the bottom of the evaporator and covers the lower tubes, while gas in the upper parts is pulled into the suction line by the compressor. The advantage of using this type of evaporator is that it provides better part load performance.

The standard evaporator is constructed with 2 chilled water passes. A one pass evaporator is available for applications where low pressure drop is needed. A three pass is available for brine applications.

Evaporators are rated for a minimum 235 PSIG (16 barg) refrigerant side design working pressure.

Two pass water piping connections are on the same end of the evaporator and control panel or rear connection is available. One and three pass will have connections at opposite ends, with front or rear selection of inlet. The outlet will be on the opposite end.

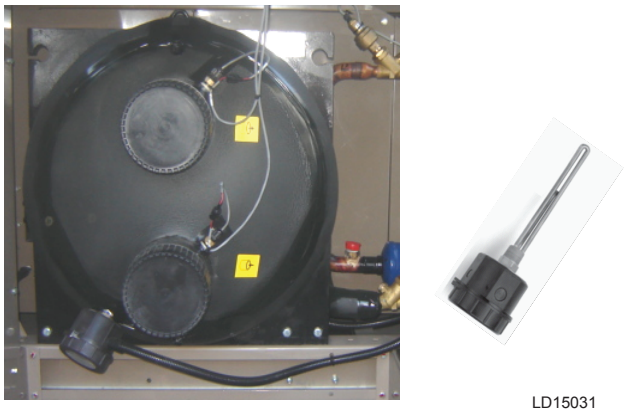

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FIGURE 7 - 2-PASS EVAPORATOR WITH OPTIONAL IMMERSION HEATER

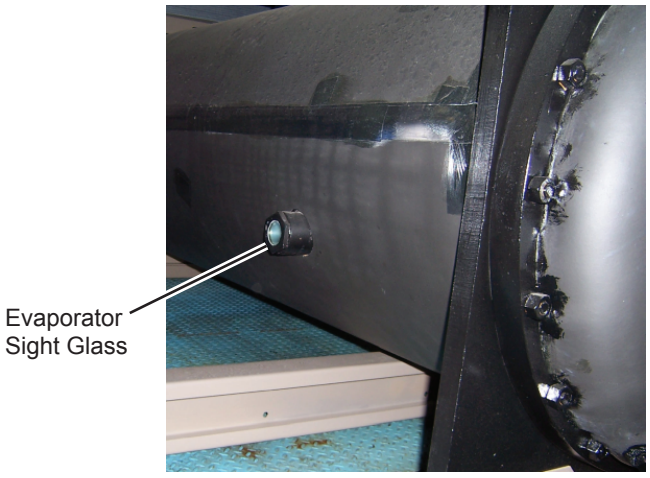

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FIGURE 8 - EVAPORATOR SIGHT GLASS

A large sight glass is an integral part of the evaporator and is provided to simplify adjusting the refrigerant charge in the field. Neither weighing refrigerant or checking sub-cooling is required for checking charge. See *System Charge on page 185*.

A band heater is standard on the evaporator and provides freeze protection to 0°F (-17.78°C). An optional immersion water box heater is also available and provides protection to -20 °F (-28.89°C).

Freeze prevention requires chiller power to remain ON. When the immersion heater option is utilized, a separate 120VAC or 240VAC field supplied power source is required.

Standard insulation is 3/4 inches thick with 1-1/2 inches as an option.

Water-side pressure rating is 150 PSIG as standard with 300 PSIG as an option.

2-Pass Evaporator

Water box connection is available at either end of the evaporator and connections are interchangeable. The standard connection is opposite the control panel end of the chiller. Optional connection is at the control panel end.

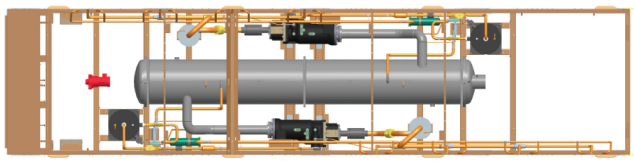

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FIGURE 9 - 2-PASS EVAPORATOR STANDARD ARRANGEMENT

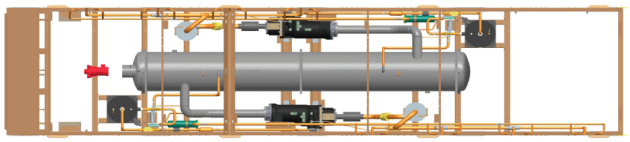

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FIGURE 10 - 2-PASS EVAPORATOR OPTIONAL ARRANGEMENT

Water connection options include victaulic as standard and welded flanges (ANSI and Metric) as an option. Water connections and chilled liquid piping should be insulated by the installing contractor after the piping is installed. Suction piping is made of steel and is an integral part of the evaporator.

LD15031

FIGURE 11 - SUCTION PIPING

Condenser

Two types of condensers are offered. Microchannel high efficiency coils are standard. Copper tube and louvered aluminum fin coils are available as an option as well as copper tube with copper non-louvered fin. Coated coil options are available for environments where corrosion is a concern. The coated coil options include post-dipped Phenolic coated microchannel coils and post-dipped tube and fin coils. Pre-coated aluminum fins are also available in the copper tube and aluminum fin options. The condenser design working pressure is 375 PSIG (25.9 barg).

Multiple standard low sound, high efficiency TEAO motor driven fans move air through the coils. The direct drive, corrosion resistant, glass fiber reinforced polypropylene composite fan blades are dynamically and statically balanced. The fans are vertical discharge from extended orifices for efficiency and low sound. Fan guards are constructed from heavy-gauge, PVC-coated galvanized steel. High flow fans are available for 400V/50 Hz and 380V/60Hz application to allow high ambient operations. Fan VSD control provides improved efficiency and reduced noise. A VSD controls the fans on each refrigerant circuit.

LD15033

FIGURE 12 - VSD ENCLOSURE

Flash Tank / Receiver, Flash Tank Feed Valve and Economizer Valve

A flash tank is fitted to both refrigerant circuits. The flash tank is a shell type refrigerant reservoir designed to sustain 2 phase refrigerant. The purpose of the flash tank/receiver is to increase the efficiency of the system and to store refrigerant charge due to the small capacity of the microchannel coils. A portion of the liquid fed into the flash tank gases off, cooling the remaining liquid in the tank. Both liquid and gas exist in the flash tank. The refrigerant gas in the flash tank/receiver is fed to the economizer port on the compressor at a point on the rotors approximately 1.65 x suction when the economizer valve is stepped open. The liquid in the tank is fed to the evaporator through a fixed orifice.

The vapor feed through a stepper valve to the economizer port of the compressor is at an intermediate pressure between discharge and suction (1.25 x suction) and therefore little energy is required to pump it back through the compressor to condenser pressure. This results in a very small loss to system efficiency.

The design working pressure of the flash tank is 450 PSIG (31 barg). The Flash Tank Feed Valve feeding the flash tank/receiver is activated on startup. The Feed Valve on the flash tank functions to control the sub-cooling in the condenser. The Flash Tank Feed Valve is a stepper motor valve.

The Flash Tank Feed and Economizer Valves are controlled by 2 phase drive signals from a stand-alone Stepper Motor valve controller in the Control Panel. Signals from sensors such as discharge line pressure and discharge line temperature are sent to the Chiller Control Board, which in turn sends control signals to the Valve Controller. The control algorithm in the Chiller Control Board will attempt to control sub-cooling in the condenser to the programmed setpoint by modulating the Flash Tank Feed Valve.

Liquid Line Pressure Transducer

The liquid line pressure transducer is used to compute the saturated discharge temperature for operation of the VI solenoids. This is a 0 to 400 PSIG transducer. System 1 input on the Chiller Control Board is J17-14 and System 2 is J17-15. The transducer is also used to calculate liquid line sub-cooling, which is used to control the condenser Flash Tank Feed Valve operation.

Oil Separator/Oil System/Oil Cooling

A centrifugal type oil separator (450 PSIG DWP) is placed in the discharge line on the outlet of the oil separator to capture oil leaving the compressor. Once the oil is removed from the gas stream, it leaves the bottom of the separator and is returned to the top of the compressor.

Oil that escapes into the system finds its way into the evaporator. This oil mixes with the liquid refrigerant charge in the evaporator.

A line from the bottom of the evaporator allows a small amount of liquid refrigerant and oil to be fed through a filter and eductor-jet pump arrangement. Flow to operate the venturi type eductor comes from the gas being compressed by the rotors in the compressor at 1.65 x suction pressure. See *Figure 14 on page 27*.

Refrigerant and oil from the eductor are then fed back into the top of the suction line where it enters the suction end of the compressor. Oil cooling occurs from the refrigerant coming out of the eductor flashing in the suction line, which aids in cooling the oil, motor and compressor.

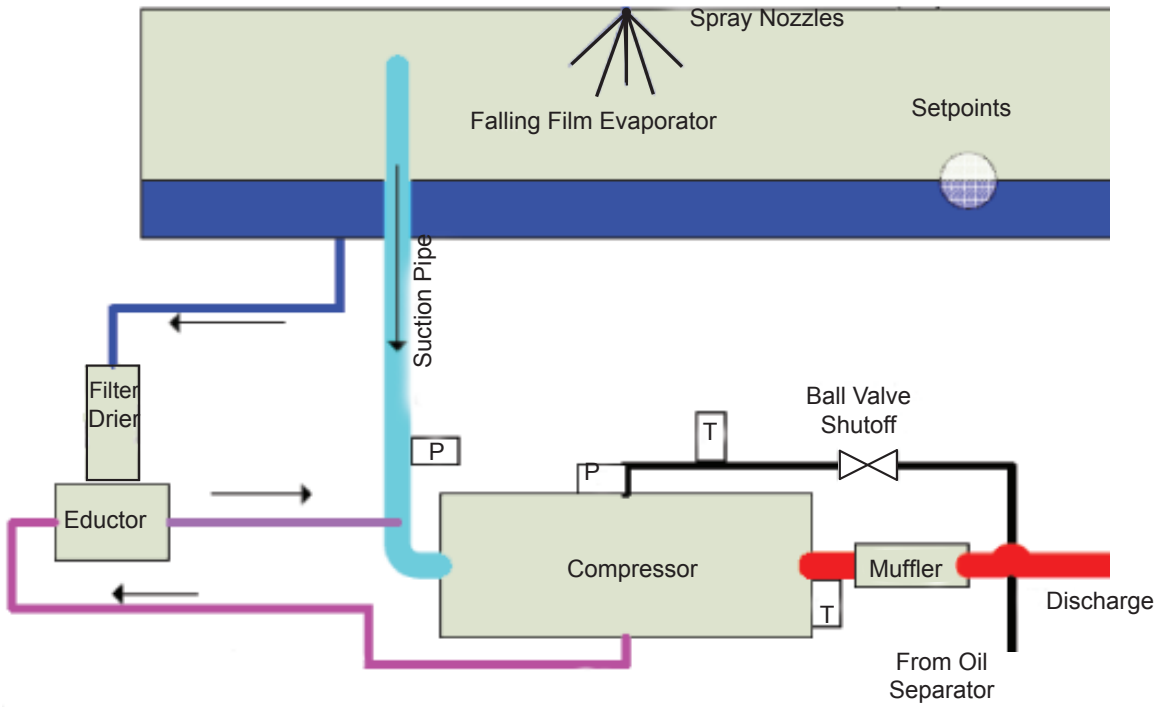

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FIGURE 13 - EDUCTOR OIL MANAGEMENT

The eductor works at any speed of compressor operation, but is more efficient when the system is operating at full compressor speed

YORK "L" oil is used for all refrigerant applications. Oil flows from the oil separator, back to the compressor at high pressure. This high pressure “oil injection” forces the oil into the compressor, where it is fed to the bearings and rotors for lubrication. After lubricating the bearings, it is injected through orifices on a closed thread near the suction end of the rotors. The oil is automatically injected due to the pressure difference between the discharge pressure and the reduced pressure at the suction end of the rotors. This lubricates the rotors as well as provides an oil seal against leakage around the rotors to ensure refrigerant compression efficiency.

Oil also provides cooling by transferring much of the heat of compression from the gas to the oil, keeping discharge temperatures down and reducing the chance for oil breakdown. Oil injected into the rotor cage flows into the rotors at a point about 1.2 x suction. This ensures that a required minimum differential of at least 30 PSIG exists between discharge and 1.2 x suction, to force oil into the rotor case.

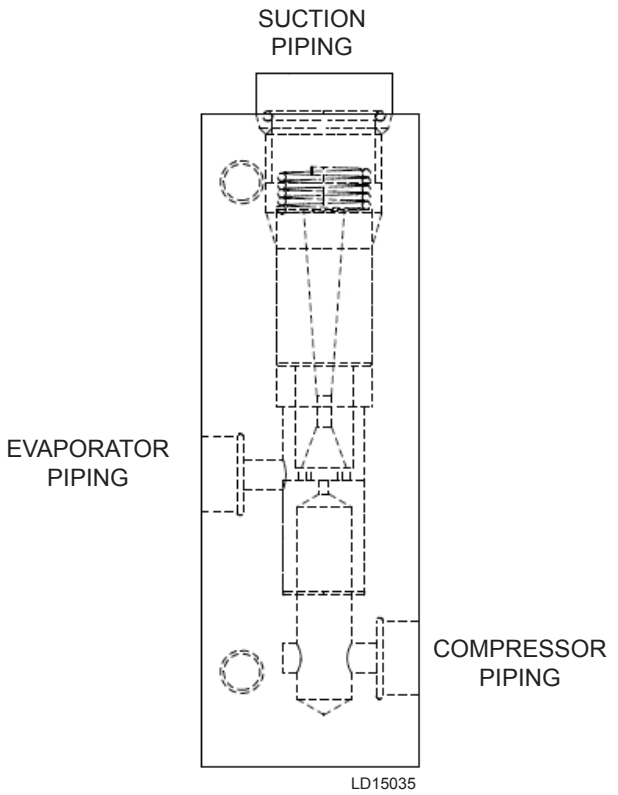

FIGURE 14 - EDUCTOR - JET PUMP

A minimum of 10 PSIG (0.6 barg) is all that is required to ensure protection of the compressor. The oil pressure safety is monitored as the difference between suction pressure and the pressure of the oil entering the rotor case. Maximum working pressure of the oil separator is 450 PSIG (31 barg). Oil level should be above the bottom of the “lower” oil sight glass when the compressor is running. Oil level should not be above the bottom of the “upper” sight glass.

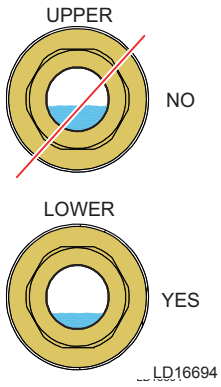

FIGURE 15 - OIL LEVEL

Eductor-Jet Pump Filter Drier

If the eductor filter becomes clogged, a noticeable rise in oil temperature will be noted along with a rise of refrigerant level in the evaporator. The oil temperature will rise due to the lack of cooling that occurs from refrigerant leaving the eductor flashing and cooling the suction gas. The refrigerant level in the evaporator will rise from the oil stacking up in the evaporator.

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FIGURE 16 - EDUCTOR FILTER DRIER

Eductor Operation

The oil eductor is nothing more than a jet pump, used to draw the oil/refrigerant mixture out of the evaporator and provide a gentle boost to elevate it about 24 inches to enter the suction line and return to the compressor.

Higher pressure gas from the compressor port in the closed thread space (motive force) is routed into the educator block and through a metering orifice. This causes a high velocity gas stream into the nozzle inlet. This creates a low pressure at the nozzle inlet, drawing liquid refrigerant and oil out of the evaporator. The nozzle inlet has small "notches" around the base allowing the oil/refrigerant to be drawn into the gas stream. As the mixture moves through the expanding part of the nozzle, the high velocity/low pressure is transitioned to a lower velocity/higher pressure to pump the fluid up to the suction line entrance point. The system only works within the correct pressure ratio range across the orifice.

Economizer

A flash tank/receiver is utilized to provide additional sub-cooling, for increased capacity and efficiency. See *Figure 18 on page 30*. Liquid in the flash tank/receiver is allowed to gas off from the liquid refrigerant being fed to evaporator. This provides additional liquid sub-cooling. The vapor from the refrigerant that gases off is fed into the compressor rotors at about 1.25 x suction. The flow is modulated by a stepper valve to optimize the control. See *Figure 19 on page 30*.

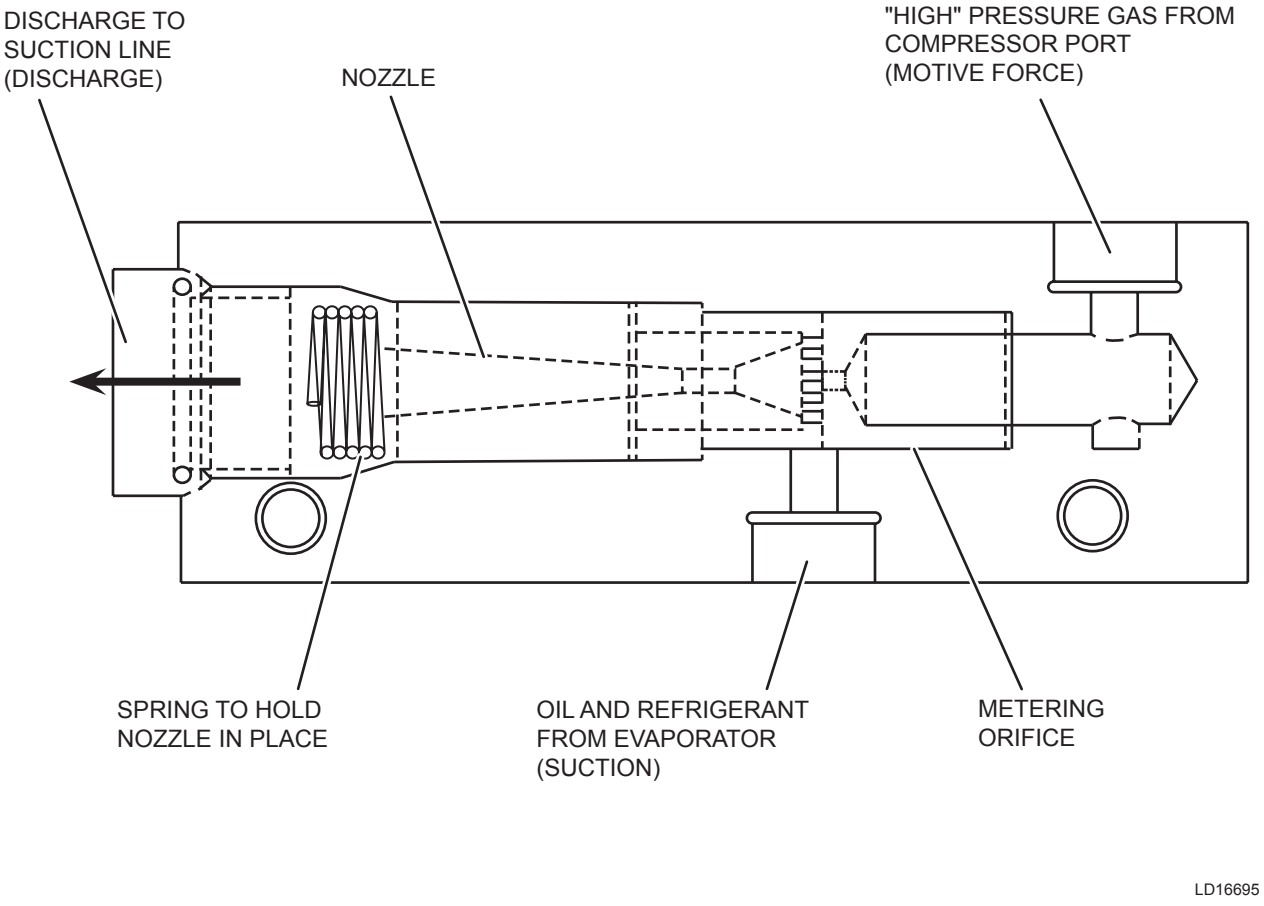

FIGURE 17 - EDUCTOR

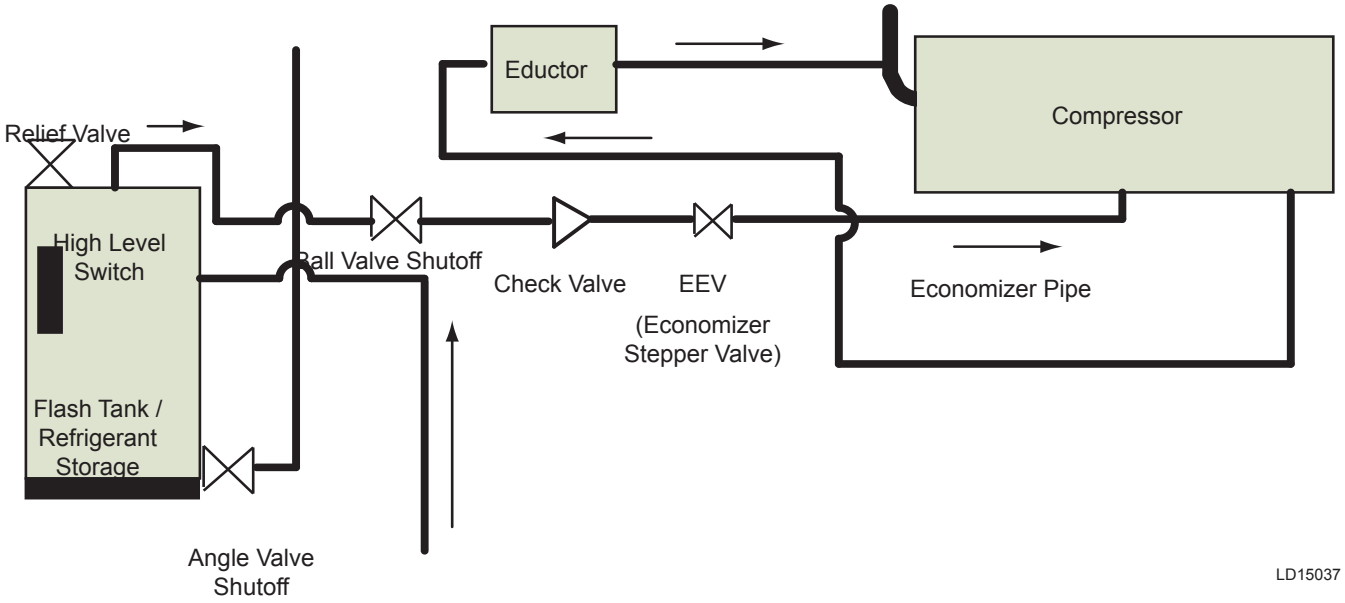

FIGURE 18 - ECONOMIZER CIRCUIT

FIGURE 19 - ECONOMIZER STEPPER CONTROL VALVE

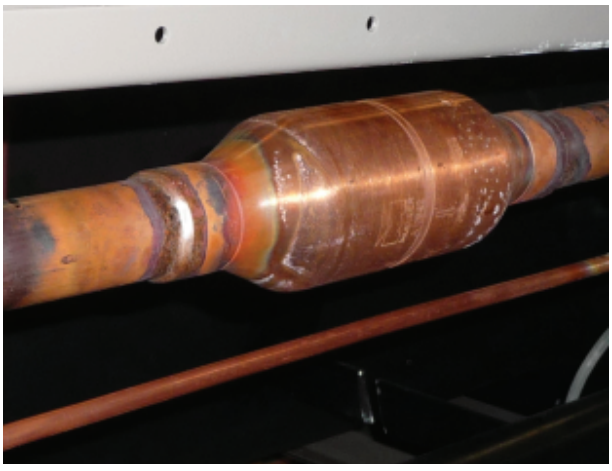

FIGURE 20 - CHECK VALVE

A check valve is installed to prevent a pressure drop in the line from affecting the eductor oil flow. A Flash Tank Level Switch (High Level Switch) protects the compressor from the economizer opening with a flash tank full of liquid.

Relief Valves

Two relief valves are installed in each refrigerant circuit. A 325 PSIG relief valve is located on each flash tank and a 250 PSIG relief valve is located on the suction line of the compressor near the evaporator.

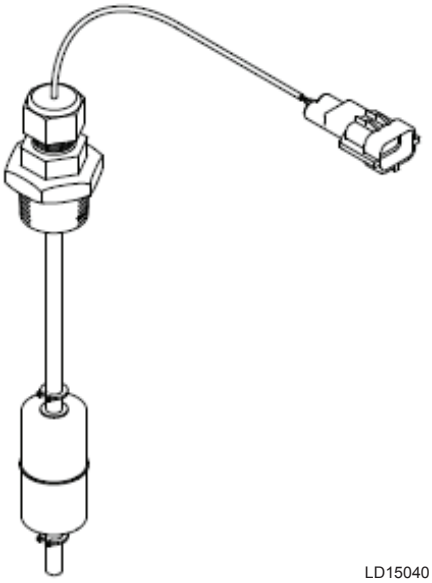

FIGURE 21 - FLASH TANK LEVEL SWITCH (HIGH LEVEL SWITCH)

Capacity Control

When cooling is needed, one or more compressors, as determined by the system microprocessor based on deviation from setpoint, will start at minimum speed with low inrush current. Variable speed operation of the compressor reduces the capacity and allows smooth balancing of the compressor capacity with the cooling load.

Capacity control is accomplished by varying the number of compressors and the speed of the compressors with the VSD to promote stable, smooth, and precise loading/unloading.

Hot Gas Bypass is not required with VSD control of the compressors.

Power and Control Panel

All controls and the VSD are factory-wired and function tested. The panel enclosures are designed to NEMA 3R (IP55) rating and are manufactured from powder-painted steel with hinged, latched, and gasket sealed outer doors with wind struts for safer servicing.

The power and micro control panels are combined into a single control/power cabinet which include:

- Compressor VSD Controls
- Chiller Microprocessor Controls
- Fan Controls
- All Other Chiller Controls

The Display and keypad are accessible through an access door without opening the main doors to the electrical cabinet.

Power Compartment

Each power compartment contains:

- 115VAC Control Transformer
- VSD
- ON/OFF Unit Switch
- Microcomputer, Keypad and Display
- Chiller Control and VSD Logic Boards
- Relay Boards
- U.L. units use an incoming Single Point Power (standard utilizing either a Lockable Circuit Breaker or Terminal Block). C.E. units use a non-fused disconnect switch.

Current transformers sense each phase of motor current, and send corresponding signals to the Chiller Logic Board. Monitoring current protects the compressor motors from damage due to low motor current, high motor current, short circuit current, single phasing, and compressor overload.

Short Circuit Withstand Rating of the chiller is 65,000 Amps for 380V, 400V and 460V units. Ratings are in accordance with UL508C.

Microprocessor and VSD Controls

Microprocessors on the Chiller Control Board and VSD Logic Board control starting, stopping, loading, unloading, safeties, and chilled liquid temperature control. Chilled liquid control decisions are a function of temperature deviation from setpoint and the rate of change of temperature.

The standard controls include:

- Brine Chilling
- Thermal Storage
- Run Signal Contacts
- Unit Alarm Contacts
- Chilled Liquid Pump Control
- Automatic reset after power failure
- Automatic system optimization to match operating conditions

Remote cycling, optional current limiting, optional temperature setpoint reset, and optional remote sound limit can be accomplished by connecting user-supplied signals to the microprocessor.

Unit operating software is stored in non-volatile memory. Field programmed setpoints are retained in lithium battery backed real time clock (RTC) memory for 10 years.

Display

The display consists of a liquid crystal 2 line by 40 characters per line display, with backlighting for outdoor viewing of operating parameters and program points.

Parameters are displayed in 5 languages in either English (°F and PSIG) or Metric (°C and Barg) units, and for each circuit, the following items can be displayed:

- Entering and leaving chilled liquid, and ambient temperature.
- Day, date and time. Daily start/stop times. Holiday and Manual Override status.
- Compressor operating hours and starts.
- Run permissive status. Compressor run status.
- Anti-recycle timers.
- System suction, discharge (and discharge superheat), and oil pressures and temperatures.
- Percent full load compressor motor current and average motor current. Compressor motor speed (frequency).
- Cutout status and setpoints for supply chilled liquid temperature, low suction pressure, high discharge pressure and temperature, high oil temperature, low ambient, and low leaving liquid temperature.
- Unloading limit setpoints for high discharge pressure and compressor motor current.
- Status of evaporator heater, condenser fans, load/unload timers, and chilled water pump.
- "Out of range" message.
- Up to 10 fault shutdown histories.

Keypad

An operator keypad allows complete control of the system from a central location. The keypad utilizes an overlay to allow use in 8 languages. The keypad is sealed, color-coded and 36 buttoned with keys for Display, Entry, Setpoints, Clock, Print, Program, Unit ON/OFF and other functions. Details on several of these keys are as follows:

Status

Allows viewing present unit or system status displayed by the microprocessor.

Entry

Numeric keypad and supporting keys used to confirm Setpoint changes, cancel inputs, advance day, and change AM/PM.

Setpoints

For setting chilled liquid temperature, chilled liquid range, remote reset temperature range.

Date/Time

Used to set time, daily or holiday start/stop schedule, manual override for servicing, and sound limiting schedule.

Print

Used to display or print operating data or system fault shutdown history for last ten faults. Printouts are generated through an RS-232 port via a separate printer.

Program

For setting low leaving liquid temperature cutout, average motor current limit, and pulldown demand limit.

Displays are also provided for programming low ambient cutout, low suction pressure cutout, superheat setpoint, and so on, under the PROGRAM key.

Unit Switch

A master UNIT switch allows activation or de-activation of the chiller system. Separate system switches for controlling each system are provided as part of the chiller control panel keypad.

Variable Speed Drive (VSD)

The VSD (variable speed drive) is a liquid cooled, transistorized, PWM inverter, which provides speed control to vary the speed of 2 compressor motors. The VSD changes the duration of the voltage pulses supplied to the motor to enable control of compressor speed to match the system load. A PWM generator, on the VSD Logic Board, with a switching frequency of 3125 Hz modulates the voltage signal pulses to the compressor to provide a relatively constant V/F ratio. In some cases, the V/F ratio is slightly modified to provide additional torque to the motor. Sample 3 phase current waveforms are shown in *Figure 22 on page 32* to show the sinusoidal characteristics of the current drawn by the compressor motors.

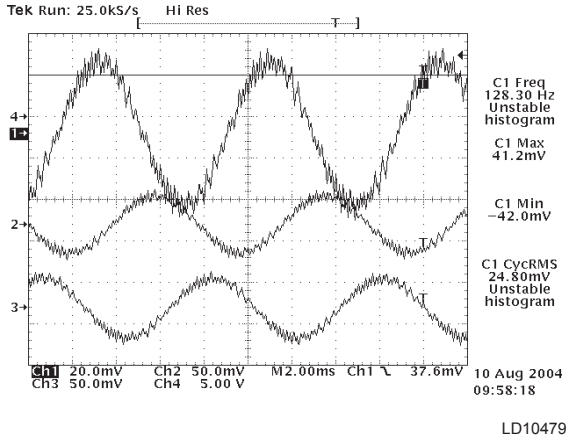

FIGURE 22 - PWM CURRENT WAVEFORM

A Sample PWM voltage waveforms is shown in *Figure 23 on page 33*. The pulses near the sides of the rectangular groups of waves are notably narrower, representing the lower voltage of a sinusoidal waveform as it rises or falls from the “0” crossing.

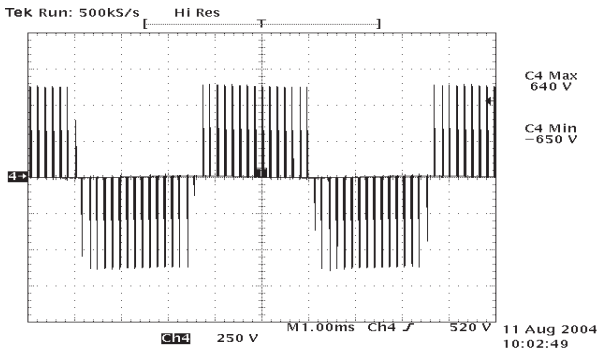

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FIGURE 23 - PWM VOLTAGE WAVEFORM

The power section of the drive is composed of four major blocks.

1. AC to DC rectifier section with accompanying
2. Pre-charge circuit
3. A DC link filter section, a three phase DC to AC inverter section
4. Output suppression network

The AC to DC rectifier utilizes a semi-converter formed by the connection of three SCR/diode modules (1SCR through 3SCR) in a three phase bridge configuration. The modules are mounted on a liquid cooled heatsink. Use of the semi-converter configuration permits implementation of a separate pre-charge circuit to limit the flow of current into the DC link filter capacitors when the drive is switched ON and it also provides a fast disconnect from the power mains when the drive is switched OFF. When the drive is turned OFF, the SCR's in the semi-converter remain in a non-conducting mode and the DC link filter capacitors remain uncharged. When the drive is commanded to run, the DC link filter capacitors are slowly charged via the semi-converter. The SCR’s are then gated fully on.

Three power fuses (1FU - 3FU), an optional circuit breaker (1SW) and a standard 5% impedance minimum 3-phase line reactor connect the AC to DC converter to the incoming power. Very fast semiconductor power fuses are utilized to ensure that the SCR/diode module packages do not rupture if a catastrophic failure were to occur on the DC link. The SCR Trigger Board provides the gating pulses for the SCR’s as commanded by the VSD Logic Board.

The DC Link filter section of the drive consists of a group of electrolytic filter capacitors (C1-C6). This capacitor bank effectively smooths the ripple voltage from the AC to DC rectifier while simultaneously providing a large energy reservoir for use by the DC to AC inverter section of the drive. In order to achieve the required voltage capability for the capacitor portion of the filter, filter capacitor “banks” are formed by connecting two groups of parallel capacitors in series to form a capacitor “bank”. In order to assure an equal sharing of the voltage between the series connected capacitors and to provide a discharge means for the capacitor bank when the VSD is powered OFF, “bleeder” resistors (1RES and 2RES) are connected across the capacitor banks.

The DC to AC inverter section of the VSD serves to convert the rectified and filtered DC back to AC at the magnitude and frequency commanded by the VSD Logic Board. The inverter section is actually composed of two identical inverter output phase assemblies. These assemblies are in turn composed of 3 pairs of Insulated Gate Bipolar Transistor (IGBT) modules mounted to a liquid cooled heatsink, and a IGBT Gate Driver Board, which provides the ON and OFF gating pulses to the IGBT’s as determined by the VSD Logic Board. In order to minimize the parasitic inductance between the IGBT’s and the capacitor banks, copper plates, which electrically connect the capacitors to one another and to the IGBT’s are connected together using a “laminated bus” structure.

This “laminated bus” structure is a actually composed of a pair of copper bus plates with a thin sheet of insulating material acting as the separator/insulator. The “laminated bus” structure forms a parasitic capacitor, which acts as a small valued capacitor, effectively canceling the parasitic inductance of the bus bars themselves. To further cancel the parasitic inductances, a series of small film capacitors are connected between the positive and negative plates of the DC link.

The VSD output suppression network is composed of a series of capacitors and resistors connected in a three phase delta configuration. The parameters of the suppression network components are chosen to work in unison with the parasitic inductance of the DC to AC inverter sections in order to simultaneously limit both the rate of change of voltage and the peak voltage applied to the motor windings. By limiting the peak voltage to the motor windings, as well as the rate-of-change of motor voltage, we can avoid problems commonly associated with PWM motor drives, such as stator-winding end-turn failures and electrical fluting of motor bearings.

FIGURE 24 - GLYCOL COOLING COIL

The VSD is cooled by a propylene glycol cooling loop. The loop utilizes a glycol pump, which pumps glycol through the VSD heatsinks to cool the power components. The glycol is then circulated through the condenser to reject the heat from the VSD. The cooled glycol is then circulated back through the loop.

Various ancillary sensors and boards are used to send information back to the VSD Logic Board. Each IGBT Power Module within the DC to AC inverter section contains a thermistor heatsink temperature sensor to provide temperature information to the VSD Logic Board. The Bus Isolator board utilizes three resistors on the board to provide a "safe" impedance (resistance) between the DC link filter capacitors located on the output phase bank assemblies and the VSD Logic Board. It provides the means to sense the positive, midpoint and negative connection points of the VSD's DC link without applying high voltage to the VSD Logic Board.

A Current transformer is included on each output phase assembly to provide motor current information to the VSD Logic Board.

Glycol Coil and VSD Cooling

Glycol cooling coils for the power panel and each system IGBT heat sink are mounted on the ends of some of the condenser "V" sections. The glycol is cooled in the coil by air flowing through the coil and out the condenser fan discharge. The glycol is used to cool the VSD. The cooled glycol is routed back to the internal cooling coil in the VSD cabinet and the IGBT heat sinks. A glycol pump is used to pump the glycol through the system.

ACCESSORIES AND OPTIONS

Sound Reduction Options

Low Noise Kits

The standard chiller configuration is equipped with standard acoustic treatments on the refrigerant lines and compressors. There are several additional options to help further reduce sound at its source:

- **Level 1 Reduction** – This option includes a compressor enclosure to reduce sound of the standard chiller. This option is typically used for daytime operation where background noise is lower than normal city traffic, and so on.
- **Level 2 Reduction** - This option includes a compressor enclosure with an enhanced, sound absorptive interior lining. This option is offered in combination with ultra quiet fans with variable speed control for optimal sound reduction. This option is typically selected for locations near residential areas, hotels, or hospitals, and so on, where background noise is low.

Ultra Quiet Fans

The chiller is equipped with specially designed fans and motors to provide lower sound levels yet retain appropriate airflow. The result is reduced fan generated sound with minimal effect on the chiller capacity or efficiency at standard AHRI conditions.

Variable Speed Control

Variable speed control of condenser fans provides better reduction in sound and improved unit efficiency at part load conditions.

SilentNight™

Standard variable speed compressors result in a chiller system that has lower part load sound values than conventional air-cooled chillers.

Over 99% of chiller operating hours occur when building loads are less than design and/or ambient temperatures are less than design. As a result, all YVAA model chillers will operate with less than full load sound output nearly all the time. This is especially important on evenings and weekends when neighbors are home the most. Due to time of day based sound regulations it may be desirable to force the chiller to a lower sound level on demand. The SilentNight™ control option provides a control input to limit sound output of the chiller based on time of day. This feature is programmable at the chiller panel or can be controlled remotely via signal (4 to 20mA or 0 to 10VDC) from a BAS system.

High Static Fans - (400V/50Hz, 380V/60Hz and 460V/60HZ)

Condenser fans with higher power motors suitable for high external static pressure, up to 100Pa (0.4 in. water), across condenser coils. Select this option if additional air-flow resistance may be present due to flow restrictions such as field installed ducts, filters, sound-enclosures and so on. **(Factory-mounted)**

High Airflow Fans - (400V/50Hz, 380V/60Hz and 460V/60HZ)

Condenser fans with airfoil type blades and high power motors providing extra airflow across coils. In some chiller configurations, this option can provide an increase in chiller capacity. Contact your local Johnson Controls representative for more information. **(Factory-mounted)**

Condenser Coil Protection

Post-Coated Epoxy Dipped Condenser

Micro-channel condenser coils applied with electro-deposited and baked flexible epoxy coating that is finished with a polyurethane UV resistant top-coat suitable for highly corrosive applications.

Protective Chiller Panels

Wire Panels (Full Unit)

UV stabilized black polyvinyl chloride coated, heavy gauge, welded wire mesh guards mounted on the exterior of the unit. Protects condenser coil faces and prevents unauthorized access to refrigerant components (compressors, pipes, evaporator, and so on), yet provides free air flow. This can cut installation cost by eliminating the need for separate, expensive fencing. **(Factory-mounted)**

Louvered Panels (Condenser Coils Only)

Louvered panels, painted the same color as the unit, are mounted over the exterior condenser coil faces on the sides of the unit to visually screen and protect coils. **(Factory-mounted)**

Louvered Panels (Full Unit)

Louvered panels, painted the same color as the unit, enclose the unit to protect condenser coils from incidental damage, visually screen internal components, and prevent unauthorized access to internal components. **(Factory-mounted)**

Louvered (Condensers)/Wire Panels (Mechanical)

Louvered panels, painted the same color as the unit, are mounted on external condenser coil faces. Heavy gauge, welded wire-mesh, coated to resist corrosion, around base of machine to restrict unauthorized access. **(Factory-mounted)**

End Hail Guard

Louvered panels, painted the same color as the unit, are installed on the rear of the unit (opposite end of the control panel) to protect the exposed condenser from flying debris or hail. **(Field or Factory-mounted)**

V-Guard Panels

Solid panels, painted the same color as the unit, are installed along the sides of the units to cover exposed piping within the condenser section without impacting airflow. These guard panels can be combined with End Hail Guard option for additional protection from debris. **(Field or Factory-mounted)**

Evaporator Options

Double Thick 1-1/2 inches Insulation

Double thickness insulation is provided. **(Factory-mounted)**

Flange Kit

Provides contractor with the couplings best suited to tie into the chilled water piping. All flanges are ANSI 150 PSIG (10.3 barg). **(Field mounted)**. Options include:

- **ANSI/AWWA C-606 flanges -** 2 flanges, for applications where field piping has existing flanges.
- **ANSI/AWWA C-606 flanges -** 4 flanges, for applications where customer wants flanged connections which do not exist on the field piping.

- **Weld flanges -** 2 flanges, for customer to weld to evaporator to mate to existing flanges on field piping.
- **Weld flanges -** 4 flanges, for customer to weld to evaporator and customer wants flanged connections which do not exist on the field piping.

One Pass, Two Pass and Three Pass Evaporator

The standard evaporator is constructed with two chilled water passes through the evaporator. Use the one pass evaporator to minimize pressure drop when there is a small difference between entering and leaving water temperatures or when multiple chillers are piped in series. The three pass option is recommended for brine applications or where a greater water temperature difference is required but efficiency cannot be sacrificed.

Connection Location

The standard unit configuration is available with fluid inlet connections at rear (opposite control panel end) of unit. Options are available for front fluid inlet on select configurations.

Water Box Heater

The standard unit comes with evaporator shell heaters and water pump control software. Optional water box heaters are required for storage below 0°F (-17°C).

Pressure Vessel Options

The evaporator can be provided with either ASME or PED pressure vessel codes certification.

Controls Options

High Ambient Operation

This provides special control logic coupled with high airflow fans to permit high ambient up to 125°F (52°C) operation. Fans are airfoil type blades with high power motors. This option may also allow for increased machine capacity, allowing the selection of a smaller chassis to meet specific capacity requirements.

Building Automation System Interface (Temperature)

Chillers can accept 4 to 20mA or 0 to 10VDC input, to allow remote reset of the Leaving Chilled Liquid Temperature Setpoint. The setpoint can be positively offset upwards up to 40°F (22.2°C), useful for ice storage or process applications or for periods where higher chilled liquid temperatures are adequate for low loads. Available alone or in combination with BAS Load Limit.

Building Automation System Interface (Load Limit)

Chillers can accept 4 to 20mA or 0 to 10VDC input, to allow remote reset of the Load Limit Setpoint. The setpoint can limit system demand from 30 to 100%. Available alone or in combination with BAS Temperature Reset.

E-Link

The optional E-Link gateway provides communication between the equipment and Building Automation Systems, including BACnet (MS/TP), Modbus, LON and N2.

Thermal Storage

Provides special control logic and modifications to produce leaving chilled brine temperatures below 40°F (4.4°C), primarily at times of low ambient temperatures (night time). You may opt to produce ice to supplement cooling and significantly decrease energy costs. The capability of the chiller is enhanced by using both ice and chilled water simultaneously, during times of peak cooling needs.

General Options

Flow Switch Accessory

Vapor proof SPDT, NEMA 3R switch, 150 PSIG (10.3 barg) DWP, 20°F to 250°F (-7°C to 121°C) with 1inch NPT (IPS) connection for upright mounting in horizontal pipe. This flow switch or equivalent must be furnished with each unit. **(Field-mounted).**

Differential Pressure Switch

Alternative to the paddle-type flow switch, range is 3 to 45 PSIG (0.2 to 3 barg) with 1/4 inch NPTE pressure connections. **(Field-mounted)**

Building Automation System Interface

Chiller will accept 4 to 20mA or 0 to 10VDC input to reset the leaving chilled liquid temperature. **(Factory-mounted)**

Chicago Code Relief Valve

Special relief valves per Chicago code. **(Factory-mounted)**

Dual Pressure Relief Valve

Two safety relief valves are mounted in parallel; one is always operational to assist in valve replacement during maintenance.

Pressure Relief (CE/PED) Service Valve Kit

Each relief valve is mounted on a sealable ball valve to aid maintenance**. (Factory-mounted)**

Terminal Block [not available for CE marked units]

Terminal Block connections shall be provided at the point of incoming single point connection for field connection and inter-connecting wiring to the compressors. Separate external protection must be supplied, by others, in the incoming power wiring, which must comply with local codes.

Circuit Breaker or Non-fused Disconnect Switch

Power panel will come equipped with an optional factory mounted circuit breaker or non-fused disconnect switch at the point of incoming single or multi-point connections that provides the following:

- A means to disconnect power mounted on chiller.
- Circuit breaker sized to provide the motor branch circuit protection, short circuit protection and ground fault protection for the motor branch-circuit conductors, the motor control apparatus and the motors. (Chiller mounted circuit breaker option sized for branch circuit protection eliminates the need to provide a separate 'line of sight' disconnect and separate branch circuit protection device.)
- A lockable operating handle that extends through power panel door. This allows power to be disconnected without opening any panel doors.
- A Short Circuit Withstand Rating of 65,000 amps when the chiller electrical enclosure when using circuit breaker option is 380, 400, and 460V. Rated IAW UL508.

Convenience Outlet

Shipped loose 115V female 10.0-amp GFI (Ground Fault Interrupt) that powers maintenance tools even when unit disconnect switch is positioned in the OFF position. Power to GFI to be supplied by the customer. Kit protects against rain and moisture ingress. **(Field-mounted).** See *Figure 79 on page 163.*

Special Requirement Documents

There are three options to select from:

- **Special Requirement Document Package** (SRDP) includes Pressure Vessel Report, Unit Run Test Report, Production System Check Sheet and Final Unit Inspection Check Sheet.
- **Materials Package** includes steel mill material reports for vessels in addition to the SRDP (may be combined with Witness Factory Run Package).
- **Witness Factory Run Package** combines the SRDP with a customer opportunity to witness the Factory Run Test of their chiller. The test is an operational run test and conditions are dependent on the ambient and water loop temperatures at the time of the test. Contact your Johnson Controls representative for further information.

Vibration Isolation

Elastomeric Isolation

This option is recommended for normal installations. It provides very good performance in most applications for the least cost. **(Field-mounted)**

One Inch Spring Isolators

Spring and cage type isolators for mounting under the unit base rails. They are level adjustable. Nominal deflection is 1 inch and it may vary slightly by application. **(Field-mounted)**

Two Inch Seismic Spring Isolators

Restrained Spring-Flex Mounting isolators incorporate a rugged welded steel housing with vertical and horizontal limit stops. Housings designed to withstand a minimum 1.0g accelerated force in all directions up to 2 inches (51mm). The deflection may vary slightly by application. They are level adjustable. **(Field-mounted).**

Building Automation System Option

An optional E-Link Gateway provides an economical and versatile connection between YORK equipment and open/standard protocols. It efficiently manages the communication protocols currently used by YORK equipment, exposing the data in a consistent, organized, and defined fashion. The E-Link Gateway is a factory-installed option and fits directly inside the equipment control panel.

A simple switch selection allows configuration of the required equipment profile and output protocol, which reduces equipment connectivity startup time. Protocols include BACnet (MS/TP), Modbus, LON and N2.

The model number denotes the following characteristics of the unit.

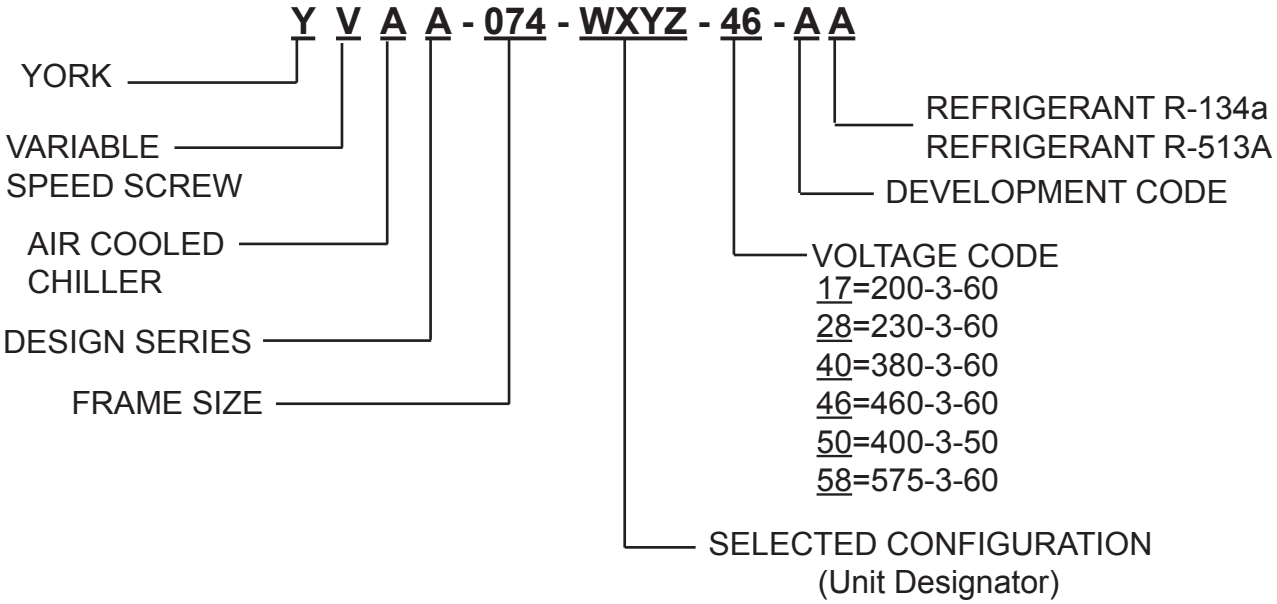

FIGURE 25 - UNIT MODEL NUMBER NOMENCLATURE

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TABLE 1 - COMPLETE PIN NUMBER DESCRIPTION

FEATURE	FEATURE DESCRIPTION	OPTION	OPTION DESCRIPTION
CONTRACT	Contract Number	NUM	Contract Number = {num}
ORDER	Order quantity	QTY	Order quantity = {ord_qty}
USA	USA origin	N	USA origin not required
		Y	USA origin required
SHIPWT	Shipping Weight	LBS	Crane/Rigging Shipping Weight
		KGS	Crane/Rigging Shipping Weight
MODEL	Model (PIN 1)	Y	York
COMPRTYP	Compressor Type (PIN 2)	V	Variable Speed Screw
CHILLERTYP	Chiller Type (PIN 3)	A	Air-cooled Chiller
DESIGNSER	Design Series (PIN 4)	A	Design Series
UNTDSG	Unit Designator (PIN 5-8) (PINS 5 through 7 are the Frame Size)	0153	0153 / 0543
		0543	
		0183	0183 / 0643
		0643	
		0213	0213 / 0743
		0743	
		0233	0233 / 0843
		0843	
		0263	0263 / 0943
		0943	
		0273	0273/0963
		0963	
		0303	0303 / 1093
		1093	
		0323	0323/1143
		1143	
		0333	0333/1173
		1173	
		0343	0343 / 1193
		1193	
		0373*	0373 / 1343
		1343*	
		0413*	0413 / 1443
		1443*	
		0443*	0443 / 1543
		1543*	
		0483*	0483 / 1693
		1693*	
		0523	0523 / 1843
		1843	
		0165	0165 / 0565
		0565	

* Option has not yet been designed

TABLE 1 - COMPLETE PIN NUMBER DESCRIPTION (CONT'D)

FEATURE	FEATURE DESCRIPTION	OPTION	OPTION DESCRIPTION
UNTDSG (Cont'd)	Unit Designator (PIN 5-8) (PINS 5 through 7 are the Frame Size) (Cont'd)	0195	0195 / 0665
		0665	
		0215	0215 / 0765
		0765	
		0245	0245 / 0865
		0865	
		0275	0275 / 0965
		0965	
		0295	0295 / 1015
		1015	
		0305	0305 / 1065
		1065	
		0345	0345 / 1215
		1215	
		0375*	0375 / 1315
		1315*	
		0425*	0425 / 1515
		1515*	
		0475*	0475 / 1665
		1665*	
		0178	0178 / 0588
		0588	
		0198	0198 / 0688
		0688	
		0218	0218 / 0788
		0788	
		0248	0248 / 0888
		0888	
		0278	0278 / 0988
		0988	
		0308	0308 / 1088
		1088	
		0318	0318 / 1188
		1188	
		0368*	0368 / 1288
		1288*	
		0398*	0398 / 1388
		1388*	
		0428*	0428 / 1488
		1488*	
		0200	0200 / 0700
		0700	
		0500	0500 / 1750
		1750	

* Option has not yet been designed

TABLE 1 - COMPLETE PIN NUMBER DESCRIPTION (CONT'D)

FEATURE	FEATURE DESCRIPTION	OPTION	OPTION DESCRIPTION
FLOADEFF	Full Load Efficiency (PIN 9)	For Marketing Purposes Only	
PLOADEFF	Part Load Efficiency (PIN 10)	For Marketing Purposes Only	
SOUND	Sound (PIN 11)	For Marketing Purposes Only	
VOLTAGE	Voltage (PIN 12, 13)	17	200/3/60
		28	230/3/60
		40	380/3/60
		46	460/3/60
		50	380-415/3/50
		58	575/3/60
MODLVL	Modification Level (PIN 14)	B	Modification Level
REF	Refrigerant (PIN 15)	A	R-134a Refrigerant
		H	R-513A Refrigerant
STARTERTYP	Starter Type (PIN 16)	V	Standard VSD
		R*	VSD with Active Filter
		Q	Special quote
POWERFLD	Power Field (PIN 17)	B	SP Circuit Breaker w/ Lockable Handle
		D*	MP Supply TB
		M*	MP Circuit Breaker w/Lockable Handle
		N	SP NF Disconnect Switch w/Lockable Handle
		P*	MP NF Disconnect Switch w/ Lockable Handle
		S	SP Supply TB
		Q	Special quote
PIN18	PIN 18	X	No selection
		Q	Special quote
PANELOPT	Panel Options (PIN 19)	X	No selection
		O	Convenience outlet
		M*	Convenience Outlet with KW meter
		W*	KW meter
		Q	Special quote
AMB	Ambient Kits PIN 20	X	No selection
		B*	Both Low and High Ambient kits
		H	High Ambient kit
		L*	Low Ambient kit
		Q	Special quote
BAS	BAS Reset/Offset (PIN 21)	X	No selection
		B	BAS/EMS Both Temp and Current Reset/Offset
		C	BAS/EMS Current Reset/Offset
		E	BACNet Elink Kit (factory mounted)
		L	LON E-Link Kit (factory mounted)
		T	BAS/EMS Temp Reset/Offset
		Q	Special quote

* Option has not yet been designed

TABLE 1 - COMPLETE PIN NUMBER DESCRIPTION (CONT'D)

FEATURE	FEATURE DESCRIPTION	OPTION	OPTION DESCRIPTION
LANGDESP	Language/Display (PIN 22)	A	English
		C	English LCD with Chinese keypad overlay
		E*	Chinese
		F	French
		G	German
		H	Hungarian
		I	Italian
		J*	Japanese
		K*	Korean
		L	Polish
		N*	Dutch
		P	Portuguese
		R*	Russian
		S	Spanish
		W*	Swedish
		Z*	Czech
		Q*	Special quote
SYSPARM	System Parameter (PIN 23)	X	No selection
		K	Quick Start
		M	Quick Start and Silent Night / Load limiting control option
		N	Silent Night sound / Load limiting control option
		Q	Special quote
SAFETYCDE	Safety Code (PIN 24)	C	European Safety Code (CE)
		G	China Safety Code (GB)
		L	N. American Safety Code (cUL/cETL)
		Q	Special Safety Code
SENSOR	Sensor (PIN 25)	X	No selection
		Q	Special quote
PUMPCTRL	Pump Control (PIN 26)	X	No selection
		Q	Special quote
REMOTEPNL	Remote Panel (PIN 27)	X	No selection
		O*	Optiview Remote Control Panel
		Q	Special quote
SEQCTRL	Sequence Control (PIN 28)	X	No selection
		S*	Sequence Control and Automatic Lead Transfer = {seq}
		Q	Special quote
FANFQ	Maximum Fan Frequency (PIN 29, 30)		
LWT	Leaving Water Temp (PIN 31, 32)	TS*	Thermal storage

* Option has not yet been designed

TABLE 1 - COMPLETE PIN NUMBER DESCRIPTION (CONT'D)

FEATURE	FEATURE DESCRIPTION	OPTION	OPTION DESCRIPTION
PIPECODE	Piping Code (PIN 33)	X	No selection
		C	Chicago Code Relief
		R	Dual Relief Valves
		Q	Special quote
METERDEV	Metering Device (PIN 34)	E*	EEV
		O	Orifice
		Q	Special quote
VALVEOPT	Valve Options (PIN 35)	X	No selection
		F	Suction and filter dryer service valve
		S	Suction service valve
		Q	Special quote
PIN36	PIN 36	X	No selection
		Q	Special quote
PIN37	PIN 37	X	No selection
		Q	Special quote
CPRVAR	Compressor Variation (PIN 38)	S	Standard Compressor
		V	Optimized Compressor
		Q	Special quote
CPRFQ	Compressor Frequency (PIN 39, 40, 41)		
HTR	Heaters (PIN 42)	X	No selection
		W	Water box heaters
		Q	Special quote
DWP	DWP (PIN 43)	1	150PSIG DWP Waterside
		3	300PSIG DWP Waterside
		Q	Special quote
INS	Insulation (PIN 44)	D	Double Thickness
		S	Single Thickness
		Q	Special quote
SHPLOSFLG	Ship Loose Flange Kit (PIN 45)	X	No selection
		F	Victaulic Flanges with welded mating flanges (4 shipped loose)
		M	Weldable flanges with mating weldable flanges (4 shipped loose)
		V	Victaulic Flanges (2 shipped loose)
		W	Weldable flanges (2 shipped loose)
		Q	Special quote

* Option has not yet been designed

TABLE 1 - COMPLETE PIN NUMBER DESCRIPTION (CONT'D)

FEATURE	FEATURE DESCRIPTION	OPTION	OPTION DESCRIPTION
FLOW	Flow Switch (PIN 46)	X	No selection
		D	One Differential Pressure Switch
		E	Two Differential Pressure Switches
		F	Three Differential Pressure Switches
		G	One Thermal Dispersion Switch
		H	Two Thermal Dispersion Switch
		I	Three Thermal Dispersion Switch
		S	One Flow Switch
		T	Two Flow Switches
		U	Three Flow Switches
		Q	Special quote
VESSEL	Vessel Codes (PIN 47)	A	ASME Pressure Vessel Codes
		E	PED Pressure Vessel Codes
		G	GB Pressure Vessel Codes
		Q	Special quote
CLR	Evaporator (PIN 48)	1	Integral One Water Pass Evaporator
		2	Integral Two Water Pass Evaporator
		3	Integral Triple Water Pass Evaporator
		A*	Remote One Water Pass Evaporator
		B*	Remote Two Water Pass Evaporator
		C*	Remote Triple Water Pass Evaporator
		Q	Special quote
EVAPCONN	Evaporator Connection Location (PIN 49)	B	Back Fluid Inlet Connection (opposite control panel end)
		F	Front Fluid Inlet Connection (control panel end)
		Q	Special quote
COILS	Coils (PIN 50)	A	Copper tube aluminum fin coils
		B	Pre-Coated Slit-Fin Coils (tube and fin)
		C	Copper Fin Coils (tube and fin)
		E	Pre-Coated Non-Slit Fin Coils (tube and fin)
		M	Microchannel coils
		N	Post-coated Microchannel coils
		P	Post-Coated Dipped Coils (tube and fin)
		Q	Special quote
PIN51	PIN 51	X	No selection
		Q	Special quote

* Option has not yet been designed

TABLE 1 - COMPLETE PIN NUMBER DESCRIPTION (CONT'D)

FEATURE	FEATURE DESCRIPTION	OPTION	OPTION DESCRIPTION
FANTYP	Fan Type (PIN 52)	F	Low Sound Fans
		G	High Airflow Fans
		H	High Static Fans
		K	High Airflow Fans with Variable Speed Control
		L	Ultra Quiet Fans
		M	Ultra Quiet Fans with Variable Speed Control
		V	Low Sound Fans with Variable Speed Control
		W*	Whisper Quiet Fans
		Z*	Whisper Quiet Fans with Variable Speed Control
		Q	Special quote
ENCLPNL	Enclosure Panels (PIN 53)	X	No selection
		1	Wire (Full Unit) Encl Panels (factory)
		2*	Wire (Full Unit) Encl Panels (field)
		3	Wire/Louvered Encl Panels (factory)
		4*	Wire/Louvered Encl Panels (field)
		5	Louvered (cond only) Encl Panels (factory)
		6*	Louvered (cond only) Encl Panels (field)
		7	Louvered (full unit) Encl Panels (factory)
		8*	Louvered (full unit) Encl Panels (field)
		9	End Louver (End Hail Guard) Encl Panels (Factory)
		A*	End Louver (End Hail Guard) Encl Panels(Field)
		B	V-Guard Panels only (factory)
		C*	V-Guard Panels only (field)
		D	V-Guard Panels plus Hail Guards (factory)
		E*	V-Guard Panels plus Hail Guards (field)
		F	Top Edge Guard (factory)
		G*	Top Edge Guard (field)
		P	Rear Protection Kit (factory)
		R*	Rear Protection Kit (field)
		Q	Special quote
NOISERDCT	Noise Reduction Kit (PIN 54)	X	No selection
		E	Economical Low Noise kit
		N	Low Noise kit (level 2 reduction) (factory)
		O*	Low Noise kit (level 2 reduction) (field)
		R	Low Noise kit (level 1 reduction) (factory)
		S*	Low Noise kit (level 1 reduction) (field)
		U*	Low Noise kit (level 3 reduction) (factory)
		V*	Low Noise kit (level 3 reduction) (field)
		A	Low Noise Kit (Basic) (factory)
		Y	Low Noise Kit (level 0 reduction) (field)
		Q	Special quote

* Option has not yet been designed

TABLE 1 - COMPLETE PIN NUMBER DESCRIPTION (CONT'D)

FEATURE	FEATURE DESCRIPTION	OPTION	OPTION DESCRIPTION
ISOL	Vibration Isolators (PIN 55)	X	No selection
		1	1inch Deflection Isolators
		N	Neoprene Isolators
		S	Seismic Isolators
		Q	Special quote
STRMOD	Structural Modification (PIN 56)	X	No selection
		D	Unit shipped in two pieces
		S*	Seismic Unit
		Q	Special quote
PIN57	PIN 57	X	No selection
		Q	Special quote
SPAPP	Special Applications (PIN 58)	X	No selection
		D	Desuperheater
		F*	Free cooling
		H*	Full heat recovery
		Q	Special quote
PMPPKG	Pump Package (PIN 59)	X	No selection
		Q	Special quote
PMPPKGOPT	Pump Package options (PIN 60)	X	No Selection
		Q	Special quote
SRDOCS	Spec Req Documents (PIN 61)	X	No Selection
		A	Base, Material and Witness Documents
		B	Base Documents
		M	Base and Material Documents
		W	Base and Witness Documents
		Q	Special quote
EXWTY	Extended Warranty (PIN 62)	For Marketing Purpose Only!	
REFWTY	Refrigerant Warranty (PIN 63)	For Marketing Purpose Only!	

* Option has not yet been designed

TABLE 1 - COMPLETE PIN NUMBER DESCRIPTION (CONT'D)

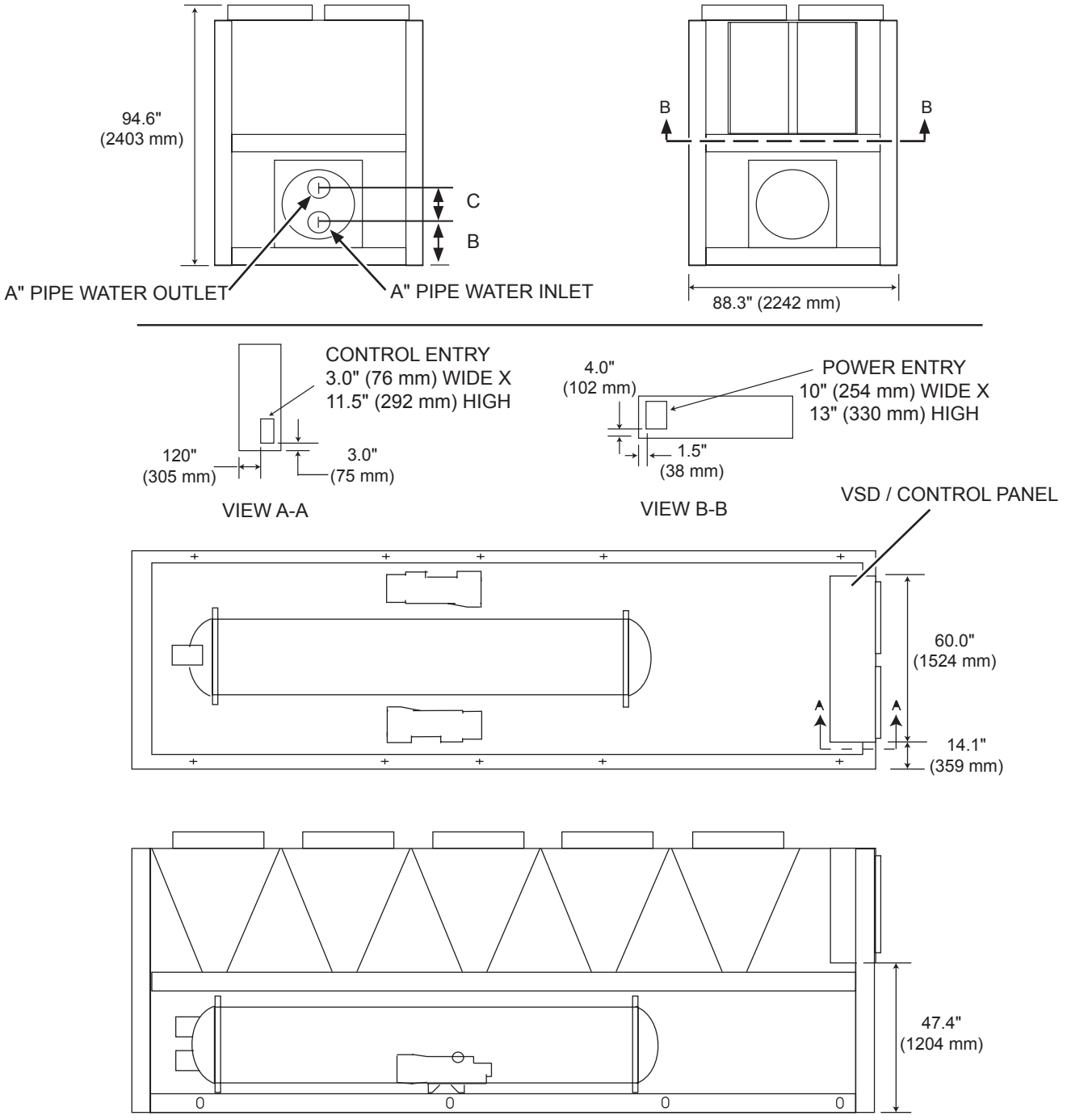
FEATURE	FEATURE DESCRIPTION	OPTION	OPTION DESCRIPTION
SHIPINS	Ship Instructions (PIN 64)	S	No Containerization required with Shipping Bag
		A	Buy American Act Compliance with Shipping Bag
		B	Both Buy America Act Compliance and Container Shipped without Shipping Bag (Factory Prep)
		C	Container Shipped without Shipping Bag (Factory Load US Port)
		D	Container Shipped with Shipping Bag (Factory Load US Port)
		E	Container Shipped with Shipping Bag (Factory Load Mexico Port)
		F	Container Shipped with Shipping Bag (Factory Prep)
		G	Both Buy America Act Compliance and Container Shipped with Shipping Bag (Factory Prep)
		M	Container Shipped without Shipping Bag (Factory Load Mexico Port)
		N	No Containerization required without Shipping Bag
		P	Container Shipped without Shipping Bag (Factory Prep)
		U	Buy America Act Compliance without Shipping Bag
		Q	Special quote
STKPGRM	Stock Program (PIN 65)	For Marketing Purpose Only!	
LOC	Mfg location (Plant selection to make order live)	GZH	Guangzhou, China
		MTY	Monterrey, Mexico
		SAB	Sabadell, Spain
		SAT	San Antonio, Texas

* Option has not yet been designed

DIMENSIONS

The data below is applicable to select configurations. Other configurations are available through our configuration/selection software.

Please contact your nearest Johnson Controls Sales Office for the chiller configuration that best matches your specific needs.



NOTES:

LD16178

1. Dimensions shown in English and Metric units.
2. VSD/Control Panel doors extend beyond the end of the unit base by 54 mm (2-1/8").
3. Optical circuit breaker handle extends beyond the end of the unit base by 102 mm (4").
4. The drawings indicate dimensions for the listed standard configurations. For other configurations, contact your nearest Johnson Controls Sales Office.

FIGURE 26 - YVAA0153 DIMENSIONS

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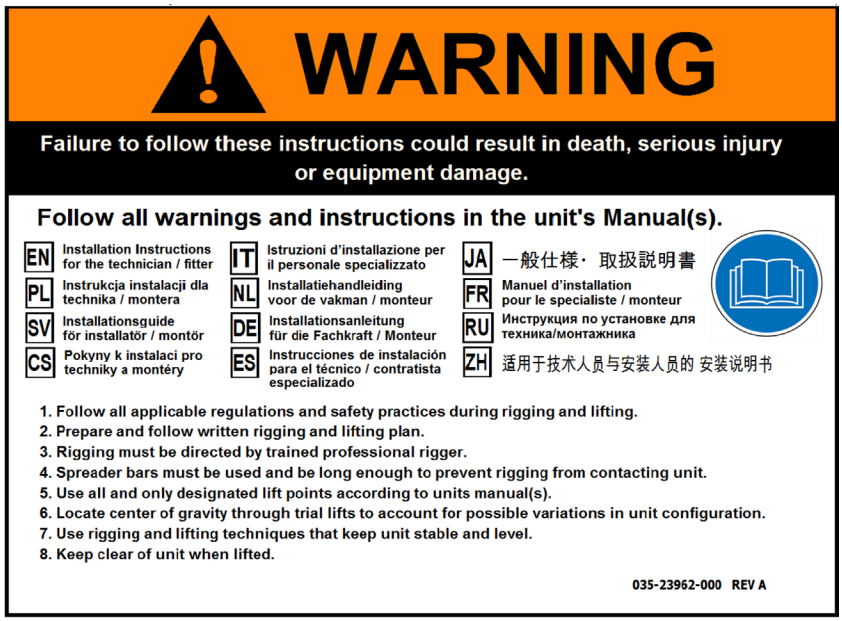
SECTION 3 - RIGGING, HANDLING AND STORAGE



Rigging and lifting should only be done by a professional rigger in accordance with a written rigging and lifting plan. The most appropriate rigging and lifting method will depend on job specific factors, such as the rigging equipment available and site needs. Therefore, a professional rigger must determine the rigging and lifting method to be used, and it is beyond the scope of this manual to specify rigging and lifting details.

LIFTING WEIGHTS

Refer to the unit nameplate for unit shipping weight. Note that weight may vary depending on unit configuration at the time of lifting. See the Physical Data tables within this manual for further information regarding shipping and operating weights.

DELIVERY AND STORAGE

To ensure consistent quality and maximum reliability, all units are tested and inspected before leaving the factory. Units shipped are completely assembled, containing refrigerant under pressure. Units are shipped without export crating unless specified within the Sales Order.

If the unit is to be put into storage, prior to installation, the following precautions should be observed:

- The chiller must be “blocked” so that the base is not permitted to sag or bow.
- Ensure that all openings such as water connections, are securely capped.
- Do not store at locations, those exposed to high ambient air temperatures,that may exceed relief valve settings.

  Refer to *Long-Term Storage Requirement - Field Preparation (Form 50.20-NM7)*.
- Condensers should be covered to protect the coils and fins from potential damage and corrosion, particularly where building work is in progress.
- The unit should be stored in a location where there is minimal activity in order to limit the risk of accidental physical damage.
- To prevent inadvertent operation of the pressure relief devices, the unit must not be steam cleaned.
- It is recommended that the unit is periodically inspected during storage.

INSPECTION

Remove any transit packing and inspect the package to ensure that all components have been delivered and that no damage has occurred during transit. If any damage is evident, it should be noted on the carrier’s freight bill and a claim entered in accordance with the instructions given on the advice note.

Major damage must be reported immediately to your local Johnson Controls representative.

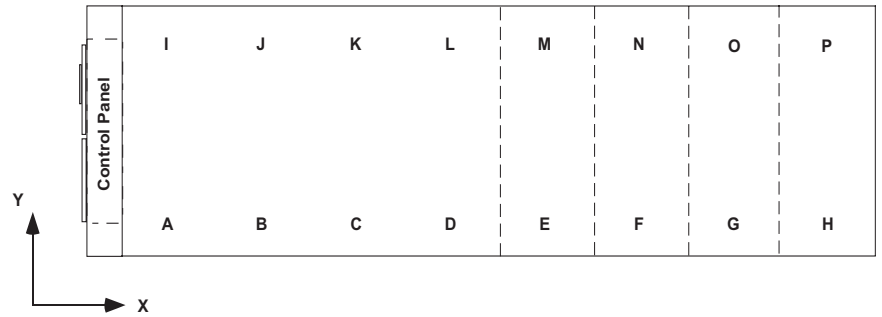


TABLE 2 - UNIT RIGGING

YVAA MODEL			DESCRIPTION	UNITS	RIGGING HOLES								APPROX. CENTER OF GRAVITY [1]	
FRAME	COND	EVAP			A	B	C	D	E	F	G	H	X (IN)	Y (IN)
015	3	B	Rigging Hole Location	in.	18	60	116	192					106	46
				mm.	464	1512	2937	4866					2682	1164
			Point Load 1	lbs.	1036	1675	1675	1372						
				kg.	470	760	760	622						
016	5	B	Rigging Hole Location	in.	18	60	137	214					132	46
				mm.	464	1533	3485	5436					3348	1158
			Point Load 1	lbs.	626	1141	3081	1194						
				kg.	284	518	1398	542						
017	8	C	Rigging Hole Location	in.	12	73	144	197	260				151	46
				mm.	314	1845	3654	5012	6593				3835	1173
			Point Load 1	lbs.	625	1746	2573	1287	1103					
				kg.	283	792	1167	584	500					
018	3	A	Rigging Hole Location	in.	18	60	143	220					132	46
				mm.	464	1533	3637	5599					3365	1161
			Point Load 1	lbs.	502	1454	2886	1143						
				kg.	228	660	1309	518						
019	5	A	Rigging Hole Location	in.	18	60	143	227	272				144	46
				mm.	464	1533	3636	5761	6920				3649	1162
			Point Load 1	lbs.	469	1471	2779	1390	256					
				kg.	213	667	1261	630	116					
019	8	B	Rigging Hole Location	in.	18	60	137	215	302				154	46
				mm.	464	1533	3485	5456	7670				3912	1161
			Point Load 1	lbs.	418	1630	2443	1657	715					
				kg.	190	739	1108	752	324					
020	0	C	Rigging Hole Location	in.	18	60	131	214					114	46
				mm.	464	1518	3332	5430					2907	1168
			Point Load 1	lbs.	1199	750	3466	1280						
				kg.	544	340	1572	581						
021	3	A	Rigging Hole Location	in.	18	60	143	227	272				144	45
				mm.	464	1533	3636	5761	6920				3655	1155
			Point Load 1	lbs.	472	1467	2824	1412	257					
				kg.	214	665	1281	640	117					
021	5	C	Rigging Hole Location	in.	12	73	144	197	260				158	46
				mm.	314	1845	3654	5012	6593				4013	1176
			Point Load 1	lbs.	483	1990	1990	1673	1322					
				kg.	219	903	903	759	600					

NOTES:

1. Microchannel condenser coils only.
2. Rigging and lifting the unit must be done safely by a professional rigger as discussed above in this section. The rigger should locate the center of gravity through trial lifts to account for possible variations in unit configuration. Contact your nearest Johnson Controls Sales Office for weight data.
3. All rigging holes are 3" x 2".

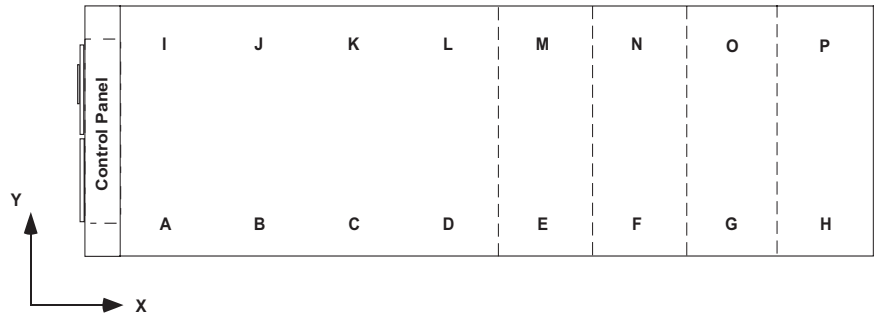


TABLE 2 - UNIT RIGGING (CONT'D)

YVAA MODEL			DESCRIPTION	UNITS	RIGGING HOLES								APPROX. CENTER OF GRAVITY 1	
FRAME	COND	EVAP			I	J	K	L	M	N	O	P	X (IN)	Y (IN)
015	3	B	Rigging Hole Location	in.	18	60	116	192					106	46
				mm.	464	1512	2937	4866					2682	1164
			Point Load 1	lbs.	952	1655	1655	1496						
				kg.	432	751	751	679						
016	5	B	Rigging Hole Location	in.	18	60	137	214					132	46
				mm.	464	1533	3485	5436					3348	1158
			Point Load 1	lbs.	608	1121	3058	1255						
				kg.	276	508	1387	569						
017	8	C	Rigging Hole Location	in.	12	73	144	197	260				151	46
				mm.	314	1845	3654	5012	6593				3835	1173
			Point Load 1	lbs.	634	1612	2611	1305	1172					
				kg.	288	731	1184	592	532					
018	3	A	Rigging Hole Location	in.	18	60	143	220					132	46
				mm.	464	1533	3637	5599					3365	1161
			Point Load 1	lbs.	508	1422	2912	1193						
				kg.	230	645	1321	541						
019	5	A	Rigging Hole Location	in.	18	60	143	227	272				144	46
				mm.	464	1533	3636	5761	6920				3649	1162
			Point Load 1	lbs.	484	1419	2833	1416	264					
				kg.	220	644	1285	642	120					
019	8	B	Rigging Hole Location	in.	18	60	137	215	302				154	46
				mm.	464	1533	3485	5456	7670				3912	1161
			Point Load 1	lbs.	398	1633	2451	1716	715					
				kg.	181	741	1112	778	324					
020	0	C	Rigging Hole Location	in.	18	60	131	214					114	46
				mm.	464	1518	3332	5430					2907	1168
			Point Load 1	lbs.	1107	776	3428	1384						
				kg.	502	352	1555	628						
021	3	A	Rigging Hole Location	in.	18	60	143	227	272				144	45
				mm.	464	1533	3636	5761	6920				3655	1155
			Point Load 1	lbs.	485	1416	2842	1421	265					
				kg.	220	642	1289	645	120					
021	5	C	Rigging Hole Location	in.	12	73	144	197	260				158	46
				mm.	314	1845	3654	5012	6593				4013	1176
			Point Load 1	lbs.	475	1937	1937	1721	1387					
				kg.	215	879	879	781	629					

NOTES:

1. Microchannel condenser coils only.
2. Rigging and lifting the unit must be done safely by a professional rigger as discussed above in this section. The rigger should locate the center of gravity through trial lifts to account for possible variations in unit configuration. Contact your nearest Johnson Controls Sales Office for weight data.
3. All rigging holes are 3" x 2".

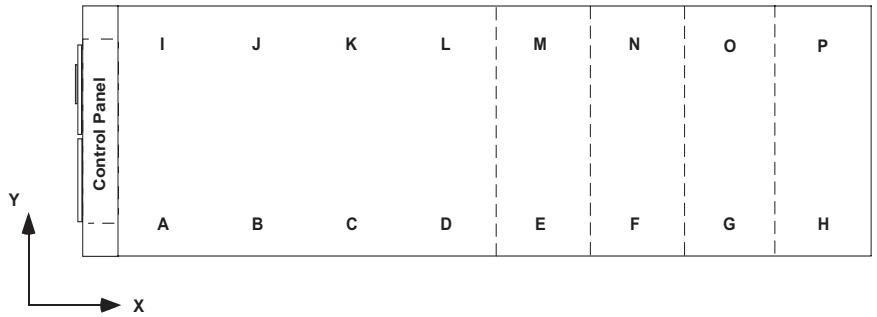


TABLE 2 - UNIT RIGGING (CONT'D)

YVAA MODEL			DESCRIPTION	UNITS	RIGGING HOLES								APPROX. CENTER OF GRAVITY 1	
FRAME	COND	EVAP			A	B	C	D	E	F	G	H	X (IN)	Y (IN)
021	8	C	Rigging Hole Location	in.	12	73	163	254	324				161	46
				mm.	314	1845	4144	6443	8217				4086	1173
			Point Load 1	lbs.	518	2344	3047	1501	428					
				kg.	235	1063	1382	681	194					
023	3	B	Rigging Hole Location	in.	18	60	137	215	272				140	46
				mm.	464	1533	3484	5455	6919				3553	1160
			Point Load 1	lbs.	342	2052	2048	2048	144					
				kg.	155	931	929	929	65					
024	5	C	Rigging Hole Location	in.	18	60	149	240	324				159	46
				mm.	464	1533	3789	6088	8217				4033	1174
			Point Load 1	lbs.	358	2130	2982	2151	307					
				kg.	162	966	1353	976	139					
024	8	C	Rigging Hole Location	in.	12	73	163	254	347				177	46
				mm.	314	1845	4144	6525	6525				4500	1172
			Point Load 1	lbs.	697	1921	3078	1741	871					
				kg.	316	871	1396	790	395					
026	3	B	Rigging Hole Location	in.	18	60	137	215	302				152	45
				mm.	464	1533	3484	5455	7669				3866	1153
			Point Load 1	lbs.	515	1613	2513	1682	714					
				kg.	234	732	1140	763	324					
027	3	D	Rigging Hole Location	in.	12	73	121	181	243	324			177	46
				mm.	314	1845	3073	4602	6170	8219			4506	1176
			Point Load 1	lbs.	736	1021	1226	3065	1393	696				
				kg.	334	463	556	1390	632	316				
027	5	E	Rigging Hole Location	in.	12	73	121	181	264	324			177	46
				mm.	314	1845	3073	4602	6717	8218			4506	1176
			Point Load 1	lbs.	872	569	1525	3812	1146	573				
				kg.	396	258	692	1729	520	260				
027	8	E	Rigging Hole Location	in.	12	73	121	181	243	347			187	46
				mm.	314	1845	3073	4602	6170	8826			4747	1173
			Point Load 1	lbs.	616	1372	1138	2845	1937	968				
				kg.	279	622	516	1290	879	439				
029	5	E	Rigging Hole Location	in.	12	73	179	290	347				186	47
				mm.	314	1845	4551	7358	8825				4712	1186
			Point Load 1	lbs.	500	1930	4518	1506	533					
				kg.	227	875	2049	683	242					

NOTES:

1. Microchannel condenser coils only.
2. Rigging and lifting the unit must be done safely by a professional rigger as discussed above in this section. The rigger should locate the center of gravity through trial lifts to account for possible variations in unit configuration. Contact your nearest Johnson Controls Sales Office for weight data.
3. All rigging holes are 3" x 2".

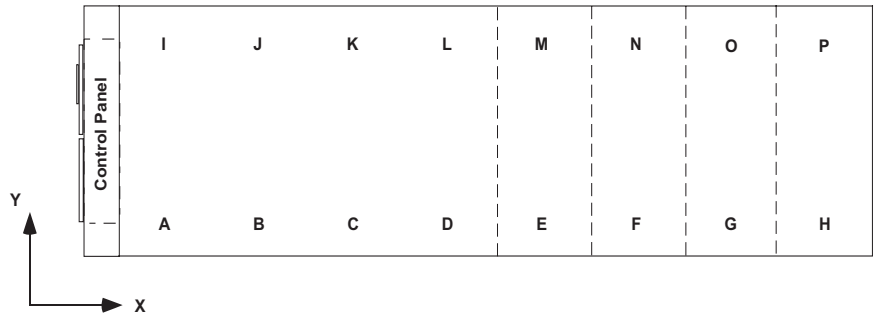


TABLE 2 - UNIT RIGGING (CONT'D)

YVAA MODEL			DESCRIPTION	UNITS	RIGGING HOLES								APPROX. CENTER OF GRAVITY [1]	
FRAME	COND	EVAP			I	J	K	L	M	N	O	P	X (IN)	Y (IN)
021	8	C	Rigging Hole Location	in.	12	73	163	254	324				161	46
				mm.	314	1845	4144	6443	8217				4086	1173
			Point Load [1]	lbs.	510	2282	2967	1743	336					
				kg.	231	1035	1346	791	152					
023	3	B	Rigging Hole Location	in.	18	60	137	215	272				140	46
				mm.	464	1533	3484	5455	6919				3553	1160
			Point Load [1]	lbs.	330	2037	2067	2067	152					
				kg.	150	924	938	938	69					
024	5	C	Rigging Hole Location	in.	18	60	149	240	324				159	46
				mm.	464	1533	3789	6088	8217				4033	1174
			Point Load [1]	lbs.	354	2079	2911	2340	261					
				kg.	161	943	1320	1061	118					
024	8	C	Rigging Hole Location	in.	12	73	163	254	347				177	46
				mm.	314	1845	4144	6525	6525				4500	1172
			Point Load [1]	lbs.	697	1800	3169	1773	886					
				kg.	316	816	1437	804	402					
026	3	B	Rigging Hole Location	in.	18	60	137	215	302				152	45
				mm.	464	1533	3484	5455	7669				3866	1153
			Point Load [1]	lbs.	493	1623	2486	1723	714					
				kg.	224	736	1128	782	324					
027	3	D	Rigging Hole Location	in.	12	73	121	181	243	324			177	46
				mm.	314	1845	3073	4602	6170	8219			4506	1176
			Point Load [1]	lbs.	653	1083	1174	2936	1527	763				
				kg.	296	491	533	1332	693	346				
027	5	E	Rigging Hole Location	in.	12	73	121	181	264	324			177	46
				mm.	314	1845	3073	4602	6717	8218			4506	1176
			Point Load [1]	lbs.	803	586	1494	3734	1252	626				
				kg.	364	266	678	1694	568	284				
027	8	E	Rigging Hole Location	in.	12	73	121	181	243	347			187	46
				mm.	314	1845	3073	4602	6170	8826			4747	1173
			Point Load [1]	lbs.	542	1407	1099	2747	2054	1027				
				kg.	246	638	498	1246	932	466				
029	5	E	Rigging Hole Location	in.	12	73	179	290	347				186	47
				mm.	314	1845	4551	7358	8825				4712	1186
			Point Load [1]	lbs.	434	1937	4698	1566	583					
				kg.	197	879	2131	710	264					

NOTES:

1. Microchannel condenser coils only.
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3. All rigging holes are 3" x 2".

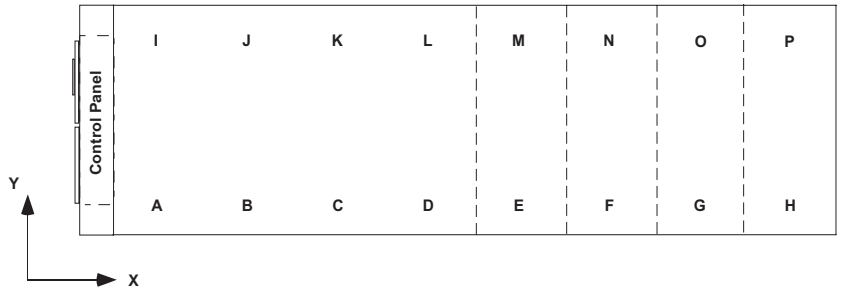

TABLE 2 - UNIT RIGGING (CONT'D)

YVAA MODEL			DESCRIPTION	UNITS	RIGGING HOLES								APPROX. CENTER OF GRAVITY 1	
FRAME	COND	EVAP			A	B	C	D	E	F	G	H	X (IN)	Y (IN)
030	3	C	Rigging Hole Location	in.	12	73	161	254	348				175	47
				mm.	314	1845	4092	6443	8824				4441	1184
			Point Load [1]	lbs.	748	1875	3196	1748	874					
				kg.	339	850	1450	793	396					
030	5	C	Rigging Hole Location	in.	12	73	161	254	306	391			186	47
				mm.	314	1845	4092	6443	7763	9941			4729	1183
			Point Load [1]	lbs.	559	2024	3021	2164	302	752				
				kg.	254	918	1370	982	137	341				
030	8	E	Rigging Hole Location	in.	12	73	121	179	243	296	391		196	47
				mm.	314	1845	3073	4550	6170	7510	9943		4971	1183
			Point Load [1]	lbs.	1113	323	2182	2182	1309	1505	753			
				kg.	505	147	990	990	594	683	342			
031	8	E	Rigging Hole Location	in.	12	73	121	179	243	353	435		207	46
				mm.	314	1845	3073	4550	6169	8962	11059		5256	1181
			Point Load [1]	lbs.	1028	575	2009	2009	2022	1580	527			
				kg.	466	261	911	911	917	717	239			
032	3	E	Rigging Hole Location	in.	12	73	121	181	243	347			186	46
				mm.	314	1845	3073	4602	6170	8826			4717	1171
			Point Load [1]	lbs.	701	1261	1250	3125	1960	980				
				kg.	318	572	567	1417	889	445				
033	3	C	Rigging Hole Location	in.	12	73	163	254	306	391			186	46
				mm.	314	1845	4144	6443	7765	9942			4737	1166
			Point Load [1]	lbs.	550	2052	3327	2098	333	752				
				kg.	249	931	1509	952	151	341				
034	3	E	Rigging Hole Location	in.	12	73	121	181	243	296	392		196	46
				mm.	314	1845	3073	4602	6170	7510	9943		4974	1169
			Point Load [1]	lbs.	1087	408	2224	2224	1456	1505	753			
				kg.	493	185	1009	1009	660	683	342			
034	5	E	Rigging Hole Location	in.	12	73	121	181	243	353	435		207	46
				mm.	314	1845	3073	4602	6170	8963	11060		5254	1167
			Point Load [1]	lbs.	1002	659	2048	2048	2173	1580	527			
				kg.	454	299	929	929	986	717	239			
036	8	J	Rigging Hole Location	in.	12	73	181	238	302	392	434	501	208	46
				mm.	314	1845	4602	6039	7662	9957	11024	12725	5283	1168
			Point Load [1]	lbs.	142	2884	4376	929	1857	697	310	520		
				kg.	64	1308	1985	421	842	316	141	236		
037	3	F	Rigging Hole Location	in.	12	73	181	238	302	435			210	49
				mm.	314	1845	4602	6039	7662	11059			5334	1245
			Point Load [1]	lbs.	396	2152	4507	396	2142	881				
				kg.	179	976	2044	179	972	400				

NOTES:

1. Microchannel condenser coils only.
2. Rigging and lifting the unit must be done safely by a professional rigger as discussed in Section 3 above. The rigger should locate the center of gravity through trial lifts to account for possible variations in unit configuration. Contact your nearest Johnson Controls Sales Office for weight data.
3. All rigging holes are 3" x 2".

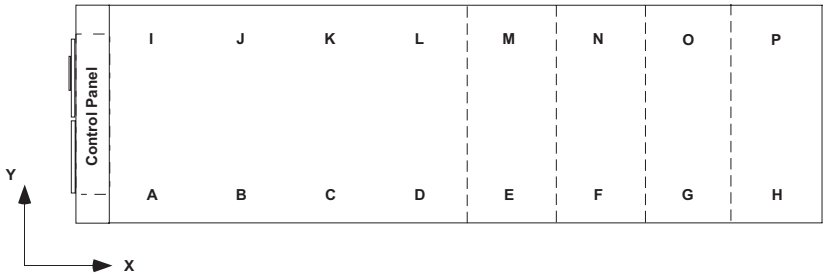

TABLE 2 - UNIT RIGGING (CONT'D)

YVAA MODEL			DESCRIPTION	UNITS	RIGGING HOLES								APPROX. CENTER OF GRAVITY 1	
FRAME	COND	EVAP			I	J	K	L	M	N	O	P	X (IN)	Y (IN)
030	3	C	Rigging Hole Location	in.	12	73	163	254	347				175	47
				mm.	314	1845	4092	6443	8824				4441	1184
			Point Load [1]	lbs.	748	1784	3464	1785	892					
				kg.	339	809	1571	810	405					
030	5	C	Rigging Hole Location	in.	12	73	161	254	306	391			186	47
				mm.	314	1845	4092	6443	7763	9941			4729	1183
			Point Load [1]	lbs.	411	2226	2990	2374	299	752				
				kg.	186	1010	1356	1077	136	341				
030	8	E	Rigging Hole Location	in.	12	73	121	179	243	296	391		196	47
				mm.	314	1845	3073	4550	6170	7510	9943		4971	1183
			Point Load [1]	lbs.	1073	398	2162	2162	1547	1505	753			
				kg.	487	181	981	981	702	683	342			
031	8	E	Rigging Hole Location	in.	12	73	121	179	243	353	435		207	46
				mm.	314	1845	3073	4550	6169	8962	11059		5256	1181
			Point Load [1]	lbs.	988	650	1988	1988	2259	1580	527			
				kg.	448	295	902	902	1025	717	239			
032	3	E	Rigging Hole Location	in.	12	73	121	181	243	347			186	46
				mm.	314	1845	3072	4601	6169	8825			4717	1171
			Point Load [1]	lbs.	604	1370	1204	3010	2060	1030				
				kg.	274	621	546	1365	934	467				
033	3	C	Rigging Hole Location	in.	12	73	163	254	306	391			186	46
				mm.	314	1845	4144	6443	7765	9942			4737	1166
			Point Load [1]	lbs.	373	2354	2951	2387	295	752				
				kg.	169	1068	1339	1083	134	341				
034	3	E	Rigging Hole Location	in.	12	73	121	181	243	296	392		196	46
				mm.	314	1845	3073	4602	6170	7510	9943		4974	1169
			Point Load [1]	lbs.	1038	514	2135	2135	1578	1505	753			
				kg.	471	233	968	968	716	683	342			
034	5	E	Rigging Hole Location	in.	12	73	121	181	243	353	435		207	46
				mm.	314	1845	3073	4602	6170	8963	11060		5254	1167
			Point Load [1]	lbs.	953	765	1959	1959	2295	1580	527			
				kg.	432	347	889	889	1041	717	239			
036	8	J	Rigging Hole Location	in.	12	73	181	238	302	392	434	501	208	46
				mm.	314	1845	4602	6039	7662	9957	11024	12725	5283	1168
			Point Load [1]	lbs.	130	2825	5741	935	1871	827	312	475		
				kg.	59	1281	2604	424	849	375	141	215		
037	3	F	Rigging Hole Location	in.	12	73	181	238	302	435			210	49
				mm.	314	1845	4602	6039	7662	11059			5334	1245
			Point Load [1]	lbs.	368	2116	5853	368	2287	881				
				kg.	167	960	2655	167	1037	400				

NOTES:

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3. All rigging holes are 3" x 2".

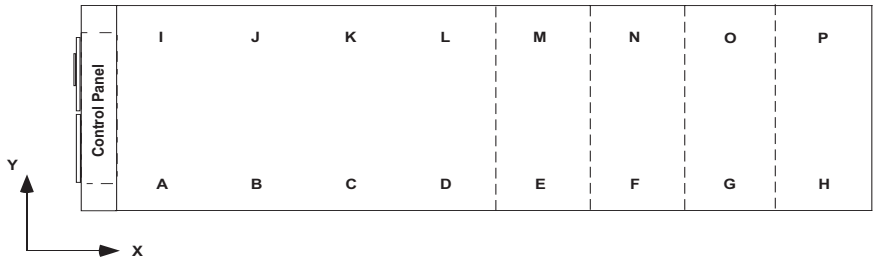

TABLE 2 - UNIT RIGGING (CONT'D)

YVAA MODEL			DESCRIPTION	UNITS	RIGGING HOLES								APPROX. CENTER OF GRAVITY [1]	
FRAME	COND	EVAP			A	B	C	D	E	F	G	H	X (IN)	Y (IN)
037	5	J	Rigging Hole Location	in.	12	73	181	238	302	435			198	46
				mm.	314	1845	4602	6039	7662	11059			5029	1168
			Point Load [1]	lbs.	268	2654	4794	288	2430	881				
				kg.	131	1024	2175	131	1102	400				
039	8	J	Rigging Hole Location	in.	12	73	181	238	302	435	478	545	218	46
				mm.	314	1845	4602	6039	7358	11059	12135	13835	5537	1168
			Point Load [1]	lbs.	101	2865	4576	1068	2019	72	169	1517		
				kg.	47	1300	2076	484	916	33	77	688		
041	3	H	Rigging Hole Location	in.	12	73	181	238	302	435			219	46
				mm.	314	1845	4601	6039	7662	11059			5663	1168
			Point Load [1]	lbs.	423	2025	4375	423	1910	881				
				kg.	192	918	1984	192	867	400				
042	5	H	Rigging Hole Location	in.	12	73	181	238	302	435	478	545	222	46
				mm.	314	1845	4602	6039	7358	11059	12135	13835	5639	1169
			Point Load [1]	lbs.	85	2831	3122	1273	1707	74	172	1534		
				kg.	39	1284	1416	577	774	34	78	696		
042	8	J	Rigging Hole Location	in.	12	73	181	238	302	435	494	572	227	46
				mm.	314	1845	4602	6039	7358	11059	12546	14541	5766	1168
			Point Load [1]	lbs.	204	2793	5125	71	2514	454	1056	551		
				kg.	93	1267	2325	32	1140	206	479	250		
044	3	G	Rigging Hole Location	in.	12	73	181	238	290	435	478	545	227	46
				mm.	314	1845	4602	6039	7662	11059	12135	13835	5766	1168
			Point Load [1]	lbs.	189	2952	5346	608	2066	77	176	1557		
				kg.	89	1339	2425	276	937	35	80	706		
047	5	J	Rigging Hole Location	in.	12	73	181	238	290	435	494	572	234	46
				mm.	314	1845	4602	6039	7358	11059	12546	14541	5944	1168
			Point Load [1]	lbs.	335	3102	5541	318	2792	518	1055	551		
				kg.	152	1407	2513	144	1266	235	479	250		
048	3	G	Rigging Hole Location	in.	12	73	181	238	290	435	494	572	234	46
				mm.	314	1845	4602	6039	7358	11059	12546	14529	5944	1168
			Point Load [1]	lbs.	338	2564	5914	104	2308	518	1055	551		
				kg.	153	1163	2683	47	1047	235	479	250		
050	0	J	Rigging Hole Location	in.	12	73	181	238	290	435			204	46
				mm.	305	1854	4597	6045	7366	11049			5182	1168
			Point Load [1]	lbs.	142	3568	4804	961	2572	937				
				kg.	64	1618	2179	436	1167	425				
052	3	J	Rigging Hole Location	in.	12	73	181	238	290	435	494		234	46
				mm.	305	1854	4597	6045	7366	11049	12548		5944	1168
			Point Load [1]	lbs.	335	3102	5541	318	2792	518	1055			
				kg.	152	1407	2513	144	1266	235	478			

NOTES:

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3. All rigging holes are 3" x 2".

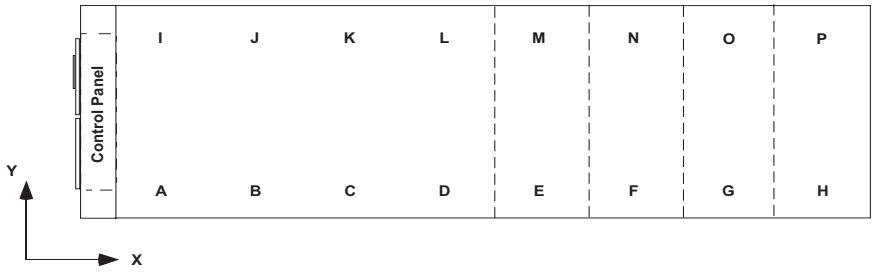

TABLE 2 - UNIT RIGGING (CONT'D)

YVAA MODEL			DESCRIPTION	UNITS	RIGGING HOLES								APPROX. CENTER OF GRAVITY [1]	
FRAME	COND.	EVAP.			I	J	K	L	M	N	O	P	X (IN)	Y (IN)
037	5	J	Rigging Hole Location	in.	12	73	181	238	302	435			198	46
				mm.	314	1845	4602	6039	7662	11059			5029	1168
			Point Load [1]	lbs.	268	2613	6131	268	2574	881				
				kg.	122	1185	2781	122	1168	400				
039	8	J	Rigging Hole Location	in.	12	73	181	238	302	435	478	545	218	46
				mm.	314	1845	4602	6039	7358	11059	12135	13835	5537	1168
			Point Load [1]	lbs.	108	2759	5815	980	2153	70	167	1504		
				kg.	49	1251	2638	445	977	32	76	682		
041	3	H	Rigging Hole Location	in.	12	73	181	238	302	435			219	46
				mm.	314	1845	4601	6039	7662	11059			5663	1168
			Point Load [1]	lbs.	406	1977	5529	406	2008	881				
				kg.	184	897	2508	184	911	400				
042	5	H	Rigging Hole Location	in.	12	73	181	238	302	435	478	545	222	46
				mm.	314	1845	4602	6039	7358	11059	12135	13835	5639	1169
			Point Load [1]	lbs.	92	2725	4362	1185	1841	72	170	1520		
				kg.	42	1236	1979	538	835	33	77	689		
042	8	J	Rigging Hole Location	in.	12	73	181	238	302	435	494	572	227	46
				mm.	314	1845	4602	6039	7358	11059	12546	14541	5766	1168
			Point Load [1]	lbs.	198	2927	5792	323	2635	454	1056	551		
				kg.	90	1328	2627	147	1195	206	479	250		
044	3	G	Rigging Hole Location	in.	12	73	181	238	290	435	478	545	227	46
				mm.	314	1845	4602	6039	7358	11059	12135	13835	5766	1168
			Point Load [1]	lbs.	119	3024	5101	796	2117	78	176	1561		
				kg.	54	1372	2314	361	960	35	80	708		
047	5	J	Rigging Hole Location	in.	12	73	181	238	290	435	494	572	234	46
				mm.	314	1845	4602	6039	7358	11059	12546	14541	5944	1168
			Point Load [1]	lbs.	263	3176	5295	496	2858	518	1055	551		
				kg.	119	1441	2402	225	1296	235	479	250		
048	3	G	Rigging Hole Location	in.	12	73	181	238	290	435			234	46
				mm.	305	1854	4597	6045	7366	11049			5944	1168
			Point Load [1]	lbs.	270	2630	5677	282	2367	518	1055	551		
				kg.	122	1193	2575	128	1074	235	479	250		
050	0	J	Rigging Hole Location	in.	12	73	181	238	290	435			204	46
				mm.	305	1854	4597	6045	7366	11049			5182	1168
			Point Load [1]	lbs.	1323	3541	4795	959	2620	937				
				kg.	600	1606	2175	435	1188	425				
052	3	J	Rigging Hole Location	in.	12	73	181	238	290	435	494	572	234	46
				mm.	305	1854	4597	6045	7366	11049	12548	14529	5944	1168
			Point Load [1]	lbs.	263	3176	5295	496	2858	518	1055	551		
				kg.	119	1441	2402	225	1296	235	478	250		

NOTES:

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3. All rigging holes are 3" x 2".

NOTE

Weights and approximate center of gravity location shown for base unit. Any options selected may add weight to the unit and affect the center of gravity. Locate the center of gravity through trial lifts to account for possible variations in unit configuration. Contact your nearest Johnson Controls Sales Office for weight data.

UNIT REMOVAL FROM SHIPPING CONTAINER

1. Place a clevis pin into the holes provided at the end of each base rail on the unit. Attach chains or nylon straps through the clevis pins and hook onto a suitable lift truck for pulling the unit out of the container.
2. Slowly place tension on the chains or straps until the unit begins to move and then slowly pull the unit from the container. Be sure to pull straight so the sides do not scrape the container.
3. Place a lifting fixture on the forks of the lift truck and reattach the chain or strap. Slightly lift the front of the unit to remove some weight from the floor of the container. Continue pulling the unit with an operator on each side to guide the lift truck operator.
4. Pull the unit until the lifting locations are outside of the container. Place 4 X 4 blocks of wood under the base rails of the unit. Gently rest the unit on the blocks and remove the chains and lift truck.

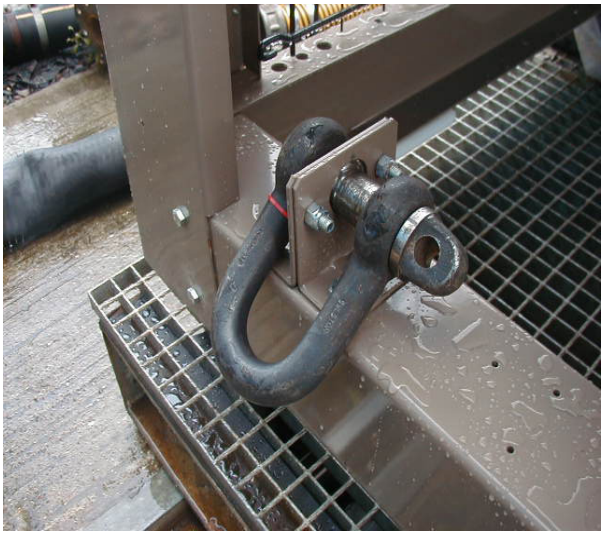


FIGURE 27 - LIFT LUG TO REMOVE UNIT FROM SHIPPING CONTAINER

5. Once the unit is completely removed from the container, follow the professional written rigging plan to lift the unit. See the danger note on page 51.

LIFTING USING LUGS

Units are provided with lifting holes in the base frame which accept the accessory lifting lug set as shown in the figure below. The lugs (RH and LH) should be inserted into the respective holes in the base frame and turned so that the spring loaded pin engages into the hole and the flanges on the lug lock behind the hole. The lugs should be attached to the cables/chains using shackles or safety hooks.

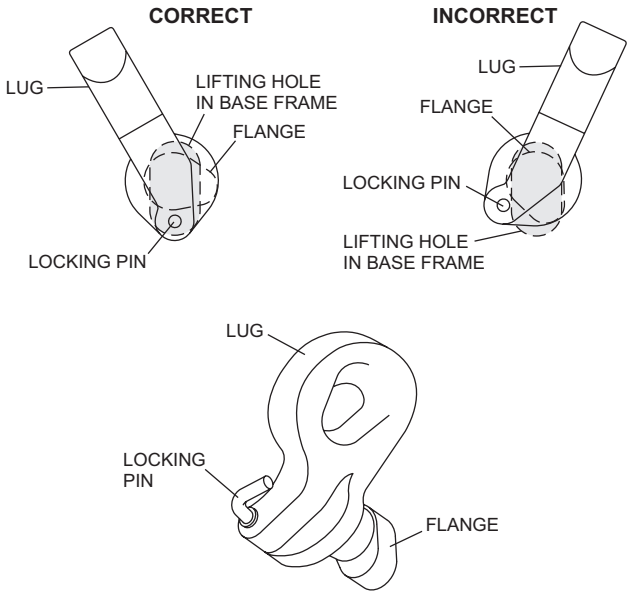


FIGURE 28 - ACCESSORY LIFTING LUGS

LIFTING USING SHACKLES

The shackles should be inserted into the respective holes in the base frame and secured from the inside.

Use spreader bars to avoid lifting chains hitting the chiller. Various methods of spreader bar arrangements may be used, keeping in mind the intent is to keep the unit stable and to keep the chains from hitting the chiller and causing damage.

Never lift the chiller using a forklift or by hooking to the top rails. Use only the lifting holes provided.

Lifting Instructions are placed on a label on the chiller and on the shipping bag.

SECTION 4 - INSTALLATION

LOCATION REQUIREMENTS

For optimum performance and trouble-free service, it is essential that the installation site meets the location and space requirements for the model being installed.

It is important to ensure that the minimum service access space is maintained for cleaning and maintenance purposes.

OUTDOOR INSTALLATIONS

The units are designed for outdoor installation and can be installed at ground level on a suitable flat level foundation easily capable of supporting the weight of the unit, or on a suitable rooftop location. In both cases, an adequate supply of air is required. Avoid locations where the sound output and air discharge from the unit may be objectionable.

The location should be selected for minimum sun exposure and away from boiler flues and other sources of airborne chemicals that could attack the condenser coils and steel parts of the unit.

If located in an area accessible to unauthorized persons, steps must be taken to prevent access to the unit by means of a protective fence. This will help to prevent the possibility of vandalism, accidental damage, or possible harm caused by unauthorized removal of protective guards or opening panels to expose rotating or high voltage components.

For ground level locations, the unit must be installed on a suitable flat and level concrete base that extends to fully support the two side channels of the unit base frame. A one-piece concrete slab, with footings extending below the frost line is recommended. To avoid noise and vibration transmission, the unit should not be secured to the building foundation.

On rooftop locations, choose a place with adequate structural strength to safely support the entire operating weight of the unit and service personnel. The unit can be mounted on a concrete slab, similar to ground floor locations, or on steel channels of suitable strength. The channels should be spaced with the same centers as the unit side and front base rails. This will allow vibration isolators to be fitted if required. Isolators are recommended for rooftop locations.

Mounting holes (5/8 inches) are provided in the base rails for bolting the unit to its foundation. See *Table 12 on page 94* for location of the mounting holes.

Any ductwork or attenuators fitted to the unit must not have a total static pressure resistance, at full unit airflow, exceeding the capability of the fans installed in the unit.

The condenser fans are propeller-type and are not recommended for use with ductwork, filters or other impediments to airflow in the condenser air stream.

When it is desirable to surround the unit(s) in addition to whatever optional louver package is selected, it is recommended that the screening be able to pass the required chiller CFM without exceeding 0.1 inch w.g. (24.9084 pa) external static pressure.

Protection against corrosive environments is available by ordering the units with cured epoxy-coating on the microchannel condenser coil. Epoxy-coated coils should be used with any units being installed at the seashore where salt spray/mist may hit the units, or where acid rain is prevalent.

On installations where winter operation is intended and snow accumulations are expected, additional elevation must be provided to insure normal condenser air flow.

Avoid locations near windows or structures where normal operating sounds may be objectionable.

LOCATION CLEARANCES

Adequate clearances around the unit(s) are required for the unrestricted airflow for the air-cooled condenser coils and to prevent re-circulation of warm discharge air back onto the coils. If clearances given are not maintained, airflow restriction or re-circulation will cause a loss of unit performance, an increase in power consumption, and may cause the unit to malfunction. Consideration should also be given to the possibility of down drafts, caused by adjacent buildings, which may cause re-circulation or uneven unit airflow.

For locations where significant cross winds are expected, such as exposed roof tops, an enclosure of solid or louver type is recommended to prevent wind turbulence interfering with the unit airflow.

When units are installed in an enclosure, the enclosure height should not exceed the height of the unit on more than one side. If the enclosure is of louvered construction, the same requirement of static pressure loss applies as for ducts and attenuators stated above.

Recommended Minimum Clearances

Recommended clearances for the YVAA units are:

- Side to wall – 6' (1.83m)
- Rear to wall – 6' (1.83m)
- Control panel end to wall – 4' (1.22m)
- Top – no obstructions whatsoever
- Distance between adjacent units – 10' (3.05m)

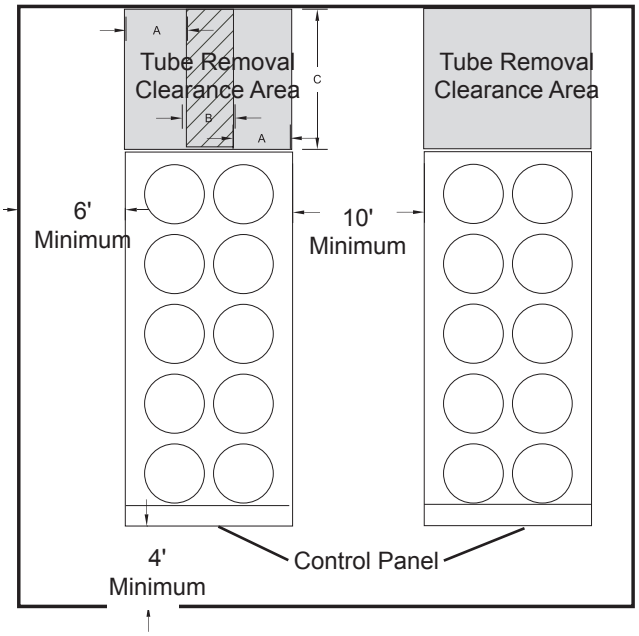


FIGURE 29 - ACCEPTABLE MINIMUM CLEARANCES AROUND/BETWEEN UNIT(S)

CAUTION

Clearance dimensions provided in Figure 26 on page 48, are necessary to maintain good airflow and ensure correct unit operation. It is also necessary to consider access requirements for safe operation and maintenance of the unit and power and control panels. Local health and safety regulations, or practical considerations for service replacement of large components, may require larger clearances than those recommended.

TABLE 3 - MINIMUM EVAPORATOR TUBE REMOVAL CLEARANCE

MODEL YVAA			TUBE REMOVAL CLEARANCE DIMENSIONS					
			A		B		C	
FRAME	EVAP	COND	IN.	MM	IN.	MM	IN.	MM
015	3	B	26	663	36	914	132	3353
016	5	B	26	663	36	914	132	3353
017	8	C	26	663	36	914	156	3962
018	3	A	26	663	36	914	144	3658
019	5	A	26	663	36	914	144	3658
019	8	B	26	663	36	914	132	3353
020	0	C	26	663	36	914	156	3962
021	3	A	26	663	36	914	144	3658
021	5	C	26	663	36	914	156	3962
021	8	C	26	663	36	914	156	3962
023	3	B	26	663	36	914	132	3353
024	5	C	26	663	36	914	156	3962
024	8	C	26	663	36	914	156	3962
026	3	B	26	663	36	914	132	3353
027	3	D	26	663	36	914	192	4877
027	5	E	26	663	36	914	192	4877
027	8	E	26	663	36	914	192	4877
029	5	E	26	663	36	914	192	4877
030	3	C	26	663	36	914	156	3962
030	5	C	26	663	36	914	156	3962
030	8	E	26	663	36	914	192	4877
031	8	E	26	663	36	914	192	4877
032	3	E	26	663	36	914	192	4877
033	3	C	26	663	36	914	156	3962
034	3	E	26	663	36	914	192	4877
034	5	E	26	663	36	914	192	4877
036	8	J	26	663	36	914	192	4877
037	3	F	26	663	36	914	144	3658
037	5	J	26	663	36	914	192	4877
039	8	J	26	663	36	914	192	4877
041	3	H	26	663	36	914	192	4877
042	5	H	26	663	36	914	144	3658
042	8	J	26	663	36	914	192	4877
044	3	G	26	663	36	914	144	3658
047	5	J	26	663	36	914	192	4877
048	3	G	26	663	36	914	144	3658
050	0	J	26	663	36	914	192	4877
052	3	J	26	663	36	914	192	4877

VIBRATION ISOLATORS

Optional sets of vibration isolators can be supplied loose with each unit. Using the Isolator tables shipped with the unit in the information pack, see *Isolator Selection and Mounting* under *SECTION 5 - TECHNICAL DATA* to identify each mount and its correct location on the unit.

Installation

Place each mount in its correct position and lower the unit carefully onto the mounts ensuring the mount engages in the mounting holes in the unit base frame.

On adjustable mounts, transfer the unit weight evenly to the springs by turning the mount adjusting nuts (located just below the top plate of the mount) counterclockwise to raise and clockwise to lower. This should be done two turns at a time until the top plates of all mounts are between 1/4 inch (6 mm) and 1/2 inch (12 mm) clear of top of their housing and the unit base is level.

SHIPPING BRACES

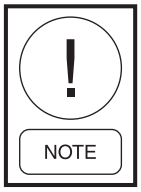
The chiller's modular design does not require shipping braces.

CHILLED LIQUID PIPING

General Requirements

The following piping recommendations are intended to ensure satisfactory operation of the unit(s). Failure to follow these recommendations could cause damage to the unit, or loss of performance, and may invalidate the warranty.

The maximum flow rate and pressure drop for the evaporator must not be exceeded at any time. See SECTION 5 - TECHNICAL DATA on page 73 for details.



The liquid must enter the evaporator at the inlet connection. The standard inlet connection for the evaporator is at the opposite end near control panel. A flow switch must be installed in the customer piping at the outlet of the evaporator and wired back to the control panel using shielded cable.

There should be a straight run of piping with at least 5 pipe diameters on either side. The flow switch should be wired to Terminals 2 and 13 on the 1TB terminal block. (See *Figure 79 on page 163* and *Figure 80 on page 164*)

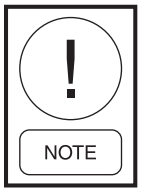
A flow switch is required to prevent damage to the evaporator caused by the unit operating without adequate liquid flow. It must be adjusted to assure it cuts out below the minimum published flow.

The flow switch used must have gold plated contacts for low voltage/current operation. Paddle type flow switches suitable for 150 PSIG (10 barg) working pressure and having a 1 inch N.P.T. connection can be obtained from Johnson Controls on request, as a unit accessory. Alternatively, a differential pressure switch fitted across an orifice plate may be used, preferably of the high/low limit type.

The chilled liquid pump(s) installed in the piping system(s) should discharge directly into the unit evaporator section of the system. The pump(s) may be controlled by the chiller controls or external to the unit. For details, see *Electrical Connection on page 68*.

Pipework and fittings must be separately supported to prevent any loading on the evaporator. Flexible connections are recommended which will also minimize transmission of vibrations to the building. Flexible connections must be used if the unit is mounted on anti-vibration mounts, as some movement of the unit can be expected in normal operation.

Piping and fittings immediately next to the evaporator should be readily de-mountable to enable cleaning before operation, and to facilitate visual inspection of the exchanger nozzles.



The evaporator must be protected by a strainer, preferably of 40 mesh, fitted as close as possible to the liquid inlet connection, and provided with a means of local isolation.

The evaporator must not be exposed to flushing velocities or debris released during flushing. It is recommended that a suitably sized bypass and valve arrangement is installed to allow flushing of the piping system. The bypass can be used during maintenance to isolate the heat exchanger without disrupting flow to other units.

Thermometer and pressure gauge connections should be provided on the inlet and outlet connections of each evaporator. Gauges and thermometers are not provided with the unit and are to be furnished by others.

Drain and air vent connections should be provided at all low and high points in the piping to permit drainage of the system and to vent any air in the pipes.

Liquid system lines at risk of freezing, due to low ambient temperatures should be protected using insulation and heater tape and/or a suitable glycol solution. The liquid pump(s) may also be used to ensure liquid is circulated when the ambient temperature approaches freezing point.

Insulation should also be installed around the evaporator nozzles. Heater tape of 21 Watts per meter under the insulation is recommended, supplied independently and controlled by an ambient temperature thermostat set to switch ON at approximately 4°F (2.2°C), above the freezing temperature of the chilled liquid.

Evaporator heater mats are installed under the insulation, and are powered from the chiller's control panel. In sub-freezing conditions, unless the evaporator has been drained or an appropriate water-to-glycol concentration is maintained, high voltage power to the chiller must be kept on to ensure the heater mats assist in evaporator freeze protection. If there is a potential for power loss, Johnson Controls recommends that the evaporator is drained or that water in the chilled water circuit be replaced with an appropriate water-to-glycol concentration.

Any debris left in the water piping between the strainer and evaporator could cause serious damage to the tubes in the evaporator and must be avoided. Be sure the piping is clean before connecting it to the evaporator. Keep evaporator nozzles and chilled liquid piping capped prior to installation to assure construction debris is not allowed to enter.

The installer/user must also ensure that the quality of the water in circulation is adequate, without any dissolved gases, which can cause oxidation of steel or copper parts within the evaporator.

WATER TREATMENT

The unit performance provided in the Design Guide is based on a fouling factor of 0.0001ft²/hr°F/Btu (0.018m2/hr°C/kW). Dirt, scale, grease and certain types of water treatment will adversely affect the heat exchanger surfaces and therefore the unit performance. Foreign matter in the water system(s) can increase the heat exchanger pressure drop, reducing the flow rate and causing potential damage to the heat exchanger tubes.

Aerated, brackish or salt water is not recommended for use in the water system(s). Johnson Controls recommends that a water treatment specialist should be consulted to determine whether the proposed water composition will adversely affect the evaporator materials of carbon steel and copper. The pH value of the water flowing through the evaporator must be kept in a range between 7 and 8.5.

PIPEWORK ARRANGEMENT

The following is a suggested piping arrangement for single unit installations.

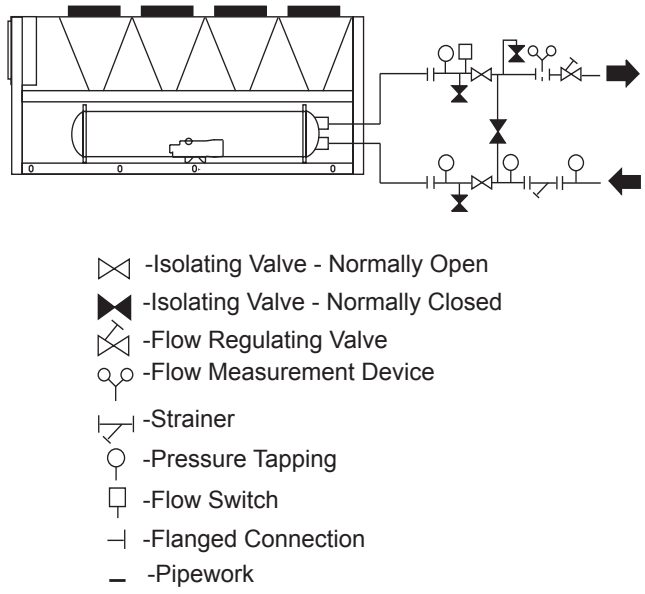


FIGURE 30 - PIPEWORK ARRANGEMENT

MINIMUM WATER VOLUME

It is good practice to include as much water volume as possible in a chilled water loop. This increases the thermal mass and “Flywheel” effect within the system (that is,. the more; the better) which in turn promotes stable water temperature control and increases reliability by reducing compressor cycling.

For air conditioning applications, a minimum of 3 gallons/ton is required. It is preferred that the gallon/ton ratio be within the 5 to 8 range. For process applications, a minimum of 6 gallons/ton ratio is required with preference towards a range of 7 to 11. Install a tank or increase pipe sizes to provide sufficient water volume.

LEAVING WATER TEMPERATURE OUT OF RANGE

The YVAA chiller line has a maximum leaving water temperature of 60°F (15.6°C). Where process applications require a chilled water temperature higher than what the chiller provides, a simple change in piping can resolve the problem. By using a mixture of chiller-cooled water and returning process water, the chilled water entering the process can be held at the desired temperature. A tank can also be used to meet high leaving water temperature requirements.

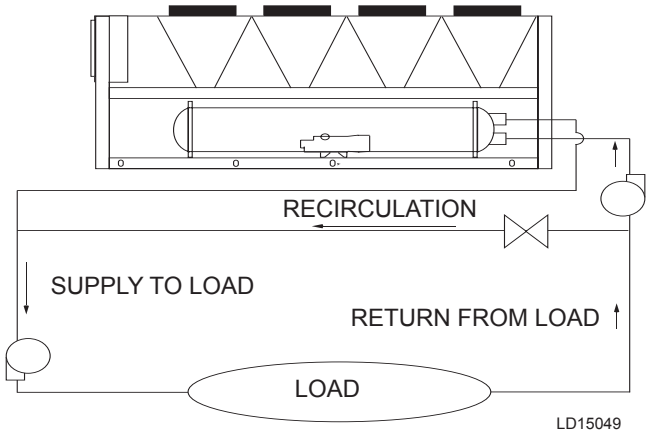


FIGURE 31 - LEAVING WATER TEMPERATURE OUT OF RANGE SUGGESTED LAYOUT

FLOW RATE OUT OF RANGE

Each YVAA evaporator has a minimum and maximum flow rate. Some process applications require a flow rate that is out of range for the evaporator.

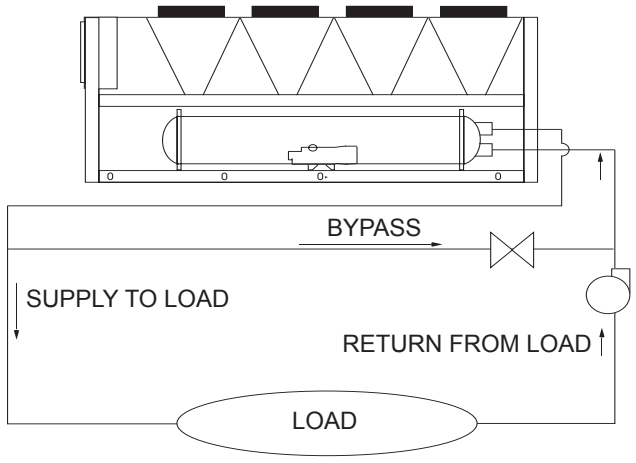


FIGURE 32 - SUGGESTED LAYOUT FOR APPLICATIONS WITH A FLOW RATE LESS THAN THE EVAPORATOR MINIMUM ALLOWABLE FLOW RATE

In those applications, a piping change can remove the problem. In applications where the required flow rate is less than the evaporator's minimum allowable flow rate, the chilled water can be recirculated to the chiller (See *Figure 32 on page 65*). In applications where the required flow rate is greater than the evaporator's maximum allowable flow rate, the chilled water can be recirculated to the load.

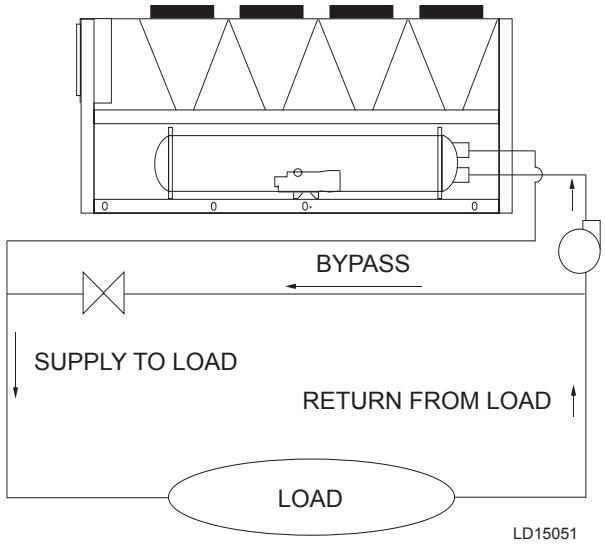


FIGURE 33 - SUGGESTED LAYOUT FOR APPLICATIONS WITH A FLOW RATE GREATER THAN THE EVAPORATOR MAXIMUM ALLOWABLE FLOW RATE

THERMAL STORAGE

Thermal storage is the practice of storing cooling energy during a period of little or no load and/or low energy costs for use during periods of high load and/or energy costs. Conventional cooling systems produce cooling when it is needed which is common during times of peak demand.

Thermal storage allows generation of cooling capacity to occur during off-peak periods and store that capacity to meet future cooling requirements. Using thermal storage can result in smaller equipment sizes, thereby reducing capital cost, and also can result in significant energy cost savings

The YVAA has special control logic to be able to produce chilled leaving brine temperatures below 40°F (4.4°C), so as to supply a storage tank with chilled liquid during times of low demand. YVAA chillers selected for thermal storage operation can also be selected to efficiently provide chilled fluid at nominal cooling loads.

VARIABLE PRIMARY FLOW

Johnson Controls recommends a maximum 10% per minute flow rate of change, based on design flow, for variable primary flow applications. Provide 8 to 10 gallons per chiller ton (8.6 to 10.8 liter per cooling KW) system water volume. Insufficient system volume and rapid flow changes can cause control problems or can even cause chiller shutdowns. There are many other design issues to evaluate with variable primary flow systems. Consult your Johnson Controls Sales Office for more information about successfully applying YVAA chillers.

CONNECTION TYPES AND SIZES

For connection sizes relevant to individual models see *SECTION 5 - TECHNICAL DATA*.

EVAPORATOR CONNECTIONS

Standard chilled liquid connections on evaporators are of the Victaulic Groove type for ASME and PED marked units and Flange type for GB marked units (see *Figure 35 on page 67* for flange dimensions on GB marked vessels).

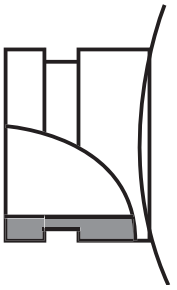


FIGURE 34 - VICTAULIC GROOVE

TABLE 4 - EVAPORATOR CONNECTIONS DIMENSIONS

FRAME	COND.	EVAP.	VICTAULIC CONNECTIONS SIZE	NOMINAL DIAMETER	FLANGE DIMENSIONS (GB ONLY) IN MM*							QTY
					B	C	D	K	L	D	N	
015	3	B	6"	DN150	170.5	27	280	241.5	22	216	8	2
016	5	B	6"	DN150	170.5	27	280	241.5	22	216	8	2
017	8	C	6"	DN150	170.5	27	280	241.5	22	216	8	2
018	3	A	6"	DN150	170.5	27	280	241.5	22	216	8	2
019	5	A	6"	DN150	170.5	27	280	241.5	22	216	8	2
019	8	B	6"	DN150	170.5	27	280	241.5	22	216	8	2
020	0	C	6"	DN150	170.5	27	280	241.5	22	216	8	2
021	3	A	6"	DN150	170.5	27	280	241.5	22	216	8	2
021	5	C	6"	DN150	170.5	27	280	241.5	22	216	8	2
021	8	C	6"	DN150	170.5	27	280	241.5	22	216	8	2
023	3	B	6"	DN150	170.5	27	280	241.5	22	216	8	2
024	5	C	6"	DN150	170.5	27	280	241.5	22	216	8	2
024	8	C	6"	DN150	170.5	27	280	241.5	22	216	8	2
026	3	B	6"	DN150	170.5	27	280	241.5	22	216	8	2
027	3	D	6"	DN150	170.5	27	280	241.5	22	216	8	2
027	5	E	8"	DN200	221.5	27	345	298.5	22	270	8	2
027	8	E	8"	DN200	221.5	27	345	298.5	22	270	8	2
029	5	E	8"	DN200	221.5	27	345	298.5	22	270	8	2
030	3	C	6"	DN150	170.5	27	280	241.5	22	216	8	2
030	5	C	6"	DN150	170.5	27	280	241.5	22	216	8	2
030	8	E	8"	DN200	221.5	27	345	298.5	22	270	8	2
031	8	E	8"	DN200	221.5	27	345	298.5	22	270	8	2
032	3	E	8"	DN200	221.5	27	345	298.5	22	270	8	2
033	3	C	6"	DN150	170.5	27	280	241.5	22	216	8	2

TABLE 4 - EVAPORATOR CONNECTIONS DIMENSIONS (CONT'D)

FRAME	COND.	EVAP.	VICTAULIC CONNECTIONS SIZE	NOMINAL DIAMETER	FLANGE DIMENSIONS (GB ONLY) IN MM*							QTY
					B	C	D	K	L	D	N	
034	3	E	8"	DN200	221.5	27	345	298.5	22	270	8	2
034	5	E	8"	DN200	221.5	27	345	298.5	22	270	8	2
036	8	J	8"	DN200	221.5	27	345	298.5	22	270	8	2
037	3	F	8"	DN200	221.5	27	345	298.5	22	270	8	2
037	5	J	8"	DN200	221.5	27	345	298.5	22	270	8	2
039	8	J	8"	DN200	221.5	27	345	298.5	22	270	8	2
041	3	H	8"	DN200	221.5	27	345	298.5	22	270	8	2
042	5	H	8"	DN200	221.5	27	345	298.5	22	270	8	2
042	8	J	8"	DN200	221.5	27	345	298.5	22	270	8	2
044	3	G	8"	DN200	221.5	27	345	298.5	22	270	8	2
047	5	J	8"	DN200	221.5	27	345	298.5	22	270	8	2
048	3	G	8"	DN200	221.5	27	345	298.5	22	270	8	2
050	0	J	8"	DN200	221.5	27	345	298.5	22	270	8	2
052	3	J	8"	DN200	221.5	27	345	298.5	22	270	8	2

* Reference *Figure 34* for flange dimensions.

Option Flanges

One of the two types of flanges may be fitted depending upon the customer or local pressure vessel code requirements.

These are Victaulic-Adapter flanges that are normally supplied loose, or weld flanges which may be supplied loose or ready-fitted. Victaulic-Adapter and weld flange dimensions are to ISO 7005 - NP10.

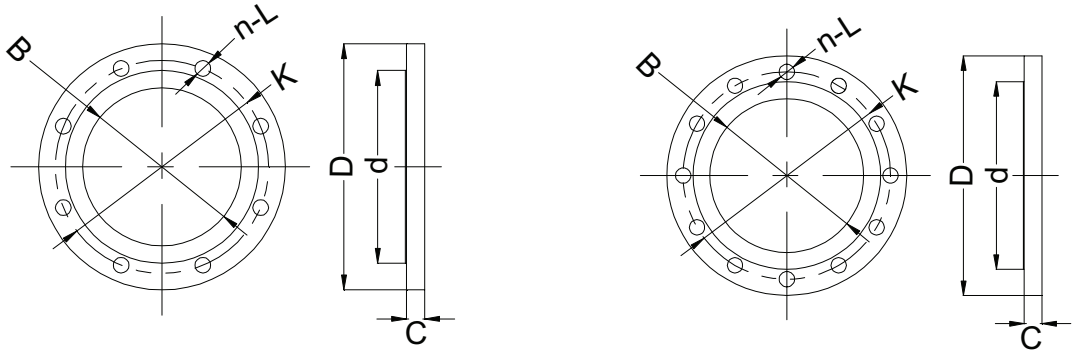


FIGURE 35 - FLANGE FOR GB VESSELS

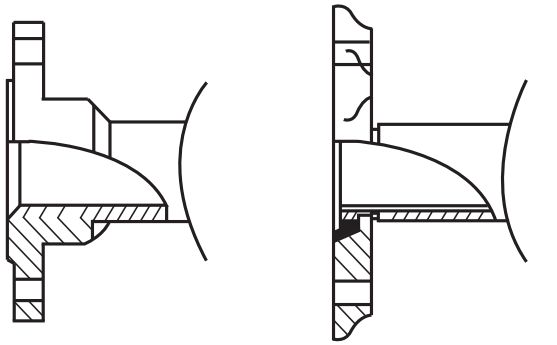


FIGURE 36 - FLANGE ATTACHMENT

REFRIGERANT RELIEF VALVE PIPING

Refrigerant relief valves protect the evaporator from internal refrigerant overpressure. A pressure relief valve is mounted on each of the main refrigerant lines connecting the evaporator to the compressors.

A piece of pipe is fitted to each valve and directed so that when the valve is activated the release of high pressure gas and liquid cannot be of a danger or a cause for an injury. For indoor installations (not recommended), pressure relief valves should be piped to the exterior of the building.

Ensure to maintain recommended and sufficient diameter size of any piping attached to a relief valve to avoid resistance to the operation of the valve. Unless, otherwise specified by local regulations. Internal diameter depends on the length of pipe required and is given by the following formula:

$D^5 = 1.447 \times L$

Where:

- D = minimum pipe internal diameter in cm
- L = length of pipe in meters

If relief piping is common to more than one valve, its cross-sectional area must be at least the total required by each valve. Valve types should not be mixed on a common pipe. Precautions should be taken to ensure the outlets of relief valves or relief valve vent pipes remain clear of obstructions at all times.

ELECTRICAL CONNECTION

The following connection recommendations are intended to ensure safe and satisfactory operation of the unit. Failure to follow these recommendations could harm people or damage the unit, and may invalidate the warranty.

No additional controls (relays, and so on) should be mounted in the control panel. Power and control wiring not connected to the control panel should not be run through the control panel. If these precautions are not followed it could lead to a risk of electrocution. In addition, electrical noise could cause malfunctions or damage the unit and its controls.

After power wiring connection, do not switch on mains power to the unit. Some internal components are live when the mains are switched on and this must only be done by "Authorized" persons familiar with starting, operating, and troubleshooting this type of equipment.

POWER WIRING

All electrical wiring should be carried out in accordance with local regulations. Route properly sized cables to cable entries on the unit.

In accordance with local codes, NEC codes, U.L. and C.E. standards, it is the user's responsibility to install over current protection devices between the supply conductors and the power supply terminals on the unit.

To ensure that no eddy currents are set up in the power panel, the cables forming the 3-phase power supply must enter via the same cable entry.

All sources of supply to the unit must be taken via a common point of isolation (not supplied by Johnson Controls).

It is recommended to use only copper power wiring to supply power to the chiller, to avoid safety and reliability issues resulting from failure of chiller power connections. Aluminum wiring is not recommended due to thermal characteristics that may cause loose terminations resulting from the contraction and expansion of the wiring. Aluminum oxide may also build up at the termination causing hot spots and eventual failure. If aluminum wiring is used to supply power to the chiller, AL-CU compression fittings should be used to transition from aluminum to copper. This transition should be done in an external box separate to the power panel. Copper conductors can then be run from the box to the chiller.

Caulk power and control wiring conduit entering the power panel to assure moist air from the building cannot enter the panel.

POWER SUPPLY WIRING

Units require only one 3-phase supply, plus earth ground. Connect the 3-phase supplies to the terminal block or optional circuit breaker located in the panel using lug sizes detailed in this section (See *Figure 74 on page 158*, *Figure 78 on page 162*, *and Figure 79 on page 163*).

Connect a ground wire from the chiller panel ground lug to the incoming line supply ground.

115VAC CONTROL SUPPLY TRANSFORMER

A 3-wire high voltage to 115VAC supply transformer is standard in the chiller. This transformer is mounted in the cabinet and steps down the high voltage supply to 115VAC to be used by the controls, VSD, feed and drain valve controller, valves, solenoids, heaters, and so on.

The high voltage for the transformer primary is taken from the chiller input. Fusing is provided for the transformer.

Removing high voltage power to the chiller will remove the 115VAC supply voltage to the control panel circuitry and the evaporator heater. In cold weather, this could cause serious damage to the chiller due to evaporator freeze-up. Do not remove power unless alternate means are taken to ensure operation of the evaporator heater.

CONTROL PANEL WIRING

All control wiring utilizing contact closures to the control panel terminal block is nominal 115VAC and must be run in shielded cable, with the shield grounded at the panel end only, and run in water tight conduit. Run shielded cable separately from high voltage power cable to avoid electrical noise pick-up. Use the control panel cable entry to avoid the power cables.

Voltage free contacts connected to the panel must be suitable for 115VAC-10ma (gold contacts recommended). If the voltage free contacts form part of a relay or contactor, the coil of the device must be suppressed using a standard R/C suppressor. The above precautions must be taken to avoid electrical noise, which could cause a malfunction or damage to the unit and its controls.

VOLTS FREE CONTACTS

Chilled Liquid Pump Starter

Terminals 23 and 24 on 1TB close to start the chilled liquid pump. This contact can be used as a master start/stop for the pump in conjunction with the daily start/stop schedule. Cycle the pumps from the unit panel if the unit will be operational or shut-down during sub-freezing conditions. See the *Evaporator Pump Control on Page 193* for more information on testing the pumps.

Run Contact

Terminals 21 and 22 on 1TB close to indicate that a system is running.

Alarm Contacts

Each system has a single voltage-free contact, which will operate to signal an alarm condition whenever any system locks out, or there is a power failure. To obtain system alarm signal, connect the alarm circuit to volt free Terminals 25 & 26 (Sys 1), Terminals 27 and 28 (Sys 2) of 1TB.

SYSTEM INPUTS

Flow Switch

A chilled liquid flow switch of suitable type MUST be connected between Terminals 2 and 13 of 1TB to provide protection against loss of liquid flow, which will cause evaporator freeze-up if the chiller is permitted to run. The flow switch circuitry is a 115VAC circuit. Contacts must be rated for low current (5mA). Gold contacts should be used.

Remote Run / Stop

A Remote Run/Stop input is available for each systems. These inputs require a dry contact to start and stop the system. System 1 remote dry contacts are connected between Terminals 2 and 15 of 1TB and System 2 dry contacts are connected between Terminals 2 and 16 of 1TB. If remote start/stop is not utilized, a jumper must be paced across the terminals to allow the system to run. The remote run/stop circuitry is a 115VAC circuit. Contacts must be rated for low current (5mA). Gold contacts should be used.

Remote Print

Closure of suitable contacts connected to Terminals 2 and 14 of 1TB will cause a hard copy printout of Operating Data/Fault History to be made if an optional printer is connected to the RS-232 port. The remote print circuitry is a 115VAC circuit. Contacts must be rated for low current (5mA). Gold contacts should be used.

Optional Remote Setpoint Offset – Temperature

A voltage signal connected to Terminals 17 and 18 of 1TB will provide a remote offset function of the chilled liquid setpoint, if required.

Optional Remote Setpoint Offset – Current

A voltage signal connected to Terminals 19 and 20 of 1TB will provide a remote setting of current limit setpoint, if required.

Optional Remote Setpoint Offset – Sound Limiting

A voltage signal connected to Terminals 40 and 41 of 1TB will provide remote setting of sound limit setpoint, if required.

DUCTWORK CONNECTION

The following ductwork recommendations are intended to ensure satisfactory operation of the unit. Failure to follow these recommendations could cause damage to the unit, or loss of performance, and may invalidate the warranty.

When ducting is to be fitted to the fan discharge it is recommended that the duct should be the same cross-sectional area as the fan outlet and straight for at least three feet (1 meter) to obtain static regain from the fan. Ductwork should be suspended with flexible hangers to prevent noise and vibration being transmitted to the structure. A flexible joint is also recommended between the duct attached to the fan and the next section for the same reason. Flexible connectors should not be allowed to concertina.

The unit is not designed to take structural loading. No significant amount of weight should be allowed to rest on the fan outlet flange, deck assemblies or condenser coil module. No more than 3 feet (1 meter) of light construction ductwork should be supported by the unit. Where cross winds may occur, any ductwork must be supported to prevent side loading on the unit.

If the ducts from two or more fans are to be combined into a common duct, back-flow dampers should be fitted in the individual fan ducts. This will prevent re-circulation of air when only one of the fans is running.

Units are supplied with outlet guards for safety and to prevent damage to the fan blades. If these guards are removed to fit ductwork, adequate alternative precautions must be taken to ensure persons cannot be harmed or put at risk from rotating fan blades.

REMOVING WATER/GLYCOL FROM THE EVAPORATOR

If the chiller is equipped with a -20°F evaporator freeze protection option, which incorporates immersion heaters, remove power from the chiller before the evaporator is drained to assure the heaters are not damaged. Failure to remove power will cause the evaporator immersion heaters to fail.

BEFORE APPLYING POWER TO THE CHILLER, ASSURE THE CHILLED LIQUID SYSTEM IS FILLED

DO NOT apply power to the chiller unless the system is filled with water or glycol. If the chiller is equipped with the -20°F option, applying power to an empty chilled liquid system will cause the evaporator immersion heaters to fail.

EVAPORATOR FREEZE DAMAGE

Power must remain on the chiller whenever the ambient temperature drops below 32°F with water in the evaporator to avoid evaporator damage. To avoid damage, assure the correct heater option for 0°F minimum ambient or -20°F minimum ambient temperature is installed, based on the lowest expected ambient temperature at the chiller location.

If glycol is installed in the evaporator, the glycol concentration must assure that the freeze point is below the lowest expected ambient temperature at the chiller location to avoid evaporator damage.

REMOTE EVAPORATOR PIPING

When remotely piped evaporators, heat recovery or other applications are encountered, the line sizes that are used in the chiller and listed in *Table 5 on page 71 below* may be useful when planning for piping connections.

TABLE 5 - REMOTE EVAPORATOR PIPING

COMPRESSOR SIZE	DISCHARGE LINE PIPE SIZE	SUCTION LINE PIPE SIZE	ECONOMIZER LINE PIPE SIZE	LIQUID LINE PIPE SIZE
124mm (MTS 24)	2-1/8”	5”	1-5/8”	1-5/8”
136mm (MTS 36)	3-1/8”	5”	1-5/8”	1-5/8”
145mm (MTS 45)	3-1/8”	5”	1-5/8”	1-5/8”
151mm (MTS 51)	3-1/8”	5”	1-5/8”	1-5/8”
170mm (MTS 70)	4-1/8”	6”	2-1/8”	2-1/8”

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SECTION 5 - TECHNICAL DATA

EVAPORATOR PRESSURE DROP

The evaporator is designed in accordance with ARI-590-92 which allows for an increase in pressure drop of up to 15% above the design value shown on *Figure 37 on page 73* and *Figure 39 on page 74*. Debris in the water may also cause additional pressure drop.

NOTE

Excessive flow above the maximum GPM will damage the evaporator.

NOTE

See Table 12 on page 101 to 114 to determine evaporator/frame size and to find the evaporator line to use.

5

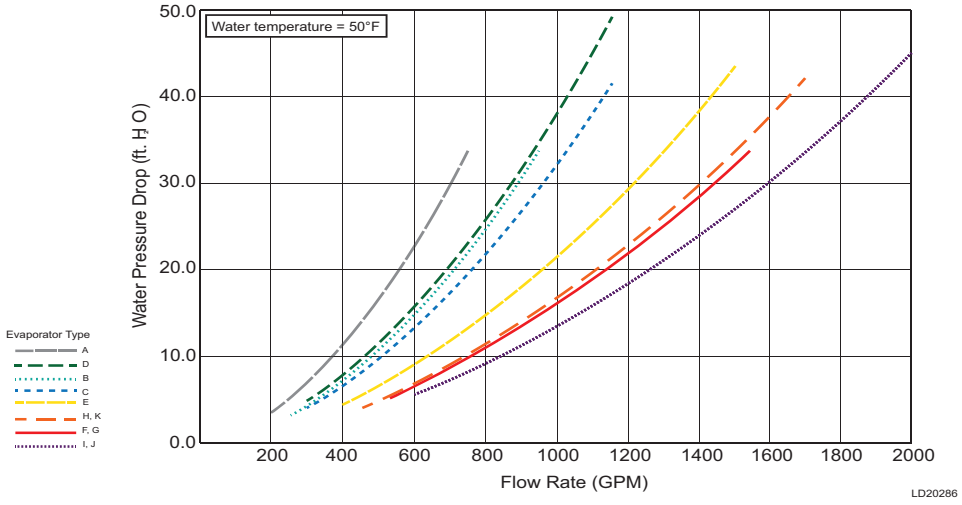

FIGURE 37 - TWO PASS WATER PRESSURE DROP, ENGLISH UNITS

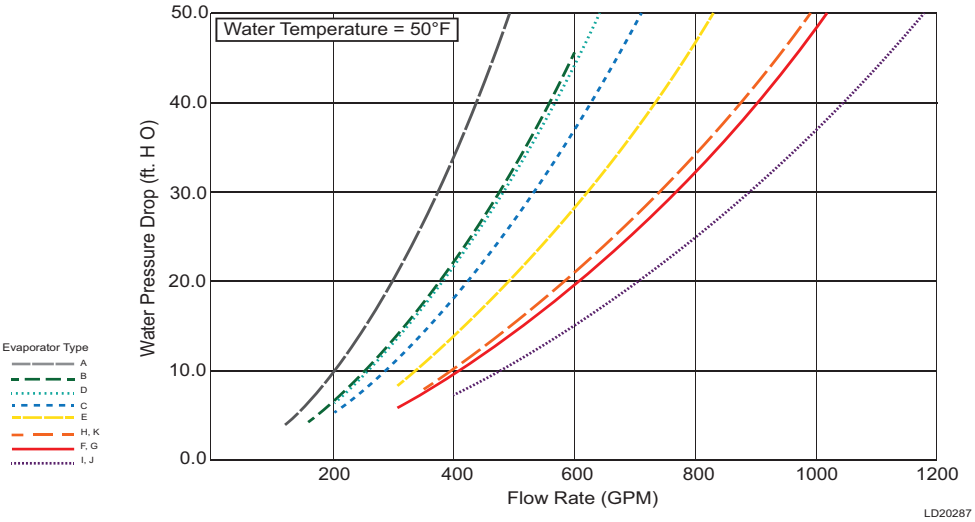

FIGURE 38 - THREE PASS WATER PRESSURE DROP, ENGLISH UNITS

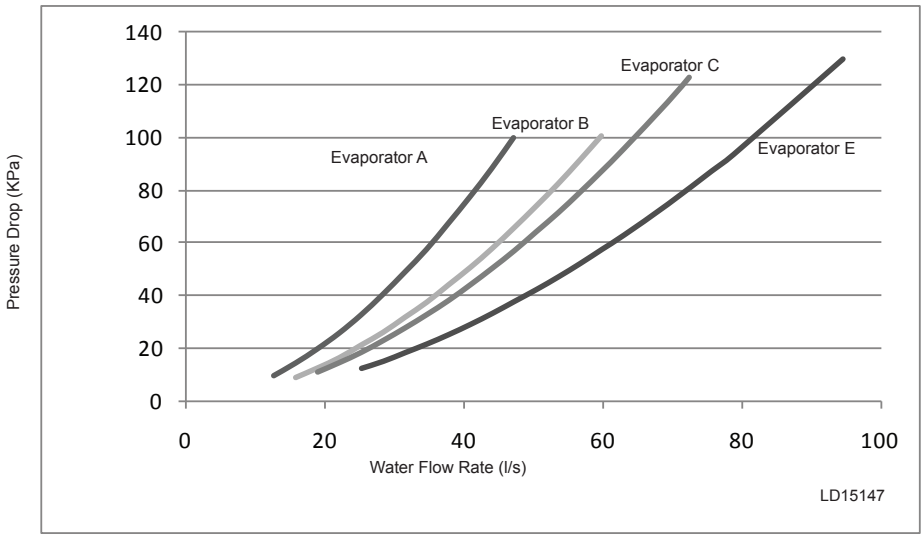

FIGURE 39 - TWO PASS WATER PRESSURE DROP, SI UNITS

Glycol Correction Factors

When using glycol solutions, pressure drops are higher than with water (see correction factors to be applied when using glycol solutions). Special care must be taken not to exceed the maximum flow rate allowed.

A. = Correction Factor

B. = Mean Temperature through Evaporator

C. = Concentration WIW

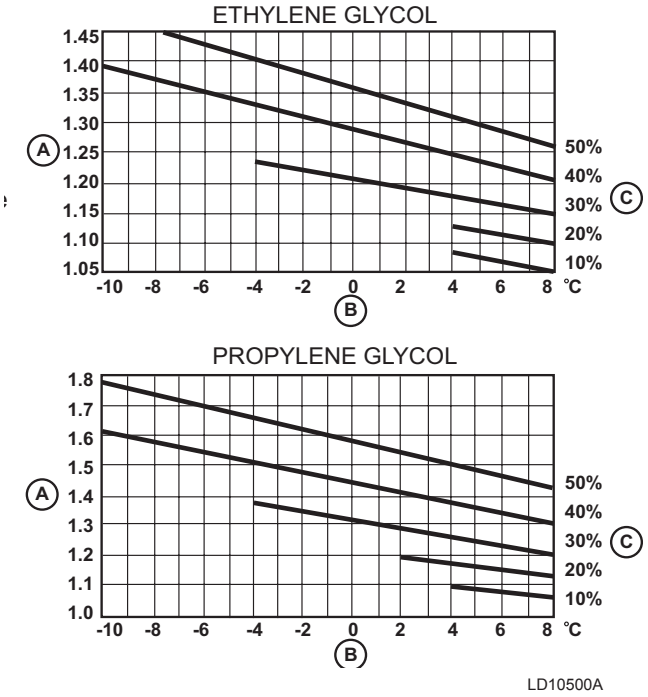

FIGURE 40 - GLYCOL CORRECTION FACTORS

REMOVING WATER/GLYCOL FROM THE EVAPORATOR

CAUTION

If the chiller is equipped with a -20°F evaporator freeze protection option, which incorporates immersion heaters, power must be removed from the chiller before the evaporator is drained to assure the heaters are not damaged. Failure to remove power will cause the evaporator immersion heaters to fail.

EVAPORATOR FREEZE DAMAGE

CAUTION

Power must remain on the chiller whenever the ambient temperature drops below 32°F with water in the evaporator to avoid evaporator damage. To avoid damage, assure the correct heater option for 0°F minimum ambient or -20°F minimum ambient temperature is installed, based on the lowest expected ambient temperature at the chiller location.

BEFORE APPLYING POWER TO THE CHILLER, ASSURE THE CHILLED LIQUID SYSTEM IS FILLED

CAUTION

DO NOT apply power to the chiller unless the system is filled with water or glycol. If the chiller is equipped with the -20°F option, applying power to an empty chilled liquid system will cause the evaporator immersion heaters to fail.

TABLE 6 - WATER TEMPERATURE AND FLOWS

MODEL NUMBER YVAA	LEAVING WATER TEMPERATURE		EVAPORATOR3 FLOW		AIR ON CONDENSER	
	MIN.1	MAX.2	MIN.4	MAX.4	MIN.	MAX
0153B	40°F (4.4°C)	60°F (15.6°C)	250 (15.8)	950 (59.9)	0°F (-17.8°C)	125°F (51.7°C)
0165B	40°F (4.4°C)	60°F (15.6°C)	250 (15.8)	950 (59.9)	0°F (-17.8°C)	125°F (51.7°C)
0178C	40°F (4.4°C)	60°F (15.6°C)	300 (18.9)	1150 (72.6)	0°F (-17.8°C)	125°F (51.7°C)
0183A	40°F (4.4°C)	60°F (15.6°C)	200 (12.6)	750 (47.3)	0°F (-17.8°C)	125°F (51.7°C)
0195A	40°F (4.4°C)	60°F (15.6°C)	200 (12.6)	750 (47.3)	0°F (-17.8°C)	125°F (51.7°C)
0198B	40°F (4.4°C)	60°F (15.6°C)	250 (15.8)	950 (59.9)	0°F (-17.8°C)	125°F (51.7°C)
0200C	40°F (4.4°C)	60°F (15.6°C)	300 (18.9)	1150 (72.6)	0°F (-17.8°C)	125°F (51.7°C)
0213A	40°F (4.4°C)	60°F (15.6°C)	200 (12.6)	750 (47.3)	0°F (-17.8°C)	125°F (51.7°C)
0215C	40°F (4.4°C)	60°F (15.6°C)	300 (18.9)	1150 (72.6)	0°F (-17.8°C)	125°F (51.7°C)
0218C	40°F (4.4°C)	60°F (15.6°C)	300 (18.9)	1150 (72.6)	0°F (-17.8°C)	125°F (51.7°C)
0233B	40°F (4.4°C)	60°F (15.6°C)	250 (15.8)	950 (59.9)	0°F (-17.8°C)	125°F (51.7°C)
0245C	40°F (4.4°C)	60°F (15.6°C)	300 (18.9)	1150 (72.6)	0°F (-17.8°C)	125°F (51.7°C)
0248C	40°F (4.4°C)	60°F (15.6°C)	300 (18.9)	1150 (72.6)	0°F (-17.8°C)	125°F (51.7°C)
0263B	40°F (4.4°C)	60°F (15.6°C)	250 (15.8)	950 (59.9)	0°F (-17.8°C)	125°F (51.7°C)
0273D	40°F (4.4°C)	60°F (15.6°C)	300 (18.9)	1150 (72.6)	0°F (-17.8°C)	125°F (51.7°C)
0275E	40°F (4.4°C)	60°F (15.6°C)	400 (25.2)	1500 (94.7)	0°F (-17.8°C)	125°F (51.7°C)
0278E	40°F (4.4°C)	60°F (15.6°C)	400 (25.2)	1500 (94.7)	0°F (-17.8°C)	125°F (51.7°C)
0295E	40°F (4.4°C)	60°F (15.6°C)	400 (25.2)	1500 (94.7)	0°F (-17.8°C)	125°F (51.7°C)
0303C	40°F (4.4°C)	60°F (15.6°C)	300 (18.9)	1150 (72.6)	0°F (-17.8°C)	125°F (51.7°C)
0305C	40°F (4.4°C)	60°F (15.6°C)	300 (18.9)	1150 (72.6)	0°F (-17.8°C)	125°F (51.7°C)
0308E	40°F (4.4°C)	60°F (15.6°C)	400 (25.2)	1500 (94.7)	0°F (-17.8°C)	125°F (51.7°C)
0318E	40°F (4.4°C)	60°F (15.6°C)	400 (25.2)	1500 (94.7)	0°F (-17.8°C)	125°F (51.7°C)
0323E	40°F (4.4°C)	60°F (15.6°C)	400 (25.2)	1500 (94.7)	0°F (-17.8°C)	125°F (51.7°C)
0333C	40°F (4.4°C)	60°F (15.6°C)	300 (18.9)	1150 (72.6)	0°F (-17.8°C)	125°F (51.7°C)
0343E	40°F (4.4°C)	60°F (15.6°C)	400 (25.2)	1500 (94.7)	0°F (-17.8°C)	125°F (51.7°C)
0345E	40°F (4.4°C)	60°F (15.6°C)	400 (25.2)	1500 (94.7)	0°F (-17.8°C)	125°F (51.7°C)
0368J	40°F (4.4°C)	60°F (15.6°C)	550 (34.1)	1880 (118.1)	0°F (-17.8°C)	125°F (51.7°C)
0373F	40°F (4.4°C)	60°F (15.6°C)	460 (29)	1540 (97)	0°F (-17.8°C)	125°F (51.7°C)
0375J	40°F (4.4°C)	60°F (15.6°C)	550 (34.1)	1880 (118.1)	0°F (-17.8°C)	125°F (51.7°C)
0398J	40°F (4.4°C)	60°F (15.6°C)	550 (34.1)	1880 (118.1)	0°F (-17.8°C)	125°F (51.7°C)
0413H	40°F (4.4°C)	60°F (15.6°C)	520 (33)	1700 (107)	0°F (-17.8°C)	125°F (51.7°C)
0425H	40°F (4.4°C)	60°F (15.6°C)	520 (33)	1700	0°F (-17.8°C)	125°F (51.7°C)
0428J	40°F (4.4°C)	60°F (15.6°C)	550 (34.1)	1880 (118.1)	0°F (-17.8°C)	125°F (51.7°C)
0443G	40°F (4.4°C)	60°F (15.6°C)	460 (29)	1540 (97)	0°F (-17.8°C)	125°F (51.7°C)
0475J	40°F (4.4°C)	60°F (15.6°C)	550 (34.1)	1880 (118.1)	0°F (-17.8°C)	125°F (51.7°C)
0483G	40°F (4.4°C)	60°F (15.6°C)	460 (29)	1540 (97)	0°F (-17.8°C)	125°F (51.7°C)
0500J	40°F (4.4°C)	60°F (15.6°C)	550 (34.1)	1880 (118.1)	0°F (-17.8°C)	125°F (51.7°C)
0523J	40°F (4.4°C)	60°F (15.6°C)	550 (34.1)	1880 (118.1)	0°F (-17.8°C)	125°F (51.7°C)

NOTES:

1. For leaving brine temperature below 40°F (4.4°C), contact your nearest Johnson Controls office for application requirements.
2. For leaving water temperature higher than 60°F (15.6°C), contact the nearest Johnson Controls office for application guidelines.
3. The evaporator is protected against freezing to 0°F (-17.8°C) with an electric heater as standard. An optional immersion heater is available for protection to -20°F (-28.8°C).
4. Flows are in gallons per minute (liters per second).
5. Data not available for Models YVAA0295E thru YVAA0345E.

The data shown in this table is applicable to selected typical configurations. Other configurations are available through our configuration/selection software. Please contact your nearest Johnson Controls Sales Office for the chiller configuration that best matches your specific needs.

TABLE 7 - PHYSICAL DATA - MICROCHANNEL COIL

UNIT FRAME	15	16	17	18	19	19	20	21	21
CONDENSER CODE	**3**	**5**	**8**	**3**	**5**	**8**	**0**	**3**	**5**
EVAPORATOR CODE	**B**	**B**	**C**	**A**	**A**	**B**	**C**	**A**	**C**
GENERAL UNIT DATA									
Number of Independent Refrigerant Circuits	2								
Refrigerant Charge, R-134a or R-513A, Ckt.-1/Ckt.-2, lbs (kg)	175/175 (79/79)	190/190 (86/86)	225/225 (102/102)	175/155 (79/70)	190/170 (86/77)	220/195 (100/88)	205/205 (93/93)	175/175 (79/79)	225/225 (102/102)
Oil Charge, Ckt.-1/Ckt.-2, gal (liters)	2.1/2.0 (8.0/7.7)	2.2/2.2 (8.5/8.5)	2.5/2.5 (9.3/9.3)	2.4/2.0 (9.2/7.7)	2.6/2.1 (9.7/8.0)	2.7/2.2 (10.4/ 8.5)	2.6/2.6 (10.0/ 10.0)	2.5/2.5 (9.3/9.3)	2.8/2.8 (10.5/ 10.5)
Minimum Load (%)	10%								
Unit shipping weight, lbs (kg) 1	11518 (5224)	12084 (5481)	14668 (6653)	12019 (5452)	12781 (5797)	13776 (6248)	13392 (6074)	12859 (5833)	14915 (6765)
Operating Weight, lbs (kg) 1	11979 (5434)	12546 (5691)	15432 (7000)	12460 (5652)	13222 (5997)	14237 (6458)	14155 (6421)	13300 (6033)	15678 (7111)
Chassis Dimensions - Length, inches (mm)	203.3 (5163)	247.2 (6280)	291.2 (7397)	247 (6274)	291.2 (7397)	335.2 (8514)	226 (5741)	291.2 (7397)	291.2 (7397)
Chassis Dimensions - Width, inches (mm)	88.3 (2242)	88.3 (2242)	88.3 (2242)	88.3 (2242)	88.3 (2242)	88.3 (2242)	88.3 (2242)	88.3 (2242)	88.3 (2242)
Chassis Dimensions - Height, inches (mm)	94.6 (2403)	94.6 (2403)	94.6 (2403)	94.6 (2403)	94.6 (2403)	94.6 (2403)	94.6 (2403)	94.6 (2403)	94.6 (2403)
COMPRESSORS, SEMI-HERMETIC SCREW									
Qty per Chiller	2								
CONDENSER FANS									
Number Ckt-1/Ckt-2	4/4	5/5	6/6	6/4	7/5	8/6	4/4	6/6	6/6
Air on Condenser (Min/Max), °F (°C)	0/125 (-17.8/51.7)								
EVAPORATOR, SHELL AND TUBE HYBRID FALLING FILM 2									
Water Volume, gal (liters)	58 (220)	58 (220)	71 (269)	48 (182)	48 (182)	58 (220)	71 (269)	48 (182)	71 (269)
Leaving Water Temperature (Min/ Max), °F (°C) 3	40/60 (4.4/15.6)								
Maximum Water Side Pressure, psig (barg)	150 (10.3)								
Maximum Refrigerant Side Pressure, psig (barg)	235 (16.2)								
Evap Drain Connection, inches (mm)	3/4								
Minimum Chilled Water Flow Rate, gpm (l/sec)	250 (15.8)	250 (15.8)	300 (18.9)	200 (12.6)	200 (12.6)	250 (15.8)	300 (18.9)	200 (12.6)	300 (18.9)
Maximum Chilled Water Flow Rate, gpm (l/sec)	950 (59.9)	950 (59.9)	1150 (72.6)	750 (47.3)	750 (47.3)	950 (59.9)	1150 (72.6)	750 (47.3)	1150 (72.6)
Inlet and Outlet Water Connections, in	6	6	6	6	6	6	6	6	6

NOTES:

1. Shipping and operating weights shown are for base unit; selected options may add weight to unit. Contact your nearest Johnson Controls Sales office for weight data.
2. For leaving liquid temperature below 40°F(4.4°C) or above 60°F (15.6°C), contact your nearest Johnson Controls Sales Office for application requirements.

TABLE 7 - PHYSICAL DATA - MICROCHANNEL COIL (CONT'D)

UNIT FRAME	21	23	24	24	26	27	27	27	29	30
CONDENSER CODE	8	3	5	8	3	3	5	8	5	3
EVAPORATOR CODE	C	B	C	C	B	D	E	E	E	C
GENERAL UNIT DATA										
Number of Independent Refrigerant Circuits	2									
Refrigerant Charge, R-134a or R-513A, Ckt.-1/Ckt.-2, lbs (kg)	240/240 (109/109)	210/190 (95/86)	250/225 (113/102)	250/250 (113/113)	210/210 (95/95)	265/265 (120/120)	265/265 (120/120)	270/270 (122/122)	310/265 (141/120)	290/245 (132/111)
Oil Charge, Ckt.-1/Ckt.-2, gal (liters)	2.9/2.9 (10.8/ 10.8)	2.7/2.6 (10.1/ 9.7)	2.9/2.8 (11.1/ 10.5)	2.9/2.9 (11.1/ 11.1)	2.7/2.7 (10.1/ 10.1)	3.0/3.0 (11.4/ 11.4)	3.0/3.0 (11.4/ 11.4)	3.1/3.1 (11.6/ 11.6)	3.8/3.1 (14.4/ 11.7)	3.7/3.0 (14.0/ 11.4)
Minimum Load (%)	10%									
Unit shipping weight, lbs (kg) 1	15677 (7111)	13288 (6027)	15873 (7200)	16634 (7545)	14076 (6385)	16275 (7382)	16991 (7707)	17753 (8052)	18205 (8258)	17114 (7763)
Operating Weight, lbs (kg) 1	16440 (7457)	13750 (6237)	16636 (7546)	17398 (7891)	14538 (6594)	17103 (7758)	17851 (8097)	18612 (8442)	19065 (8648)	17877 (8109)
Chassis Dimensions - Length, inches (mm)	335.2 (8514)	291.2 (7397)	335.2 (8514)	379.1 (9631)	335.2 (8514)	335.2 (8514)	335.2 (8514)	379.2 (9631)	379.2 (9631)	379.2 (9631)
Chassis Dimensions - Width, inches (mm)	88.3 (2242)	88.3 (2242)	88.3 (2242)	88.3 (2242)	88.3 (2242)	88.3 (2242)	88.3 (2242)	88.3 (2242)	88.3 (2242)	88.3 (2242)
Chassis Dimensions - Height, inches (mm)	94.6 (2403)	94.6 (2403)	94.6 (2403)	94.6 (2403)	94.6 (2403)	94.6 (2403)	94.6 (2403)	94.6 (2403)	94.6 (2403)	94.6 (2403)
COMPRESSORS, SEMI-HERMETIC SCREW										
Qty per Chiller	2									
CONDENSER FANS										
Number Ckt-1/Ckt-2	7/7	7/5	8/6	8/8	7/7	7/7	7/7	8/8	9/7	9/7
Air on Condenser (Min/Max), °F (°C)	0/125									
EVAPORATOR, SHELL AND TUBE HYBRID FALLING FILM 2										
Water Volume, gal (liters)	71(269)	58(220)	71(269)	71(269)	58(220)	82(310)	113(428)	113(428)	113(428)	71(269)
Leaving Water Temperature (Min/ Max), °F (°C) 3	40/60 (4.4/15.6)									
Maximum Water Side Pressure, psig (barg)	150 (10.3)									
Maximum Refrigerant Side Pressure, psig (barg)	235 (16.2)									
Evap Drain Connection, inches (mm)	3/4									
Minimum Chilled Water Flow Rate, gpm (l/sec)	300 (18.9)	250 (15.8)	300 (18.9)	300 (18.9)	250 (15.8)	300 (18.9)	400 (25.2)	400 (25.2)	400 (25.2)	300 (18.9)
Maximum Chilled Water Flow Rate, gpm (l/sec)	1150 (72.6)	950 (59.9)	1150 (72.6)	1150 (72.6)	950 (59.9)	1150 (72.6)	1500 (94.7)	1500 (94.7)	1500 (94.7)	1150 (72.6)
Inlet and Outlet Water Connections, in	6	6	6	6	6	6	8	8	8	6

NOTES:

1. Shipping and operating weights shown are for base unit; selected options may add weight to unit. Contact your nearest Johnson Controls Sales office for weight data.
2. For leaving liquid temperature below 40°F(4.4°C) or above 60°F (15.6°C), contact your nearest Johnson Controls Sales Office for application requirements.

TABLE 7 - PHYSICAL DATA - MICROCHANNEL COIL (CONT'D)

UNIT FRAME	30	30	31	32	33	34	34	36	37
CONDENSER CODE	**5**	**8**	**8**	**3**	**3**	**3**	**5**	**8**	**3**
EVAPORATOR CODE	**C**	**E**	**E**	**E**	**C**	**E**	**E**	**J**	**F**
GENERAL UNIT DATA									
Number of Independent Refrigerant Circuits	2								
Refrigerant Charge, R-134a or R-513A, Ckt.-1/Ckt.-2, lbs (kg)	295/250 (134/114)	315/275 (143/125)	315/295 (143/134)	295/295 (134/134)	290/290 (132/132)	310/310 (141/141)	315/315 (143/143)	475/320 (216/145)	420/245 (191/111)
Oil Charge, Ckt.-1/Ckt.-2, gal (liters)	3.7/3.0 (14.0/ 11.4)	3.9/3.2 (14.8/ 12.1)	3.9/3.3 (14.8/ 12.5)	3.7/3.7 (14.0/ 14.0)	3.7/3.7 (14.0/ 14.0)	3.8/3.8 (14.4/ 14.4)	3.9/3.9 (14.8/ 14.8)	4.1/4.0 (15.5/ 15.1)	4.0/2.9 (15.1/ 11.0)
Minimum Load (%)	10%								
Unit shipping weight, lbs (kg) 1	17875 (8108)	18967 (8603)	19728 (8948)	18554 (8416)	18224 (8266)	19315 (8761)	20077 (9107)	24831 (11263)	22346 (10136)
Operating Weight, lbs (kg) 1	18638 (8454)	19827 (8993)	20588 (9339)	19414 (8806)	18987 (8612)	20175 (9151)	20937 (9497)	26188 (11879)	23405 (10616)
Chassis Dimensions - Length, inches (mm)	423.1 (10748)	423.1 (10748)	467.1 (11865)	379.2 (9631)	423.1 (10748)	423.1 (10748)	467.1 (11865)	511 (12979)	467.1 (11864)
Chassis Dimensions - Width, inches (mm)	88.3 (2242)	88.3 (2242)	88.3 (2242)	88.3 (2242)	88.3 (2242)	88.3 (2242)	88.3 (2242)	88.3 (2243)	88.3 (2243)
Chassis Dimensions - Height, inches (mm)	94.6 (2403)	94.6 (2403)	94.6 (2403)	94.6 (2403)	94.6 (2403)	94.6 (2403)	94.6 (2403)	94.7 (2405)	94.7 (2405)
COMPRESSORS, SEMI-HERMETIC SCREW									
Qty per Chiller	2								
CONDENSER FANS									
Number Ckt-1/Ckt-2	10/8	10/8	8/8	8/8	9/9	9/9	10/10	14/8	13/7
Air on Condenser (Min/Max), °F (°C)	0/125 (-17.8/51.7)								
EVAPORATOR, SHELL AND TUBE HYBRID FALLING FILM [2]									
Water Volume, gal (liters)	71 (269)	113 (428)	113 (428)	113 (428)	71 (269)	113 (428)	113 (428)	147 (556)	96 (363)
Leaving Water Temperature (Min/Max), °F (°C) [2]	40/60 (4.4/15.6)								
Maximum Water Side Pressure, psig (barg)	150 (10.3)								
Maximum Refrigerant Side Pressure, psig (barg)	235 (16.2)								
Evap Drain Connection, inches (mm)	3/4								
Minimum Chilled Water Flow Rate, gpm (l/sec)	300 (18.9)	400 (25.2)	400 (25.2)	400 (25.2)	300 (18.9)	400 (25.2)	400 (25.2)	550 (34.1)	460 (29.0)
Maximum Chilled Water Flow Rate, gpm (l/sec)	1150 (72.6)	1500 (94.7)	1500 (94.7)	1500 (94.7)	1150 (72.6)	1500 (94.7)	1500 (94.7)	1880 (118.1)	1540 (97.0)
Inlet and Outlet Water Connections, in	6	8	8	8	6	8	8	8	8

NOTES:

1. Shipping and operating weights shown are for base unit; selected options may add weight to unit. Contact your nearest Johnson Controls Sales office for weight data.
2. For leaving liquid temperature below 40°F(4.4°C) or above 60°F (15.6°C), contact your nearest Johnson Controls Sales Office for application requirements.

TABLE 7 - PHYSICAL DATA - MICROCHANNEL COIL (CONT'D)

UNIT FRAME	37	39	41	42	42	44	47	48	49	50	52
CONDENSER CODE	**5**	**8**	**3**	**5**	**8**	**3**	**5**	**3**	**0**	**0**	**3**
EVAPORATOR CODE	**J**	**J**	**H**	**H**	**J**	**G**	**J**	**G**	**K**	**J**	**J**
GENERAL UNIT DATA											
Number of Independent Refrigerant Circuits	2										
Refrigerant Charge, R-134a or R-513A, Ckt.-1/Ckt.-2, lbs (kg)	470/310 (213/141)	475/360 (216/163)	460/345 (209/156)	480/365 (218/166)	475/385 (215/175)	370/370 (168/168)	445/445 (202/202)	385/385 (175/175)	390/390 (179/179)	405/405 (184/184)	445/445 (202/202)
Oil Charge, Ckt.-1/Ckt.-2, gal (liters)	4.1/3.8 (15.5/ 14.4)	4.1/4.1 (15.5/ 15.5)	4.0/4.0 (15.1/ 15.1)	4.1/4.1 (15.5/ 15.5)	4.1/4.1 (15.5/ 15.5)	4.0/4.0 (15.1/ 15.1)	4.2/4.2 (15.9/ 15.9)	4.0/4.0 (15.1/ 15.1)	4.0/4.0 (15.1/ 15.1)	4.0/4.0 (15.1/ 15.1)	4.2/4.2 (15.9/ 15.9)
Minimum Load (%)	10%										
Unit shipping weight, lbs (kg) 1	24070 (10918)	25941 (11767)	21242 (9635)	22765 (10326)	26703 (12112)	25942 (11767)	28427 (12894)	26704 (12113)	24762 (11232)	25968 (11779)	28427 (12894)
Operating Weight, lbs (kg) 1	25426 (11533)	27298 (12382)	22049 (10001)	23572 (10692)	28060 (12728)	27001 (12247)	29784 (13510)	27763 (12593)	25847 (11724)	27325 (12394)	29784 (13510)
Chassis Dimensions - Length, inches (mm)	467.1 (11864)	555.3 (14104)	467.1 (11864)	555.3 (14104)	599.3 (15222)	555.3 (14104)	599.3 (15222)	599.3 (15222)	467.1 (11864)	467.1 (11865)	599.3 (15222)
Chassis Dimensions - Width, inches (mm)	88.3 (2243)	88.3 (2243)	88.3 (2243)	88.3 (2243)	88.3 (2243)	88.3 (2243)	88.3 (2243)	88.4 (2244)	88.3 (2242)	88.3 (2243)	88.3 (2243)
Chassis Dimensions - Height, inches (mm)	94.7 (2405)	94.7 (2405)	94.7 (2405)	94.7 (2405)	94.7 (2405)	94.7 (2405)	94.7 (2405)	94.7 (2405)	94.6 (2403)	94.7 (2405)	94.7 (2405)
COMPRESSORS, SEMI-HERMETIC SCREW											
Qty per Chiller	2										
CONDENSER FANS											
Number Ckt-1/Ckt-2	13/7	14/10	12/8	14/10	14/12	12/12	13/13	13/13	10/10	10/10	13/13
Air on Condenser (Min/Max), °F (°C)	0/125										
EVAPORATOR, SHELL AND TUBE HYBRID FALLING FILM [2]											
Water Volume, gal (liters)	147(556)	147(556)	130(492)	130(492)	147(556)	96(363)	147(556)	96(363)	130 (492)	147(556)	147(556)
Leaving Water Temperature (Min/Max), °F (°C) [2]	40/60 (4.4/15.6)										
Maximum Water Side Pressure, psig (barg)	150 (10.3)										
Maximum Refrigerant Side Pressure, psig (barg)	235 (16.2)										
Evap Drain Connection, inches (mm)	3/4										
Minimum Chilled Water Flow Rate, gpm (l/sec)	550 (34.1)	550 (34.1)	520 (33.0)	520 (33.0)	550 (34.1)	460 (29.0)	550 (34.1)	460 (29.0)	25847 (11724)	550 (34.1)	550 (34.1)
Maximum Chilled Water Flow Rate, gpm (l/sec)	1880 (118.1)	1880 (118.1)	1700 (107.0)	1700 (107.0)	1880 (118.1)	1540 (97.0)	1880 (118.1)	1540 (97.0)	1870 (118)	1880 (118.1)	1880 (118.1)
Inlet and Outlet Water Connections, in	8	8	8	8	8	8	8	8	8	8	8

NOTES:

1. Shipping and operating weights shown are for base unit; selected options may add weight to unit. Contact your nearest Johnson Controls Sales office for weight data.
2. For leaving liquid temperature below 40°F(4.4°C) or above 60°F (15.6°C), contact your nearest Johnson Controls Sales Office for application requirements.

TABLE 8 - PHYSICAL DATA - ROUND TUBE COIL

UNIT FRAME	15	18	20	21	23	26	27	30
CONDENSER CODE	3	3	0	3	3	3	3	3
EVAPORATOR CODE	B	A	C	A	B	B	D	C
GENERAL UNIT DATA								
Number of Independent Refrigerant Circuits	2							
Refrigerant Charge, R-134a, Ckt.-1/Ckt.-2, lbs (kg)	211/211 (96/96)	229/191 (104/87)	241/241 (109/109)	229/229 (104/104)	273/235 (124/107)	273/273 (124/124)	328/328 (149/149)	371/308 (168/140)
Oil Charge, Ckt.-1/Ckt.-2, gal (liters)	2.1/2.0 (8.0/7.7)	2.4/2.0 (9.2/7.7)	2.6/2.6 (9.9/9.9)	2.5/2.5 (9.5/9.5)	2.7/2.6 (10.3/9.9)	2.7/2.7 (10.3/10.3)	3.0/3.0 (11.4/11.4)	3.7/3.0 (14.0/11.4)
Minimum Load (%)	10%							
Unit shipping weight, Round Tube cond coils, lbs (kg)[2]	12354 (5604)	13064 (5926)	14228 (6454)	14113 (6402)	14542 (6596)	15539 (7048)	17738 (8046)	18786 (8521)
Unit shipping weight, Round Tube with Copper Fin cond coils, lbs (kg)[2]	13674 (6202)	14714 (6674)	15548 (7052)	16093 (7300)	16522 (7494)	17849 (8096)	20048 (9094)	21426 (9719)
Operating Weight, Round Tube cond coils, lbs (kg) [2]	12815 (5813)	13505 (6126)	14991 (6800)	14554 (6602)	15004 (6806)	16001 (7258)	18566 (8421)	19549 (8867)
Operating Weight, Round Tube with Copper Fin cond coils, lbs (kg) [2]	14135 (6412)	15155 (6874)	16311 (7399)	16534 (7500)	16984 (7704)	18311 (8306)	20876 (9469)	22189 (10065)
Chassis Dimensions - Length, inches (mm)	203.3 (5163)	247 (6274)	226 (5740)	291.2 (7397)	291.2 (7397)	335.2 (8514)	335.2 (8514)	379.2 (9631)
Chassis Dimensions - Width, inches (mm)	88.3 (2242)	88.3 (2242)	88.3 (2242)	88.3 (2242)	88.3 (2242)	88.3 (2242)	88.3 (2242)	88.3 (2242)
Chassis Dimensions - Height, inches (mm)	94.6 (2403)	94.6 (2403)	94.6 (2403)	94.6 (2403)	94.6 (2403)	94.6 (2403)	94.6 (2403)	94.6 (2403)
COMPRESSORS, SEMI-HERMETIC SCREW								
Qty per Chiller	2							
CONDENSER FANS								
Number Ckt-1/Ckt-2	4/4	6/4	4/4	6/6	7/5	7/7	7/7	9/7
Air on Condenser (Min/Max), °F (°C)	0/125 (-17.8/51.7)							
EVAPORATOR, SHELL AND TUBE HYBRID FALLING FILM								
Water Volume, gal (liters)	58 (220)	48 (182)	71 (269)	48 (182)	58 (220)	58 (220)	82 (310)	71 (269)
Leaving Water Temperature (Min/Max), °F (°C) [2]	40/60 (4.4/15.6)							
Maximum Water Side Pressure, psig (barg)	150 (10.3)							
Maximum Refrigerant Side Pressure, psig (barg)	235 (16.2)							
Evap Drain Connection, inches (mm)	3/4							
Minimum Chilled Water Flow Rate, gpm (l/sec)	250 (15.8)	200 (12.6)	300 (18.9)	200 (12.6)	250 (15.8)	250 (15.8)	300 (18.9)	300 (18.9)
Maximum Chilled Water Flow Rate, gpm (l/sec)	950 (59.9)	750 (47.3)	1150 (72.6)	750 (47.3)	950 (59.9)	950 (59.9)	1150 (72.6)	1150 (72.6)
Inlet and Outlet Water Connections, in	6	6	6	6	6	6	6	6

NOTES:

Shipping and operating weights shown are for base unit; selected options may add weight to unit. Contact your nearest Johnson Controls Sales office for weight data.

1. R-513A is not an option.
2. For leaving liquid temperature below 40°F(4.4°C) or above 60°F (15.6°C), contact your nearest Johnson Controls Sales Office for application requirements.

TABLE 8 - PHYSICAL DATA - ROUND TUBE COIL (CONT'D)

UNIT FRAME	32	33	34	37	41	44	48	49	50	52
CONDENSER CODE	3	3	3	3	3	3	3	0	0	3
EVAPORATOR CODE	E	C	E	F	H	G	G	K	J	J
GENERAL UNIT DATA										
Number of Independent Refrigerant Circuits	2									
Refrigerant Charge, R-134a, Ckt.-1/Ckt.-2, lbs (kg)	367/367 (166/166)	371/371 (168/168)	391/391 (177/177)	537/308 (244/140)	568/417 (258/189)	478/478 (217/217)	502/502 (228/228)	480/480 (218/218)	495/495 (224/224)	562/562 (255/255)
Oil Charge, Ckt.-1/Ckt.-2, gal (liters)	3.7/3.7 (14.0/ 14.0)	3.7/3.7 (14.0/ 14.0)	3.8/3.8 (14.4/ 14.4)	4.0/2.9 (15.1/ 11.0)	4.0/4.0 (15.1/ 15.1)	4.0/4.0 (15.1/ 15.1)	4.0/4.0 (15.1/ 15.1)	4.0/4.0 (15.1/ 15.1)	4.0/4.0 (15.1/ 15.1)	4.2/4.2 (15.9/ 15.9)
Minimum Load (%)	10%									
Unit shipping weight, Round Tube cond coils, lbs (kg)[2]	20226 (9174)	20105 (9119)	21196 (9614)	24436 (11084)	23332 (10583)	28450 (12905)	29421 (13345)	26852 (12180)	28058 (12727)	31144 (14127)
Unit shipping weight, Round Tube with Copper Fin cond coils, lbs (kg)[2]	22866 (10372)	23075 (10467)	24166 (10962)	27736 (12581)	26632 (12080)	32410 (14701)	33711 (15291)	31098 (14106)	31358 (14224)	35434 (16073)
Operating Weight, Round Tube cond coils, lbs (kg) [2]	21086 (9564)	20868 (9466)	22056 (10004)	25495 (11564)	24139 (10949)	29509 (13385)	30480 (13825)	27937 (12672)	29415 (13342)	32501 (14742)
Operating Weight, Round Tube with Copper Fin cond coils, lbs (kg) [2]	23726 (10762)	23838 (10813)	25026 (11352)	28795 (13061)	27439 (12446)	33469 (15181)	34770 (15771)	32183 (14598)	32715 (14839)	36791 (16688)
Chassis Dimensions - Length, inches (mm)	379.2 (9631)	423.1 (10748)	423.1 (10748)	467.1 (11864)	467.1 (11864)	555.3 (14104)	599.3 (15222)	467.1 (11864)	467.1 (11864)	599.3 (15222)
Chassis Dimensions - Width, inches (mm)	88.3 (2242)	88.3 (2242)	88.3 (2242)	88.3 (2243)	88.3 (2243)	88.3 (2243)	88.4 (2244)	88.3 (2242)	88.4 (2244)	88.3 (2243)
Chassis Dimensions - Height, inches (mm)	94.6 (2403)	94.6 (2403)	94.6 (2403)	94.7 (2405)	94.7 (2405)	94.7 (2405)	94.7 (2405)	94.6 (2403)	94.7 (2405)	94.7 (2405)
COMPRESSORS, SEMI-HERMETIC SCREW										
Qty per Chiller	2									
CONDENSER FANS										
Number Ckt-1/Ckt-2	8/8	9/9	9/9	13/7	12/8	12/12	13/13	10/10	10/10	13/13
Air on Condenser (Min/Max), °F (°C)	0/125 (-17.8/51.7)									
EVAPORATOR, SHELL AND TUBE HYBRID FALLING FILM										
Water Volume, gal (liters)	113 (428)	71 (269)	113 (428)	96 (363)	130 (492)	96 (363)	96 (363)	130 (492)	147 (556)	147 (556)
Leaving Water Temperature (Min/Max), °F (°C) [2]	40/60 (4.4/15.6)									
Maximum Water Side Pressure, psig (barg)	150 (10.3)									
Maximum Refrigerant Side Pressure, psig (barg)	235 (16.2)									
Evap Drain Connection, inches (mm)	3/4									
Minimum Chilled Water Flow Rate, gpm (l/sec)	400 (25.2)	300 (18.9)	400 (25.2)	460 (29.0)	520 (33.0)	460 (29.0)	460 (29.0)	470 (30)	550 (34.1)	550 (34.1)
Maximum Chilled Water Flow Rate, gpm (l/sec)	1500 (94.7)	1150 (72.6)	1500 (94.7)	1540 (97.0)	1700 (107.0)	1540 (97.0)	1540 (97.0)	1870 (118)	1880 (118.1)	1880 (118.1)
Inlet and Outlet Water Connections, in	8	6	8	8	8	8	8	8	8	8

NOTES:

Shipping and operating weights shown are for base unit; selected options may add weight to unit. Contact your nearest Johnson Controls Sales office for weight data.

1. R-513A is not an option.
2. For leaving liquid temperature below 40°F(4.4°C) or above 60°F (15.6°C), contact your nearest Johnson Controls Sales Office for application requirements.

TABLE 9 - FAN DATA

UNIT FRAME		015	016	017	018	019	019	020	021
CONDENSER CODE		3	5	8	3	5	8	0	3
EVAPORATOR CODE		B	B	C	A	A	B	C	A
LOW SOUND FANS									
FAN RPM	60 Hz / 50 Hz	1150/950							
TOTAL CHILLER AIRFLOW	cfm	100000	125000	150000	125000	150000	175001	100000	150000
	m^3/sec	47	59	71	59	71	83	47	71
ULTRA QUIET FANS									
FAN RPM	60 Hz / 50 Hz	850/720							
TOTAL CHILLER AIRFLOW	cfm	88920	111149	133379	111149	133379	155609	88920	133379
	m^3/sec	42	52	63	52	63	73	42	63
HIGH AIRFLOW FANS									
FAN RPM	60 Hz / 50 Hz	1150/950							
TOTAL CHILLER AIRFLOW	cfm	126400	158000	189600	158000	189600	221200	126400	189600
	m^3/sec	60	75	89	75	89	104	60	89
HIGH STATIC FANS									
FAN RPM	60 Hz / 50 Hz	1150/950							
TOTAL CHILLER AIRFLOW	cfm	108495	135619	162742	135619	162742	189866	108495	162742
	m^3/sec	51	64	77	64	77	90	51	77

UNIT FRAME		021	021	023	024	024	026	027	027
CONDENSER CODE		5	8	3	5	8	3	3	5
EVAPORATOR CODE		C	C	B	C	C	B	D	E
LOW SOUND FANS									
FAN RPM	60 Hz / 50 Hz	1150/950							
TOTAL CHILLER AIRFLOW	cfm	150000	175001	150000	175001	200001	175001	175001	175001
	m^3/sec	71	83	71	83	94	83	83	83
ULTRA QUIET FANS									
FAN RPM	60 Hz / 50 Hz	850/720							
TOTAL CHILLER AIRFLOW	cfm	133379	155609	133379	155609	177839	155609	155609	155609
	m^3/sec	63	73	63	73	84	73	73	73
HIGH AIRFLOW FANS									
FAN RPM	60 Hz / 50 Hz	1150/950							
TOTAL CHILLER AIRFLOW	cfm	189600	221200	189600	221200	252800	221200	221200	221200
	m^3/sec	89	104	89	104	119	104	104	104
HIGH STATIC FANS									
FAN RPM	60 Hz / 50 Hz	1150/950							
TOTAL CHILLER AIRFLOW	cfm	162742	189866	162742	189866	216990	189866	189866	189866
	m^3/sec	77	90	77	90	102	90	90	90

NOTE: The data shown in this table is applicable to typical configurations. Other configurations may be available.

TABLE 9 - FAN DATA (CONT'D)

UNIT FRAME		027	029	030	030	030	031	032	033
CONDENSER CODE		8	5	3	5	8	8	3	3
EVAPORATOR CODE		E	E	C	C	E	E	E	C
LOW SOUND FANS									
FAN RPM	60 Hz / 50 Hz	1150/950							
TOTAL CHILLER AIRFLOW	cfm	200001	200001	200001	225001	225001	250001	200001	225001
	m^3/sec	94	94	94	106	106	118	94	106
ULTRA QUIET FANS									
FAN RPM	60 Hz / 50 Hz	850/720							
TOTAL CHILLER AIRFLOW	cfm	177839	177839	177839	200069	200069	222299	177839	200069
	m^3/sec	84	84	84	94	94	105	84	94
HIGH AIRFLOW FANS									
FAN RPM	60 Hz / 50 Hz	1150/950							
TOTAL CHILLER AIRFLOW	cfm	252800	252800	252800	284400	284400	316000	252800	284400
	m^3/sec	119	119	119	134	134	149	119	134
HIGH STATIC FANS									
FAN RPM	60 Hz / 50 Hz	1150/950							
TOTAL CHILLER AIRFLOW	cfm	216990	216990	216990	244113	244113	271237	216990	244113
	m^3/sec	102	102	102	115	115	128	102	115

UNIT FRAME		034	034	036	037	037	039	041	042
CONDENSER CODE		3	5	8	3	5	8	3	5
EVAPORATOR CODE		E	E	J	F	J	J	H	H
LOW SOUND FANS									
FAN RPM	60 Hz / 50 Hz	1150/950							
TOTAL CHILLER AIRFLOW	cfm	225001	250001	275000	250000	250000	300000	250000	300000
	m^3/sec	106	118	129	118	118	141	118	141
ULTRA QUIET FANS									
FAN RPM	60 Hz / 50 Hz	850/720							
TOTAL CHILLER AIRFLOW	cfm	200069	222299	244530	222300	222300	266760	222300	266760
	m^3/sec	94	105	116	105	105	126	105	126
HIGH AIRFLOW FANS									
FAN RPM	60 Hz / 50 Hz	1150/950							
TOTAL CHILLER AIRFLOW	cfm	284400	316000	347600	316000	316000	379200	316000	379200
	m^3/sec	134	149	165	150	150	180	150	180
HIGH STATIC FANS									
FAN RPM	60 Hz / 50 Hz	1150/950							
TOTAL CHILLER AIRFLOW	cfm	244113	271237	298361	271238	271238	325485	271238	325485
	m^3/sec	115	128	140	128	128	153	128	153

NOTE: The data shown in this table is applicable to typical configurations. Other configurations may be available.

TABLE 9 - FAN DATA (CONT'D)

UNIT FRAME		042	044	047	048	050	052
CONDENSER CODE		8	3	5	3	0	3
EVAPORATOR CODE		J	G	J	G	J	J
LOW SOUND FANS							
FAN RPM	60 Hz / 50 Hz	1150/950					
TOTAL CHILLER AIRFLOW	cfm	325000	300000	325000	325000	250001	325001
	m^3/sec	153	141	153	153	118	153
ULTRA QUIET FANS							
FAN RPM	60 Hz / 50 Hz	850/720					
TOTAL CHILLER AIRFLOW	cfm	288990	266760	288990	288990	222299	288988
	m^3/sec	137	126	137	137	105	136
HIGH AIRFLOW FANS							
FAN RPM	60 Hz / 50 Hz	1150/950					
TOTAL CHILLER AIRFLOW	cfm	410800	379200	410800	410800	316000	410800
	m^3/sec	195	180	195	195	149	194
HIGH STATIC FANS							
FAN RPM	60 Hz / 50 Hz	1150/950					
TOTAL CHILLER AIRFLOW	cfm	352609	325485	352609	352609	271237	352608
	m^3/sec	166	153	166	166	128	166

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EVAPORATOR OPTIONS

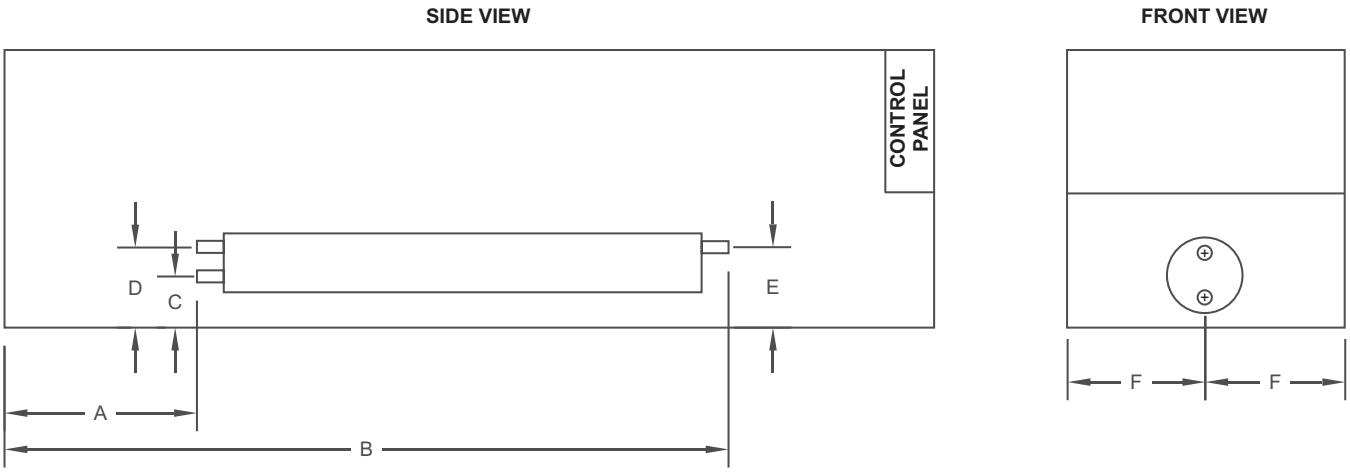

TABLE 10 - STANDARD (TWO-PASS, REAR INLET/OUTLET) EVAPORATOR

FRAME	CONDENSER	EVAPORATOR	A	C	D	F	C-606 CONNECTION SIZE	WATER VOLUME GALLONS (LITERS)	MIN. CHILLED WATER FLOW RATE GPM (L/S)	MAX. CHILLED WATER FLOW RATE GPM (L/S)
015	3	B	6.9	15.1	26.5	44.1	6	58	250	950
			(176)	(384)	(674)	(1121)		(220)	(16)	(60)
016	5	B	29.4	15.1	26.5	44.1	6	58	250	950
			(745)	(384)	(674)	(1121)		(220)	(16)	(60)
017	8	C	34.9	15.1	26.5	44.1	6	71	300	1150
			(887)	(384)	(674)	(1121)		(269)	(19)	(73)
018	3	A	17.7	14.1	25.5	44.1	6	48	200	750
			(449)	(359)	(649)	(1121)		(182)	(13)	(47)
019	5	A	61.5	14.1	25.5	44.1	6	48	200	750
			(1563)	(359)	(649)	(1121)		(182)	(13)	(47)
019	8	B	117.3	15.3	26.7	44.1	6	58	250	950
			(2979)	(388)	(678)	(1121)		(220)	(16)	(60)
020	0	C	1.7	15.1	26.5	44.1	6	71	300	1150
			(43)	(384)	(674)	(1121)		(269)	(19)	(73)
021	3	A	61.7	14.1	25.5	44.1	6	48	200	750
			(566)	(359)	(649)	(1121)		(182)	(13)	(47)
021	5	C	34.9	15.1	26.5	44.1	6	71	300	1150
			(887)	(384)	(674)	(1121)		(269)	(19)	(73)
021	8	C	78.9	15.3	26.7	44.1	6	71	300	1150
			(2004)	(388)	(678)	(1121)		(269)	(19)	(73)
023	3	B	73.3	15.1	26.5	44.1	6	58	250	950
			(1862)	(384)	(674)	(1121)		(220)	(16)	(60)
024	5	C	92.9	15.3	26.7	44.1	6	71	300	1150
			(2359)	(388)	(678)	(1121)		(269)	(19)	(73)
024	8	C	122.9	15.3	26.7	44.1	6	71	300	1150
			(3121)	(388)	(678)	(1121)		(269)	(19)	(73)
026	3	B	117.3	15.3	26.7	44.1	6	58	250	950
			(2979)	(388)	(678)	(1121)		(220)	(16)	(60)
027	3	D	42.9	15.3	26.7	44.1	6	82	300	1150
			(1090)	(388)	(678)	(1121)		(310)	(19)	(73)

NOTES:
1. Dimensions are in inches (mm) and weights are in pounds (kg).
2. Data not available for Models YVAA0278E through YVAA0345E.

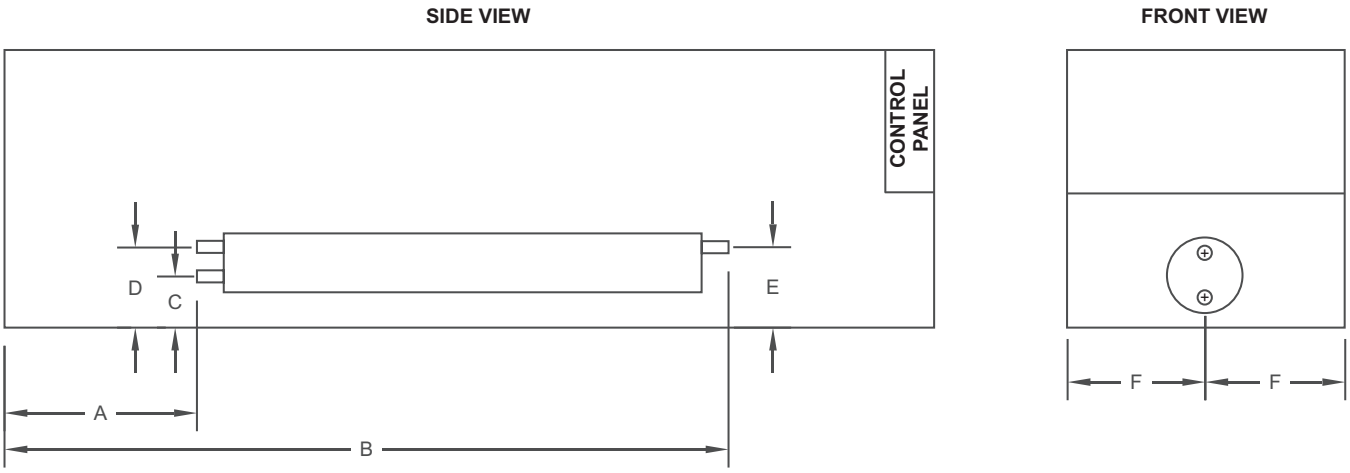

TABLE 10 - STANDARD (TWO-PASS, REAR INLET/OUTLET) EVAPORATOR (CONT'D)

FRAME	CONDENSER	EVAPORATOR	A	C	D	F	C-606 CONNECTION SIZE	WATER VOLUME GALLONS (LITERS)	MIN. CHILLED WATER FLOW RATE GPM (L/S)	MAX. CHILLED WATER FLOW RATE GPM (L/S)
027	**5**	**E**	44.3	15.5	29.5	44.1	8	113	400	1500
			(1125)	(394)	(749)	(1121)		(428)	(25)	(95)
027	**8**	**E**	88.3	15.5	29.5	44.1	8	113	400	1500
			(2242)	(394)	(749)	(1121)		(428)	(25)	(95)
029	**5**	**E**	88.3	15.5	29.5	44.1	8	113	400	1500
			(2242)	(394)	(749)	(1121)		(428)	(25)	(95)
030	**3**	**C**	122.9	15.3	26.7	44.1	6	71	300	1150
			(3121)	(388)	(678)	(1121)		(269)	(19)	(73)
030	**5**	**C**	166.8	15.1	26.5	44.1	6	71	300	1150
			(4235)	(384)	(674)	(1121)		(269)	(19)	(73)
030	**8**	**E**	132.2	15.5	29.5	44.1	8	113	400	1500
			(3359)	(394)	(749)	(1121)		(428)	(25)	(95)
031	**8**	**E**	176.2	15.5	29.5	44.1	8	113	400	1500
			(4476)	(394)	(749)	(1121)		(428)	(25)	(95)
032	**3**	**E**	88.3	15.5	29.5	44.1	8	113	400	1500
			(2242)	(394)	(749)	(1121)		(428)	(25)	(95)
033	**3**	**C**	166.9	15.3	26.7	44.1	6	71	300	1150
			(4238)	(388)	(678)	(1121)		(269)	(19)	(73)
034	**3**	**E**	132.2	15.5	29.5	44.1	8	113	400	1500
			(3359)	(394)	(749)	(1121)		(428)	(25)	(95)
034	**5**	**E**	176.2	15.5	29.5	44.1	8	113	400	1500
			(4476)	(394)	(749)	(1121)		(428)	(25)	(95)
036	**8**	**J**	209	15.5	29.5	44.1	8	147	550	1880
			(5309)	(394)	(749)	(1121)		(556)	(35)	(119)
037	**3**	**F**	180.9	15.8	28.8	44.2	8	96	460	1540
			(4595)	(402)	(732)	(1122)		(363)	(29)	(97)
037	**5**	**J**	164.4	16.3	30.3	44.1	8	147	550	1880
			(4176)	(414)	(769)	(1121)		(556)	(35)	(119)
039	**8**	**J**	252.5	16.3	30.3	44.1	8	147	550	1880
			(6414)	(414)	(769)	(1121)		(556)	(35)	(119)

NOTES:
1. Dimensions are in inches (mm) and weights are in pounds (kg).
2. Data not available for Models YVAA0278E through YVAA0345E.

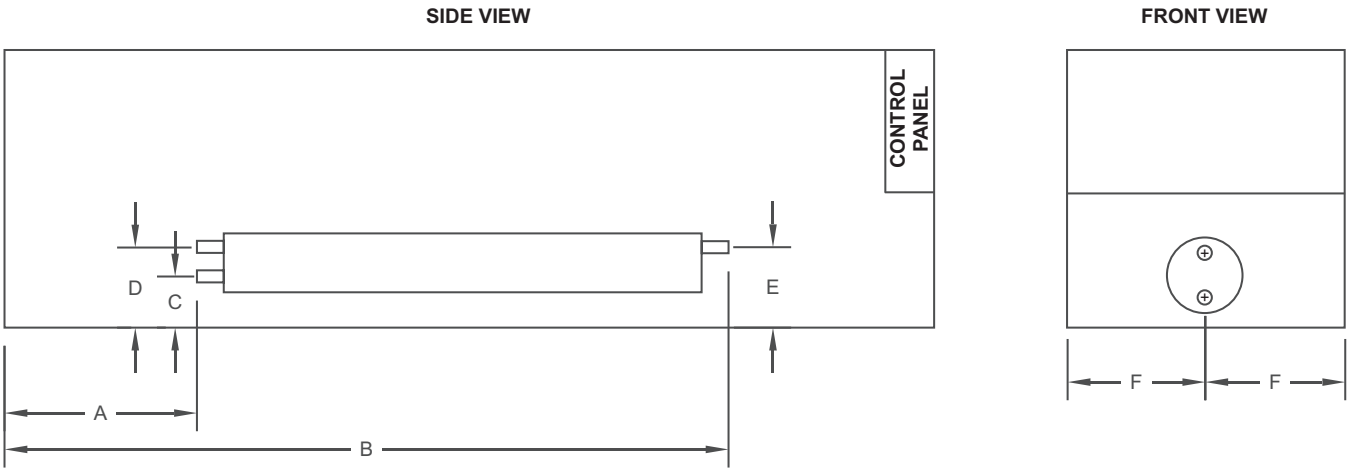

TABLE 10 - STANDARD (TWO-PASS, REAR INLET/OUTLET) EVAPORATOR (CONT'D)

FRAME	CONDENSER	EVAPORATOR	A	C	D	F	C-606 CONNECTION SIZE	WATER VOLUME GALLONS (LITERS)	MIN. CHILLED WATER FLOW RATE GPM (L/S)	MAX. CHILLED WATER FLOW RATE GPM (L/S)
041	**3**	**H**	164.6	15.5	29.47	44.2	8	130	520	1700
			(4180)	(394)	(749)	(1122)		(492)	(33)	(107)
042	**5**	**H**	252.6	15.5	29.5	44.1	8	130	520	1700
			(6416)	(394)	(749)	(1121)		(492)	(33)	(107)
042	**8**	**J**	295.5	16.3	30.3	44.1	8	147	550	1880
			(7506)	(414)	(769)	(1121)		(556)	(35)	(119)
044	**3**	**G**	287.1	15.8	28.8	44.2	8	96	460	1540
			(7292)	(402)	(732)	(1122)		(363)	(29)	(97)
047	**5**	**J**	309.1	16.3	30.3	44.2	8	147	550	1880
			(7852)	(414)	(769)	(1122)		(556)	(35)	(119)
048	**3**	**G**	331	15.8	28.8	44.2	8	96	460	1540
			(8409)	(402)	(732)	(1122)		(363)	(29)	(97)
050	**0**	**J**	177	16.3	30.3	44.2	8	147	550	1880
			(4495)	(414)	(769)	(1122)		(556)	(35)	(119)
052	**3**	**J**	309.1	16.3	30.3	44.2	8	147	550	1880
			(7852)	(414)	(769)	(1122)		(556)	(35)	(119)

NOTES:
1. Dimensions are in inches (mm) and weights are in pounds (kg).
2. Data not available for Models YVAA0278E through YVAA0345E.

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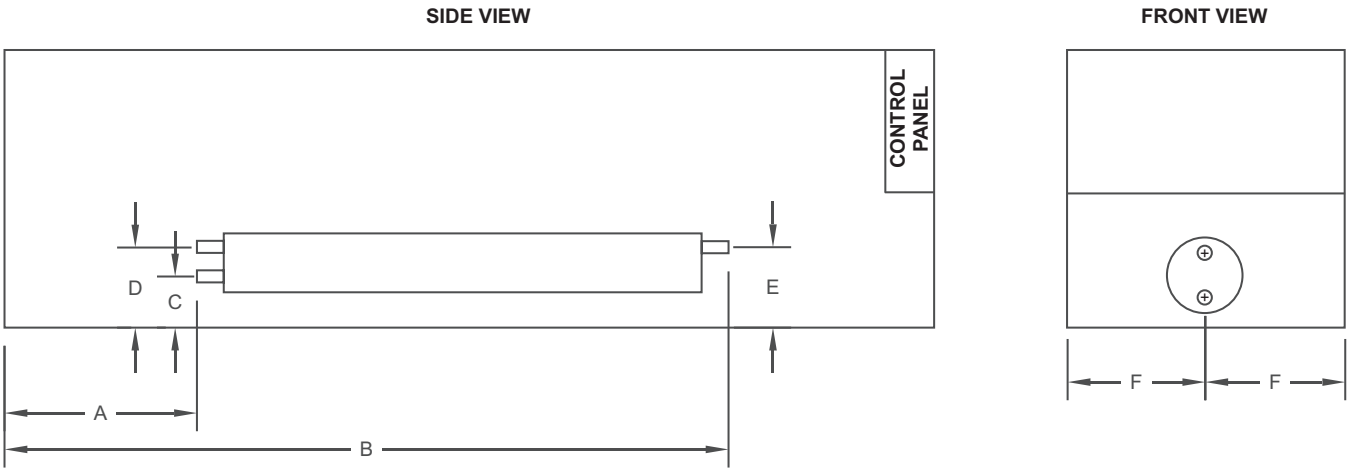


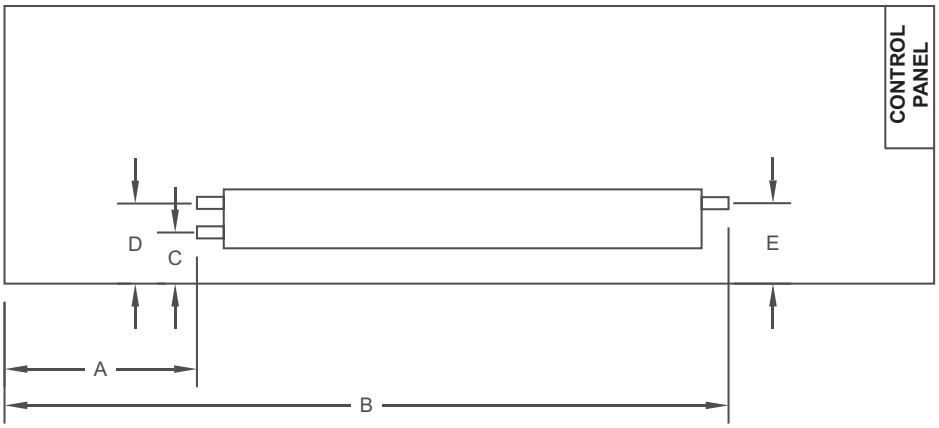
TABLE 11 - OPTIONAL THREE-PASS REAR INLET/FRONT OUTLET EVAPORATOR

FRAME	CONDENSER	EVAPORATOR	A	B	C	E	F	C-606 CONNECTION SIZE	WATER VOLUME GALLONS (LITERS)	MIN. CHILLED WATER FLOW RATE GPM (L/S)	MAX. CHILLED WATER FLOW RATE GPM (L/S)
015	3	B	6.9	168.9	15.1	26.5	44.1	5	58	160	600
			(176)	(4291)	(384)	(674)	(1121)		(220)	(10)	(38)
016	5	B	29.4	191.4	15.1	26.5	44.1	5	58	160	600
			(745)	(4860)	(384)	(674)	(1121)		(220)	(10)	(38)
017	8	C	34.9	220.9	15.1	26.5	44.1	6	71	200	750
			(887)	(5611)	(384)	(674)	(1121)		(269)	(13)	(47)
018	3	A	17.7	190.2	14.1	25.5	44.1	5	48	120	500
			(449)	(4831)	(359)	(649)	(1121)		(182)	(8)	(32)
019	5	A	61.5	234.0	14.1	25.5	44.1	5	48	120	500
			(1563)	(5945)	(359)	(649)	(1121)		(182)	(8)	(32)
019	8	B	117.3	279.3	15.3	26.7	44.1	5	58	160	600
			(2979)	(7094)	(388)	(678)	(1121)		(220)	(10)	(38)
020	0	C	1.7	187.7	15.1	26.5	44.1	6	71	200	750
			(43)	(4767)	(384)	(674)	(1121)		(269)	(13)	(47)
021	3	A	61.7	234.2	14.1	25.5	44.1	5	48	120	500
			(1566)	(5948)	(359)	(649)	(1121)		(182)	(8)	(32)
021	5	C	34.9	220.9	15.1	26.5	44.1	6	71	200	750
			(887)	(5611)	(384)	(674)	(1121)		(269)	(13)	(47)
021	8	C	78.9	264.9	15.3	26.7	44.1	6	71	200	750
			(2004)	(6728)	(388)	(678)	(1121)		(269)	(13)	(47)
023	3	B	73.3	235.3	15.1	26.5	44.1	5	58	160	600
			(1862)	(5977)	(384)	(674)	(1121)		(220)	(10)	(38)
024	5	C	92.9	278.9	15.3	26.7	44.1	6	71	200	750
			(2359)	(7083)	(388)	(678)	(1121)		(269)	(13)	(47)
024	8	C	122.9	308.9	15.3	26.7	44.1	6	71	200	750
			(3121)	(7845)	(388)	(678)	(1121)		(269)	(13)	(47)
026	3	B	117.3	279.3	15.3	26.7	44.1	5	58	160	600
			(2979)	(7094)	(388)	(678)	(1121)		(220)	(10)	(38)
027	3	D	42.9	264.9	15.3	26.7	44.1	6	82	200	750
			(1090)	(6729)	(388)	(678)	(1121)		(310)	(13)	(47)
027	5	E	44.3	263.3	15.5	29.5	44.1	6	113	300	850
			(1125)	(6688)	(394)	(749)	(1121)		(428)	(19)	(54)

NOTES:

1. Dimensions are in inches (mm) and weights are in pounds (kg).
2. Data not available for Models YVAA0278E through YVAA0345E.

SIDE VIEW



FRONT VIEW

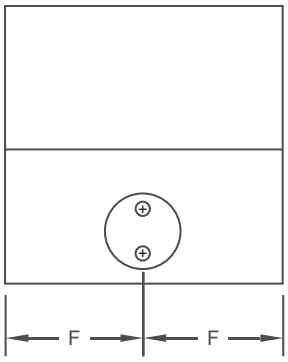


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TABLE 11 - OPTIONAL THREE-PASS REAR INLET/FRONT OUTLET EVAPORATOR (CONT'D)

FRAME	CONDENSER	EVAPORATOR	A	B	C	E	F	C-606 CONNECTION SIZE	WATER VOLUME GALLONS (LITERS)	MIN. CHILLED WATER FLOW RATE GPM (L/S)	MAX. CHILLED WATER FLOW RATE GPM (L/S)
027	**8**	**E**	88.3	307.3	15.5	29.5	44.1	6	113	300	850
			(2242)	(7805)	(394)	(749)	(1121)		(428)	(19)	(54)
029	**5**	**E**	88.3	307.3	15.5	29.5	44.1	6	113	300	850
			(2242)	(7805)	(394)	(749)	(1121)		(428)	(19)	(54)
030	**3**	**C**	122.9	308.9	15.3	26.7	44.1	6	71	200	750
			(3121)	(7845)	(388)	(678)	(1121)		(269)	(13)	(47)
030	**5**	**C**	166.8	352.8	15.1	26.5	44.1	6	71	200	750
			(4235)	(8959)	(384)	(674)	(1121)		(269)	(13)	(47)
030	**8**	**E**	132.2	351.2	15.5	29.5	44.1	6	113	300	850
			(3359)	(8922)	(394)	(749)	(1121)		(428)	(19)	(54)
031	**8**	**E**	176.2	395.2	15.5	29.5	44.1	6	113	300	850
			(4476)	(10039)	(394)	(749)	(1121)		(428)	(19)	(54)
032	**3**	**E**	88.3	307.3	15.5	29.5	44.1	6	113	300	850
			(2242)	(7805)	(394)	(749)	(1121)		(428)	(19)	(54)
033	**3**	**C**	166.9	352.9	15.3	26.7	44.1	6	71	200	750
			(4238)	(8962)	(388)	(678)	(1121)		(269)	(13)	(47)
034	**3**	**E**	132.2	351.2	15.5	29.5	44.1	6	113	300	850
			(3359)	(8922)	(394)	(749)	(1121)		(428)	(19)	(54)
034	**5**	**E**	176.2	395.2	15.5	29.5	44.1	6	113	300	850
			(4476)	(10039)	(394)	(749)	(1121)		(428)	(19)	(54)
036	**8**	**J**	209	427.8	15.5	29.5	44.1	8	147	350	1400
			(5309)	(10866)	(394)	(749)	(1121)		(556)	(25)	(88)
037	**3**	**F**	180.9	354.9	15.8	44.2	44.2	6	94	310	1070
			(4595)	(9015)	(402)	(1122)	(1122)		(356)	(20)	(68)
037	**5**	**J**	164.4	383.7	16.3	30.3	44.1	8	147	400	1400
			(4176)	(9746)	(414)	(769)	(1121)		(556)	(25)	(88)
039	**8**	**J**	252.5	471.5	16.3	30.3	44.1	8	147	400	1400
			(6414)	(11976)	(414)	(769)	(1121)		(556)	(25)	(88)
041	**3**	**H**	164.6	383.3	15.5	44.2	44.2	6	128	350	1200
			(4180)	(9737)	(394)	(1122)	(1122)		(485)	(22)	(76)

NOTES:

1. Dimensions are in inches (mm) and weights are in pounds (kg).
2. Data not available for Models YVAA0278E through YVAA0345E.

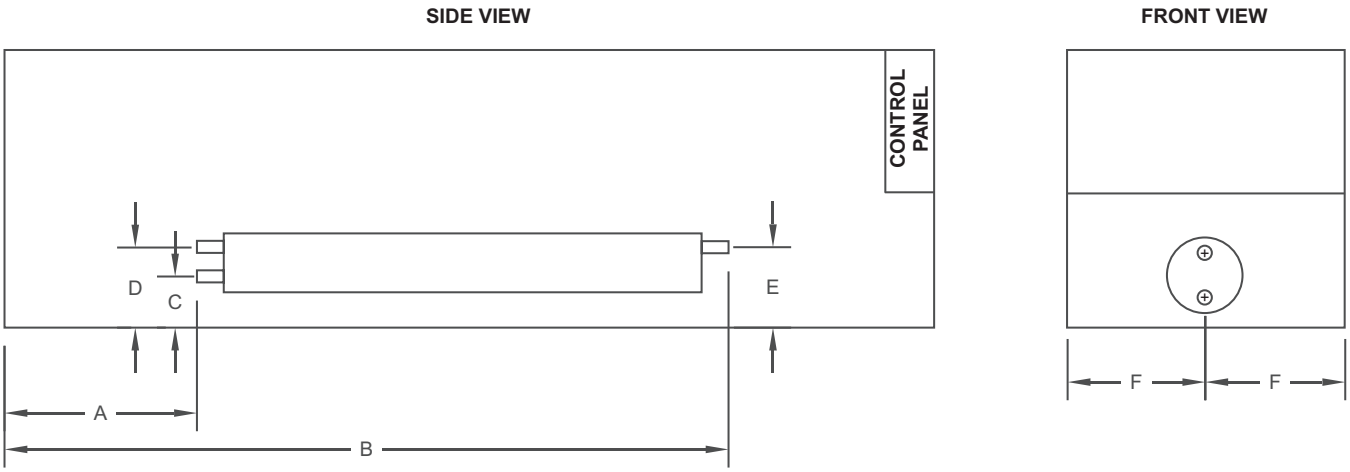

TABLE 11 - OPTIONAL THREE-PASS REAR INLET/FRONT OUTLET EVAPORATOR (CONT'D)

FRAME	CONDENSER	EVAPORATOR	A	B	C	E	F	C-606 CONNECTION SIZE	WATER VOLUME GALLONS (LITERS)	MIN. CHILLED WATER FLOW RATE GPM (L/S)	MAX. CHILLED WATER FLOW RATE GPM (L/S)
042	5	H	252.6	471.5	15.5	29.5	44.1	6	128	350	1200
			(6416)	(11976)	(394)	(749)	(1121)		(485)	(22)	(76)
042	8	J	295.5	515.4	16.3	30.3	44.1	8	147	400	1400
			(7506)	(13091)	(414)	(769)	(1121)		(556)	(25)	(88)
044	3	G	287.1	461.1	15.8	44.2	44.2	6	94	310	1070
			(7292)	(11712)	(402)	(1122)	(1122)		(356)	(20)	(68)
047	5	J	309.1	528.3	16.3	16.3	44.1	8	147	400	1400
			(7852)	(13421)	(414)	(769)	(1122)		(556)	(25)	(88)
048	3	G	331	505.1	15.8	44.2	44.2	6	94	310	1070
			(8409)	(12829)	(402)	(1122)	(1122)		(356)	(20)	(68)
050	0	J	176.3	395.6	16.3	30.3	44.1	8	147	400	1400
			(4479)	(10048)	(414)	(769)	(1122)		(556)	(25)	(88)
052	3	J	308.5	527.8	16.3	30.3	44.1	8	147	400	1400
			(7836)	(13405)	(414)	(769)	(1122)		(556)	(25)	(88)

NOTES:
1. Dimensions are in inches (mm) and weights are in pounds (kg).
2. Data not available for Models YVAA0278E through YVAA0345E.

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TABLE 12 - ISOLATOR SELECTION AND MOUNTING LOCATIONS

YVAA CONFIGURATION			DESCRIPTION	1	2	3	4	5	6	7	8
FRAME	COND	EVAP									
015	3	B	Isolator X-Dimension (in)	10 (263)	73 (1852)	144 (3662)	193 (4900)				
			Isolator Y-Dimension (in)	1 (34)							
016	5	B	Isolator X-Dimension (in)	10 (263)	77 (1943)	118 (3000)	157 (3985)	220 (5589)			
			Isolator Y-Dimension (in)	1 (34)							
017	8	C	Isolator X-Dimension (in)	10 (263)	81 (2057)	149 (3779)	187 (4756)	251 (6368)			
			Isolator Y-Dimension (in)	1 (34)							
018	3	A	Isolator X-Dimension (in)	10 (263)	76 (1943)	124 (3152)	163 (4137)	210 (5323)			
			Isolator Y-Dimension (in)	1 (34)							
019	5	A	Isolator X-Dimension (in)	10 (259)	76 (1939)	118 (2997)	157 (3982)	208 (5295)	281 (7132)		
			Isolator Y-Dimension (in)	1 (34)							
019	8	B	Isolator X-Dimension (in)	10 (263)	76 (1943)	118 (3000)	157 (3985)	209 (5299)	308 (7823)		
			Isolator Y-Dimension (in)	1 (34)							
020	0	C	Isolator X-Dimension (in)	10 (263)	76 (1943)	118 (3000)	157 (3985)	209 (5299)	281 (7136)		
			Isolator Y-Dimension (in)	1 (34)							
021	3	A	Isolator X-Dimension (in)	10 (263)	81 (2057)	149 (3779)	187 (4756)	251 (6368)			
			Isolator Y-Dimension (in)	1 (34)							
021	5	C	Isolator X-Dimension (in)	10 (263)	81 (2057)	149 (3779)	187 (4756)	251 (6368)			
			Isolator Y-Dimension (in)	1 (34)							
021	8	C	Isolator X-Dimension (in)	10 (263)	81 (2057)	149 (3779)	187 (4756)	235 (5968)	301 (7653)		
			Isolator Y-Dimension (in)	1 (34)							
023	3	B	Isolator X-Dimension (in)	10 (263)	76 (1943)	118 (2999)	157 (3984)	209 (5298)	281 (7135)		
			Isolator Y-Dimension (in)	1 (34)							
024	5	C	Isolator X-Dimension (in)	10 (263)	76 (1943)	128 (3260)	173 (4391)	220 (5579)	301 (7654)		
			Isolator Y-Dimension (in)	1 (34)							

NOTES:
1. Contact your nearest Johnson Controls Sales Office for weight data.
2. All isolator mounting holes are 19mm.
3. Dimensions are in inches (mm).

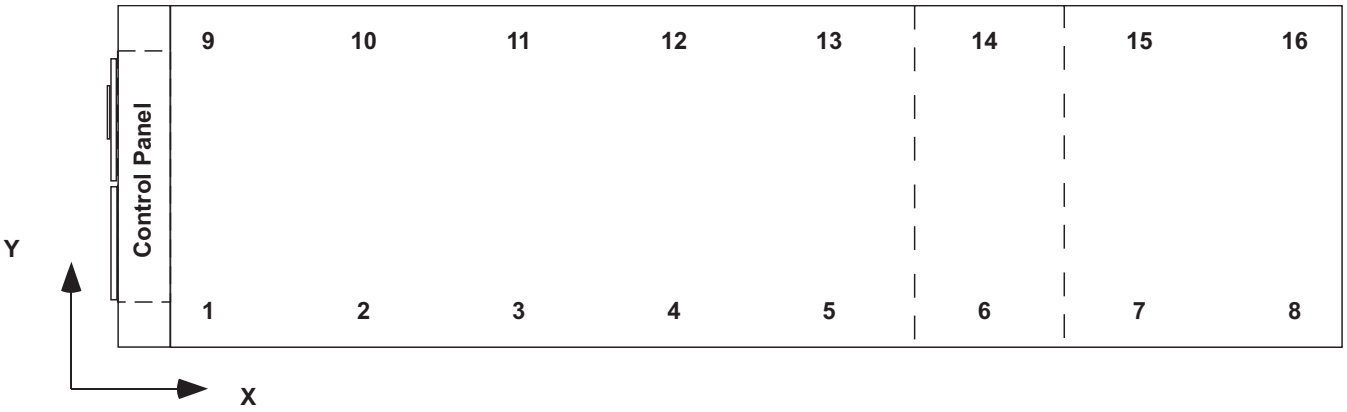


TABLE 12 - ISOLATOR SELECTION AND MOUNTING LOCATIONS (CONT'D)

YVAA CONFIGURATION			DESCRIPTION	9	10	11	12	13	14	15	16
FRAME	COND	EVAP									
015	3	B	Isolator X-Dimension	10 (263)	73 (1852)	144 (3662)	193 (4900)				
			Isolator Y-Dimension	87 (2206)							
016	5	B	Isolator X-Dimension	10 (263)	77 (1943)	118 (3000)	157 (3985)	220 (5589)			
			Isolator Y-Dimension	87 (2206)							
017	8	C	Isolator X-Dimension	10 (263)	81 (2057)	149 (3779)	187 (4756)	251 (6368)			
			Isolator Y-Dimension	87 (2206)							
018	3	A	Isolator X-Dimension	10 (263)	76 (1943)	124 (3152)	163 (4137)	210 (5323)			
			Isolator Y-Dimension	87 (2206)							
019	5	A	Isolator X-Dimension	10 (259)	76 (1939)	118 (2997)	157 (3982)	208 (5295)	281 (7132)		
			Isolator Y-Dimension	87 (2206)							
019	8	B	Isolator X-Dimension	10 (263)	76 (1943)	118 (3000)	157 (3985)	209 (5299)	308 (7823)		
			Isolator Y-Dimension	87 (2206)							
020	0	C	Isolator X-Dimension	10 (263)	76 (1943)	118 (3000)	157 (3985)	209 (5299)	281 (7136)		
			Isolator Y-Dimension	87 (2206)							
021	3	A	Isolator X-Dimension	10 (263)	81 (2057)	149 (3779)	187 (4756)	251 (6368)			
			Isolator Y-Dimension	87 (2206)							
021	5	C	Isolator X-Dimension	10 (263)	81 (2057)	149 (3779)	187 (4756)	251 (6368)			
			Isolator Y-Dimension	87 (2206)							
021	8	C	Isolator X-Dimension	10 (263)	81 (2057)	149 (3779)	187 (4756)	235 (5968)	301 (7653)		
			Isolator Y-Dimension	87 (2206)							
023	3	B	Isolator X-Dimension	10 (263)	76 (1943)	118 (2999)	157 (3984)	209 (5298)	281 (7135)		
			Isolator Y-Dimension	87 (2206)							
024	5	C	Isolator X-Dimension	10 (263)	76 (1943)	128 (3260)	173 (4391)	220 (5579)	301 (7654)		
			Isolator Y-Dimension	87 (2206)							

NOTES:
1. Contact your nearest Johnson Controls Sales Office for weight data.
2. All isolator mounting holes are 19mm.
3. Dimensions are in inches (mm).

TABLE 12 - ISOLATOR SELECTION AND MOUNTING LOCATIONS (CONT'D)

YVAA CONFIGURATION			DESCRIPTION	1	2	3	4	5	6	7	8
FRAME	COND	EVAP									
024	8	C	Isolator X-Dimension (in)	10 (263)	81 (2057)	143 (3638)	187 (4748)	245 (6232)	339 (8609)		
			Isolator Y-Dimension (in)	1 (34)							
026	3	B	Isolator X-Dimension (in)	10 (263)	77 (1943)	118 (2999)	157 (3984)	209 (5298)	308 (7823)		
			Isolator Y-Dimension (in)	1 (34)							
027	0	D	Isolator X-Dimension	10 (263)	81 (2057)	149 (3779)	187 (4756)	264 (6709)			
			Isolator Y-Dimension	1 (34)							
027	3	D	Isolator X-Dimension (in)	10 (263)	81 (2057)	161 (4084)	201 (5105)	301 (7654)			
			Isolator Y-Dimension (in)	1 (34)							
027	5	E	Isolator X-Dimension (in)	10 (263)	81 (2057)	161 (4084)	201 (5105)	301 (7654)			
			Isolator Y-Dimension (in)	1 (34)							
027	8	E	Isolator X-Dimension (in)	10 (263)	81 (2057)	161 (4095)	201 (5105)	298 (7582)	339 (8609)		
			Isolator Y-Dimension (in)	1 (34)							
029	5	E	Isolator X-Dimension (in)	10 (263)	81 (2057)	161 (4095)	201 (5105)	296 (7512)	339 (8609)		
			Isolator Y-Dimension (in)	1 (34)							
030	3	C	Isolator X-Dimension (in)	10 (263)	81 (2057)	143 (3638)	187 (4748)	245 (6232)	339 (8608)		
			Isolator Y-Dimension (in)	1 (34)							
030	5	C	Isolator X-Dimension (in)	10 (260)	81 (2057)	144 (3663)	187 (4755)	277 (7047)	383 (9726)		
			Isolator Y-Dimension (in)	1 (34)							
030	8	E	Isolator X-Dimension (in)	10 (260)	81 (2054)	161 (4081)	201 (5102)	298 (7579)	383 (9723)		
			Isolator Y-Dimension (in)	1 (34)							
031	8	E	Isolator X-Dimension (in)	10 (263)	81 (2057)	161 (4084)	201 (5105)	298 (7582)	427 (10843)		
			Isolator Y-Dimension (in)	1 (34)							
032	3	E	Isolator X-Dimension (in)	10 (263)	81 (2057)	161 (4084)	201 (5105)	298 (7582)	339 (8609)		
			Isolator Y-Dimension (in)	1 (34)							
033	3	C	Isolator X-Dimension (in)	10 (263)	81 (2057)	143 (3636)	188 (4781)	245 (6232)	383 (9726)		
			Isolator Y-Dimension (in)	1 (34)							
034	3	E	Isolator X-Dimension (in)	10 (263)	81 (2057)	161 (4084)	201 (5105)	298 (7582)	383 (9726)		
			Isolator Y-Dimension (in)	1 (34)							
034	5	E	Isolator X-Dimension (in)	10 (263)	81 (2057)	161 (4084)	201 (5105)	298 (7582)	427 (10843)		
			Isolator Y-Dimension (in)	1 (34)							

NOTES:

1. Contact your nearest Johnson Controls Sales Office for weight data.
2. All isolator mounting holes are 19mm.
3. Dimensions are in inches (mm).

TABLE 12 - ISOLATOR SELECTION AND MOUNTING LOCATIONS (CONT'D)

YVAA CONFIGURATION			DESCRIPTION	9	10	11	12	13	14	15	16
FRAME	COND	EVAP									
024	8	C	Isolator X-Dimension	10 (263)	81 (2057)	143 (3638)	187 (4748)	245 (6232)	339 (8609)		
			Isolator Y-Dimension	87 (2206)							
026	3	B	Isolator X-Dimension	10 (263)	77 (1943)	118 (2999)	157 (3984)	209 (5298)	308 (7823)		
			Isolator Y-Dimension	87 (2206)							
027	0	D	Isolator X-Dimension	10 (263)	81 (2057)	149 (3779)	187 (4756)	264 (6709)			
			Isolator Y-Dimension	1 (34)							
027	3	D	Isolator X-Dimension	10 (263)	81 (2057)	161 (4084)	201 (5105)	301 (7654)			
			Isolator Y-Dimension	87 (2206)							
027	5	E	Isolator X-Dimension	10 (263)	81 (2057)	161 (4084)	201 (5105)	301 (7654)			
			Isolator Y-Dimension	87 (2206)							
027	8	E	Isolator X-Dimension	10 (263)	81 (2057)	161 (4095)	201 (5105)	298 (7582)	339 (8609)		
			Isolator Y-Dimension	87 (2206)							
029	5	E	Isolator X-Dimension	10 (263)	81 (2057)	161 (4095)	201 (5105)	296 (7512)	339 (8609)		
			Isolator Y-Dimension	87 (2206)							
030	3	C	Isolator X-Dimension	10 (263)	81 (2057)	143 (3638)	187 (4748)	245 (6232)	339 (8608)		
			Isolator Y-Dimension	87 (2206)							
030	5	C	Isolator X-Dimension	10 (260)	81 (2057)	144 (3663)	187 (4755)	277 (7047)	383 (9726)		
			Isolator Y-Dimension	87 (2206)							
030	8	E	Isolator X-Dimension	10 (260)	81 (2054)	161 (4081)	201 (5102)	298 (7579)	383 (9723)		
			Isolator Y-Dimension	87 (2206)							
031	8	E	Isolator X-Dimension	10 (263)	81 (2057)	161 (4084)	201 (5105)	298 (7582)	427 (10843)		
			Isolator Y-Dimension	87 (2206)							
032	3	E	Isolator X-Dimension	10 (263)	81 (2057)	161 (4084)	201 (5105)	298 (7582)	339 (8609)		
			Isolator Y-Dimension	87 (2206)							
033	3	C	Isolator X-Dimension	10 (263)	81 (2057)	143 (3636)	188 (4781)	245 (6232)	383 (9726)		
			Isolator Y-Dimension	87 (2206)							
034	3	E	Isolator X-Dimension	10 (263)	81 (2057)	161 (4084)	201 (5105)	298 (7582)	383 (9726)		
			Isolator Y-Dimension	87 (2206)							
034	5	E	Isolator X-Dimension	10 (263)	81 (2057)	161 (4084)	201 (5105)	298 (7582)	427 (10843)		
			Isolator Y-Dimension	87 (2206)							

NOTES:
1. Contact your nearest Johnson Controls Sales Office for weight data.
2. All isolator mounting holes are 19mm.
3. Dimensions are in inches (mm).

TABLE 12 - ISOLATOR SELECTION AND MOUNTING LOCATIONS (CONT'D)

YVAA CONFIGURATION			DESCRIPTION	1	2	3	4	5	6	7	8
FRAME	COND	EVAP									
036	8	J	Isolator X-Dimension (in)	10 (263)	81 (2057)	145 (3680)	205 (5219)	284 (7218)	383 (9725)	439 (11157)	495 (12577)
			Isolator Y-Dimension (in)	1 (34)							
037	3	F	Isolator X-Dimension (in)	10 (263)	81 (2057)	145 (3680)	206 (5219)	284 (7218)	427 (10842)		
			Isolator Y-Dimension (in)	1 (34)							
037	5	J	Isolator X-Dimension (in)	10 (263)	81 (2057)	145 (3680)	206 (5219)	284 (7218)	427 (10842)		
			Isolator Y-Dimension (in)	1 (34)							
039	8	J	Isolator X-Dimension (in)	10 (263)	81 (2057)	145 (3680)	206 (5219)	284 (7218)	427 (10842)	483 (12274)	539 (13694)
			Isolator Y-Dimension (in)	1 (34)							
041	3	H	Isolator X-Dimension (in)	10 (263)	81 (2057)	145 (3680)	205 (5219)	284 (7218)	427 (10843)		
			Isolator Y-Dimension (in)	1 (34)							
042	5	H	Isolator X-Dimension (in)	10 (254)	81 (2057)	145 (3680)	206 (5219)	284 (7218)	427 (10842)	483 (12274)	539 (13694)
			Isolator Y-Dimension (in)	1 (34)							
042	8	J	Isolator X-Dimension (in)	10 (260)	81 (2054)	145 (3677)	205 (5216)	284 (7215)	427 (10839)	505 (12817)	562 (14262)
			Isolator Y-Dimension (in)	1 (34)							
044	3	G	Isolator X-Dimension (in)	10 (263)	81 (2057)	154 (3907)	206 (5219)	284 (7218)	427 (10842)	483 (12274)	539 (13694)
			Isolator Y-Dimension (in)	1 (34)							
047	5	J	Isolator X-Dimension (in)	10 (263)	81 (2057)	154 (3907)	206 (5219)	284 (7218)	427 (10842)	505 (12820)	562 (14265)
			Isolator Y-Dimension (in)	1 (34)							
048	3	G	Isolator X-Dimension (in)	10 (263)	81 (2057)	154 (3907)	206 (5219)	284 (7218)	427 (10842)	505 (12820)	562 (14265)
			Isolator Y-Dimension (in)	1 (34)							
049	0	K	Isolator X-Dimension	10 (263)	81 (2057)	154 (3907)	205 (5219)	284 (7218)	427 (10842)		
			Isolator Y-Dimension	1 (34)							
050	0	J	Isolator X-Dimension (in)	10 (263)	81 (2057)	154 (3908)	205 (5219)	284 (7218)	427 (10843)		
			Isolator Y-Dimension (in)	1 (34)							
052	3	J	Isolator X-Dimension (in)	10 (263)	81 (2057)	154 (3907)	206 (5219)	284 (7218)	427 (10842)	505 (12820)	562 (14265)
			Isolator Y-Dimension (in)	1 (34)							

NOTES:

1. Contact your nearest Johnson Controls Sales Office for weight data.
2. All isolator mounting holes are 19mm.
3. Dimensions are in inches (mm).

TABLE 12 - ISOLATOR SELECTION AND MOUNTING LOCATIONS (CONT'D)

YVAA CONFIGURATION			DESCRIPTION	9	10	11	12	13	14	15	16
FRAME	COND	EVAP									
036	8	J	Isolator X-Dimension (in)	10 (263)	81 (2057)	145 (3680)	205 (5219)	284 (7218)	383 (9725)	439 (11157)	495 (12577)
			Isolator Y-Dimension (in)	1 (34)							
037	3	F	Isolator X-Dimension (in)	10 (263)	81 (2057)	145 (3680)	206 (5219)	284 (7218)	427 (10842)		
			Isolator Y-Dimension (in)	1 (34)							
037	5	J	Isolator X-Dimension (in)	10 (263)	81 (2057)	145 (3680)	206 (5219)	284 (7218)	427 (10842)		
			Isolator Y-Dimension (in)	87 (2206)							
039	8	J	Isolator X-Dimension (in)	10 (263)	81 (2057)	145 (3680)	206 (5219)	284 (7218)	427 (10842)	483 (12274)	539 (13694)
			Isolator Y-Dimension (in)	87 (2206)							
041	3	H	Isolator X-Dimension (in)	10 (263)	81 (2057)	145 (3680)	205 (5219)	284 (7218)	427 (10843)		
			Isolator Y-Dimension (in)	87 (2206)							
042	5	H	Isolator X-Dimension (in)	10 (254)	81 (2057)	145 (3680)	206 (5219)	284 (7218)	427 (10842)	483 (12274)	539 (13694)
			Isolator Y-Dimension (in)	87 (2206)							
042	8	J	Isolator X-Dimension (in)	10 (260)	81 (2054)	145 (3677)	205 (5216)	284 (7215)	427 (10839)	505 (12817)	562 (14262)
			Isolator Y-Dimension (in)	87 (2206)							
044	3	G	Isolator X-Dimension (in)	10 (263)	81 (2057)	154 (3907)	206 (5219)	284 (7218)	427 (10842)	483 (12274)	539 (13694)
			Isolator Y-Dimension (in)	87 (2206)							
047	5	J	Isolator X-Dimension (in)	10 (263)	81 (2057)	154 (3907)	206 (5219)	284 (7218)	427 (10842)	505 (12820)	562 (14265)
			Isolator Y-Dimension (in)	87 (2206)							
048	3	G	Isolator X-Dimension (in)	10 (263)	81 (2057)	154 (3907)	206 (5219)	284 (7218)	427 (10842)	505 (12820)	562 (14265)
			Isolator Y-Dimension (in)	87 (2206)							
049	0	K	Isolator X-Dimension	10 (263)	81 (2057)	154 (3907)	205 (5219)	284 (7218)	427 (10842)		
			Isolator Y-Dimension	1 (34)							
050	0	J	Isolator X-Dimension (in)	10 (263)	81 (2057)	154 (908)	205 (5219)	284 (7218)	427 (10843)		
			Isolator Y-Dimension (in)	1 (34)							
052	3	J	Isolator X-Dimension (in)	10 (263)	81 (2057)	154 (3907)	206 (5219)	284 (7218)	427 (10842)	505 (12820)	562 (14265)
			Isolator Y-Dimension (in)	1 (34)							

NOTES:
1. Contact your nearest Johnson Controls Sales Office for weight data.
2. All isolator mounting holes are 19mm.
3. Dimensions are in inches (mm).

ONE INCH DEFLECTION SPRING ISOLATORS INSTALLATION INSTRUCTIONS

Read instructions in their entirety before beginning installation.

1. Isolators are shipped fully assembled and are to be positioned in accordance with the submittal drawings or as otherwise recommended.
2. Set isolators on floor, housekeeping pad or sub-base, ensuring that all isolator centerlines match the equipment mounting holes. The VMC group recommends that the isolator base ("B") be installed on a level surface. Shim or grout as required, leveling all isolator bases to the same elevation [1/4-inch (6.35 mm) maximum difference can be tolerated].
3. Bolt or anchor all isolators to supporting structure utilizing base slotted holes ("C").

NOTE

Other materials, compounds or finishes with equal or superior properties may be submitted as they become available.

4. Place equipment on top of isolators making sure that mounting holes of the equipment line up with isolator positioning pin ("H").
5. The adjustment process can only begin after the equipment or machine is at its full operating weight.
6. Adjust each isolator in sequence by turning spring adjusting bolt ("D") one full counterclockwise turn at a time. Repeat this procedure on all isolators, one at a time.
7. Continue adjusting each isolator until a minimum of 1/4 inches (6.35 mm) clearance is achieved between the lower housing and upper housing. (See *Figure 41 on page 100*).
8. Fine adjust isolators to level equipment.
9. Installation is complete.

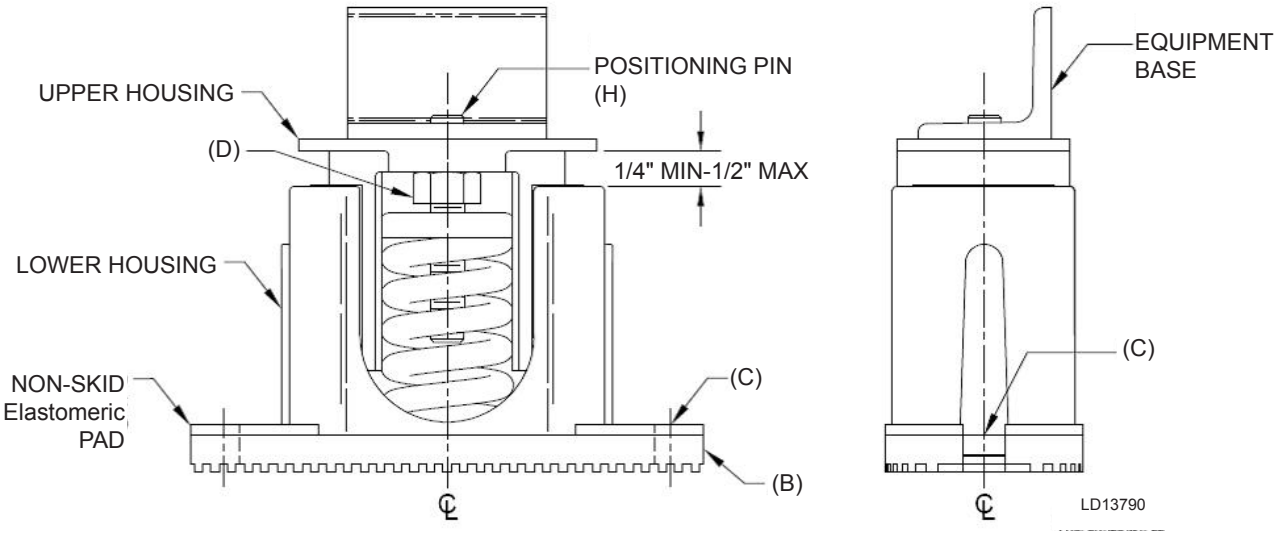


FIGURE 41 - CROSS SECTIONAL VIEW OF ONE INCH DEFLECTION SPRING ISOLATOR

ONE INCH DEFLECTION SPRING ISOLATORS

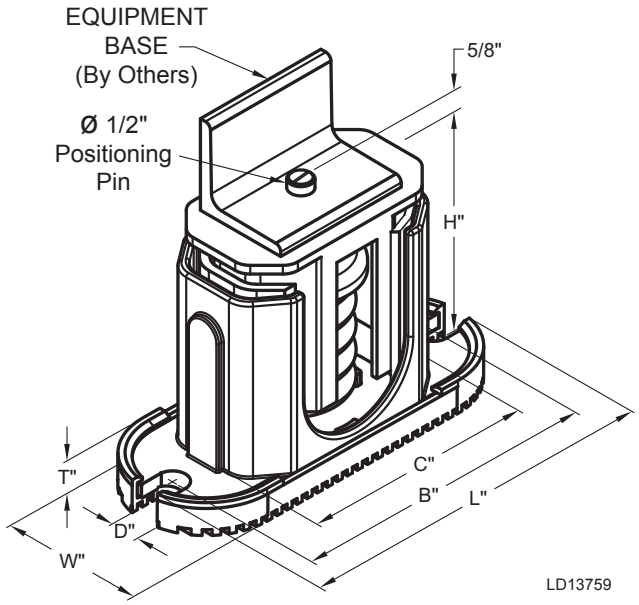


TABLE 13 - ONE INCH DEFLECTION SPRING ISOLATORS CROSS-REFERENCE

MOUNT TYPE	DIMENSION DATA (INCHES)						
	W	D	L	B	C	T	H
CP	3	5/8	7-3/4	6-1/2	4-3/4	1/2	5-5/8
C2P	3	5/8	10-1/2	9-1/4	7-3/4	9/16	6

MODEL NUMBER	COLOR CODE	RATED CAPACITY (FOR UNITS WITH ALL LOAD POINTS LESS THAN 1785 LBS (810 KG)		YORK P/N
		(LBS.)	(KG)	
CP-1D-510	BLACK	Up thru 434	Up thru 197	029-25334-002
CP-1D-900	DARK GREEN	435 thru 765	198 thru 347	029-25334-003
CP-1D-1200	GRAY	766 thru 1020	348 thru 463	029-25334-004
CP-1D-1360	WHITE	1021 thru 1156	464 thru 524	029-25334-005
CP-1D-1785N	GRAY/RED	1157 thru 1785	525 thru 810	029-25334-006

MODEL NUMBER	COLOR CODE	RATED CAPACITY (FOR UNITS WITH ANY LOAD POINT ABOVE 1518 LBS (689 KG)		YORK P/N
		(LBS.)	(KG)	
C2P-1D-1350	DARK PURPLE	Up thru 1148	Up to 521	029-25334-008
C2P-1D-1800	DARK GREEN	1149 thru 1530	522 - 694	029-25334-009
C2P-1D-2400	GRAY	1531 thru 2040	695 - 925	029-25334-010
C2P-1D-2720	WHITE	2041 thru 2312	926 - 1049	029-25334-012
C2P-1D-3570N	GRAY/RED	2313 thru 3570	1050 - 1619	029-25334-013

NOTES:

1. All dimensions are in inches per ANSI Y14.
2. Standard finish: Housing - Powder coated Spring - Powder coated. (Color: see Table Hardware - Zinc electroplate.
3. Installation requires bolting or anchoring mount to support structure with a min. (2) 5/8" dia. bolt or (2) 1/2" dia. concrete anchors.
4. All springs are designed for 50 % over-travel.
5. See the next page for Installation Instructions.
6. Isolators with 1" deflection (Pin 54 = 1) must be of the same class for the entire unit. That is, C2P's must be used at all locations on a selected unit, or all CP's.
7. * Value is de-rated by 15%.

INSTALLATION OF ELASTROMERIC ISOLATORS

Read instructions in their entirety before beginning installation.

1. Isolators are shipped fully assembled and are to be positioned in accordance with the submittal drawings or as otherwise recommended.
2. Set isolators on floor, housekeeping pad, or subbase, ensuring that all isolator centerlines match the equipment mounting holes.

NOTE

Isolators will typically appear square or rectangular in physical appearance.

3. The VMC group recommends that the isolator base (A) be installed on a level surface. Shim or grout as required, leveling all isolator bases to the same elevation [1/32 inches (0.794 mm) maximum difference can be tolerated].
4. Bolt or anchor all isolators to supporting structure utilizing base thru holes (B).
5. Remove top bolt and top washer. Place equipment on top of isolators so that mounting holes in equipment or base line up with threaded hole (C).
6. Reinstall top bolt and washer and tighten down.
7. Installation is complete.

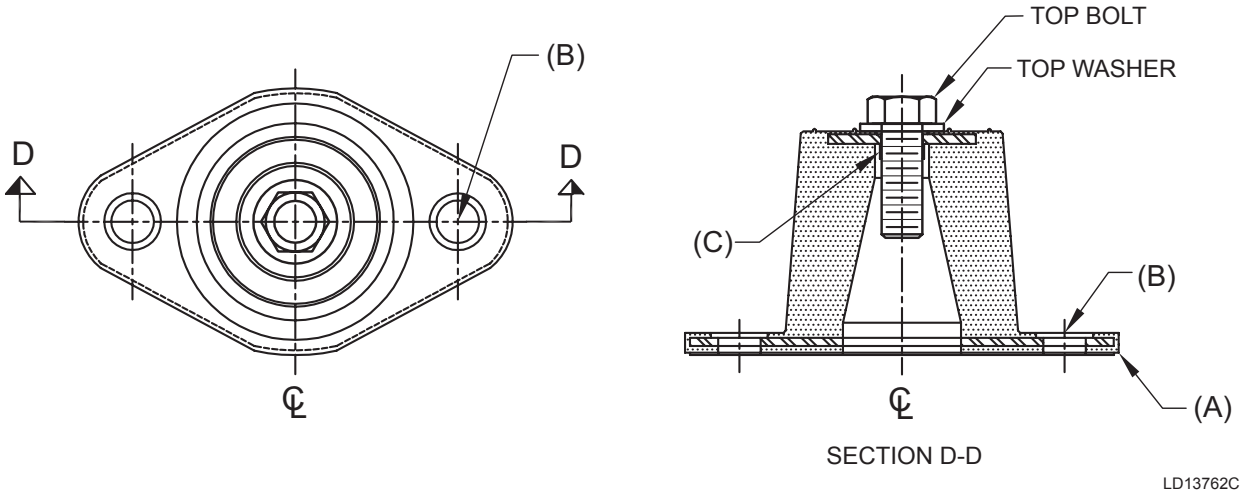


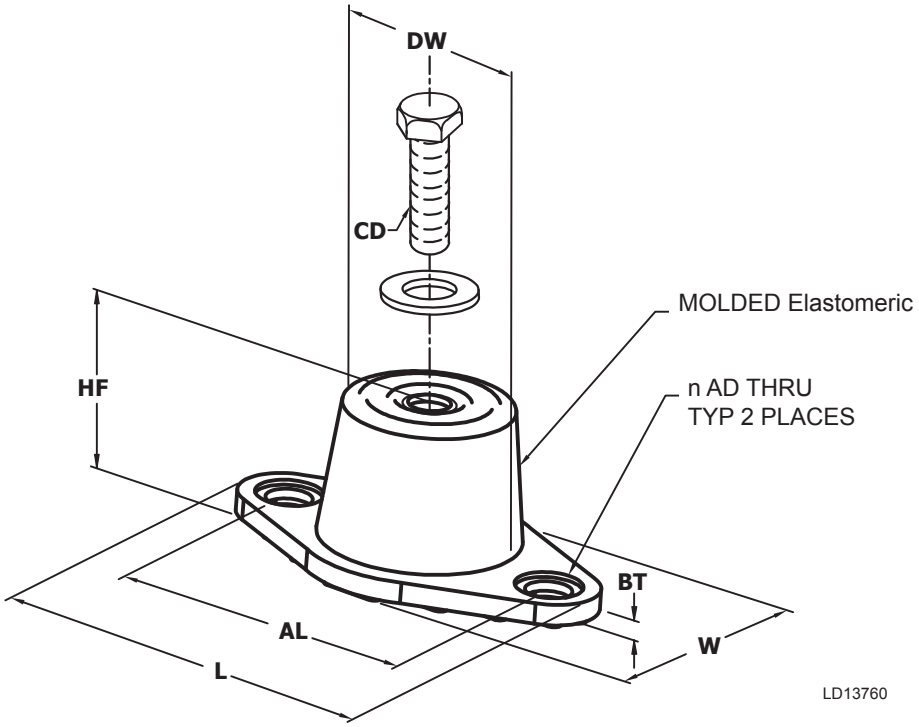
FIGURE 42 - ELASTOMERIC ISOLATOR CROSS SECTIONAL VIEW

ELASTOMERIC ISOLATOR CROSS REFERENCE

RD-Style Isolators

NOTE

Isolators will typically appear square or rectangular in physical appearance.



MOUNT TYPE	DIMENSION DATA inches / (mm)							
	L	W	HF	AL	AD	BT	CD	DW
RD1-WR	3.13 (79.50)	1.75 (44.45)	1.25 (31.75)	2.38 (60.45)	0.34 (8.64)	0.19 (4.83)	5/16-18 UNC X 3/4 (M14 X 2)	1.25 (31.75)
RD2-WR	3.88 (98.55)	2.38 (60.45)	1.75 (44.45)	3.00 (76.20)	0.34 (8.64)	0.22 (5.59)	3/8-16 UNC X 1 (M18 X 2.5)	1.75 (44.45)
RD3-WR	5.50 (139.7)	3.38 (85.85)	2.88 (73.15)	4.13 (104.90)	0.56 (14.22)	0.25 (6.35)	1/2-13 UNC X 1 (M27 X 3)	2.50 (63.50)
RD4-WR	6.25 (158.75)	4.63 (117.6)	2.75 (69.85)	5.00 (127.00)	0.56 (14.22)	0.38 (9.65)	1/2-13 UNC X 1 (M27 X 3)	3.00 (76.20)

MODEL NUMBER	ISOLATOR COLOR	WEIGHT RANGE (LBS)	WEIGHT RANGE (KGS)	YORK P/N
RD-3-CHARCOAL-WR	CHARCOAL	Up thru 825	UP TO 374	**029-25335-001**
RD-4-BRICK RED-WR	BRICK RED	826 thru 1688	375 - 766	**029-25335-002**
RD-4-CHARCOAL-WR	CHARCOAL	1689 thru 4000	767 - 1814	**029-25335-004**

NOTES:

1. All dimensions are in inches (mm) per ANSI Y14.
2. See the next page for Installation Instructions.
3. Mount molded in weather resistant durulene compound as standard; also available in other materials such as natural rubber, extreme high temperature silicone, high-damped silicone, nitrile and EDPM.
4. AL = Mounting hole center to center spacing.
5. HF = Free height of mount, prior to loading. Operating height calculated by the free height less the static deflection under load. All dimensions for reference only.
6. Hardware - Zinc electroplate.

FIGURE 43 - ELASTOMERIC ISOLATOR DATA

TWO INCH DEFLECTION ISOLATOR INSTALLATION AND ADJUSTMENT

To install and adjust mounts:

1. Supports for mountings must be leveled to installation's acceptable tolerances.
2. Mountings not subjected to seismic or wind forces do not require bolting to supports.
3. Mountings subjected to seismic or wind forces must be bolted or welded in position.
4. If mountings are welded in position, remove lower friction pad before welding.
5. Set mountings with top channels held in place by the lower restraining nuts and limit stops.
6. Place equipment on mountings and secure by bolting or welding.
7. Hold lower restraining nut in place and turn vertical limit stop bolt counter-clockwise until there is a 1/8 inches of a gap between the bolt head and the steel washer.
8. Turn adjustment bolt 8 turns on each mount.
9. Take one additional complete turn on each adjustment bolt in sequence until the top plate lifts off of the lower restraining nuts. Take no additional turns on that mount. Continue with equal turns on the other mounts until the top plates lift off of the lower restraining nuts of all mounts.
10. Hold the limit stop bolt in place and turn the lower restraining nut clockwise and tighten it against the stanchion. Repeat the same procedure on all mounts.
11. Top plate should remain at a fixed elevation, plus or minus 1/8 inches (3.18 mm).

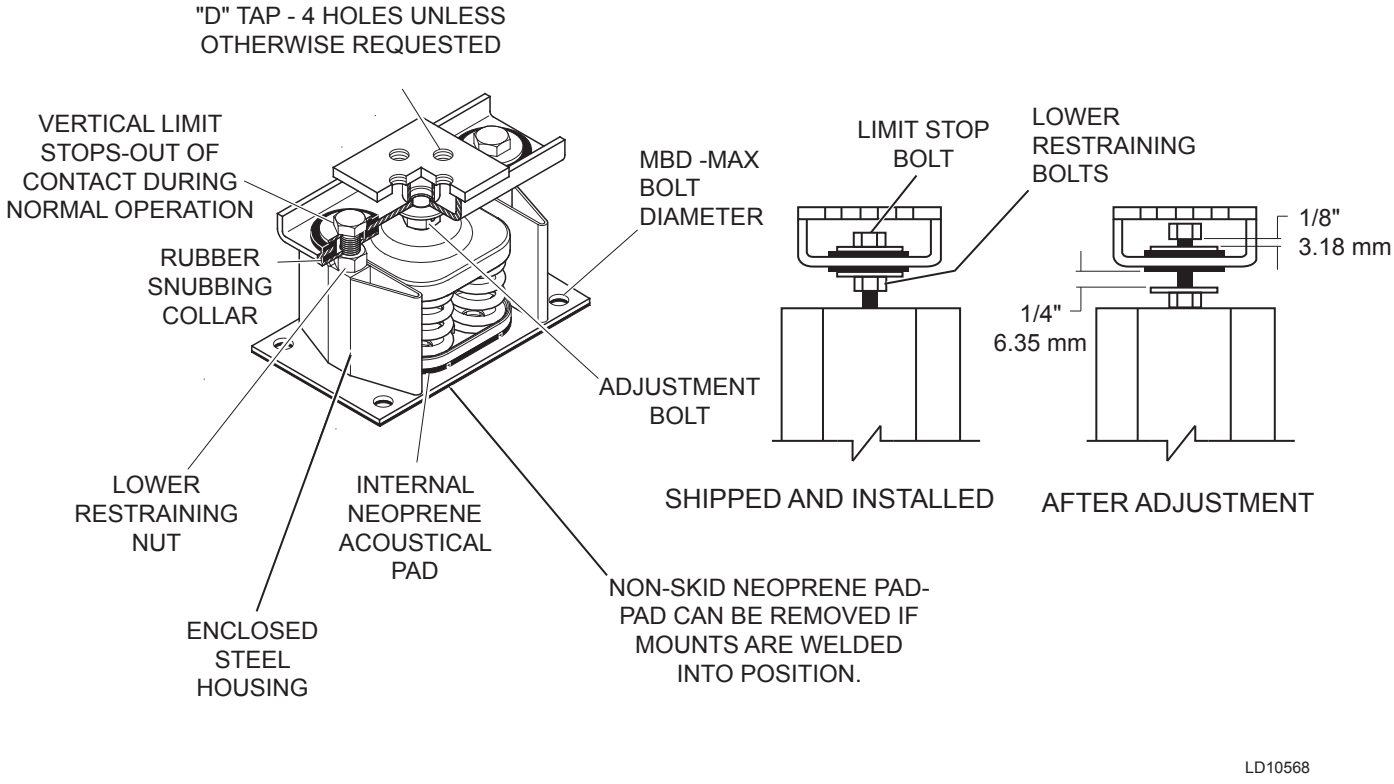
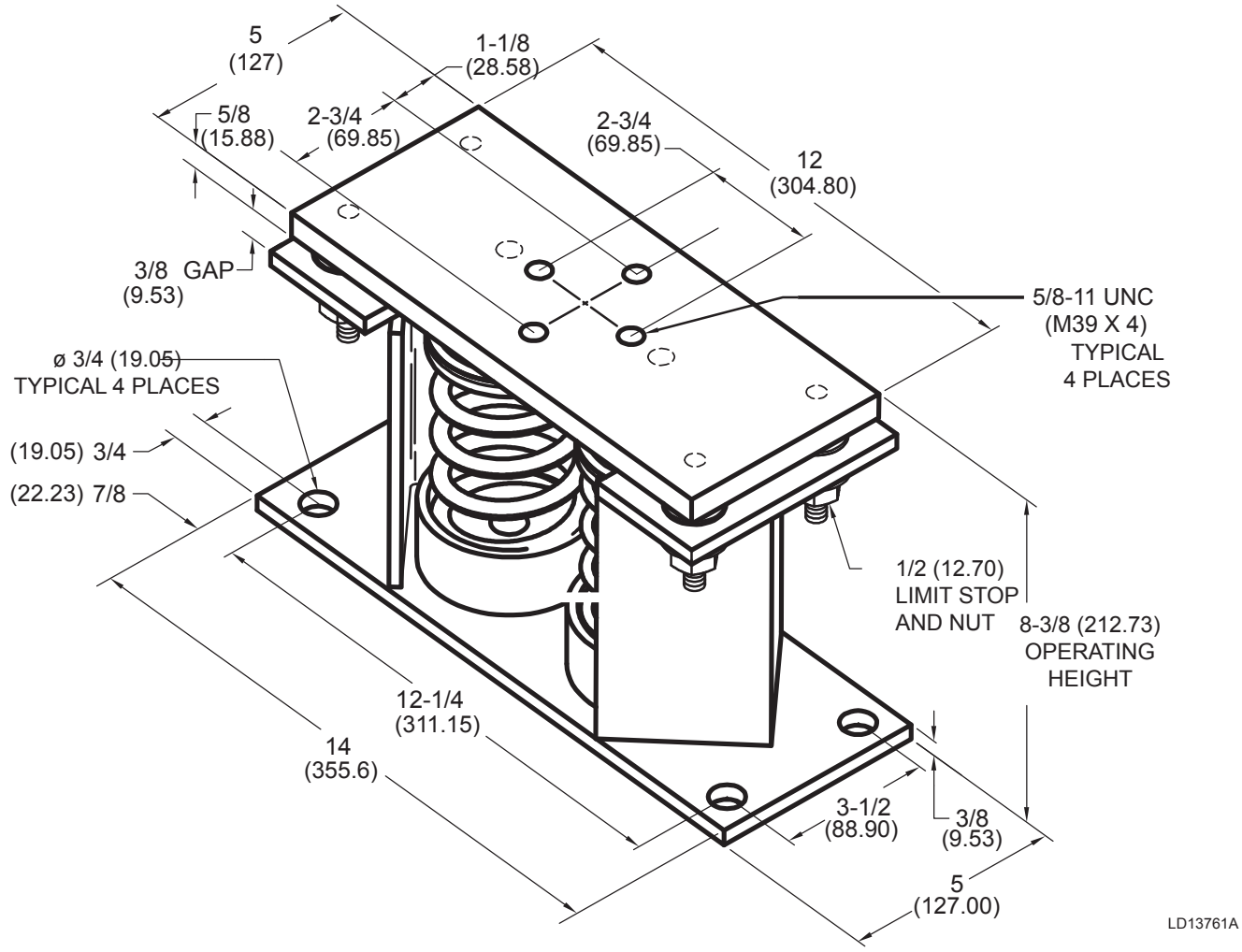


FIGURE 44 - TWO INCH DEFLECTION ISOLATOR

TWO INCH DEFLECTION RESTRAINED SPRING ISOLATOR

Y2RS



* WEIGHT RANGE (LBS)	* WEIGHT RANGE (KGS)	MODEL P/N	COLOR	YORK P/N
Up to 391	Up to 177	Y2RSI-2D-460	GREEN	029-25336-006
392 through 604	178 through 274	Y2RSI-2D-710	DK BROWN	029-25336-008
605 through 740	275 through 336	Y2RSI-2D-870	RED	029-25336-009
741 through 1020	337 through 463	Y2RSI-2D-1200N	RED/BLACK	029-25336-010
1021 through 1437	464 through 652	Y2RSI-2D-1690	PINK	029-25336-011
1438 through 2244	653 through 1018	Y2RSI-2D-2640N	PINK/GRAY	029-25336-012
2245 through 2618	1019 through 1188	Y2RSI-2D-2870N	PINK/GRAY/ORANGE	029-25336-013
2619 through 3740	1189 through 1696	Y2RSI-2D-3280N	PINK/GRAY/DK BROWN	029-25336-014

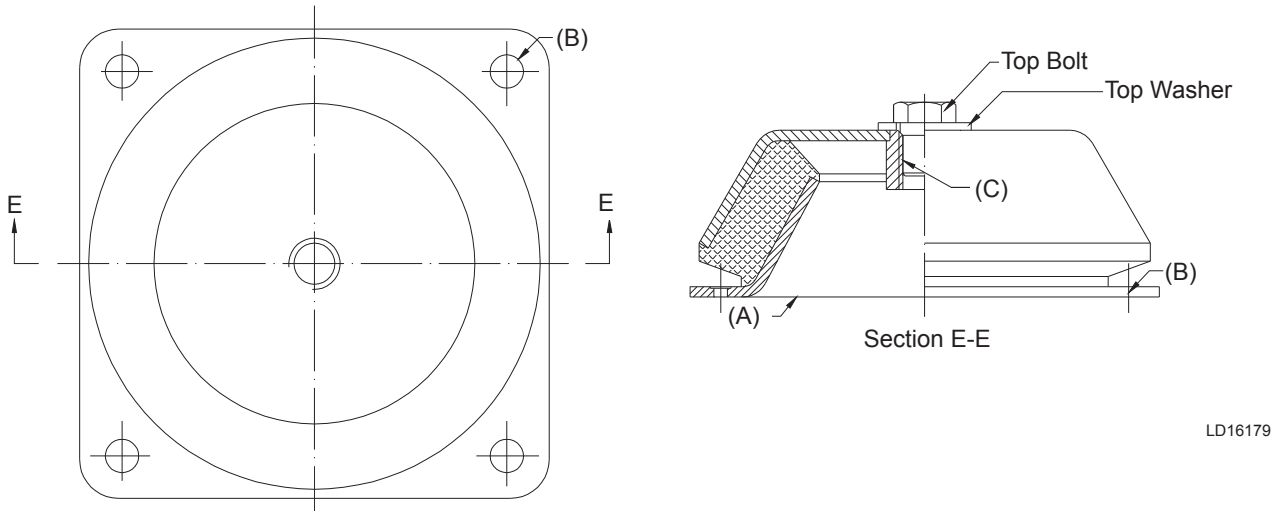
* Value is de-rated by 15%

NOTES:

1. All dimensions are in inches (mm), interpret per ANSI Y14. Standard finish: housing-powder coated (color, black), spring-powder coated (color, see table above) hardware - zinc-electroplate.
2. Equipment must be bolted or welded to the top plate to meet allowable seismic ratings.
3. All springs are designed for 50% overload capacity with exception of the 2D-3280N and 2D-2870.
4. See the next page for installation instructions.
5. Consult factory for concrete installation.

FIGURE 45 - SEISMIC ISOLATOR DATA

ELASTOMERIC ISOLATOR INSTALLATION (GB CERTIFIED UNITS)

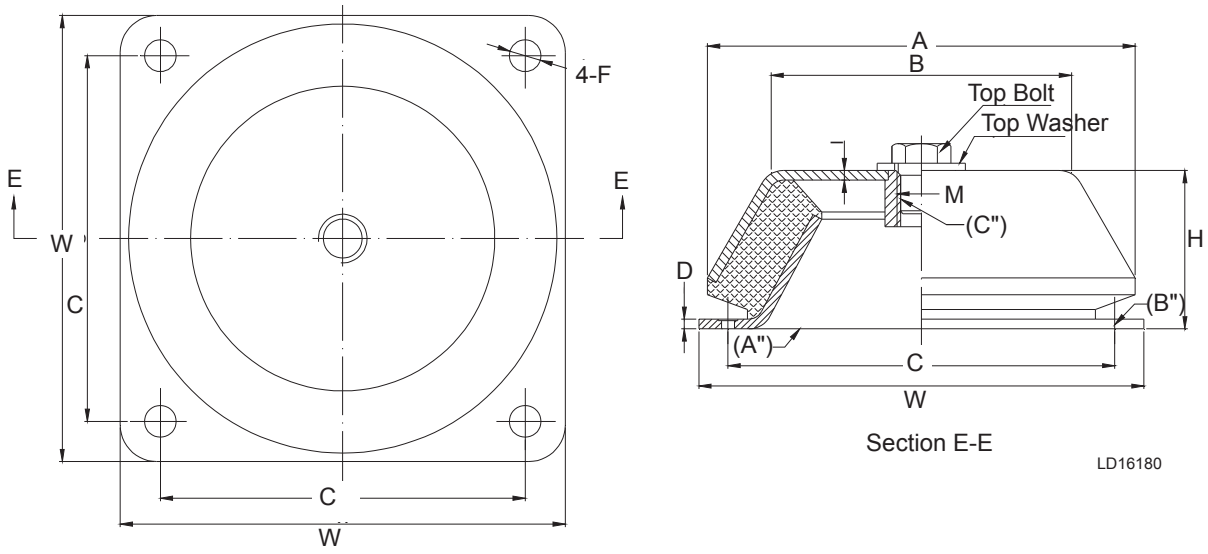


Read the following instructions before beginning installation.

1. Isolators are shipped fully assembled and are to be positioned in accordance with the submittal drawings or as otherwise recommended.
2. Set isolators on the floor, housekeeping pad or subbase, ensuring that all isolator centerlines match the equipment mounting holes. It is recommended that the isolator base (A) be installed on a level surface.

   Shim or grout the isolator as required, leveling all isolator bases to the same elevation.The maximum difference that can be tolerated is 0.03125 inches (0.78 mm).
3. Bolt or anchor all isolators to the supporting structure utilizing base thru holes (B).
4. Remove the top bolt and top washer. Place equipment on top of the isolators such that the mounting holes in the equipment or base line up with the threaded hole (C).
5. Reinstall the top bolt and washer and tighten the bolt down.

ELASTOMERIC ISOLATOR SPECIFICATIONS (GB CERTIFIED UNITS)



MOUNT TYPE	DIMENSION DATA (MM)							
	A	B	C	W	H	D	M	F
JG 1	Φ 146	Φ 95	125	150	55	3	M16	Φ 13
JG 2	Φ 176	Φ 125	150	183	65	4	M20	Φ 13

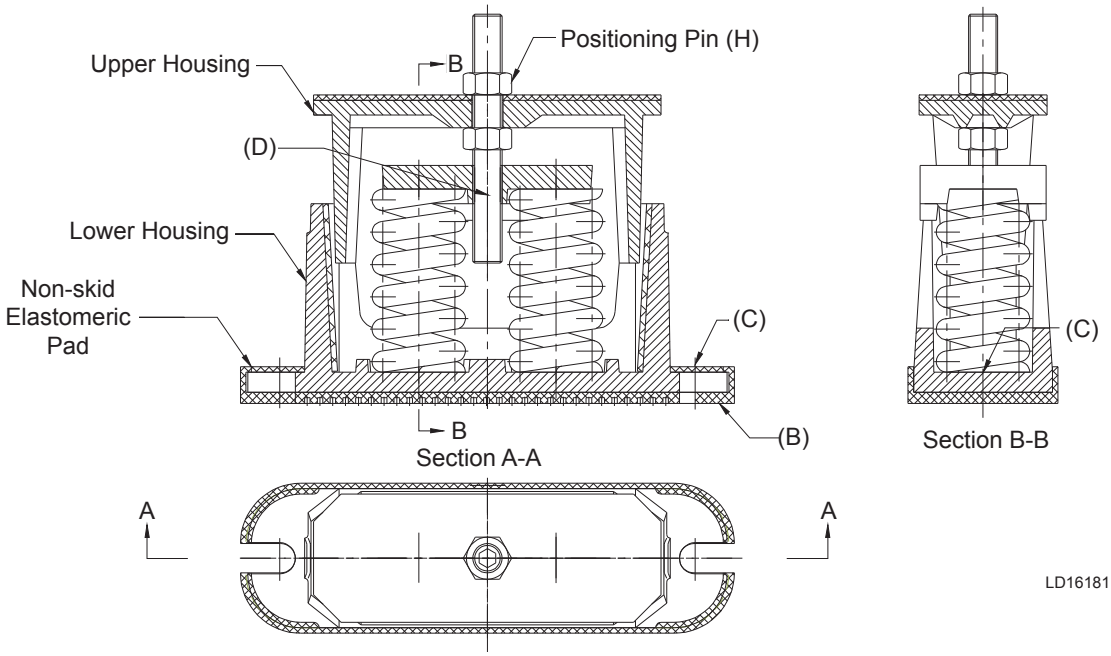
MODEL NUMBER	RATED CAPACITY FOR UNITS WITH ALL LOAD POINTS LESS THAN 1984 LBS (900 KG)		
	WEIGHT RANGE		PART NUMBER
	(LBS.)	RANGE (KG)	
JG 1-1	331 thru 661	150 thru 300	028G00031A035
JG 1-2	662 thru 1213	301 thru 550	028G00031A036
JG 1-3	1214 thru 1984	551 thru 900	028G00031A037

MODEL NUMBER	RATED CAPACITY FOR UNITS WITH ALL LOAD POINTS LESS THAN 4409 LBS (2000 KG)		
	WEIGHT RANGE		PART NUMBER
	(LBS.)	RANGE (KG)	
JG 1-1	882 thru 1984	400 thru 900	028G00031A038
JG 1-2	1985 thru 3527	901 thru 1600	028G00031A039
JG 1-3	3528 thru 4409	1601 thru 2000	028G00031A040

NOTES:

1. All dimensions are in millimeters.
2. Use either all JG 1's or all JG 2's at all locations on a unit.
3. Installation requires bolting or anchoring mount to support structure with 4 x 0.5122" (4 x 13.0 mm) diameter bolts or 2 x 0.5" (2 x 12.7mm) diameter concrete anchors.

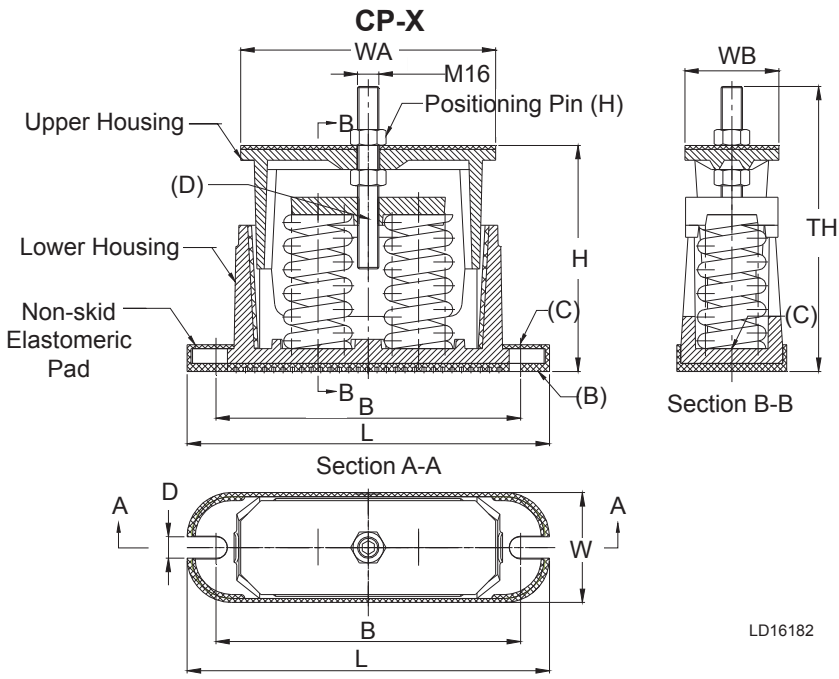
ONE INCH DEFLECTION ISOLATOR INSTALLATION (GB CERTIFIED UNITS)



Read the following instructions before beginning installation.

1. Isolators are shipped fully assembled and are to be positioned in accordance with the submittal drawings or as otherwise recommended.
2. Set isolators on the floor, housekeeping pad or subbase, ensuring that all the isolator centerlines match the equipment mounting holes. It is recommended that the isolator base (B) be installed on a level surface. Shim or grout the isolators as required, leveling all isolator bases to the same elevation. The maximum difference that can be tolerated is 0.25 inches (6.3 mm).
3. Bolt or anchor all isolators to the supporting structure utilizing base slotted holes (C).
4. Place the equipment on top of the isolators ensuring that the mounting holes on the equipment line up with the isolator positioning pin (H).
5. Ensure the equipment is at full operating weight before adjusting the isolators.
6. Adjust each isolator in sequence by turning the spring adjusting bolt (D) one full counterclockwise turn at a time. Repeat this procedure on all isolators, one at a time.
7. Continue adjusting each isolator until the same clearance is achieved between the lower housing and the upper housing for all isolators.
8. Fine adjust isolators to level the equipment.

ONE INCH DEFLECTION ISOLATOR SPRING ISOLATOR (GB CERTIFIED UNITS)



MOUNT TYPE	DIMENSION DATA (MM)							
	WA	WB	H	TH	B	L	D	W
CP-2	190	70	168	211	228	270	16	80
CP-4	193	130	160	202	228	270	16	142

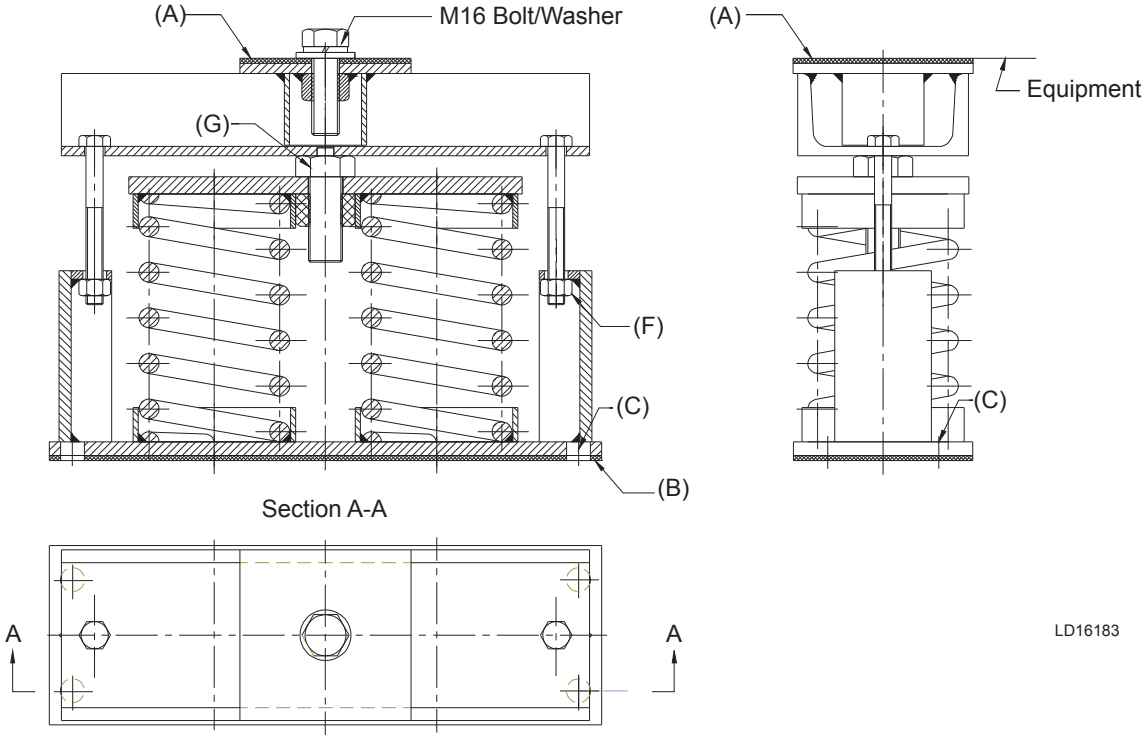
MODEL NUMBER	SPRING NUMBER	RATED CAPACITY FOR UNITS WITH ALL LOAD POINTS LESS THAN 1808 LBS (820 KG)		
		WEIGHT RANGE		PART NUMBER
		(LBS.)	RANGE (KG)	
CP-2-200	2	Up thru 441	Up thru 200	028G00031A028
CP-2-300	2	442 thru 661	201 thru 300	028G00031A029
CP-2-400	2	662 thru 882	301 thru 400	029G23000A018
CP-2-550	2	883 thru 1213	401 thru 550	029G23000A019
CP-2-680	2	1214 hru 1499	551 thru 680	028G00031A030
CP-2-820	2	1500 thru 1808	681 thru 820	029G23000A020

MODEL NUMBER	SPRING NUMBER	RATED CAPACITY FOR UNITS WITH ALL LOAD POINTS LESS THAN 3594 LBS (1630 KG)		
		WEIGHT RANGE		PART NUMBER
		(LBS.)	RANGE (KG)	
CP-4-400	4	Up thru 882	Up thru 400	029G23000A021
CP-4-550	4	883 thru 1213	401 thru 550	029G23000A022
CP-4-680	4	1214 thru 1499	551 thru 680	029G23000A023
CP-4-820	4	1500 thru 1808	681 thru 820	029G23000A024
CP-4-1100	4	1809 thru 2425	821 thru 1100	029G23000A025
CP-4-1360	4	2426 thru 2998	1101 thru 1360	029G23000A026
CP-4-1630	4	2999 thru 3594	1361 thru 1630	029G23000A027

NOTES:

1. All dimensions are in millimeters.
2. Use either all CP-2's or all CP-4's at all locations on a unit.
3. Installation requires bolting or anchoring mount to support structure with 2 x 0.625" (2x16 mm) diameter bolts or 2 x 0.5" (2x12.7mm) diameter concrete anchors.

TWO INCH DEFLECTION ISOLATOR INSTALLATION AND ADJUSTMENT (GB CERTIFIED UNITS)



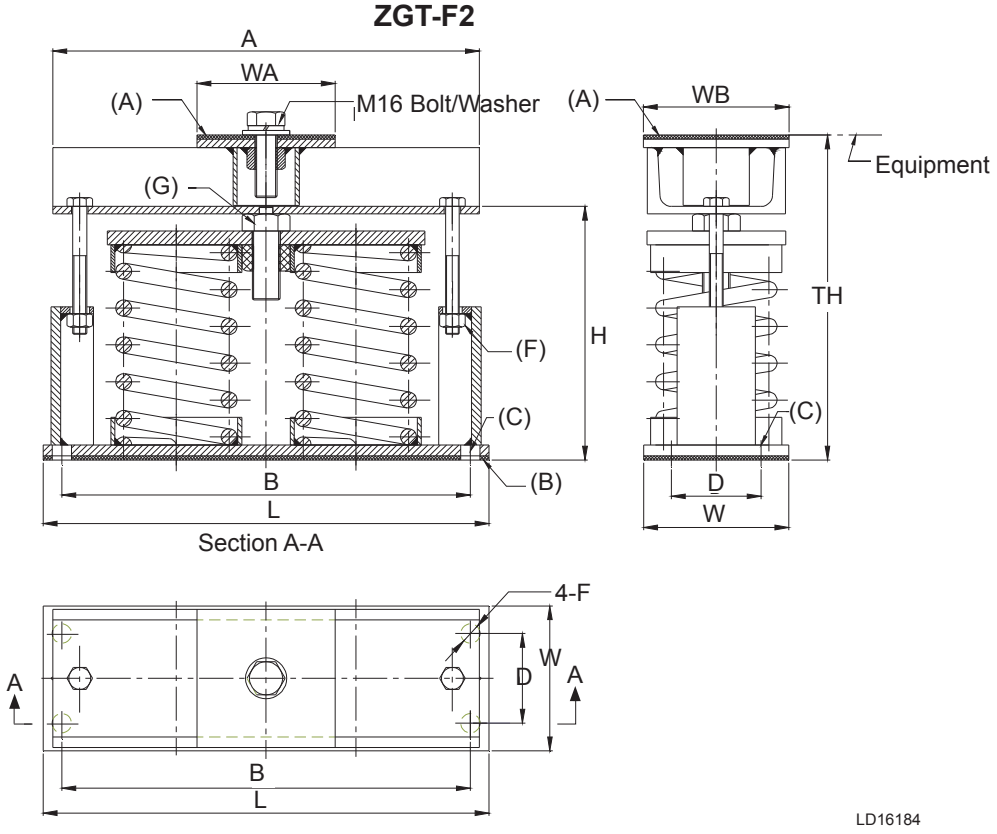
Read the following instructions before beginning installation.

1. Isolators are shipped fully assembled and are to be positioned in accordance with the submittal drawings or as otherwise recommended.
2. Set isolators on the floor, housekeeping pad, or subbase, ensuring that all isolator centerlines match the equipment mounting holes. It is recommended that the isolator base plates (B) be installed on a level surface.

   Shim or grout the isolators as required, leveling all isolator bases to the same elevation. The maximum difference that can be tolerated is 0.25 inches (6.35 mm).
3. Bolt or anchor all isolators to the supporting structure utilizing base plate thru holes (C) or, weld the base plate to the supporting structure with 0.375 inches (9.5mm) fillet, weld 2 inches (50.8mm) long at 4 inches (101.6mm) on center around the entire base plate; or as engineered for specific load and/or field conditions.
4. Ensure the equipment is at full operating weight before adjusting the isolators.
5. Bolt or anchor all isolators to the supporting structure utilizing the base slotted holes (C).
6. Place equipment on top of the isolators ensuring that the mounting holes of the equipment line up with the isolator M16 bolt.
7. Adjust each isolator in sequence by turning spring adjusting nuts (G) one full clockwise turn at a time. Repeat this procedure on all isolators, one at a time. Continue adjusting each isolator until the same clearance is achieved between the lower housing and top plate. Check the limit stop lock nuts (F) periodically to ensure that clearance between the washer and grommet is maintained.
8. Fine adjust the isolators to level equipment.
9. Adjust all limit stop lock nuts (F) per isolator, maintaining a gap between 0.25" (6.3mm) to 0.375" (9.5mm). The limit stop lock nuts must be kept at this gap to ensure uniform bolt loading during uplift (as is the case when equipment is drained).

TWO INCH DEFLECTION, RESTRAINED SPRING ISOLATOR (GB CERTIFIED UNITS)

ZGT-F2



MOUNT-TYPE	DIMENSION DATA (MM)									
	A	WA	WB	W	H	TH	B	L	D	F
ZGT-F2	290	110	110	110	150	200	283	310	60	Φ16

MODEL NUMBER	RATED CAPACITY FOR UNITS WITH ALL LOAD POINTS LESS THAN 3527 LBS (1600 KG)		
	WEIGHT RANGE		PART NUMBER
	(LBS.)	RANGE (KG)	
ZGT-F2-200	0 thru 441	0 thru 200	029G23000A031
ZGT-F2-300	442 thru 661	201 thru 300	029G23000A032
ZGT-F2-350	662 thru 772	301 thru 350	029G23000A033
ZGT-F2-500	773 thru 1102	351 thru 500	029G23000A034
ZGT-F2-650	1103 thru 1433	501 thru 650	029G23000A035
ZGT-F2-1000	1434 thru 2205	651 thru 1000	029G23000A036
ZGT-F2-1200	2206 thru 2646	1001 thru 1200	029G23000A037
ZGT-F2-1600	2647 thru 3527	1201 thru 1600	029G23000A038

NOTES:

1. All dimensions are in millimeters.
2. Equipment must be bolted or welded to the top plate to meet allowable seismic ratings.
3. Consult Johnson Controls for concrete installation.

TABLE 14 - ELECTRICAL LUG DATA

FIELD WIRING LUGS					STANDARD AND ULTRA QUIET CONDENSER FANS					
					TERMINAL BLOCK		CIRCUIT BREAKER		NON-FUSED DISCONNECT SWITCH	
YVAA MODEL			INPUT VOLTS	INPUT FREQ	WIRES PER PHASE	LUG WIRE RANGE	WIRES PER PHASE	LUG WIRE RANGE	WIRES PER PHASE	LUG WIRE RANGE
FRAME	COND	EVAP								
SINGLE POINT WIRING										
015	3	B	200	60	4	#2 - 600 kcmil				
			230	60	4	#2 - 600 kcmil	4	4/0 - 500 kcmil		
			380	60	2	#2 - 600 kcmil	2	#2/0 - 500 kcmil	2	#2 - 600 kcmil
			400	50	2	#2 - 600 kcmil	2	#2/0 - 500 kcmil	2	#2 - 600 kcmil
			460	60	2	#2 - 600 kcmil	2	#1 - 500 kcmil	2	#2 - 600 kcmil
			575	60	2	#2 - 600 kcmil	2	#1 - 500 kcmil	2	#2 - 600 kcmil
016	5	B	200	60	4	#2 - 600 kcmil				
			230	60	4	#2 - 600 kcmil	4	4/0 - 500 kcmil		
			380	60	2	#2 - 600 kcmil	2	#2/0 - 500 kcmil	2	#2 - 600 kcmil
			400	50	2	#2 - 600 kcmil	2	#2/0 - 500 kcmil	2	#2 - 600 kcmil
			460	60	2	#2 - 600 kcmil	2	#1 - 500 kcmil	2	#2 - 600 kcmil
			575	60	2	#2 - 600 kcmil	2	#1 - 500 kcmil	2	#2 - 600 kcmil
017	8	C	200	60	4	#2 - 600 kcmil				
			230	60	4	#2 - 600 kcmil	4	4/0 - 500 kcmil		
			380	60	2	#2 - 600 kcmil	2	#2/0 - 500 kcmil	2	#2 - 600 kcmil
			400	50	2	#2 - 600 kcmil	2	#2/0 - 500 kcmil	2	#2 - 600 kcmil
			460	60	2	#2 - 600 kcmil	2	#1 - 500 kcmil	2	#2 - 600 kcmil
			575	60	2	#2 - 600 kcmil	2	#1 - 500 kcmil	2	#2 - 600 kcmil
018	3	A	200	60	4	#2 - 600 kcmil				
			230	60	4	#2 - 600 kcmil	4	4/0 - 500 kcmil		
			380	60	2	#2 - 600 kcmil	2	#1 - 500 kcmil	3	#2 - 600 kcmil
			400	50	2	#2 - 600 kcmil	2	#1 - 500 kcmil	3	#2 - 600 kcmil
			460	60	2	#2 - 600 kcmil	2	#1 - 500 kcmil	2	#2 - 600 kcmil
			575	60	2	#2 - 600 kcmil	2	#1 - 500 kcmil	2	#2 - 600 kcmil
019	5	A	200	60	4	#2 - 600 kcmil				
			230	60	4	#2 - 600 kcmil	4	4/0 - 500 kcmil		
			380	60	2	#2 - 600 kcmil	2	#1 - 500 kcmil	3	#2 - 600 kcmil
			400	50	2	#2 - 600 kcmil	2	#1 - 500 kcmil	3	#2 - 600 kcmil
			460	60	2	#2 - 600 kcmil	2	#1 - 500 kcmil	2	#2 - 600 kcmil
			575	60	2	#2 - 600 kcmil	2	#1 - 500 kcmil	2	#2 - 600 kcmil
019	8	B	200	60	4	#2 - 600 kcmil				
			230	60	4	#2 - 600 kcmil	4	4/0 - 500 kcmil		
			380	60	2	#2 - 600 kcmil	2	#1 - 500 kcmil	3	#2 - 600 kcmil
			400	50	2	#2 - 600 kcmil	2	#1 - 500 kcmil	3	#2 - 600 kcmil
			460	60	2	#2 - 600 kcmil	2	#1 - 500 kcmil	2	#2 - 600 kcmil
			575	60	2	#2 - 600 kcmil	2	#1 - 500 kcmil	2	#2 - 600 kcmil
020	0	C	200	60	4	#2 - 600 kcmil				
			230	60	4	#2 - 600 kcmil	4	4/0 - 500 kcmil		
			380	60	3	#2 - 600 kcmil	3	3/0 - 400 kcmil	3	#2 - 600 kcmil
			400	50	3	#2 - 600 kcmil	3	3/0 - 400 kcmil	3	#2 - 600 kcmil
			460	60	2	#2 - 600 kcmil	2	#1 - 500 kcmil	3	#2 - 600 kcmil
			575	60	2	#2 - 600 kcmil	2	#1 - 500 kcmil	2	#2 - 600 kcmil
021	3	A	200	60	4	#2 - 600 kcmil				
			230	60	4	#2 - 600 kcmil	4	4/0 - 500 kcmil		
			380	60	2	#2 - 600 kcmil	2	#1 - 500 kcmil	3	#2 - 600 kcmil
			400	50	2	#2 - 600 kcmil	2	#1 - 500 kcmil	3	#2 - 600 kcmil
			460	60	2	#2 - 600 kcmil	2	#1 - 500 kcmil	2	#2 - 600 kcmil
			575	60	2	#2 - 600 kcmil	2	#1 - 500 kcmil	2	#2 - 600 kcmil

* Up to 4 wires per phase, consisting of 2 lugs per phase where each lug can accommodate 2 wires.

TABLE 14 - ELECTRICAL LUG DATA (CONT'D)

FIELD WIRING LUGS					HIGH AIRFLOW/HIGH STATIC CONDENSER FANS					
					TERMINAL BLOCK		CIRCUIT BREAKER		NON-FUSED DISCONNECT SWITCH	
YVAA MODEL			INPUT VOLTS	INPUT FREQ	WIRE PER PHASE	LUG WIRE RANGE	WIRES PER PHASE	LUG WIRE RANGE	WIRES PER PHASE	LUG WIRE RANGE
FRAME	COND	EVAP								
SINGLE POINT WIRING										
015	3	B	200	60	4	#1/0 - 700 kcmil				
			230	60	4	#2 - 600 kcmil	4	4/0 - 500 kcmil		
			380	60	2	#2 - 600 kcmil	2	#1 - 500 kcmil	3	#2 - 600 kcmil
			400	50	2	#2 - 600 kcmil	2	#1 - 500 kcmil	3	#2 - 600 kcmil
			460	60	2	#2 - 600 kcmil	2	#1 - 500 kcmil	3	#2 - 600 kcmil
			575	60	2	#2 - 600 kcmil	2	#1 - 500 kcmil	2	#2 - 600 kcmil
016	5	B	200	60	4	#1/0 - 700 kcmil				
			230	60	4	#2 - 600 kcmil	4	4/0 - 500 kcmil		
			380	60	2	#2 - 600 kcmil	2	#1 - 500 kcmil	3	#2 - 600 kcmil
			400	50	2	#2 - 600 kcmil	2	#1 - 500 kcmil	3	#2 - 600 kcmil
			460	60	2	#2 - 600 kcmil	2	#1 - 500 kcmil	3	#2 - 600 kcmil
			575	60	2	#2 - 600 kcmil	2	#1 - 500 kcmil	2	#2 - 600 kcmil
017	8	C	200	60	4	#1/0 - 700 kcmil				
			230	60	4	#2 - 600 kcmil	4	4/0 - 500 kcmil		
			380	60	2	#2 - 600 kcmil	2	#1 - 500 kcmil	3	#2 - 600 kcmil
			400	50	2	#2 - 600 kcmil	2	#1 - 500 kcmil	3	#2 - 600 kcmil
			460	60	2	#2 - 600 kcmil	2	#1 - 500 kcmil	3	#2 - 600 kcmil
			575	60	2	#2 - 600 kcmil	2	#1 - 500 kcmil	2	#2 - 600 kcmil
018	3	A	200	60	4	#1/0 - 700 kcmil				
			230	60	4	#2 - 600 kcmil	4	4/0 - 500 kcmil		
			380	60	3	#2 - 600 kcmil	3	3/0 - 400 kcmil	3	#2 - 600 kcmil
			400	50	3	#2 - 600 kcmil	3	3/0 - 400 kcmil	3	#2 - 600 kcmil
			460	60	2	#2 - 600 kcmil	2	#1 - 500 kcmil	3	#2 - 600 kcmil
			575	60	2	#2 - 600 kcmil	2	#1 - 500 kcmil	2	#2 - 600 kcmil
019	5	A	200	60	4	#1/0 - 700 kcmil				
			230	60	4	#2 - 600 kcmil	4	4/0 - 500 kcmil		
			380	60	3	#2 - 600 kcmil	3	3/0 - 400 kcmil	3	#2 - 600 kcmil
			400	50	3	#2 - 600 kcmil	3	3/0 - 400 kcmil	3	#2 - 600 kcmil
			460	60	2	#2 - 600 kcmil	2	#1 - 500 kcmil	3	#2 - 600 kcmil
			575	60	2	#2 - 600 kcmil	2	#1 - 500 kcmil	2	#2 - 600 kcmil
019	8	B	200	60	4	#1/0 - 700 kcmil				
			230	60	4	#2 - 600 kcmil	4	4/0 - 500 kcmil		
			380	60	3	#2 - 600 kcmil	3	3/0 - 400 kcmil	3	#2 - 600 kcmil
			400	50	3	#2 - 600 kcmil	3	3/0 - 400 kcmil	3	#2 - 600 kcmil
			460	60	2	#2 - 600 kcmil	2	#1 - 500 kcmil	3	#2 - 600 kcmil
			575	60	2	#2 - 600 kcmil	2	#1 - 500 kcmil	2	#2 - 600 kcmil
020	0	C	200	60	4	#1/0 - 700 kcmil				
			230	60	4	#2 - 600 kcmil	4	4/0 - 500 kcmil		
			380	60	3	#2 - 600 kcmil	3	3/0 - 400 kcmil	3	#2 - 600 kcmil
			400	50	3	#2 - 600 kcmil	3	3/0 - 400 kcmil	3	#2 - 600 kcmil
			460	60	3	#2 - 600 kcmil	3	3/0 - 400 kcmil	3	#2 - 600 kcmil
			575	60	2	#2 - 600 kcmil	2	#1 - 500 kcmil	2	#2 - 600 kcmil
021	3	A	200	60	4	#1/0 - 700 kcmil				
			230	60	4	#2 - 600 kcmil	4	4/0 - 500 kcmil		
			380	60	3	#2 - 600 kcmil	3	3/0 - 400 kcmil	3	#2 - 600 kcmil
			400	50	3	#2 - 600 kcmil	3	3/0 - 400 kcmil	3	#2 - 600 kcmil
			460	60	2	#2 - 600 kcmil	2	#1 - 500 kcmil	3	#2 - 600 kcmil
			575	60	2	#2 - 600 kcmil	2	#1 - 500 kcmil	2	#2 - 600 kcmil

* Up to 4 wires per phase, consisting of 2 lugs per phase where each lug can accommodate 2 wires

TABLE 14 - ELECTRICAL LUG DATA (CONT'D)

FIELD WIRING LUGS					STANDARD AND ULTRA QUIET CONDENSER FANS					
					TERMINAL BLOCK		CIRCUIT BREAKER		NON-FUSED DISCONNECT SWITCH	
YVAA MODEL			INPUT VOLTS	INPUT FREQ	WIRES PER PHASE	LUG WIRE RANGE	WIRES PER PHASE	LUG WIRE RANGE	WIRES PER PHASE	LUG WIRE RANGE
FRAME	COND	EVAP								
SINGLE POINT WIRING										
021	5	C	200	60	4	#2 - 600 kcmil				
			230	60	4	#2 - 600 kcmil	4	4/0 - 500 kcmil		
			380	60	2	#2 - 600 kcmil	2	#1 - 500 kcmil	3	#2 - 600 kcmil
			400	50	2	#2 - 600 kcmil	2	#1 - 500 kcmil	3	#2 - 600 kcmil
			460	60	2	#2 - 600 kcmil	2	#1 - 500 kcmil	2	#2 - 600 kcmil
			575	60	2	#2 - 600 kcmil	2	#1 - 500 kcmil	2	#2 - 600 kcmil
021	8	C	200	60	4	#2 - 600 kcmil				
			230	60	4	#2 - 600 kcmil	4	4/0 - 500 kcmil		
			380	60	2	#2 - 600 kcmil	2	#1 - 500 kcmil	3	#2 - 600 kcmil
			400	50	2	#2 - 600 kcmil	2	#1 - 500 kcmil	3	#2 - 600 kcmil
			460	60	2	#2 - 600 kcmil	2	#1 - 500 kcmil	2	#2 - 600 kcmil
			575	60	2	#2 - 600 kcmil	2	#1 - 500 kcmil	2	#2 - 600 kcmil
023	3	B	200	60	4	#2 - 600 kcmil				
			230	60	4	#2 - 600 kcmil	4	4/0 - 500 kcmil		
			380	60	3	#2 - 600 kcmil	3	3/0 - 400 kcmil	3	#2 - 600 kcmil
			400	50	3	#2 - 600 kcmil	3	3/0 - 400 kcmil	3	#2 - 600 kcmil
			460	60	2	#2 - 600 kcmil	2	#1 - 500 kcmil	3	#2 - 600 kcmil
			575	60	2	#2 - 600 kcmil	2	#1 - 500 kcmil	2	#2 - 600 kcmil
024	5	C	200	60	4	#2 - 600 kcmil				
			230	60	4	#2 - 600 kcmil	4	4/0 - 500 kcmil		
			380	60	3	#2 - 600 kcmil	3	3/0 - 400 kcmil	3	#2 - 600 kcmil
			400	50	3	#2 - 600 kcmil	3	3/0 - 400 kcmil	3	#2 - 600 kcmil
			460	60	2	#2 - 600 kcmil	2	#1 - 500 kcmil	3	#2 - 600 kcmil
			575	60	2	#2 - 600 kcmil	2	#1 - 500 kcmil	2	#2 - 600 kcmil
024	8	C	200	60	4	#2 - 600 kcmil				
			230	60	4	#2 - 600 kcmil	4	4/0 - 500 kcmil		
			380	60	3	#2 - 600 kcmil	3	3/0 - 400 kcmil	3	#2 - 600 kcmil
			400	50	3	#2 - 600 kcmil	3	3/0 - 400 kcmil	3	#2 - 600 kcmil
			460	60	2	#2 - 600 kcmil	2	#1 - 500 kcmil	3	#2 - 600 kcmil
			575	60	2	#2 - 600 kcmil	2	#1 - 500 kcmil	2	#2 - 600 kcmil
026	3	B	200	60	4	#2 - 600 kcmil				
			230	60	4	#2 - 600 kcmil	4	4/0 - 500 kcmil		
			380	60	3	#2 - 600 kcmil	3	3/0 - 400 kcmil	3	#2 - 600 kcmil
			400	50	3	#2 - 600 kcmil	3	3/0 - 400 kcmil	3	#2 - 600 kcmil
			460	60	2	#2 - 600 kcmil	2	#1 - 500 kcmil	3	#2 - 600 kcmil
			575	60	2	#2 - 600 kcmil	2	#1 - 500 kcmil	2	#2 - 600 kcmil
027	3	D	200	60	4	#2 - 600 kcmil				
			230	60	4	#2 - 600 kcmil	4	4/0 - 500 kcmil		
			380	60	3	#2 - 600 kcmil	3	3/0 - 400 kcmil	3	#2 - 600 kcmil
			400	50	3	#2 - 600 kcmil	3	3/0 - 400 kcmil	3	#2 - 600 kcmil
			460	60	2	#2 - 600 kcmil	2	#1 - 500 kcmil	3	#2 - 600 kcmil
			575	60	2	#2 - 600 kcmil	2	#1 - 500 kcmil	2	#2 - 600 kcmil
027	5	E	200	60	4	#2 - 600 kcmil				
			230	60	4	#2 - 600 kcmil	4	4/0 - 500 kcmil		
			380	60	3	#2 - 600 kcmil	3	3/0 - 400 kcmil	3	#2 - 600 kcmil
			400	50	3	#2 - 600 kcmil	3	3/0 - 400 kcmil	3	#2 - 600 kcmil
			460	60	2	#2 - 600 kcmil	2	#1 - 500 kcmil	3	#2 - 600 kcmil
			575	60	2	#2 - 600 kcmil	2	#1 - 500 kcmil	2	#2 - 600 kcmil

* Up to 4 wires per phase, consisting of 2 lugs per phase where each lug can accommodate 2 wires.

TABLE 14 - ELECTRICAL LUG DATA (CONT'D)

FIELD WIRING LUGS					HIGH AIRFLOW/HIGH STATIC CONDENSER FANS					
					TERMINAL BLOCK		CIRCUIT BREAKER		NON-FUSED DISCONNECT SWITCH	
YVAA MODEL			INPUT VOLTS	INPUT FREQ	WIRE PER PHASE	LUG WIRE RANGE	WIRES PER PHASE	LUG WIRE RANGE	WIRES PER PHASE	LUG WIRE RANGE
FRAME	COND	EVAP								
SINGLE POINT WIRING										
021	5	C	200	60	4	#1/0 - 700 kcmil				
			230	60	4	#2 - 600 kcmil	4	4/0 - 500 kcmil		
			380	60	3	#2 - 600 kcmil	3	3/0 - 400 kcmil	3	#2 - 600 kcmil
			400	50	3	#2 - 600 kcmil	3	3/0 - 400 kcmil	3	#2 - 600 kcmil
			460	60	2	#2 - 600 kcmil	2	#1 - 500 kcmil	3	#2 - 600 kcmil
			575	60	2	#2 - 600 kcmil	2	#1 - 500 kcmil	2	#2 - 600 kcmil
021	8	C	200	60	4	#1/0 - 700 kcmil				
			230	60	4	#2 - 600 kcmil	4	4/0 - 500 kcmil		
			380	60	3	#2 - 600 kcmil	3	3/0 - 400 kcmil	3	#2 - 600 kcmil
			400	50	3	#2 - 600 kcmil	3	3/0 - 400 kcmil	3	#2 - 600 kcmil
			460	60	2	#2 - 600 kcmil	2	#1 - 500 kcmil	3	#2 - 600 kcmil
			575	60	2	#2 - 600 kcmil	2	#1 - 500 kcmil	2	#2 - 600 kcmil
023	3	B	200	60	4	#1/0 - 700 kcmil				
			230	60	4	#2 - 600 kcmil	4	4/0 - 500 kcmil		
			380	60	3	#2 - 600 kcmil	3	3/0 - 400 kcmil	3	#2 - 600 kcmil
			400	50	3	#2 - 600 kcmil	3	3/0 - 400 kcmil	3	#2 - 600 kcmil
			460	60	3	#2 - 600 kcmil	3	3/0 - 400 kcmil	3	#2 - 600 kcmil
			575	60	2	#2 - 600 kcmil	2	#1 - 500 kcmil	2	#2 - 600 kcmil
024	5	C	200	60	4	#1/0 - 700 kcmil				
			230	60	4	#2 - 600 kcmil	4	4/0 - 500 kcmil		
			380	60	3	#2 - 600 kcmil	3	3/0 - 400 kcmil	3	#2 - 600 kcmil
			400	50	3	#2 - 600 kcmil	3	3/0 - 400 kcmil	3	#2 - 600 kcmil
			460	60	3	#2 - 600 kcmil	3	3/0 - 400 kcmil	3	#2 - 600 kcmil
			575	60	2	#2 - 600 kcmil	2	#1 - 500 kcmil	2	#2 - 600 kcmil
024	8	C	200	60	4	#1/0 - 700 kcmil				
			230	60	4	#2 - 600 kcmil	4	4/0 - 500 kcmil		
			380	60	3	#2 - 600 kcmil	3	3/0 - 400 kcmil	3	#2 - 600 kcmil
			400	50	3	#2 - 600 kcmil	3	3/0 - 400 kcmil	3	#2 - 600 kcmil
			460	60	3	#2 - 600 kcmil	3	3/0 - 400 kcmil	3	#2 - 600 kcmil
			575	60	2	#2 - 600 kcmil	2	#1 - 500 kcmil	2	#2 - 600 kcmil
026	3	B	200	60	4	#1/0 - 700 kcmil				
			230	60	4	#2 - 600 kcmil	4	4/0 - 500 kcmil		
			380	60	3	#2 - 600 kcmil	3	3/0 - 400 kcmil	3	#2 - 600 kcmil
			400	50	3	#2 - 600 kcmil	3	3/0 - 400 kcmil	3	#2 - 600 kcmil
			460	60	3	#2 - 600 kcmil	3	3/0 - 400 kcmil	3	#2 - 600 kcmil
			575	60	2	#2 - 600 kcmil	2	#1 - 500 kcmil	2	#2 - 600 kcmil
027	3	D	200	60	4	#1/0 - 700 kcmil				
			230	60	4	#2 - 600 kcmil	4	4/0 - 500 kcmil		
			380	60	3	#2 - 600 kcmil	3	3/0 - 400 kcmil	3	#2 - 600 kcmil
			400	50	3	#2 - 600 kcmil	3	3/0 - 400 kcmil	3	#2 - 600 kcmil
			460	60	3	#2 - 600 kcmil	3	3/0 - 400 kcmil	3	#2 - 600 kcmil
			575	60	2	#2 - 600 kcmil	2	#1 - 500 kcmil	2	#2 - 600 kcmil
027	5	E	200	60	4	#1/0 - 700 kcmil				
			230	60	4	#2 - 600 kcmil	4	4/0 - 500 kcmil		
			380	60	3	#2 - 600 kcmil	3	3/0 - 400 kcmil	3	#2 - 600 kcmil
			400	50	3	#2 - 600 kcmil	3	3/0 - 400 kcmil	3	#2 - 600 kcmil
			460	60	3	#2 - 600 kcmil	3	3/0 - 400 kcmil	3	#2 - 600 kcmil
			575	60	2	#2 - 600 kcmil	2	#1 - 500 kcmil	2	#2 - 600 kcmil

* Up to 4 wires per phase, consisting of 2 lugs per phase where each lug can accommodate 2 wires.

TABLE 14 - ELECTRICAL LUG DATA (CONT'D)

FIELD WIRING LUGS					STANDARD AND ULTRA QUIET CONDENSER FANS					
					TERMINAL BLOCK		CIRCUIT BREAKER		NON-FUSED DISCONNECT SWITCH	
YVAA MODEL			INPUT VOLTS	INPUT FREQ	WIRES PER PHASE	LUG WIRE RANGE	WIRES PER PHASE	LUG WIRE RANGE	WIRES PER PHASE	LUG WIRE RANGE
FRAME	COND	EVAP								
SINGLE POINT WIRING										
027	8	E	200	60	4	#2 - 600 kcmil				
			230	60	4	#2 - 600 kcmil	4	4/0 - 500 kcmil		
			380	60	3	#2 - 600 kcmil	3	3/0 - 400 kcmil	3	#2 - 600 kcmil
			400	50	3	#2 - 600 kcmil	3	3/0 - 400 kcmil	3	#2 - 600 kcmil
			460	60	2	#2 - 600 kcmil	2	#1 - 500 kcmil	3	#2 - 600 kcmil
			575	60	2	#2 - 600 kcmil	2	#1 - 500 kcmil	2	#2 - 600 kcmil
029	5	E	200	60						
			230	60						
			380	60	3	#2 - 600 kcmil	4	#4/0 - 500 kcmil	4*	#2 - 600 kcmil
			400	50	3	#2 - 600 kcmil	4	#4/0 - 500 kcmil	3	#2 - 600 kcmil
			460	60	3	#2 - 600 kcmil	3	#3/0 - 400 kcmil	3	#2 - 600 kcmil
			575	60	3	#2 - 600 kcmil	3	#3/0 - 400 kcmil	3	#2 - 600 kcmil
030	3	C	200	60						
			230	60						
			380	60	3	#2 - 600 kcmil	4	#4/0 - 500 kcmil	4*	#2 - 600 kcmil
			400	50	3	#2 - 600 kcmil	4	#4/0 - 500 kcmil	3	#2 - 600 kcmil
			460	60	3	#2 - 600 kcmil	3	#3/0 - 400 kcmil	3	#2 - 600 kcmil
			575	60	3	#2 - 600 kcmil	3	#3/0 - 400 kcmil	3	#2 - 600 kcmil
030	5	C	200	60						
			230	60						
			380	60	3	#2 - 600 kcmil	4	#4/0 - 500 kcmil	4*	#2 - 600 kcmil
			400	50	3	#2 - 600 kcmil	4	#4/0 - 500 kcmil	3	#2 - 600 kcmil
			460	60	3	#2 - 600 kcmil	3	#3/0 - 400 kcmil	3	#2 - 600 kcmil
			575	60	3	#2 - 600 kcmil	3	#3/0 - 400 kcmil	3	#2 - 600 kcmil
030	8	E	200	60						
			230	60						
			380	60	3	#2 - 600 kcmil	4	#4/0 - 500 kcmil	4*	#2 - 600 kcmil
			400	50	3	#2 - 600 kcmil	4	#4/0 - 500 kcmil	3	#2 - 600 kcmil
			460	60	3	#2 - 600 kcmil	3	#3/0 - 400 kcmil	3	#2 - 600 kcmil
			575	60	3	#2 - 600 kcmil	3	#3/0 - 400 kcmil	3	#2 - 600 kcmil
031	8	E	200	60						
			230	60						
			380	60	3	#2 - 600 kcmil	4	#4/0 - 500 kcmil	4*	#2 - 600 kcmil
			400	50	3	#2 - 600 kcmil	4	#4/0 - 500 kcmil	3	#2 - 600 kcmil
			460	60	3	#2 - 600 kcmil	3	#3/0 - 400 kcmil	3	#2 - 600 kcmil
			575	60	3	#2 - 600 kcmil	3	#3/0 - 400 kcmil	3	#2 - 600 kcmil
032	3	E	200	60						
			230	60						
			380	60	3	#2 - 600 kcmil	4	#4/0 - 500 kcmil	4*	#2 - 600 kcmil
			400	50	3	#2 - 600 kcmil	4	#4/0 - 500 kcmil	3	#2 - 600 kcmil
			460	60	3	#2 - 600 kcmil	3	#3/0 - 400 kcmil	3	#2 - 600 kcmil
			575	60	3	#2 - 600 kcmil	3	#3/0 - 400 kcmil	3	#2 - 600 kcmil
033	3	C	200	60						
			230	60						
			380	60	3	#2 - 600 kcmil	4	#4/0 - 500 kcmil	4*	#2 - 600 kcmil
			400	50	3	#2 - 600 kcmil	4	#4/0 - 500 kcmil	3	#2 - 600 kcmil
			460	60	3	#2 - 600 kcmil	3	#3/0 - 400 kcmil	3	#2 - 600 kcmil
			575	60	3	#2 - 600 kcmil	3	#3/0 - 400 kcmil	3	#2 - 600 kcmil

* Up to 4 wires per phase, consisting of 2 lugs per phase where each lug can accommodate 2 wires.

TABLE 14 - ELECTRICAL LUG DATA (CONT'D)

FIELD WIRING LUGS					HIGH AIRFLOW/HIGH STATIC CONDENSER FANS					
					TERMINAL BLOCK		CIRCUIT BREAKER		NON-FUSED DISCONNECT SWITCH	
YVAA MODEL			INPUT VOLTS	INPUT FREQ	WIRE PER PHASE	LUG WIRE RANGE	WIRES PER PHASE	LUG WIRE RANGE	WIRES PER PHASE	LUG WIRE RANGE
FRAME	COND	EVAP								
SINGLE POINT WIRING										
027	8	E	200	60	4	#1/0 - 700 kcmil				
			230	60	4	#2 - 600 kcmil	4	4/0 - 500 kcmil		
			380	60	3	#2 - 600 kcmil	3	3/0 - 400 kcmil	3	#2 - 600 kcmil
			400	50	3	#2 - 600 kcmil	3	3/0 - 400 kcmil	3	#2 - 600 kcmil
			460	60	3	#2 - 600 kcmil	3	3/0 - 400 kcmil	3	#2 - 600 kcmil
			575	60	2	#2 - 600 kcmil	2	#1 - 500 kcmil	2	#2 - 600 kcmil
029	5	E	200	60						
			230	60						
			380	60	4	#2 - 600 kcmil	4	#4/0 - 500 kcmil	4*	#2 - 600 kcmil
			400	50	4	#2 - 600 kcmil	4	#4/0 - 500 kcmil	4*	#2 - 600 kcmil
			460	60	3	#2 - 600 kcmil	4	#4/0 - 500 kcmil	3	#2 - 600 kcmil
			575	60	3	#2 - 600 kcmil	3	#3/0 - 400 kcmil	3	#2 - 600 kcmil
030	3	C	200	60						
			230	60						
			380	60	4	#2 - 600 kcmil	4	#4/0 - 500 kcmil	4*	#2 - 600 kcmil
			400	50	4	#2 - 600 kcmil	4	#4/0 - 500 kcmil	4*	#2 - 600 kcmil
			460	60	3	#2 - 600 kcmil	4	#4/0 - 500 kcmil	3	#2 - 600 kcmil
			575	60	3	#2 - 600 kcmil	3	#3/0 - 400 kcmil	3	#2 - 600 kcmil
030	5	C	200	60						
			230	60						
			380	60	4	#2 - 600 kcmil	4	#4/0 - 500 kcmil	4*	#2 - 600 kcmil
			400	50	4	#2 - 600 kcmil	4	#4/0 - 500 kcmil	4*	#2 - 600 kcmil
			460	60	3	#2 - 600 kcmil	4	#4/0 - 500 kcmil	3	#2 - 600 kcmil
			575	60	3	#2 - 600 kcmil	3	#3/0 - 400 kcmil	3	#2 - 600 kcmil
030	8	E	200	60						
			230	60						
			380	60	4	#2 - 600 kcmil	4	#4/0 - 500 kcmil	4*	#2 - 600 kcmil
			400	50	4	#2 - 600 kcmil	4	#4/0 - 500 kcmil	4*	#2 - 600 kcmil
			460	60	3	#2 - 600 kcmil	4	#4/0 - 500 kcmil	3	#2 - 600 kcmil
			575	60	3	#2 - 600 kcmil	3	#3/0 - 400 kcmil	3	#2 - 600 kcmil
031	8	E	200	60						
			230	60						
			380	60	4	#2 - 600 kcmil	4	#4/0 - 500 kcmil	4*	#2 - 600 kcmil
			400	50	4	#2 - 600 kcmil	4	#4/0 - 500 kcmil	4*	#2 - 600 kcmil
			460	60	3	#2 - 600 kcmil	4	#4/0 - 500 kcmil	3	#2 - 600 kcmil
			575	60	3	#2 - 600 kcmil	3	#3/0 - 400 kcmil	3	#2 - 600 kcmil
032	3	E	200	60						
			230	60						
			380	60	4	#2 - 600 kcmil	4	#4/0 - 500 kcmil	4*	#2 - 600 kcmil
			400	50	4	#2 - 600 kcmil	4	#4/0 - 500 kcmil	4*	#2 - 600 kcmil
			460	60	3	#2 - 600 kcmil	4	#4/0 - 500 kcmil	3	#2 - 600 kcmil
			575	60	3	#2 - 600 kcmil	3	#3/0 - 400 kcmil	3	#2 - 600 kcmil
033	3	C	200	60						
			230	60						
			380	60	4	#2 - 600 kcmil	4	#4/0 - 500 kcmil	4*	#2 - 600 kcmil
			400	50	4	#2 - 600 kcmil	4	#4/0 - 500 kcmil	4*	#2 - 600 kcmil
			460	60	3	#2 - 600 kcmil	4	#4/0 - 500 kcmil	3	#2 - 600 kcmil
			575	60	3	#2 - 600 kcmil	3	#3/0 - 400 kcmil	3	#2 - 600 kcmil

* Up to 4 wires per phase, consisting of 2 lugs per phase where each lug can accommodate 2 wires.

TABLE 14 - ELECTRICAL LUG DATA (CONT'D)

FIELD WIRING LUGS					STANDARD AND ULTRA QUIET CONDENSER FANS					
					TERMINAL BLOCK		CIRCUIT BREAKER		NON-FUSED DISCONNECT SWITCH	
YVAA MODEL			INPUT VOLTS	INPUT FREQ	WIRES PER PHASE	LUG WIRE RANGE	WIRES PER PHASE	LUG WIRE RANGE	WIRES PER PHASE	LUG WIRE RANGE
FRAME	COND	EVAP								
SINGLE POINT WIRING										
034	3	E	200	60						
			230	60						
			380	60	3	#2 - 600 kcmil	4	#4/0 - 500 kcmil	4*	#2 - 600 kcmil
			400	50	3	#2 - 600 kcmil	4	#4/0 - 500 kcmil	3	#2 - 600 kcmil
			460	60	3	#2 - 600 kcmil	3	#3/0 - 400 kcmil	3	#2 - 600 kcmil
			575	60	3	#2 - 600 kcmil	3	#3/0 - 400 kcmil	3	#2 - 600 kcmil
034	5	E	200	60						
			230	60						
			380	60	3	#2 - 600 kcmil	4	#4/0 - 500 kcmil	4*	#2 - 600 kcmil
			400	50	3	#2 - 600 kcmil	4	#4/0 - 500 kcmil	3	#2 - 600 kcmil
			460	60	3	#2 - 600 kcmil	3	#3/0 - 400 kcmil	3	#2 - 600 kcmil
			575	60	3	#2 - 600 kcmil	3	#3/0 - 400 kcmil	3	#2 - 600 kcmil
DUAL POINT WIRING										
036	8	J	200	60						
			230	60						
			380	60	3	#2 - 600 kcmil	3	#3/0 ~ 400 kcmil	3	#3/0 ~ 400 kcmil
			400	50	3	#2 - 600 kcmil	3	#3/0 ~ 400 kcmil	3	#3/0 ~ 400 kcmil
			460	60	2	#2 - 600 kcmil	2	#1 ~ 500 kcmil	2	#1 ~ 500 kcmil
			575	60	2	#2 - 600 kcmil	2	#1 ~ 500 kcmil	2	#1 ~ 500 kcmil
037	3	F	200	60						
			230	60						
			380	60	3	#2 - 600 kcmil	3	#3/0 ~ 400 kcmil	3	#3/0 ~ 400 kcmil
			400	50	3	#2 - 600 kcmil	3	#3/0 ~ 400 kcmil	3	#3/0 ~ 400 kcmil
			460	60	2	#2 - 600 kcmil	2	#1 ~ 500 kcmil	2	#1 ~ 500 kcmil
			575	60	2	#2 - 600 kcmil	2	#1 ~ 500 kcmil	2	#1 ~ 500 kcmil
037	5	J	200	60						
			230	60						
			380	60	3	#2 - 600 kcmil	3	#3/0 ~ 400 kcmil	3	#3/0 ~ 400 kcmil
			400	50	3	#2 - 600 kcmil	3	#3/0 ~ 400 kcmil	3	#3/0 ~ 400 kcmil
			460	60	2	#2 - 600 kcmil	2	#1 ~ 500 kcmil	2	#1 ~ 500 kcmil
			575	60	2	#2 - 600 kcmil	2	#1 ~ 500 kcmil	2	#1 ~ 500 kcmil
039	8	J	200	60						
			230	60						
			380	60	3	#2 - 600 kcmil	3	#3/0 ~ 400 kcmil	3	#3/0 ~ 400 kcmil
			400	50	3	#2 - 600 kcmil	3	#3/0 ~ 400 kcmil	3	#3/0 ~ 400 kcmil
			460	60	2	#2 - 600 kcmil	2	#1 ~ 500 kcmil	2	#1 ~ 500 kcmil
			575	60	2	#2 - 600 kcmil	2	#1 ~ 500 kcmil	2	#1 ~ 500 kcmil
041	3	H	200	60						
			230	60						
			380	60	3	#2 - 600 kcmil	3	#3/0 ~ 400 kcmil	3	#3/0 ~ 400 kcmil
			400	50	3	#2 - 600 kcmil	3	#3/0 ~ 400 kcmil	3	#3/0 ~ 400 kcmil
			460	60	2	#2 - 600 kcmil	2	#1 ~ 500 kcmil	2	#1 ~ 500 kcmil
			575	60	2	#2 - 600 kcmil	2	#1 ~ 500 kcmil	2	#1 ~ 500 kcmil
042	5	H	200	60						
			230	60						
			380	60	3	#2 - 600 kcmil	3	#3/0 ~ 400 kcmil	3	#3/0 ~ 400 kcmil
			400	50	3	#2 - 600 kcmil	3	#3/0 ~ 400 kcmil	3	#3/0 ~ 400 kcmil
			460	60	2	#2 - 600 kcmil	2	#1 ~ 500 kcmil	2	#1 ~ 500 kcmil
			575	60	2	#2 - 600 kcmil	2	#1 ~ 500 kcmil	2	#1 ~ 500 kcmil

* Up to 4 wires per phase, consisting of 2 lugs per phase where each lug can accommodate 2 wires.

TABLE 14 - ELECTRICAL LUG DATA (CONT'D)

FIELD WIRING LUGS					HIGH AIRFLOW/HIGH STATIC CONDENSER FANS					
					TERMINAL BLOCK		CIRCUIT BREAKER		NON-FUSED DISCONNECT SWITCH	
YVAA MODEL			INPUT VOLTS	INPUT FREQ	WIRE PER PHASE	LUG WIRE RANGE	WIRES PER PHASE	LUG WIRE RANGE	WIRES PER PHASE	LUG WIRE RANGE
FRAME	COND	EVAP								
SINGLE POINT WIRING										
034	3	E	200	60						
			230	60						
			380	60	4	#2 - 600 kcmil	4	#4/0 - 500 kcmil	4*	#2 - 600 kcmil
			400	50	4	#2 - 600 kcmil	4	#4/0 - 500 kcmil	4*	#2 - 600 kcmil
			460	60	3	#2 - 600 kcmil	4	#4/0 - 500 kcmil	3	#2 - 600 kcmil
			575	60	3	#2 - 600 kcmil	3	#3/0 - 400 kcmil	3	#2 - 600 kcmil
034	5	E	200	60						
			230	60						
			380	60	4	#2 - 600 kcmil	4	#4/0 - 500 kcmil	4*	#2 - 600 kcmil
			400	50	4	#2 - 600 kcmil	4	#4/0 - 500 kcmil	4*	#2 - 600 kcmil
			460	60	3	#2 - 600 kcmil	4	#4/0 - 500 kcmil	3	#2 - 600 kcmil
			575	60	3	#2 - 600 kcmil	3	#3/0 - 400 kcmil	3	#2 - 600 kcmil
DUAL POINT WIRING										
036	8	J	200	60						
			230	60						
			380	60	3	#2 - 600 kcmil	3	#3/0 ~ 400 kcmil	3	#3/0 ~ 400 kcmil
			400	50	3	#2 - 600 kcmil	3	#3/0 ~ 400 kcmil	3	#3/0 ~ 400 kcmil
			460	60	2	#2 - 600 kcmil	3	#3/0 ~ 400 kcmil	3	#3/0 ~ 400 kcmil
			575	60	2	#2 - 600 kcmil	2	#1 ~ 500 kcmil	2	#1 ~ 500 kcmil
037	3	F	200	60						
			230	60						
			380	60	3	#2 - 600 kcmil	3	#3/0 ~ 400 kcmil	3	#3/0 ~ 400 kcmil
			400	50	3	#2 - 600 kcmil	3	#3/0 ~ 400 kcmil	3	#3/0 ~ 400 kcmil
			460	60	2	#2 - 600 kcmil	3	#3/0 ~ 400 kcmil	3	#3/0 ~ 400 kcmil
			575	60	2	#2 - 600 kcmil	2	#1 ~ 500 kcmil	2	#1 ~ 500 kcmil
037	5	J	200	60						
			230	60						
			380	60	3	#2 - 600 kcmil	3	#3/0 ~ 400 kcmil	3	#3/0 ~ 400 kcmil
			400	50	3	#2 - 600 kcmil	3	#3/0 ~ 400 kcmil	3	#3/0 ~ 400 kcmil
			460	60	2	#2 - 600 kcmil	3	#3/0 ~ 400 kcmil	3	#3/0 ~ 400 kcmil
			575	60	2	#2 - 600 kcmil	2	#1 ~ 500 kcmil	2	#1 ~ 500 kcmil
039	8	J	200	60						
			230	60						
			380	60	3	#2 - 600 kcmil	3	#3/0 ~ 400 kcmil	3	#3/0 ~ 400 kcmil
			400	50	3	#2 - 600 kcmil	3	#3/0 ~ 400 kcmil	3	#3/0 ~ 400 kcmil
			460	60	2	#2 - 600 kcmil	3	#3/0 ~ 400 kcmil	3	#3/0 ~ 400 kcmil
			575	60	2	#2 - 600 kcmil	2	#1 ~ 500 kcmil	2	#1 ~ 500 kcmil
041	3	H	200	60						
			230	60						
			380	60	3	#2 - 600 kcmil	3	#3/0 ~ 400 kcmil	3	#3/0 ~ 400 kcmil
			400	50	3	#2 - 600 kcmil	3	#3/0 ~ 400 kcmil	3	#3/0 ~ 400 kcmil
			460	60	2	#2 - 600 kcmil	3	#3/0 ~ 400 kcmil	3	#3/0 ~ 400 kcmil
			575	60	2	#2 - 600 kcmil	2	#1 ~ 500 kcmil	2	#1 ~ 500 kcmil
042	5	H	200	60						
			230	60						
			380	60	3	#2 - 600 kcmil	3	#3/0 ~ 400 kcmil	3	#3/0 ~ 400 kcmil
			400	50	3	#2 - 600 kcmil	3	#3/0 ~ 400 kcmil	3	#3/0 ~ 400 kcmil
			460	60	2	#2 - 600 kcmil	3	#3/0 ~ 400 kcmil	3	#3/0 ~ 400 kcmil
			575	60	2	#2 - 600 kcmil	2	#1 ~ 500 kcmil	2	#1 ~ 500 kcmil

* Up to 4 wires per phase, consisting of 2 lugs per phase where each lug can accommodate 2 wires.

TABLE 14 - ELECTRICAL LUG DATA (CONT'D)

FIELD WIRING LUGS					STANDARD AND ULTRA QUIET CONDENSER FANS					
					TERMINAL BLOCK		CIRCUIT BREAKER		NON-FUSED DISCONNECT SWITCH	
YVAA MODEL			INPUT VOLTS	INPUT FREQ	WIRES PER PHASE	LUG WIRE RANGE	WIRES PER PHASE	LUG WIRE RANGE	WIRES PER PHASE	LUG WIRE RANGE
FRAME	COND	EVAP								
DUAL POINT WIRING										
042	8	J	200	60						
			230	60						
			380	60	3	#2 - 600 kcmil	3	#3/0 ~ 400 kcmil	3	#3/0 ~ 400 kcmil
			400	50	3	#2 - 600 kcmil	3	#3/0 ~ 400 kcmil	3	#3/0 ~ 400 kcmil
			460	60	2	#2 - 600 kcmil	2	#1 ~ 500 kcmil	2	#1 ~ 500 kcmil
			575	60	2	#2 - 600 kcmil	2	#1 ~ 500 kcmil	2	#1 ~ 500 kcmil
044	3	G	200	60						
			230	60						
			380	60	3	#2 - 600 kcmil	3	#3/0 ~ 400 kcmil	3	#3/0 ~ 400 kcmil
			400	50	3	#2 - 600 kcmil	3	#3/0 ~ 400 kcmil	3	#3/0 ~ 400 kcmil
			460	60	2	#2 - 600 kcmil	2	#1 ~ 500 kcmil	2	#1 ~ 500 kcmil
			575	60	2	#2 - 600 kcmil	2	#1 ~ 500 kcmil	2	#1 ~ 500 kcmil
047	5	J	200	60						
			230	60						
			380	60	3	#2 - 600 kcmil	3	#3/0 ~ 400 kcmil	3	#3/0 ~ 400 kcmil
			400	50	3	#2 - 600 kcmil	3	#3/0 ~ 400 kcmil	3	#3/0 ~ 400 kcmil
			460	60	2	#2 - 600 kcmil	2	#1 ~ 500 kcmil	2	#1 ~ 500 kcmil
			575	60	2	#2 - 600 kcmil	2	#1 ~ 500 kcmil	2	#1 ~ 500 kcmil
048	3	G	200	60						
			230	60						
			380	60	3	#2 - 600 kcmil	3	#3/0 ~ 400 kcmil	3	#3/0 ~ 400 kcmil
			400	50	3	#2 - 600 kcmil	3	#3/0 ~ 400 kcmil	3	#3/0 ~ 400 kcmil
			460	60	2	#2 - 600 kcmil	2	#1 ~ 500 kcmil	2	#1 ~ 500 kcmil
			575	60	2	#2 - 600 kcmil	2	#1 ~ 500 kcmil	2	#1 ~ 500 kcmil
050	0	J	200	60						
			230	60						
			380	60	3	#2 - 600 kcmil	3	#3/0 - 500 kcmil	3	#3/0 - 500 kcmil
			400	50	3	#2 - 600 kcmil	3	#3/0 - 500 kcmil	3	#3/0 - 500 kcmil
			460	60	2	#2 - 600 kcmil	2	#1 - 500 kcmil	2	#1 - 500 kcmil
			575	60	2	#2 - 600 kcmil	2	#1 - 500 kcmil	2	#1 - 500 kcmil
052	3	J	200	60						
			230	60						
			380	60	3	#2 - 600 kcmil	3	#3/0 - 500 kcmil	3	#3/0 - 500 kcmil
			400	50	3	#2 - 600 kcmil	3	#3/0 - 500 kcmil	3	#3/0 - 500 kcmil
			460	60	2	#2 - 600 kcmil	2	#1 - 500 kcmil	2	#1 - 500 kcmil
			575	60	2	#2 - 600 kcmil	2	#1 - 500 kcmil	2	#1 - 500 kcmil

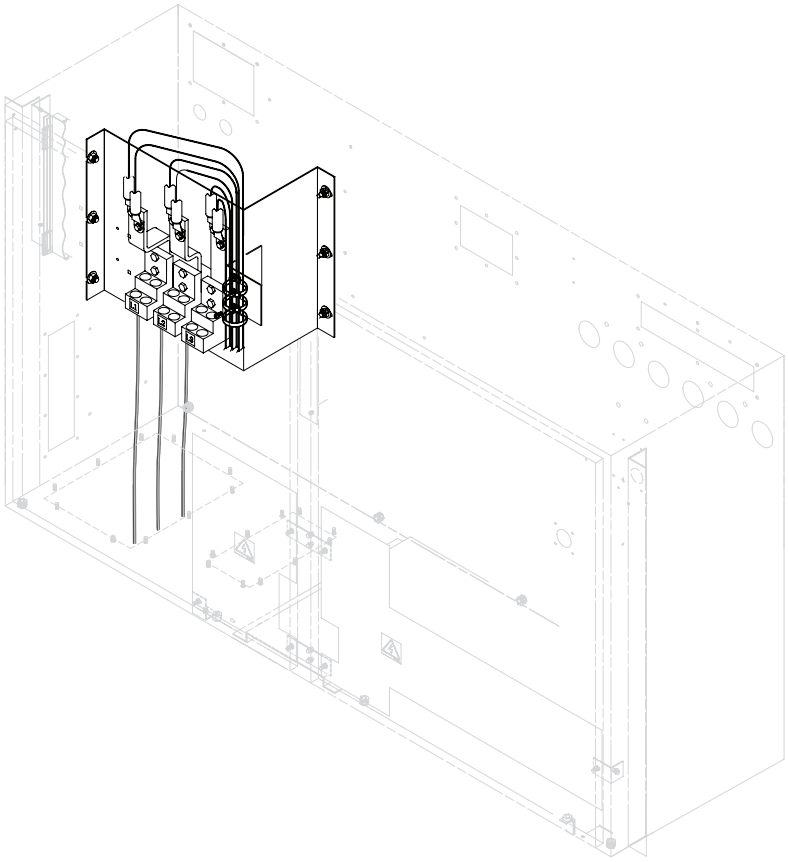
* Up to 4 wires per phase, consisting of 2 lugs per phase where each lug can accommodate 2 wires.

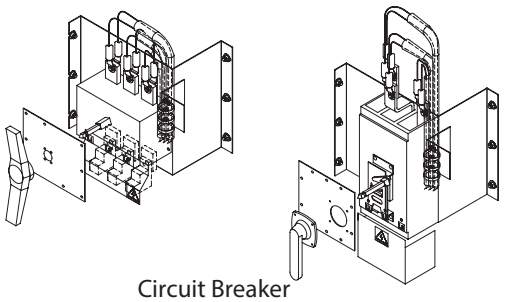
TABLE 14 - ELECTRICAL LUG DATA (CONT'D)

FIELD WIRING LUGS					HIGH AIRFLOW/HIGH STATIC CONDENSER FANS					
					TERMINAL BLOCK		CIRCUIT BREAKER		NON-FUSED DISCONNECT SWITCH	
YVAA MODEL			INPUT VOLTS	INPUT FREQ	WIRE PER PHASE	LUG WIRE RANGE	WIRES PER PHASE	LUG WIRE RANGE	WIRES PER PHASE	LUG WIRE RANGE
FRAME	COND	EVAP								
DUAL POINT WIRING										
042	8	J	200	60						
			230	60						
			380	60	3	#2 - 600 kcmil	3	#3/0 ~ 400 kcmil	3	#3/0 ~ 400 kcmil
			400	50	3	#2 - 600 kcmil	3	#3/0 ~ 400 kcmil	3	#3/0 ~ 400 kcmil
			460	60	2	#2 - 600 kcmil	3	#3/0 ~ 400 kcmil	3	#3/0 ~ 400 kcmil
			575	60	2	#2 - 600 kcmil	2	#1 ~ 500 kcmil	2	#1 ~ 500 kcmil
044	3	G	200	60						
			230	60						
			380	60	3	#2 - 600 kcmil	3	#3/0 ~ 400 kcmil	3	#3/0 ~ 400 kcmil
			400	50	3	#2 - 600 kcmil	3	#3/0 ~ 400 kcmil	3	#3/0 ~ 400 kcmil
			460	60	2	#2 - 600 kcmil	3	#3/0 ~ 400 kcmil	3	#3/0 ~ 400 kcmil
			575	60	2	#2 - 600 kcmil	2	#1 ~ 500 kcmil	2	#1 ~ 500 kcmil
047	5	J	200	60						
			230	60						
			380	60	3	#2 - 600 kcmil	3	#3/0 ~ 400 kcmil	3	#3/0 ~ 400 kcmil
			400	50	3	#2 - 600 kcmil	3	#3/0 ~ 400 kcmil	3	#3/0 ~ 400 kcmil
			460	60	2	#2 - 600 kcmil	3	#3/0 ~ 400 kcmil	3	#3/0 ~ 400 kcmil
			575	60	2	#2 - 600 kcmil	2	#1 ~ 500 kcmil	2	#1 ~ 500 kcmil
048	3	G	200	60						
			230	60						
			380	60	3	#2 - 600 kcmil	3	#3/0 ~ 400 kcmil	3	#3/0 ~ 400 kcmil
			400	50	3	#2 - 600 kcmil	3	#3/0 ~ 400 kcmil	3	#3/0 ~ 400 kcmil
			460	60	2	#2 - 600 kcmil	3	#3/0 ~ 400 kcmil	3	#3/0 ~ 400 kcmil
			575	60	2	#2 - 600 kcmil	2	#1 ~ 500 kcmil	2	#1 ~ 500 kcmil
050	0	J	200	60						
			230	60						
			380	60	3	#2 - 600 kcmil	3	#3/0 - 400 kcmil	3	#3/0 - 400 kcmil
			400	50	3	#2 - 600 kcmil	3	#3/0 - 400 kcmil	3	#3/0 - 400 kcmil
			460	60	3	#2 - 600 kcmil	3	#3/0 - 400 kcmil	3	#3/0 - 400 kcmil
			575	60						
052	3	J	200	60						
			230	60						
			380	60	3	#2 - 600 kcmil	3	#3/0 - 400 kcmil	3	#3/0 - 400 kcmil
			400	50	3	#2 - 600 kcmil	3	#3/0 - 400 kcmil	3	#3/0 - 400 kcmil
			460	60	3	#2 - 600 kcmil	3	#3/0 - 400 kcmil	3	#3/0 - 400 kcmil
			575	60						

* Up to 4 wires per phase, consisting of 2 lugs per phase where each lug can accommodate 2 wires.

2 COMPRESSOR POWER WIRING CONNECTIONS FOR SINGLE POINT CONNECTION





Circuit Breaker
(Optional)

LD17319

NOTE

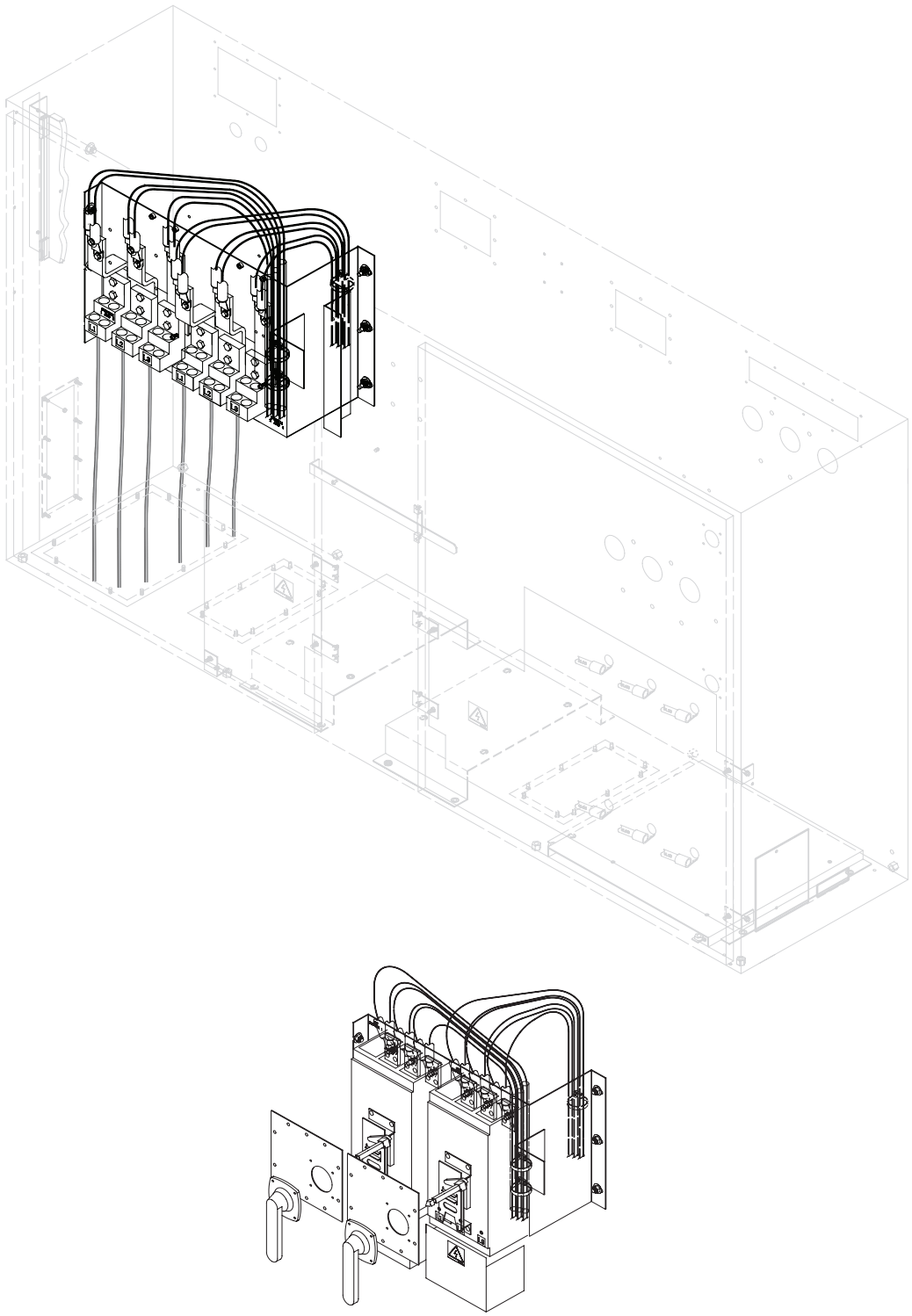
Minimum Circuit Ampacity (MCA), Minimum/Maximum Fuse Size and Minimum/Maximum Circuit Breaker size varies on chillers based upon model and options ordered. Consult YorkWorks or the chiller data plate for electrical data on a specific chiller.

Voltage Utilization Range

RATE VOLTAGE	UTILIZATION RANGE
200/60/3	180-220
230/60/3	208-254
380/60/3	342-402
460/60/3	414-508
575/60/3	520-635
400/50/3	360-440
400/60/3	360-400

FIGURE 46 - POWER WIRING - 2 COMPRESSOR CONNECTIONS

2 COMPRESSOR POWER WIRING CONNECTIONS FOR MULTIPOINT CONNECTION



Circuit Breaker
(Optional)

LD17320

FIGURE 46 - POWER WIRING - 2 COMPRESSOR CONNECTIONS (CONT'D)

SINGLE POINT CONNECTIONS
VSD CONTROL PANEL

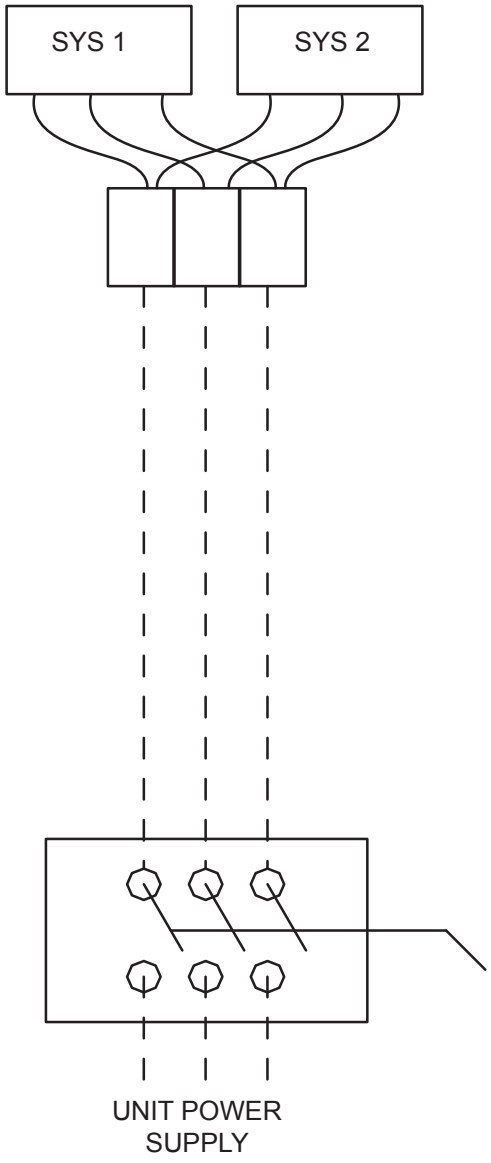
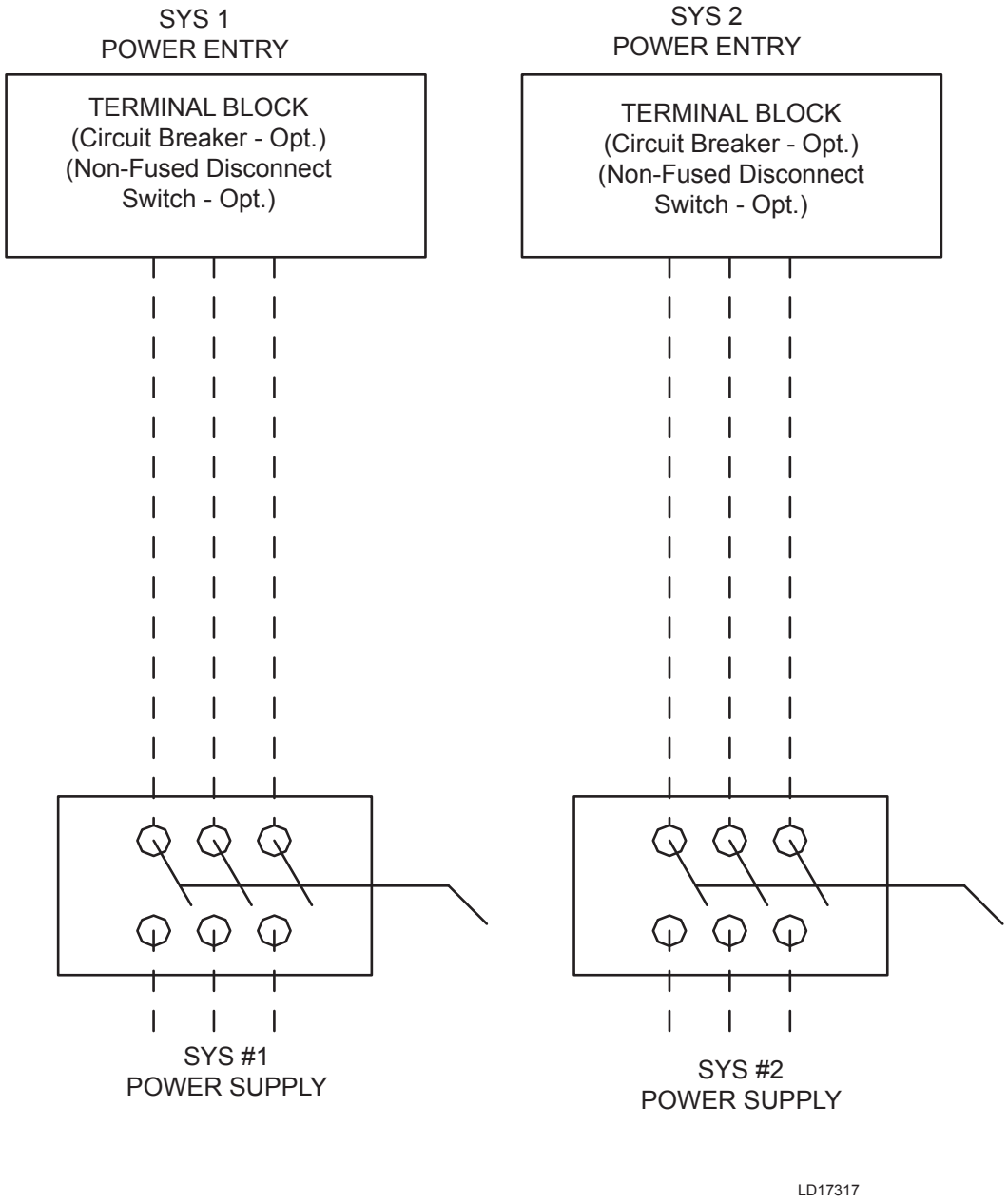


FIGURE 47 - SINGLE POINT CONNECTIONS FOR VSD CONTROL PANEL

MULTIPOINT CONNECTIONS
VSD CONTROL PANEL

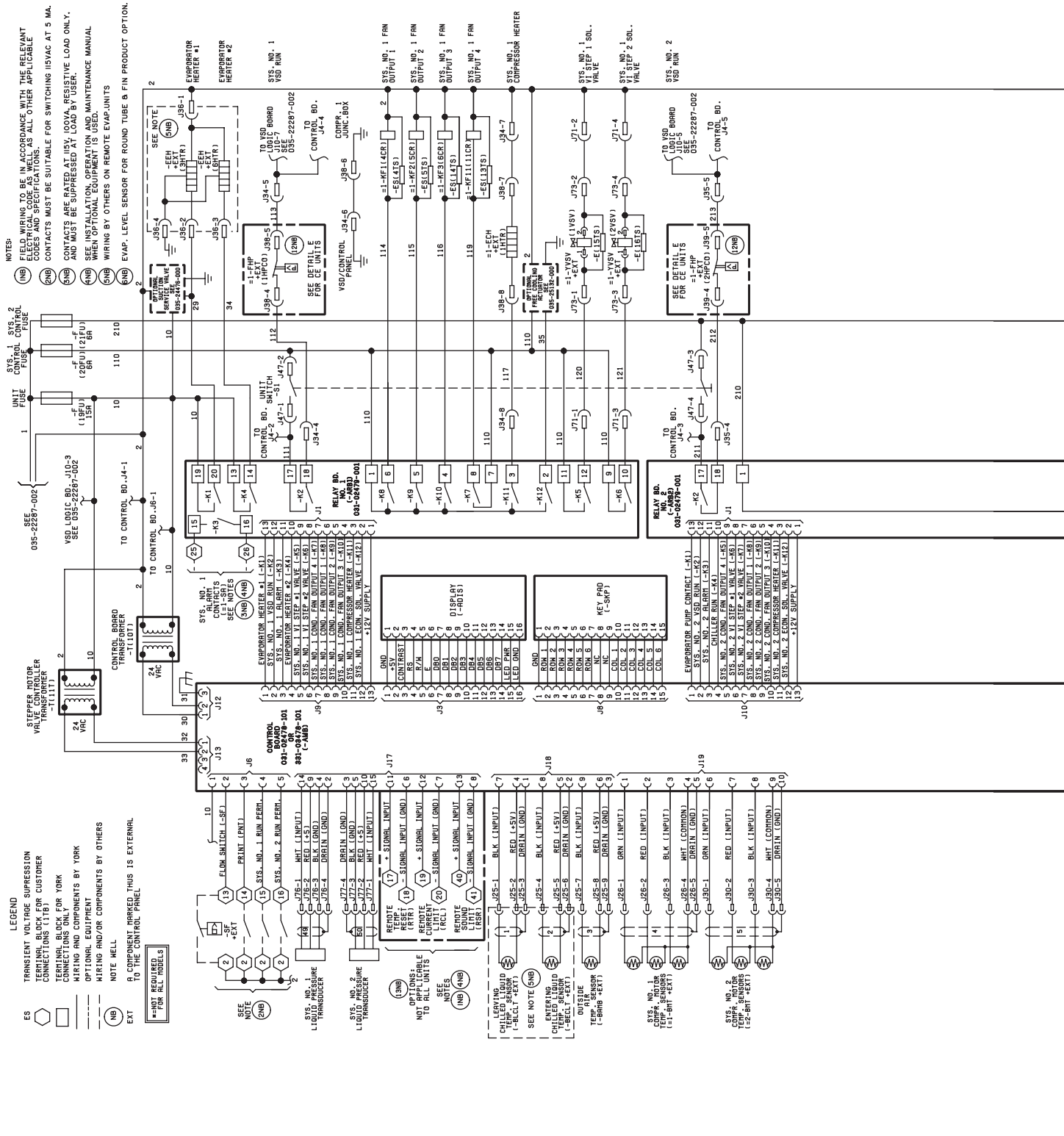


Note: Sys #1 and Sys #2 power connections located on left side mid panel.

FIGURE 48 - MULTIPOINT CONNECTIONS FOR VSD CONTROL PANEL

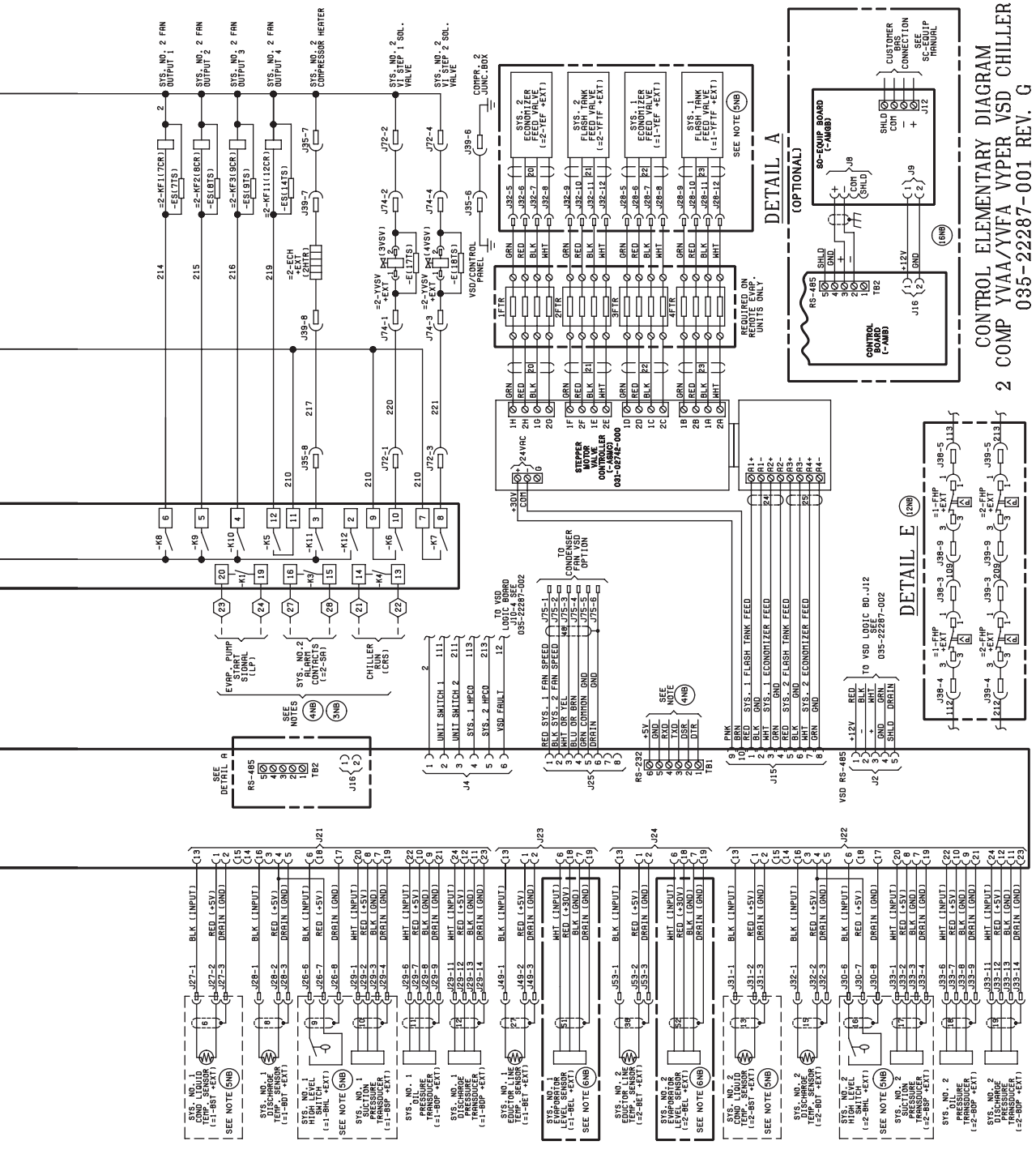
WIRING DIAGRAMS

035-22287-001 REV G



LD22792

FIGURE 49 - 2 COMPRESSOR CONTROL WIRING



LD22793

FIGURE 49 - 2 COMPRESSOR CONTROL WIRING (CONT'D)

035-22287-002 REV-

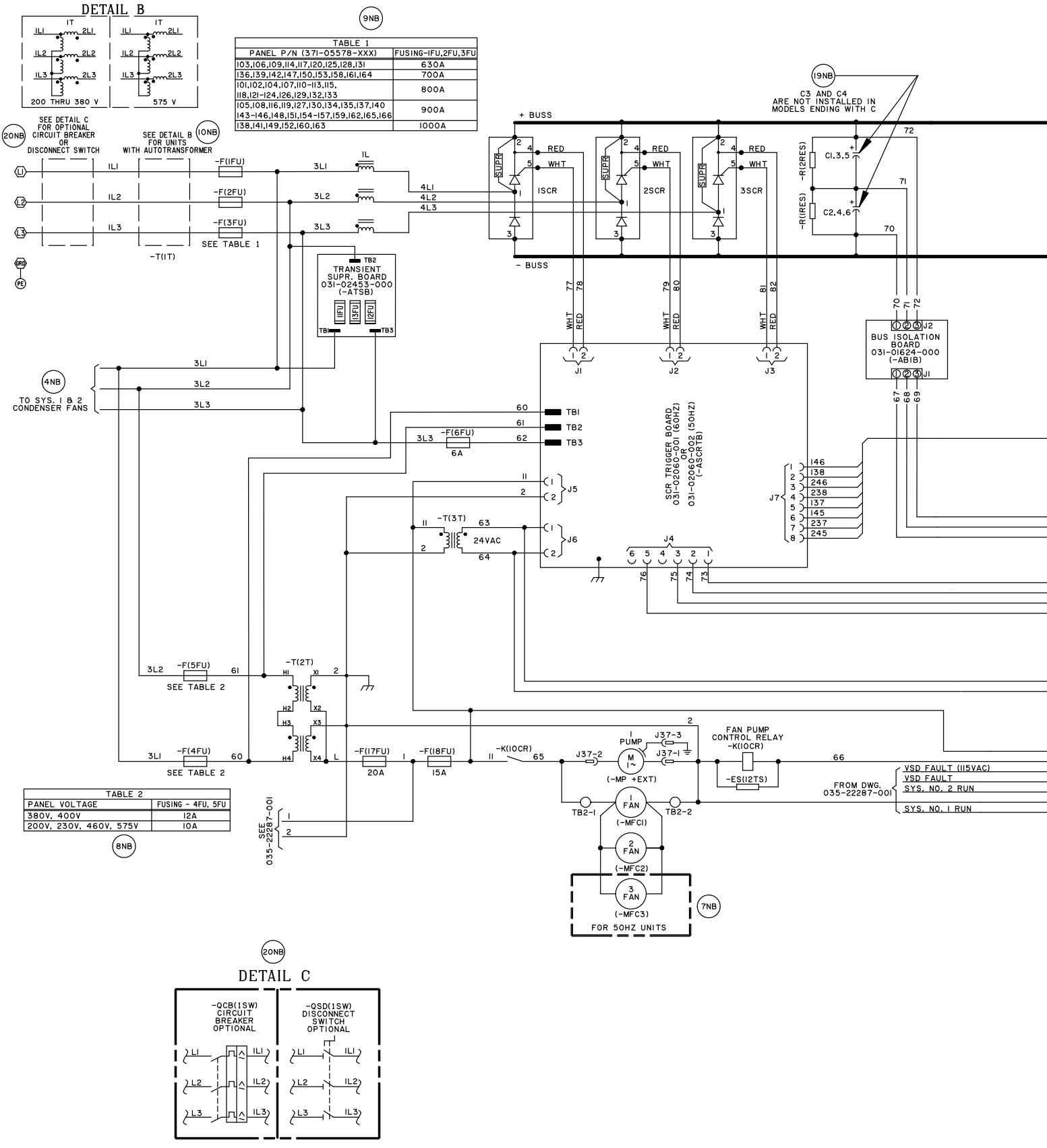


FIGURE 50 - 2 COMPRESSOR POWER WIRING

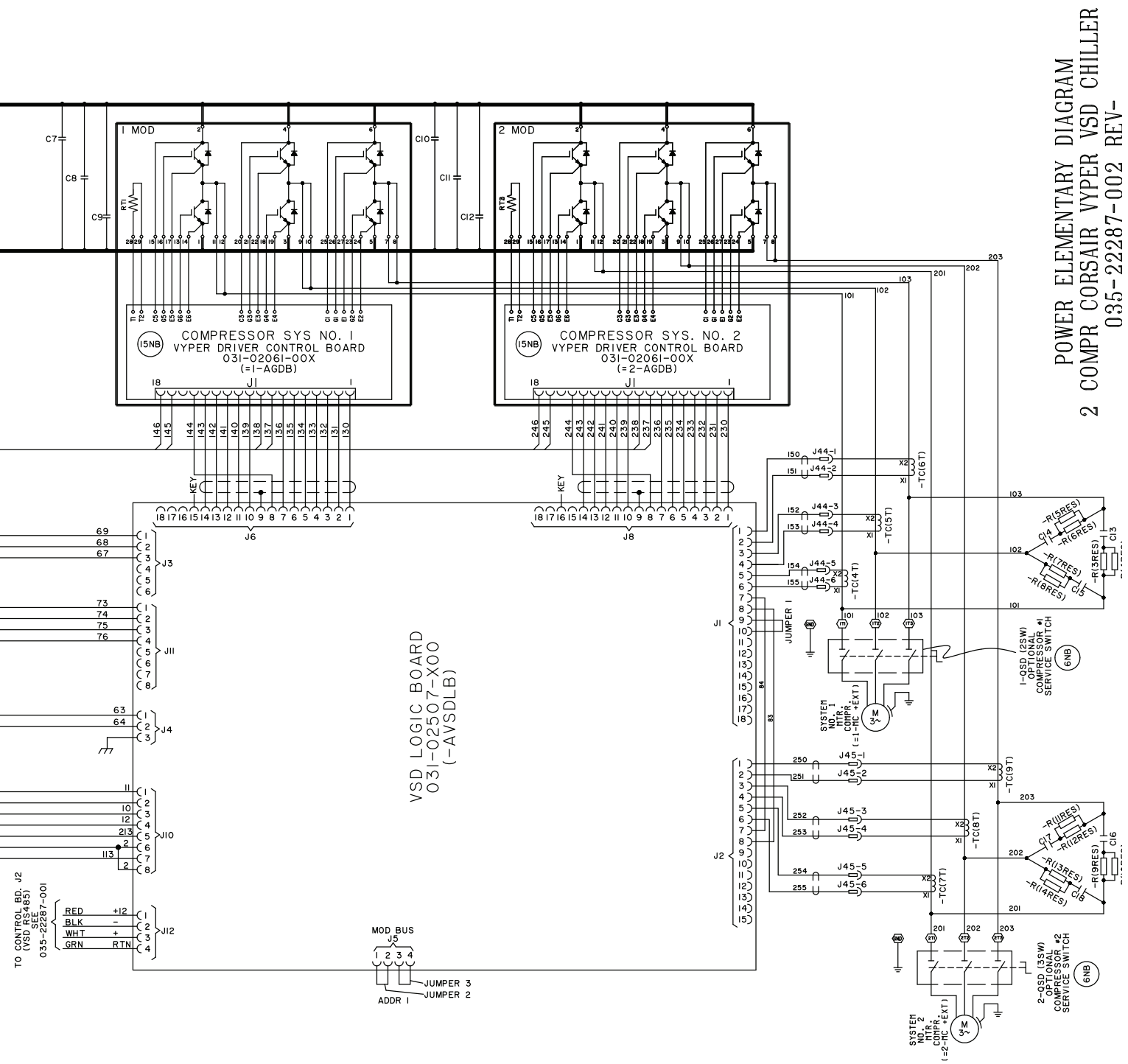


FIGURE 50 - 2 COMPRESSOR POWER WIRING (CONT'D)

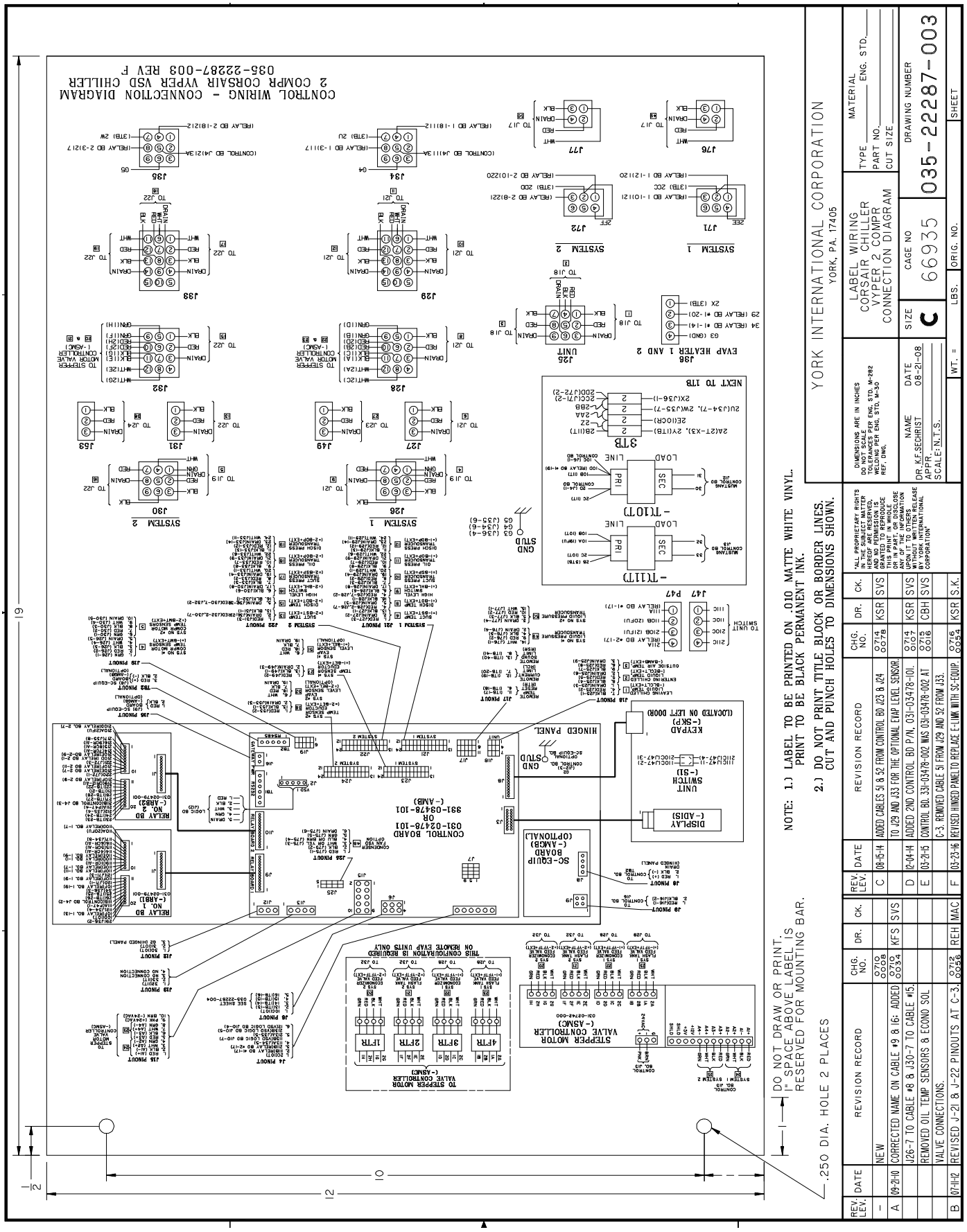


FIGURE 51 - 2 COMPRESSOR CONNECTION DIAGRAM

LD23228

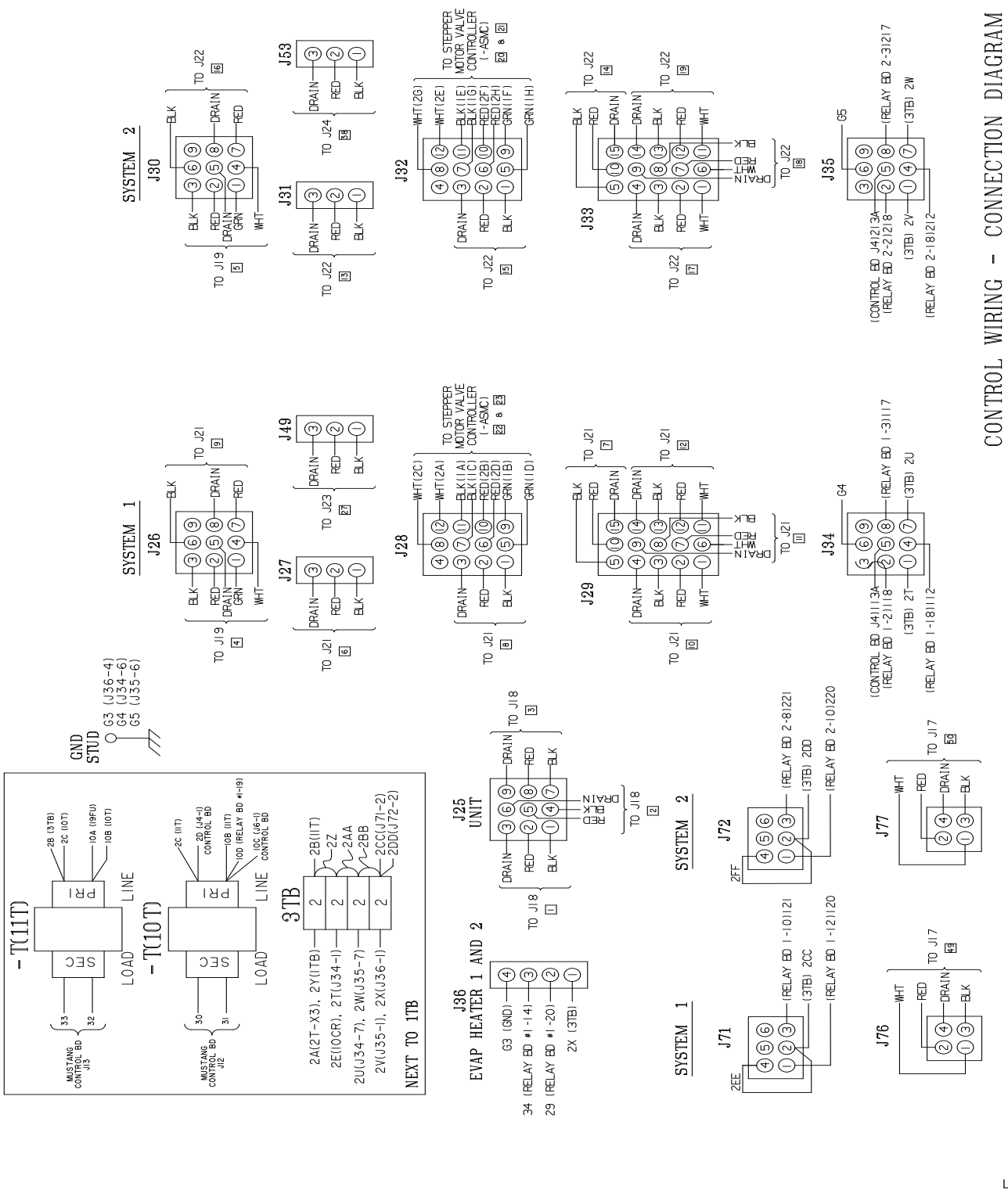


FIGURE 51 - 2 COMPRESSOR CONNECTION DIAGRAM (CONT'D)

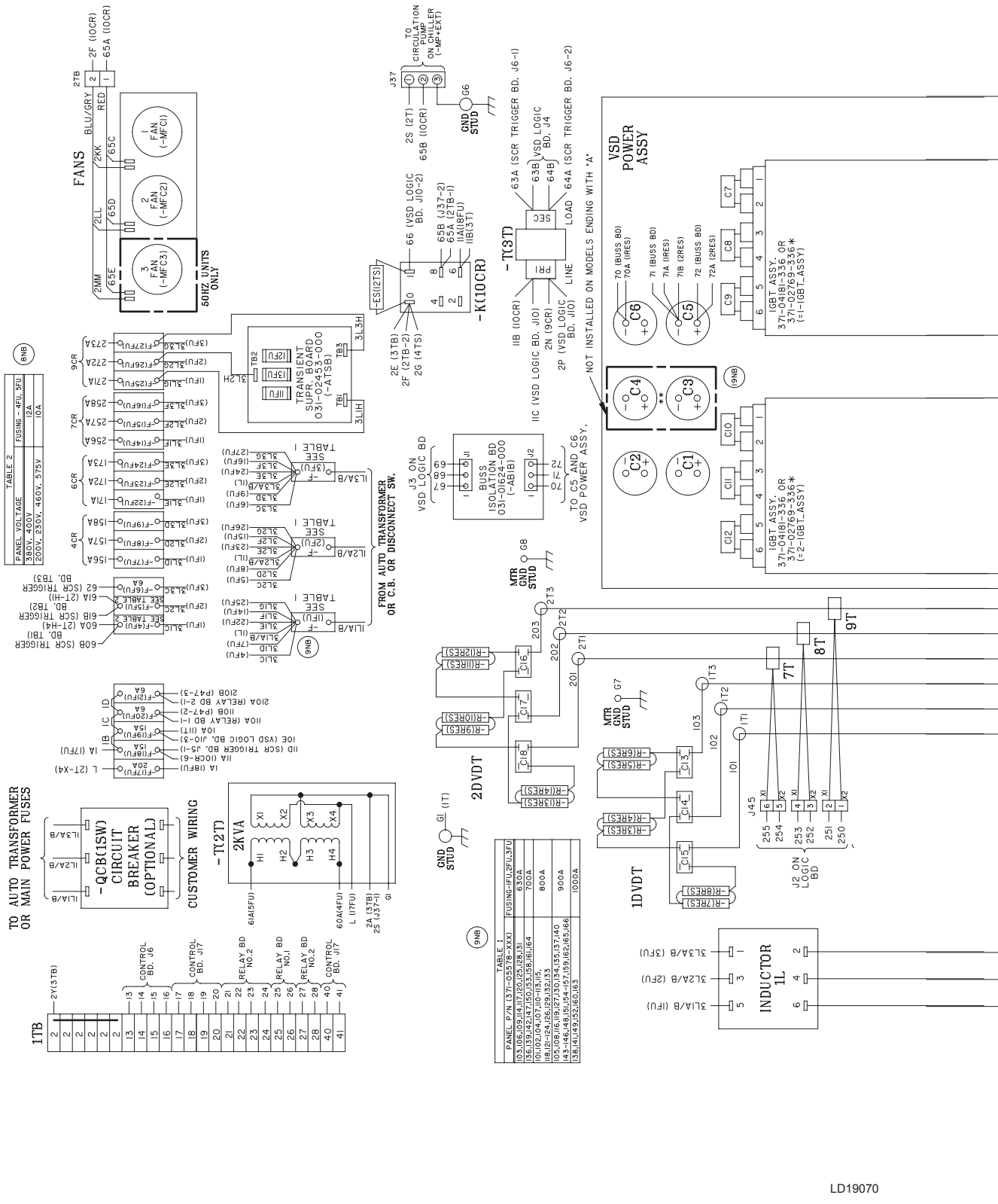


FIGURE 52 - 2 COMPRESSOR CONNECTION DIAGRAM

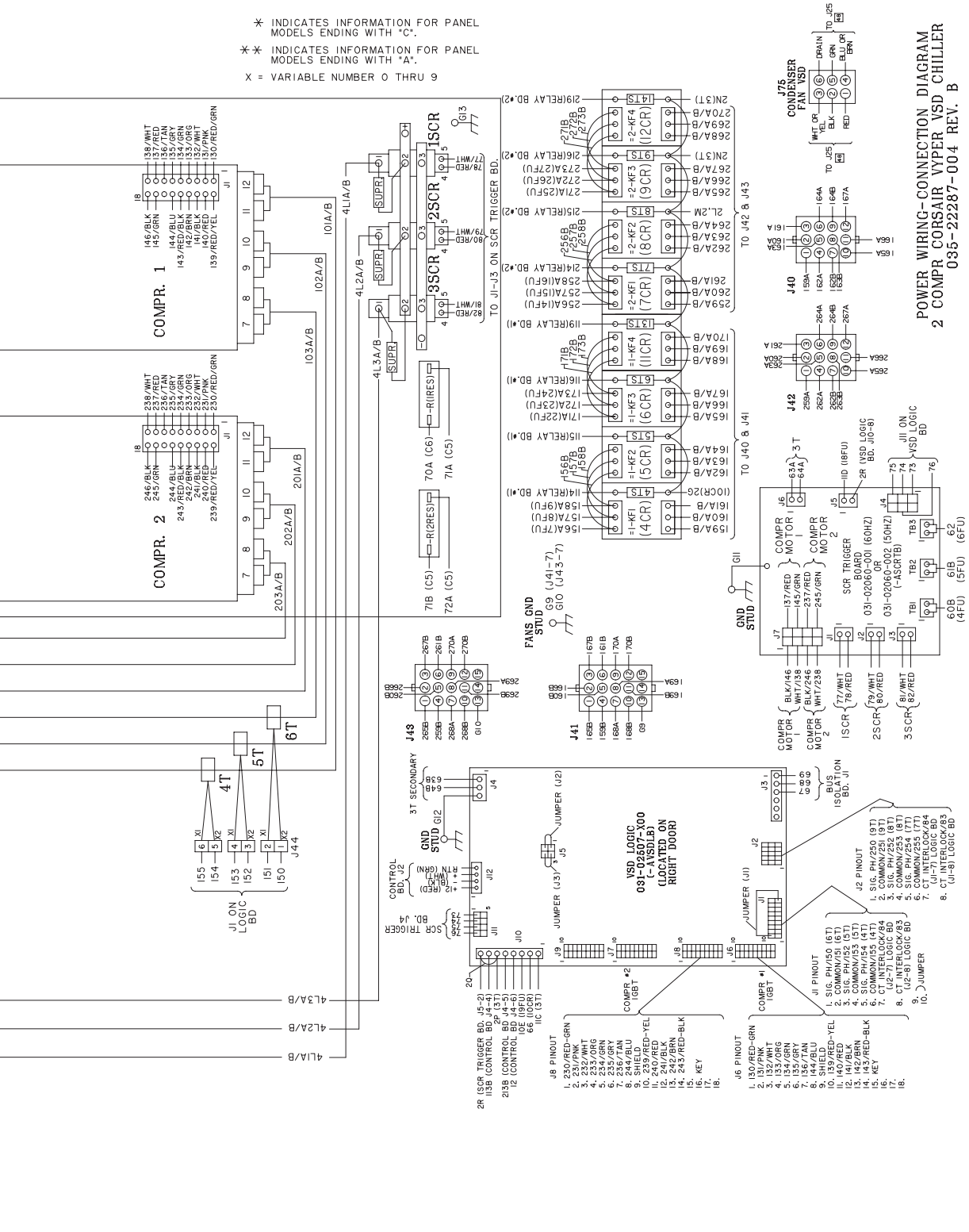


FIGURE 52 - 2 COMPRESSOR CONNECTION DIAGRAM (CONT'D)

035-22287-005 REV-

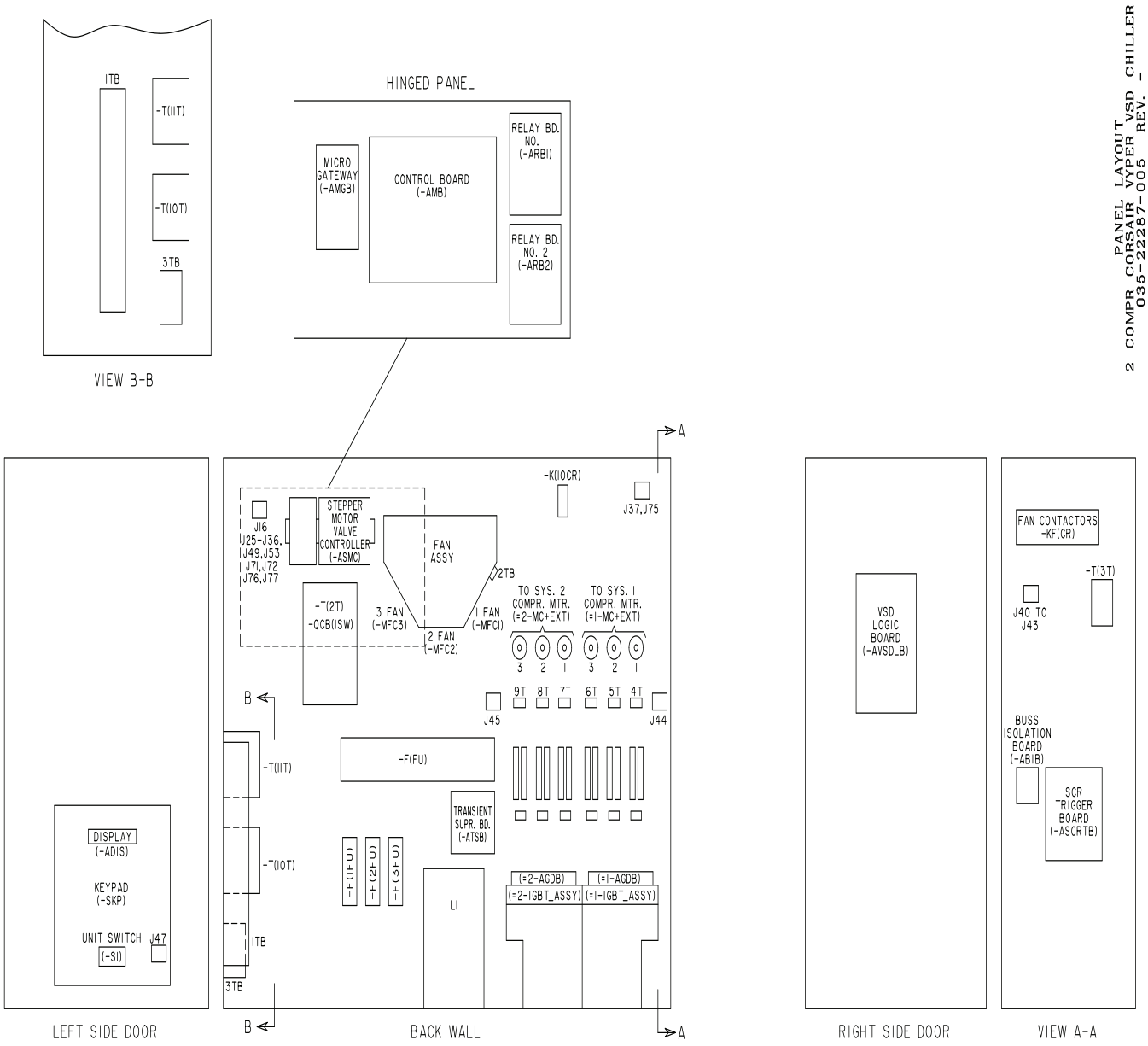


FIGURE 53 - 2 COMPRESSOR PANEL LAYOUT

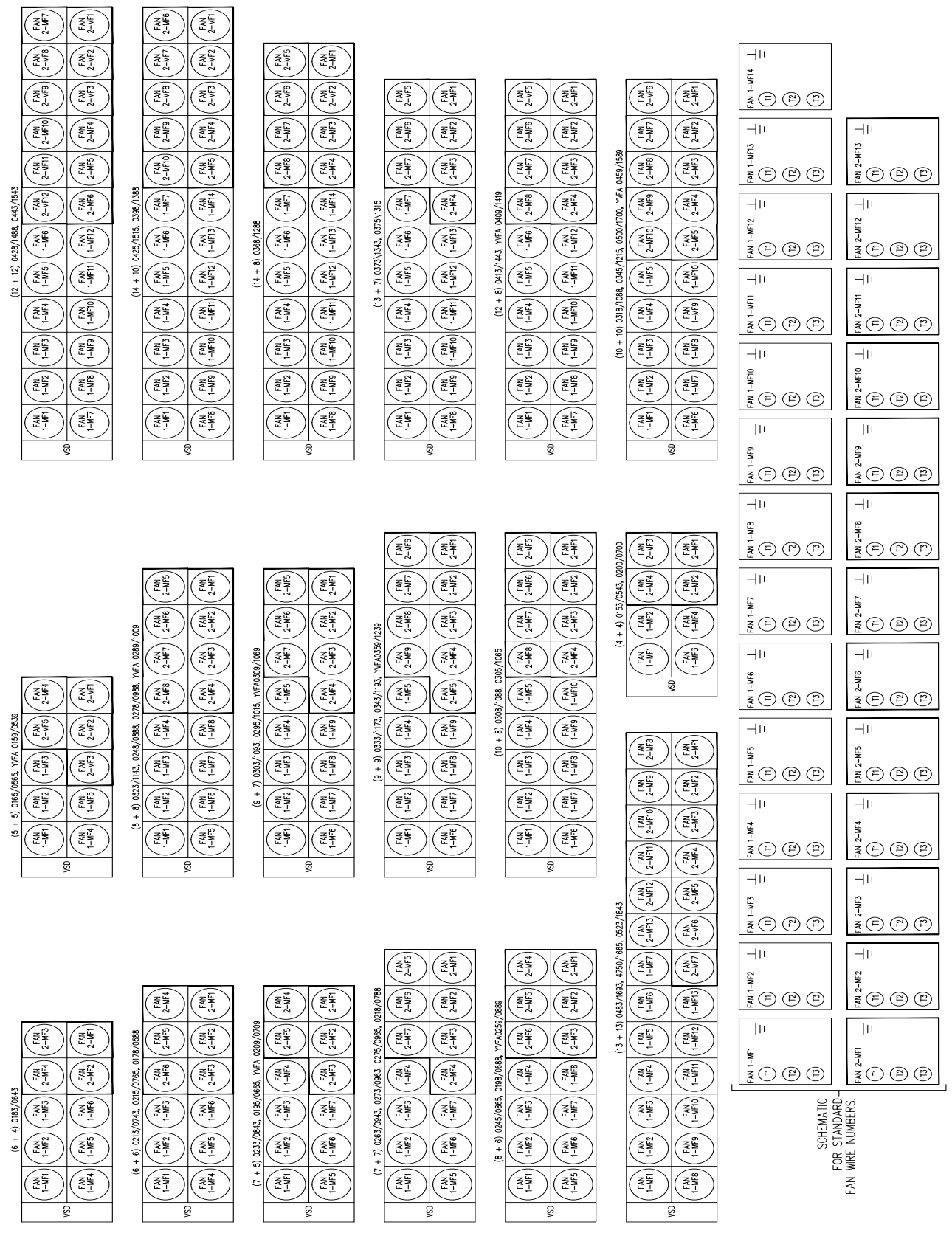


FIGURE 54 - 2 FAN SYSTEMS 1 AND 2 FAN WIRING

035-22287-018 REV B

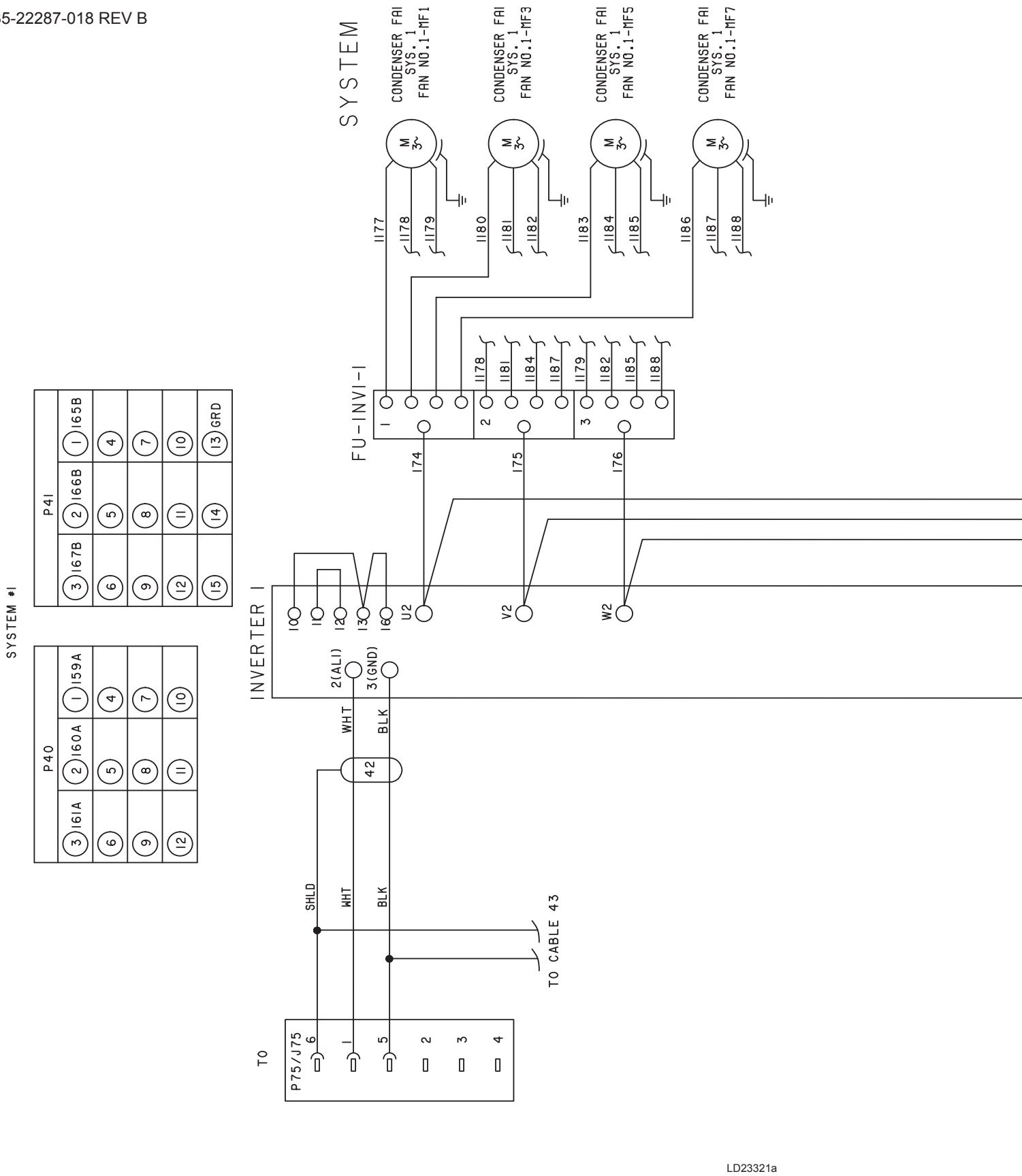


FIGURE 55 - SYSTEM 1 FAN WIRING

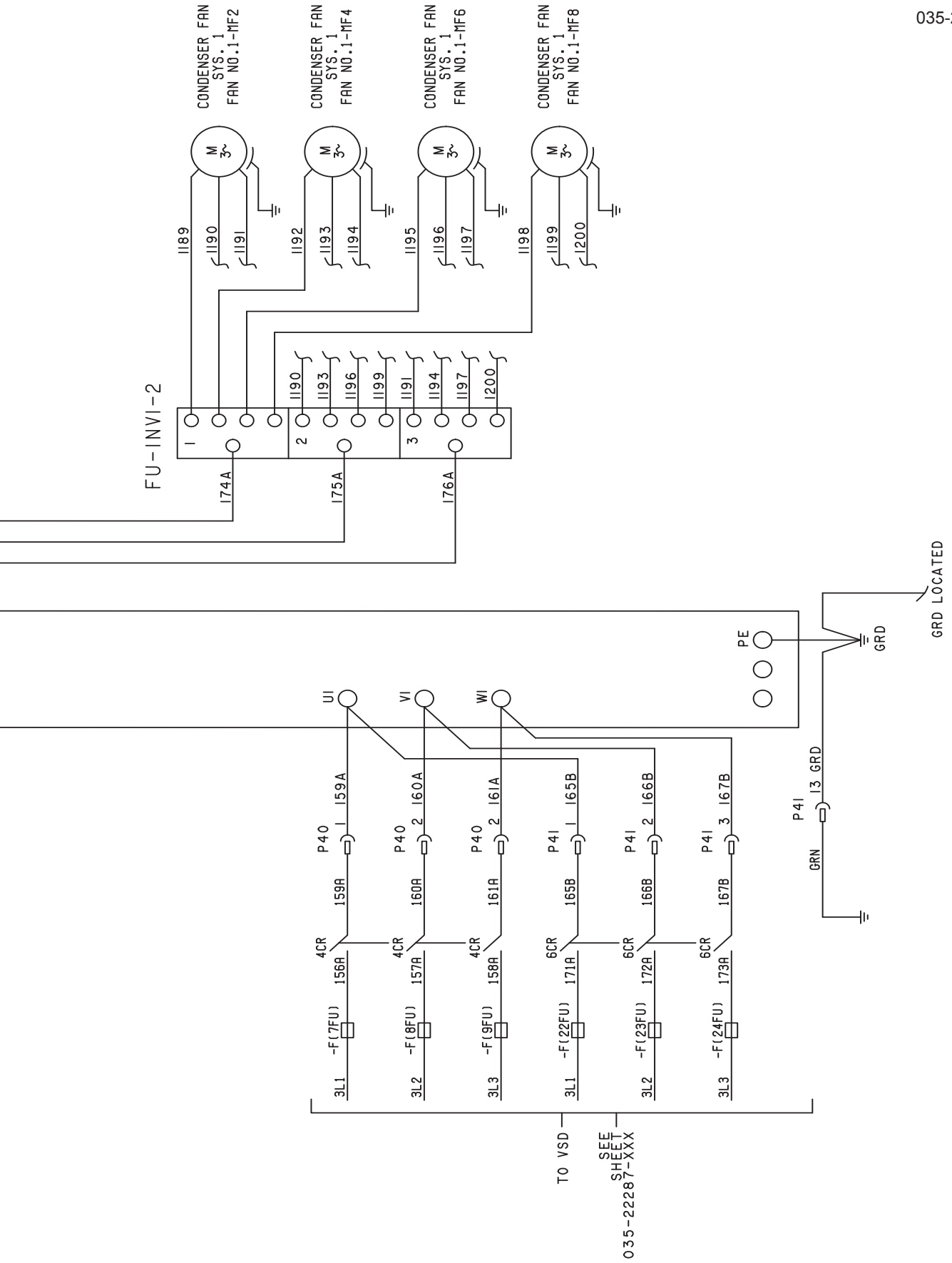
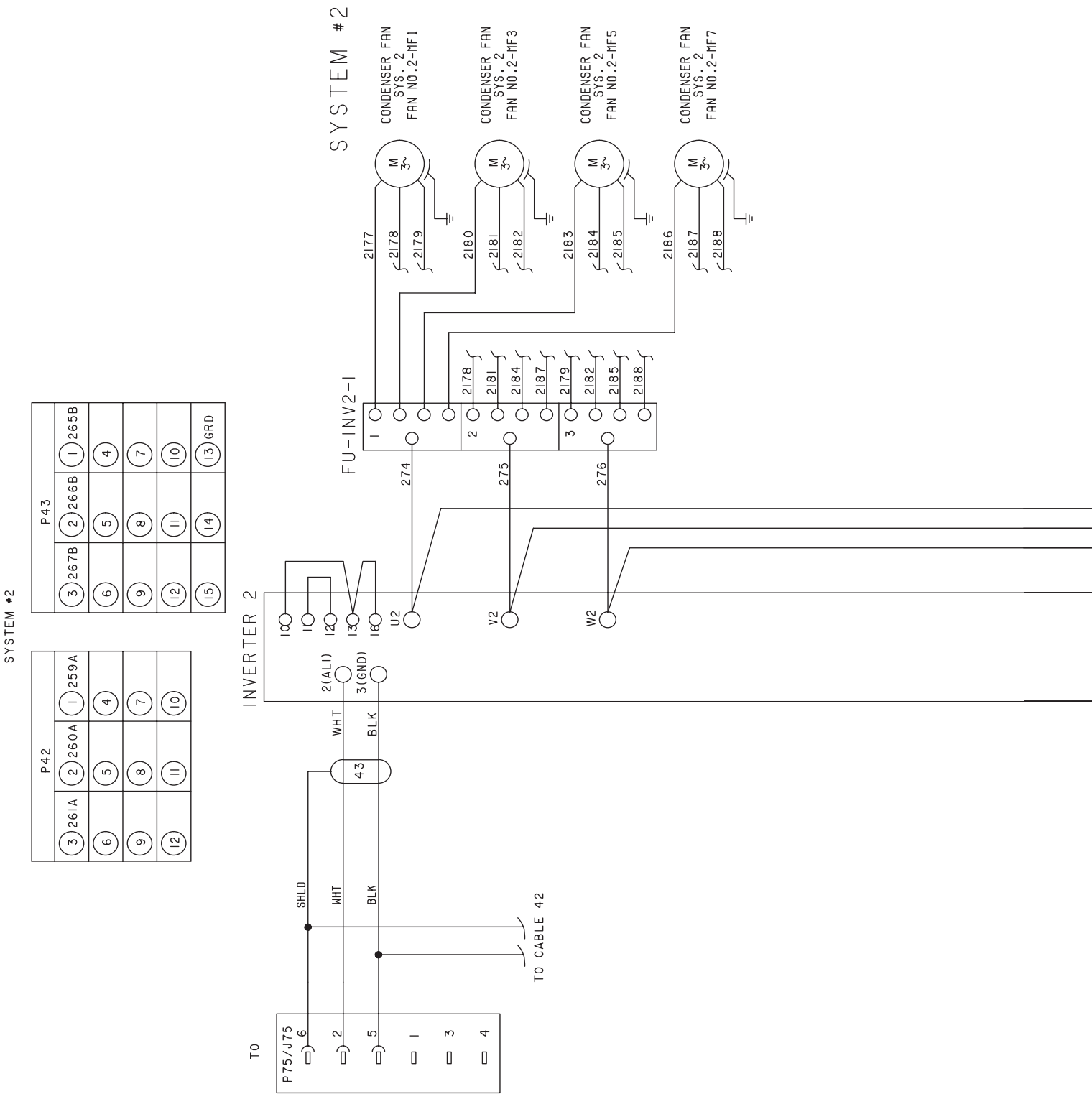
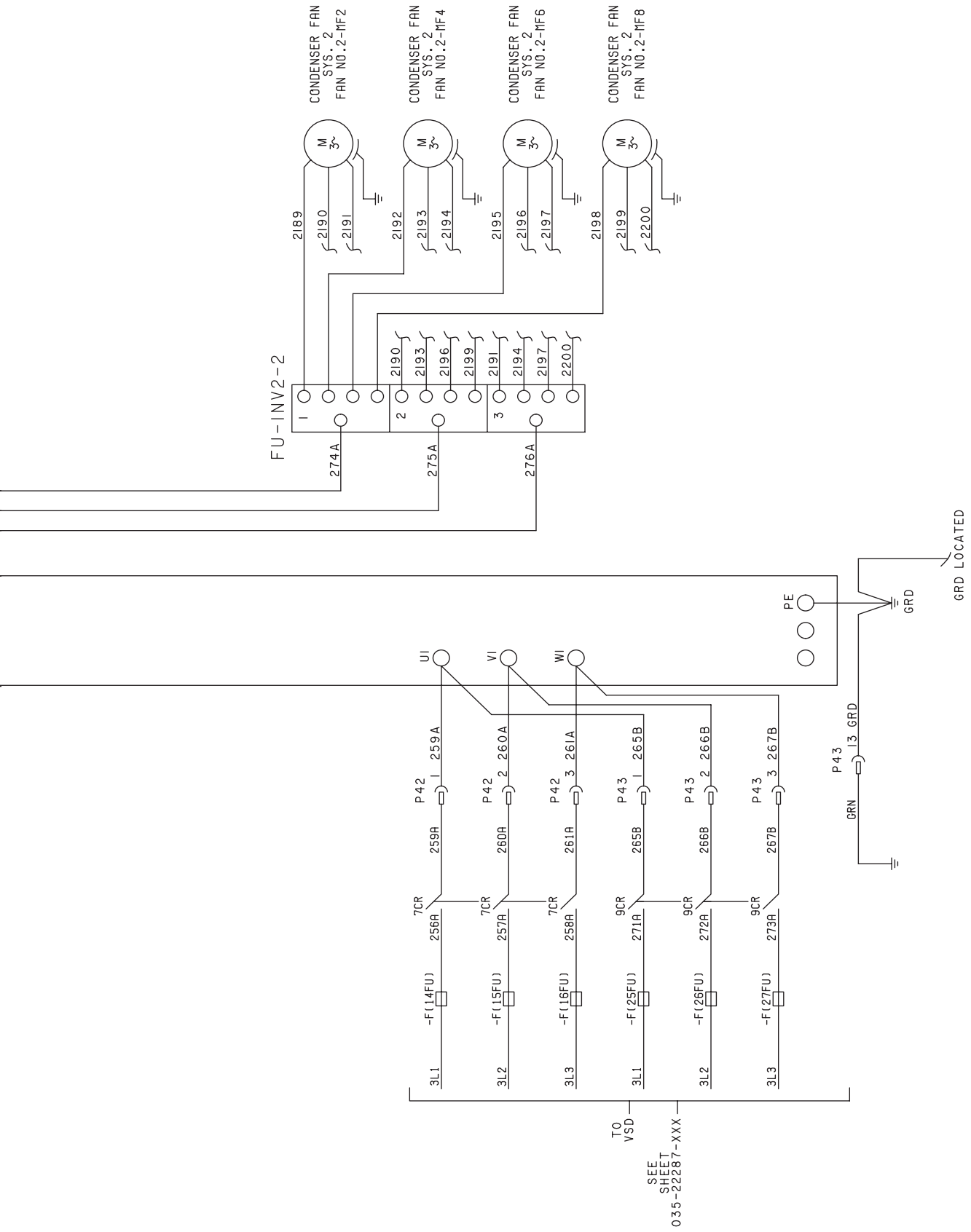


FIGURE 55 - SYSTEM 1 FAN WIRING (CONT'D)



LD22794

FIGURE 56 - SYSTEM 2 FAN WIRING



LD22795

FIGURE 56 - SYSTEM 2 FAN WIRING (CONT'D)

035-22287-032 REV-A

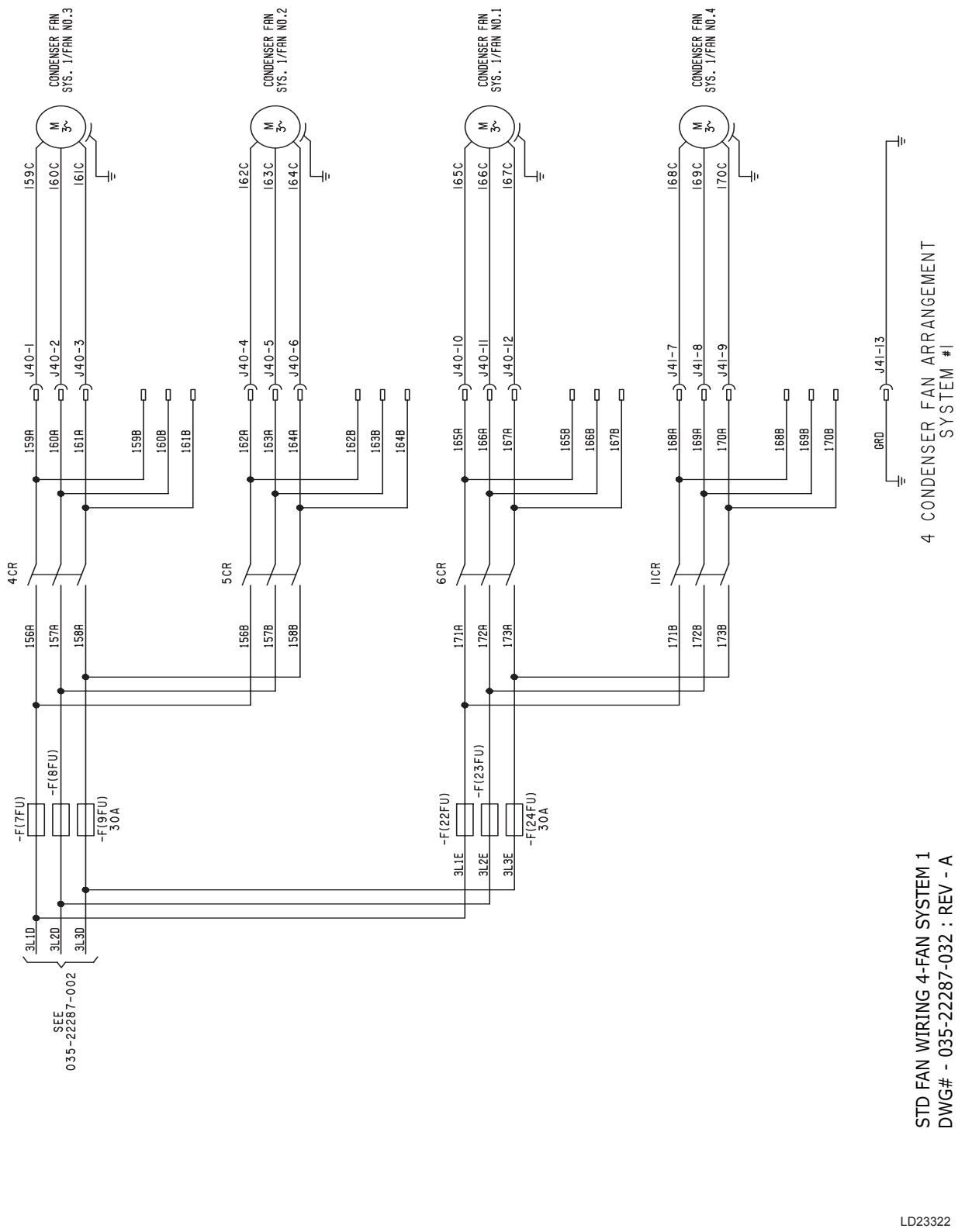


FIGURE 57 - FAN WIRING 4 FANS, SYSTEM 1

035-22287-033 REV-A

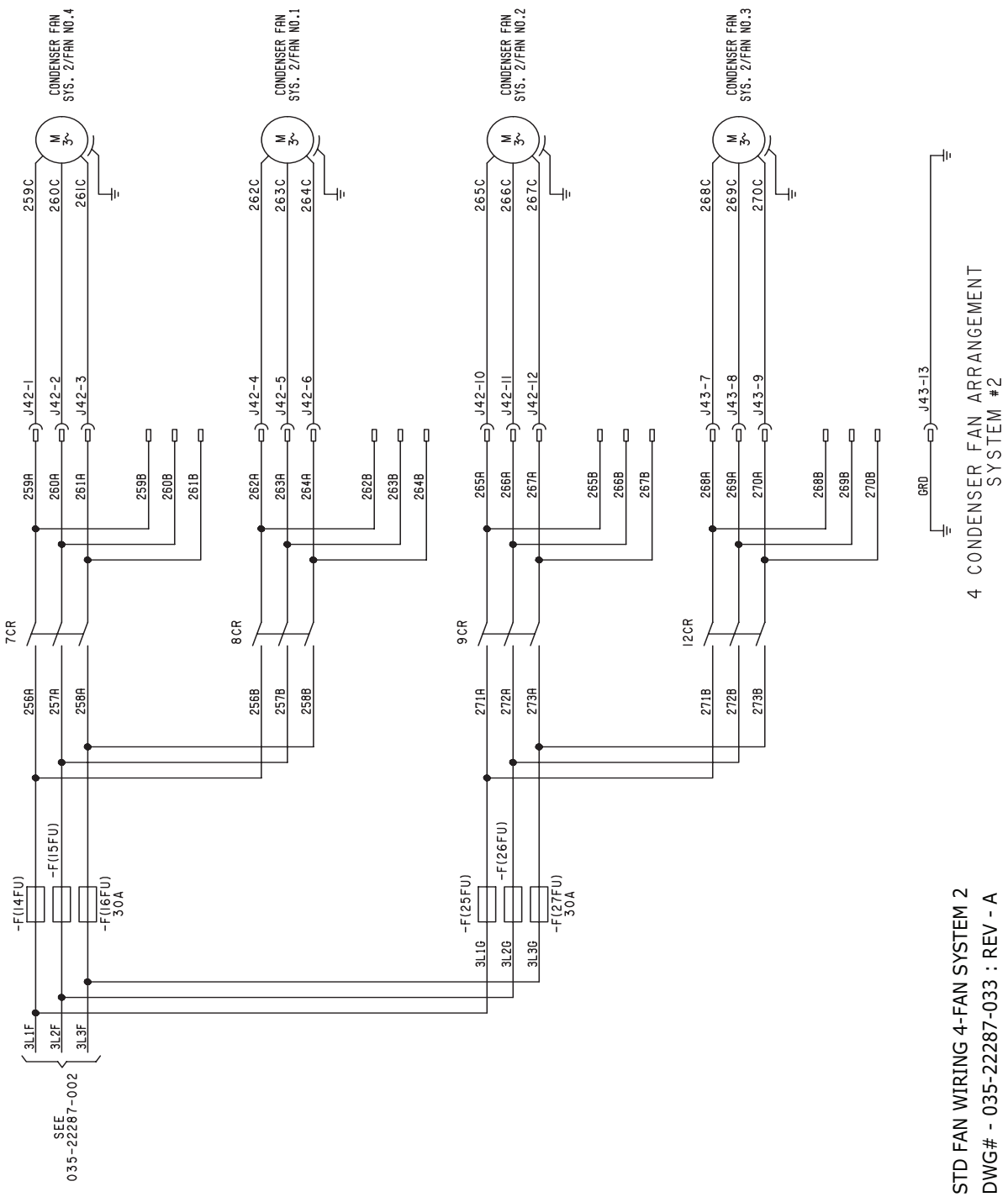


FIGURE 58 - FAN WIRING 4 FANS, SYSTEM 2

035-22287-034 REV-A

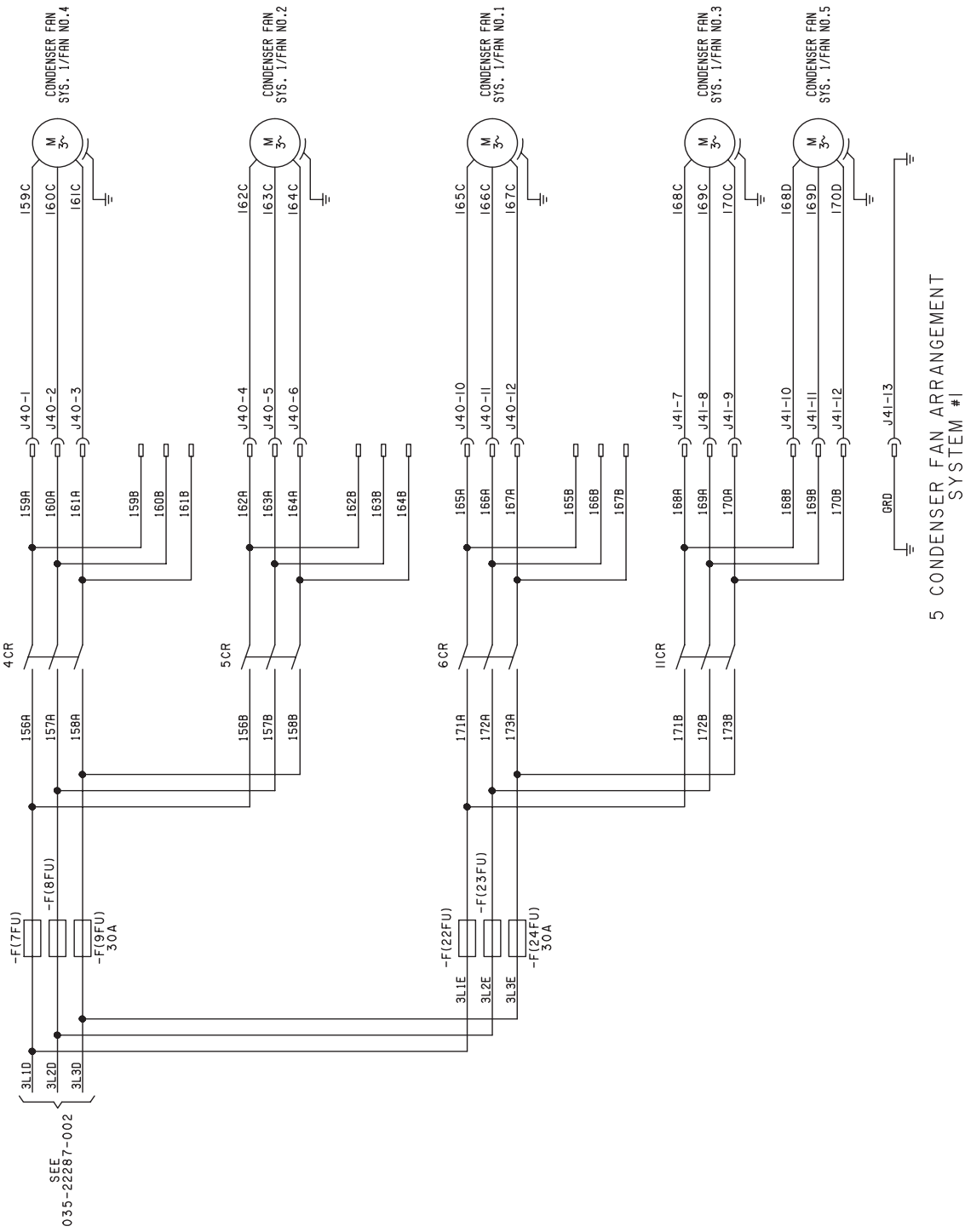


FIGURE 59 - FAN WIRING 5 FANS, SYSTEM 1

035-22287-035 REV-A

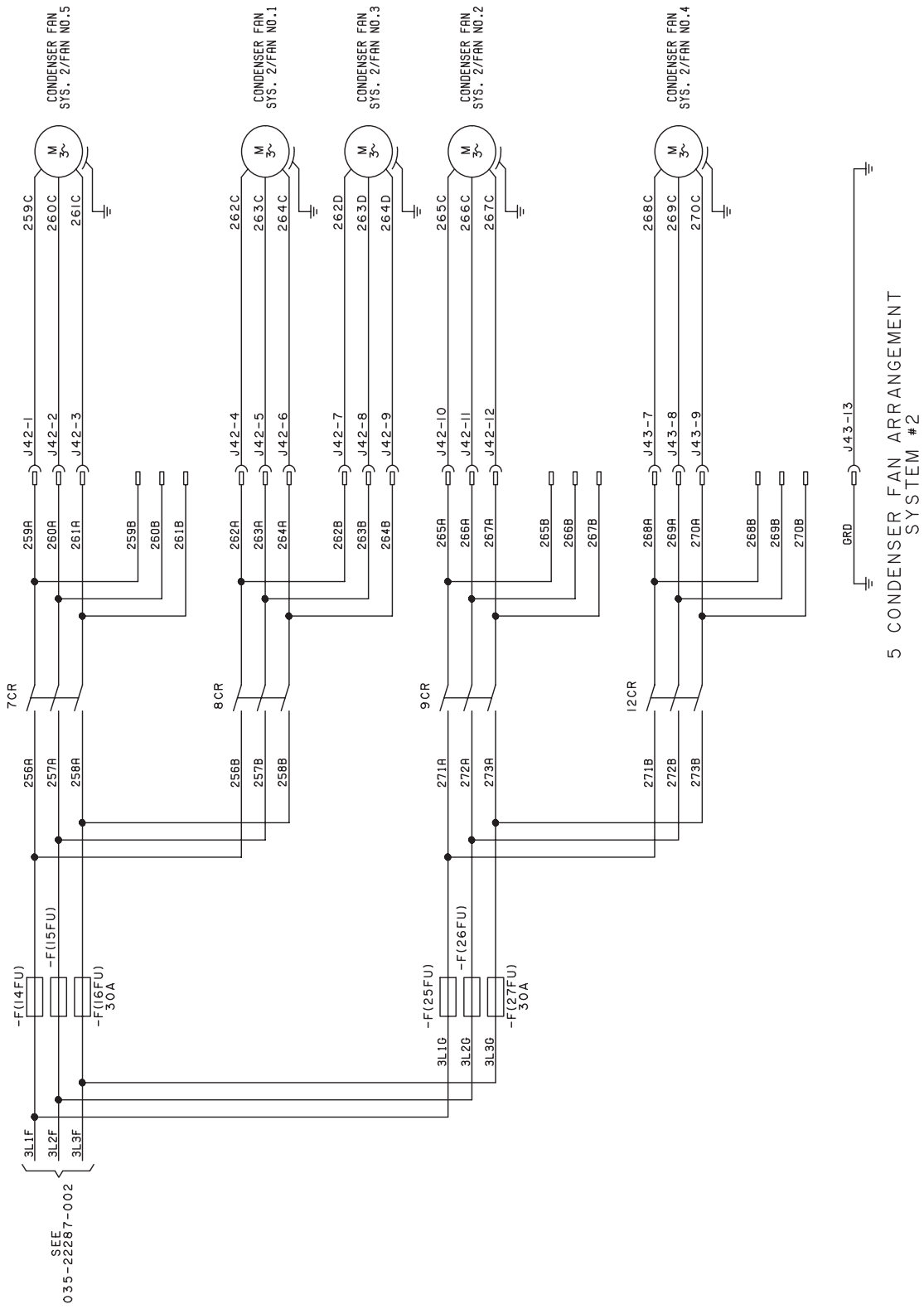


FIGURE 60 - FAN WIRING 5 FANS, SYSTEM 2

035-22287-036 REV-A

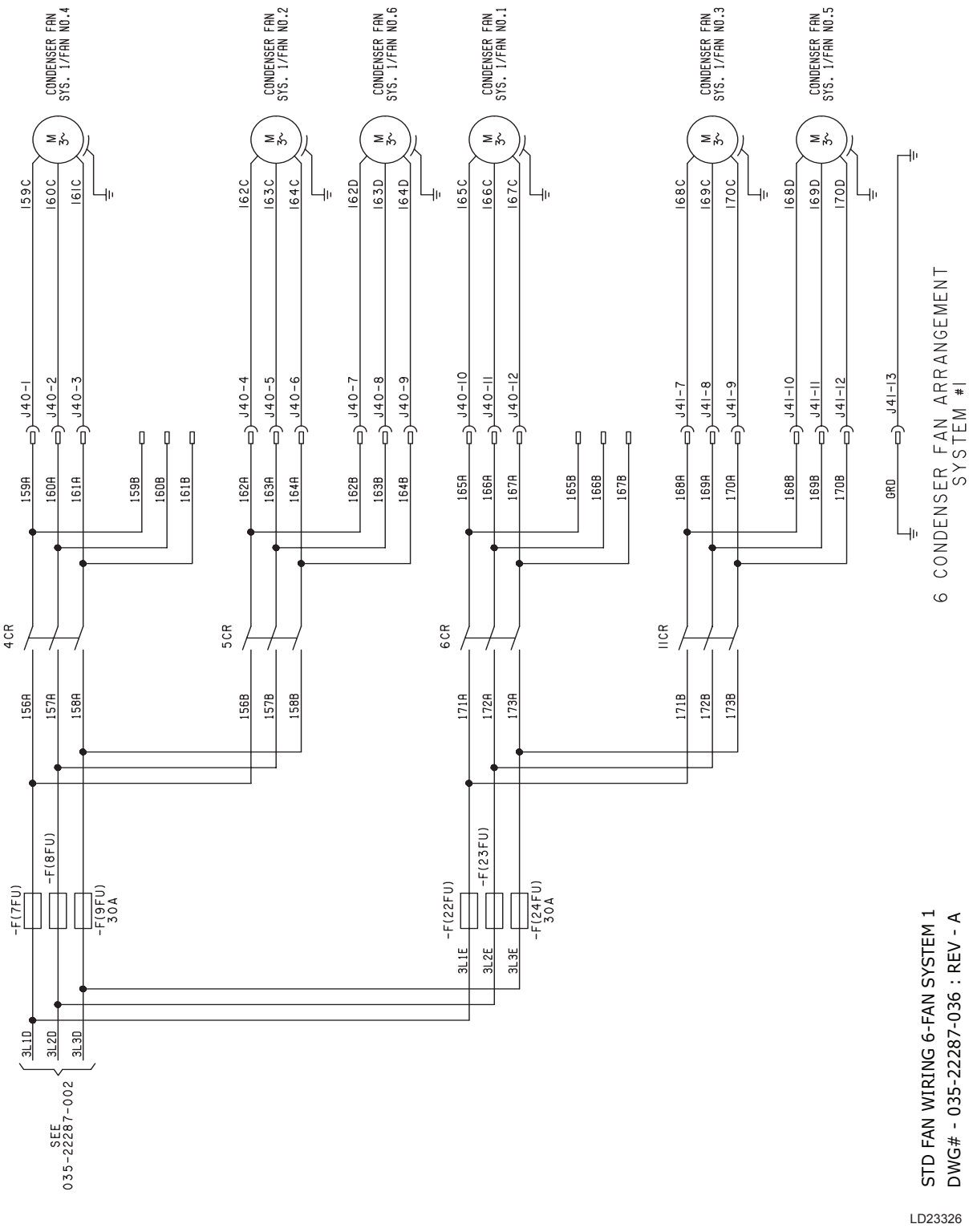


FIGURE 61 - FAN WIRING 6 FANS, SYSTEM 1

035-22287-037 REV-A

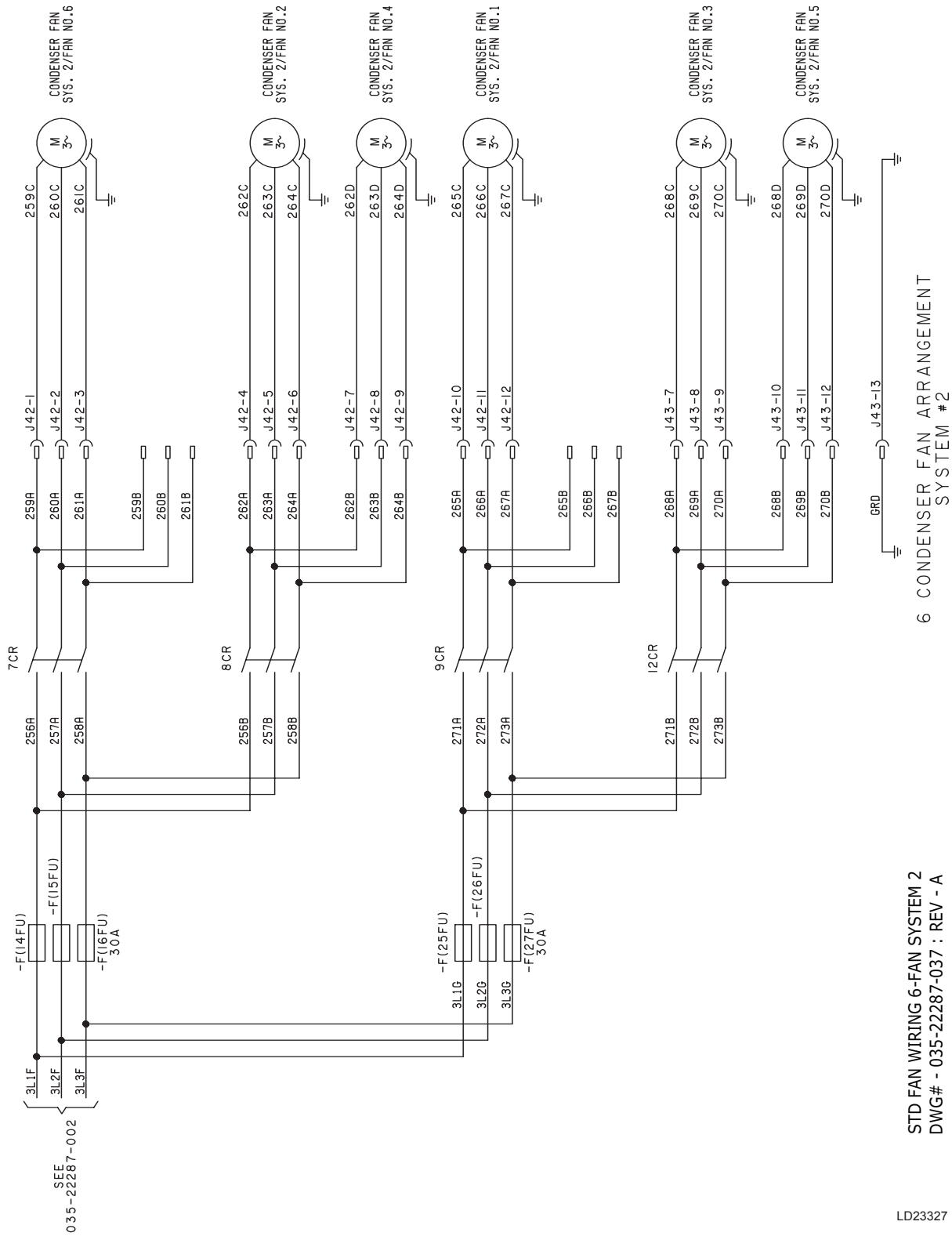


FIGURE 62 - FAN WIRING 6 FANS, SYSTEM 2

035-22287-038 REV-A

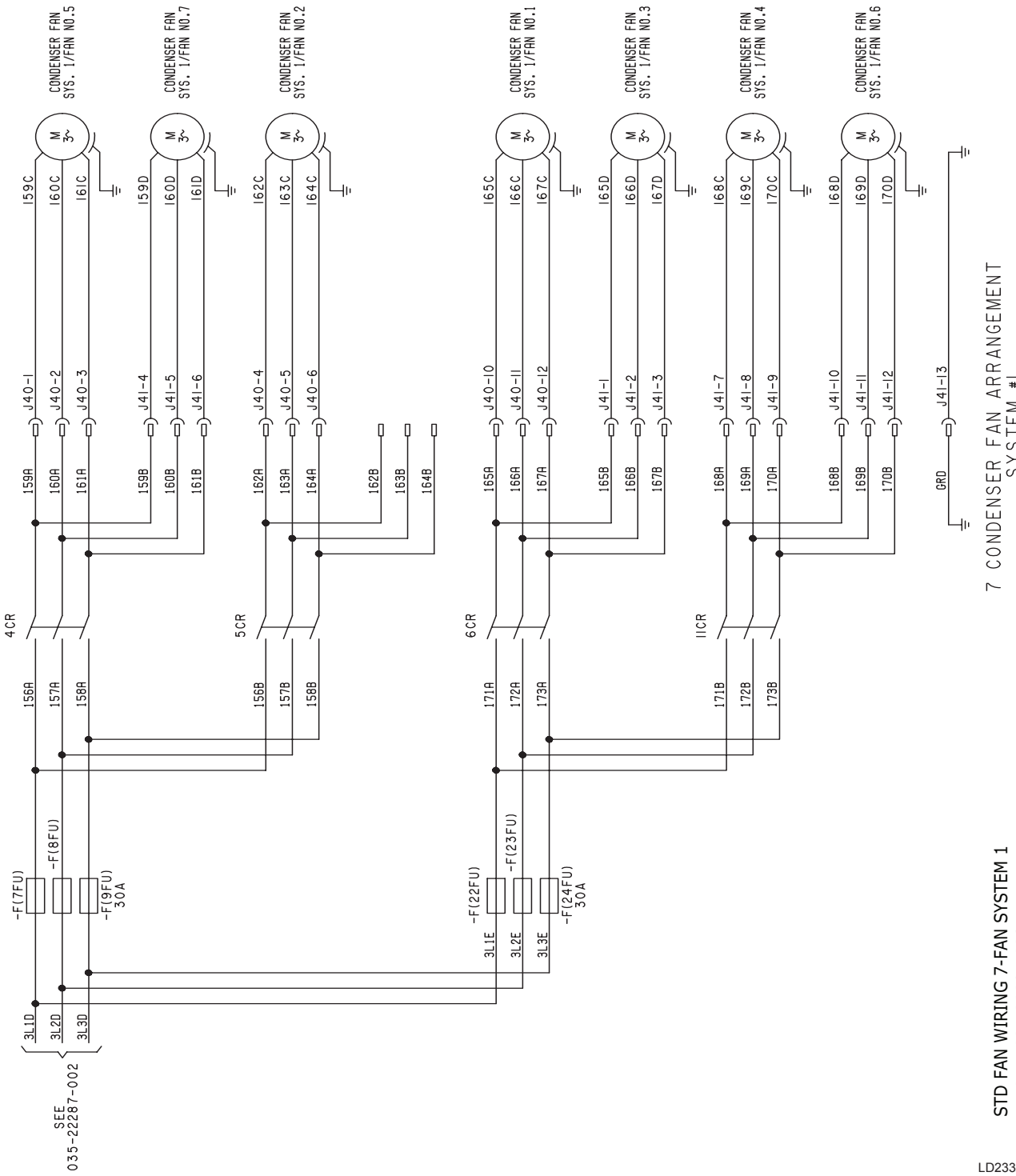


FIGURE 63 - FAN WIRING 7 FANS, SYSTEM 1

035-22287-039 REV-A

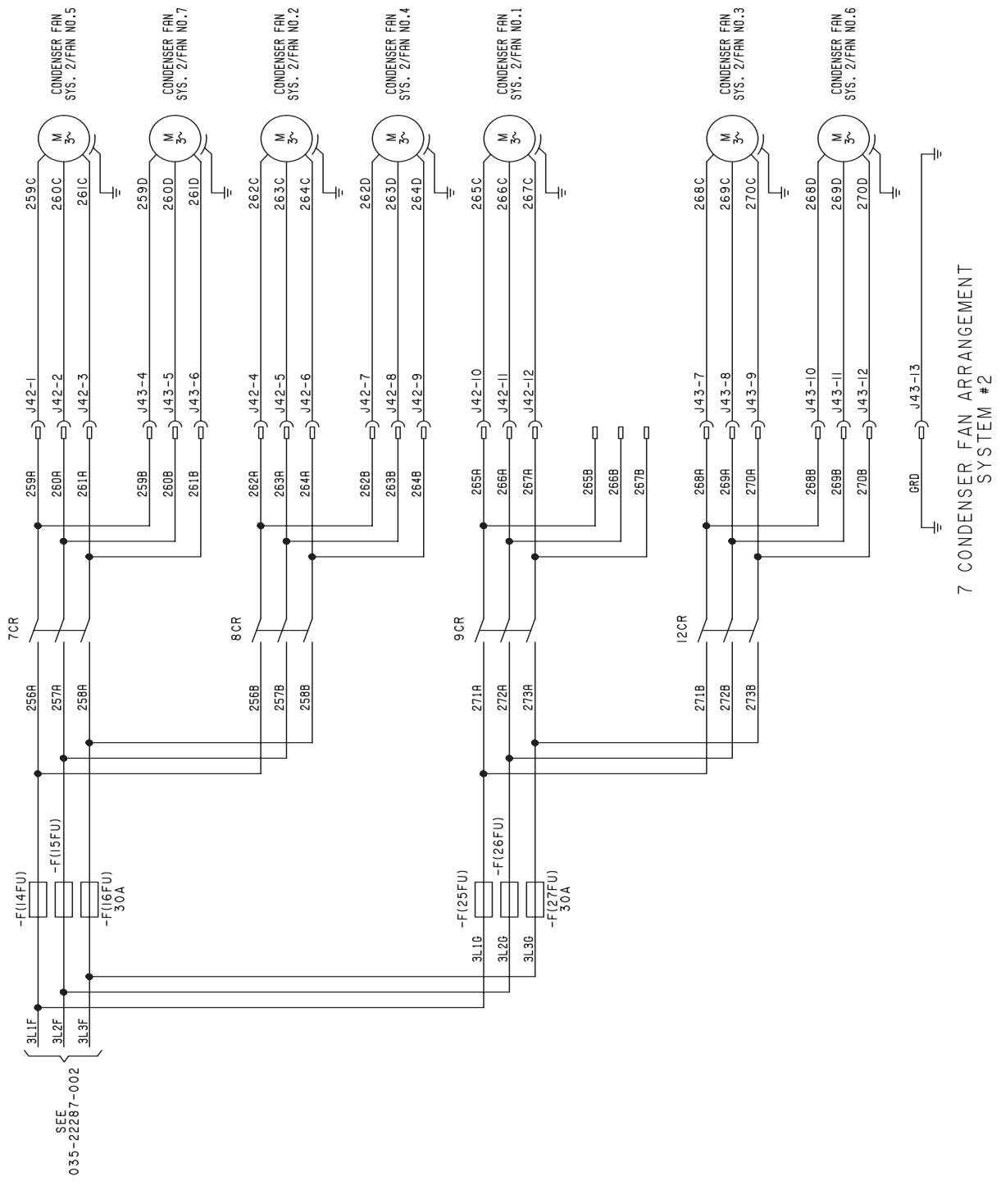


FIGURE 64 - FAN WIRING 7 FANS, SYSTEM 2

035-22287-030 REV-A

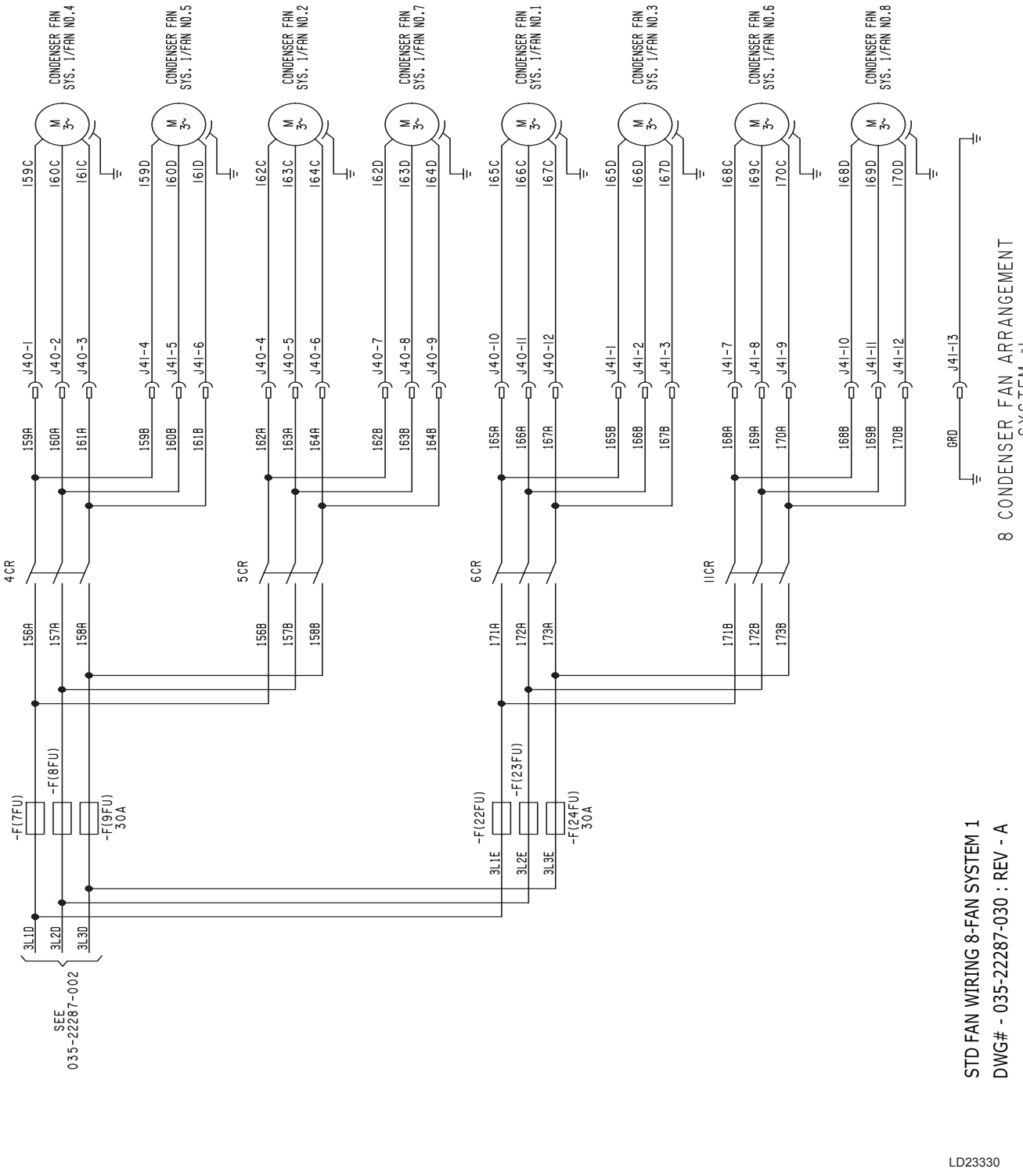


FIGURE 65 - FAN WIRING 8 FANS, SYSTEM 1

035-22287-031 REV-A

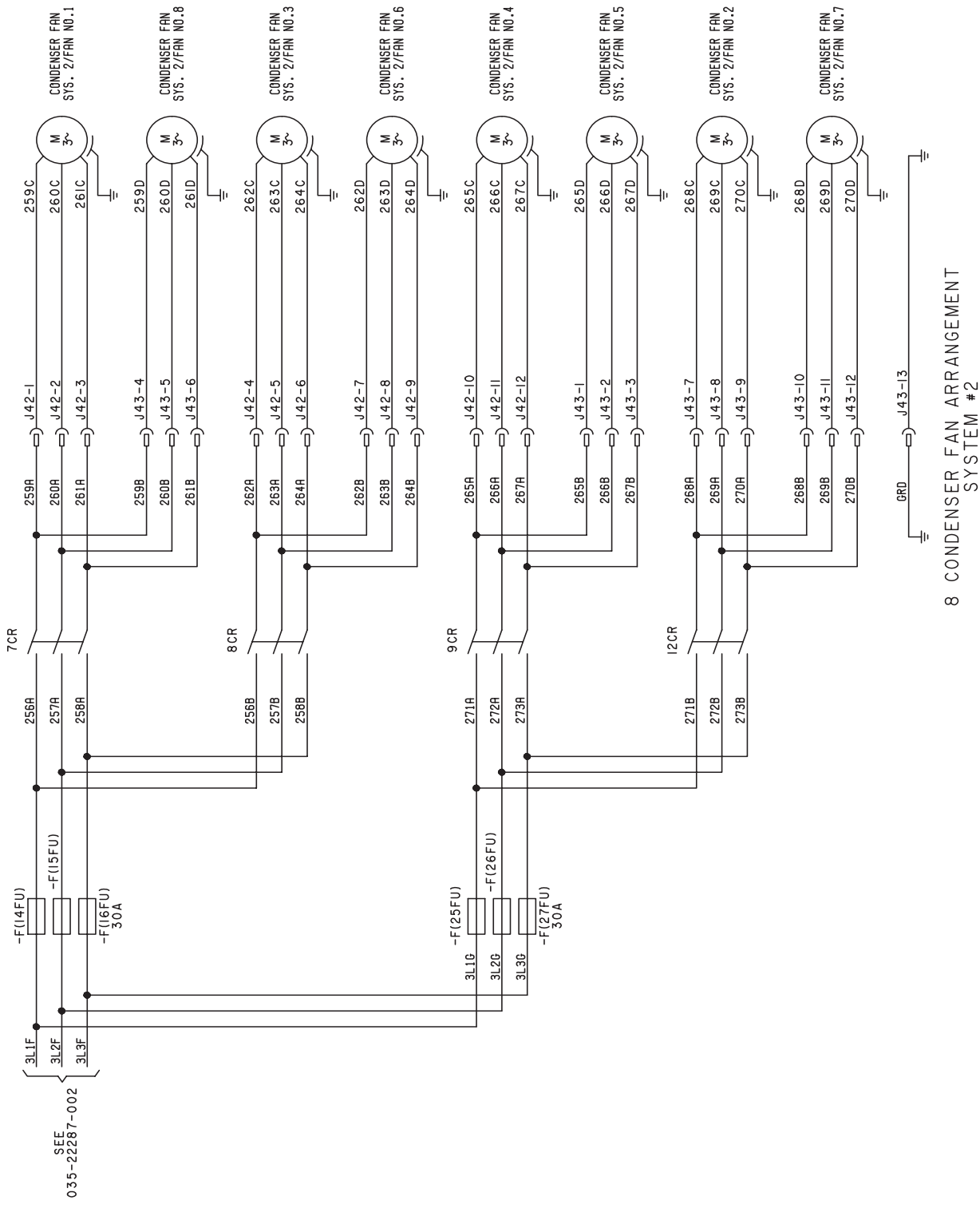


FIGURE 66 - FAN WIRING 8 FANS, SYSTEM 2

035-22287-010 REV A

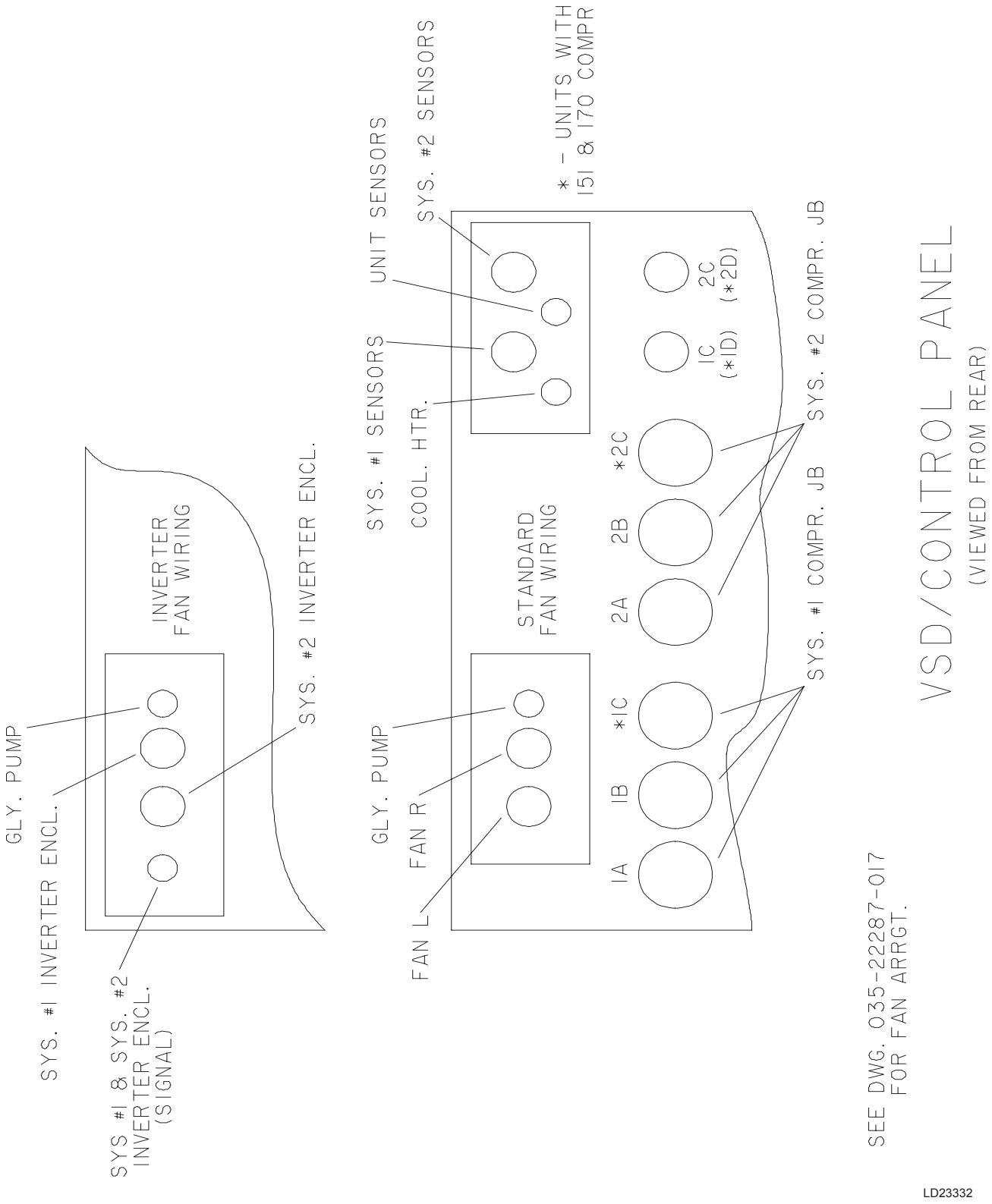


FIGURE 67 - 2 COMPRESSOR CONNECTION DIAGRAMS

035-22287-010 REV A

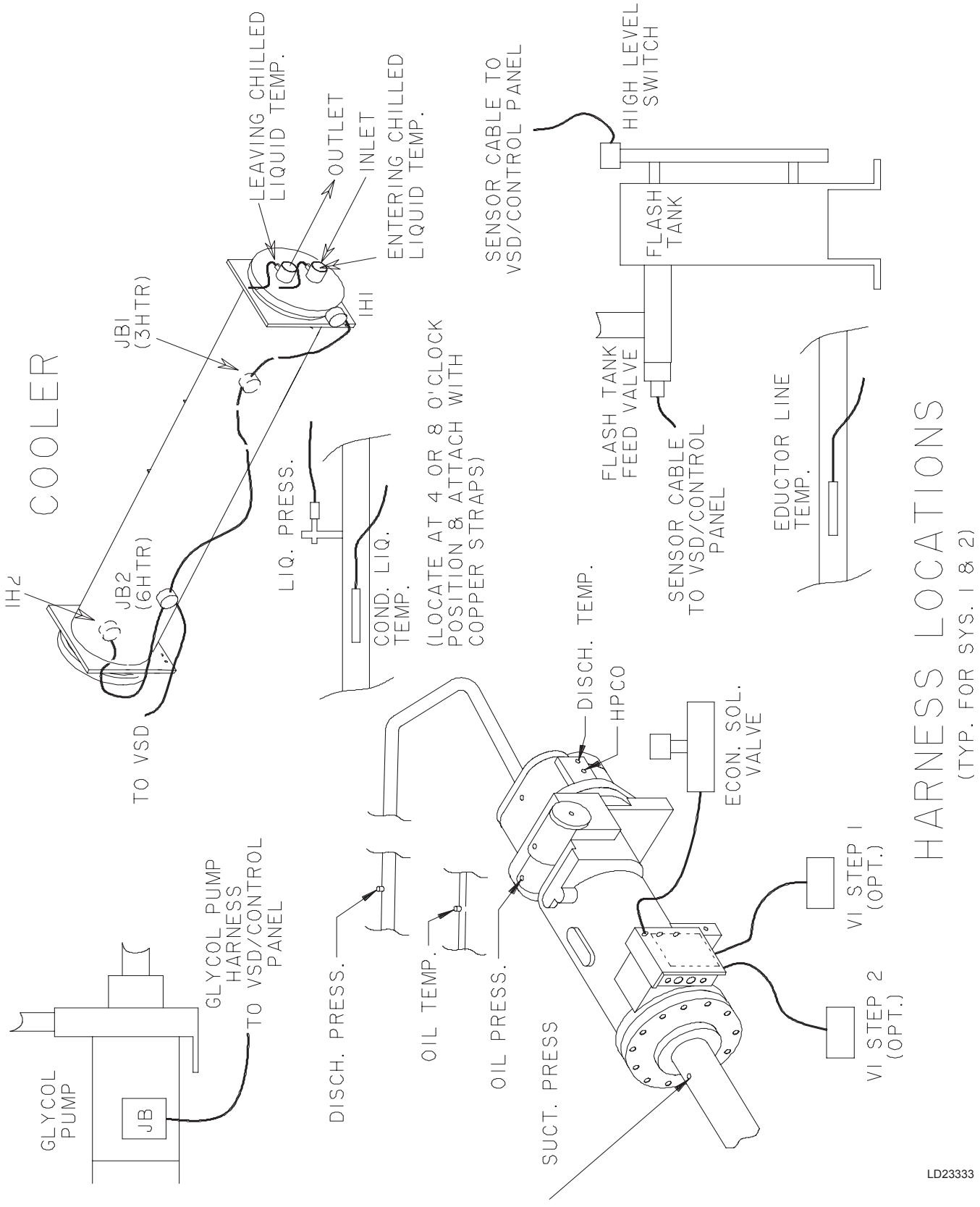


FIGURE 67 - 2 COMPRESSOR CONNECTION DIAGRAMS (CONT'D)

A	This drawing is based on IEC symbols.
B	Field wiring to be in accordance with the relevant electrical code as well as all other applicable codes and specifications.
C	All sources of supply to the unit to be taken from one main isolator. Not shown or supplied by Johnson Controls.
D	Green and yellow wire is used for PE/ GYXD (earth). Red wire used for AC control. Blue/gray wire for neutral.
E	Legend designation depicts component abbreviations. Number prefix located, if applicable, on schematic circuit, refers to system thereon. E. G. = ETH2 refers water box heater #2.
Notes	
1	The power supply for the water box heaters (700W) (2-350W) for CE units 220V-50hz for ETL/UL 115V-1-60hz UL units) should be derived from the customers water box heating circuit so that at ETL/ UL → 115V-1PH-60hz, CE → 220V-1PH-50hz low ambient the heaters come on to prevent the possibility of freezing.
2	Minimum circuit ampacity is 15A recommend #14 AWG (2.5 mm). 75°C, CU or equivalent.

Designation	Description
QCB	Circuit Breaker
QSD	Switch, Disconnect
ETH	Water Box Heater
-EXT	External to Control Panel
WBHTR	Water Box Heater
NB	Note well (see note)
	Wiring and items shown are not supplied by Johnson Controls.

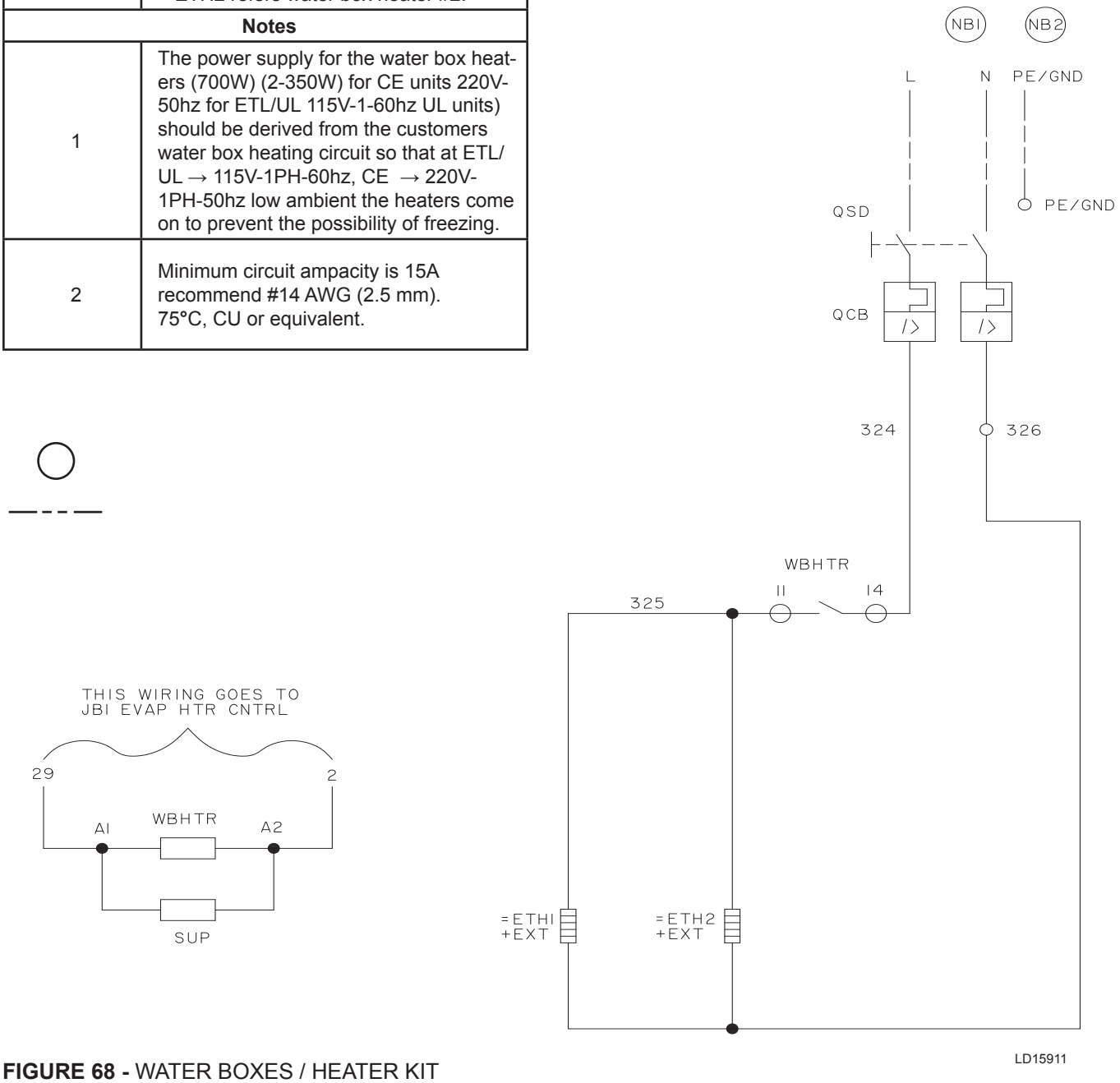


FIGURE 68 - WATER BOXES / HEATER KIT

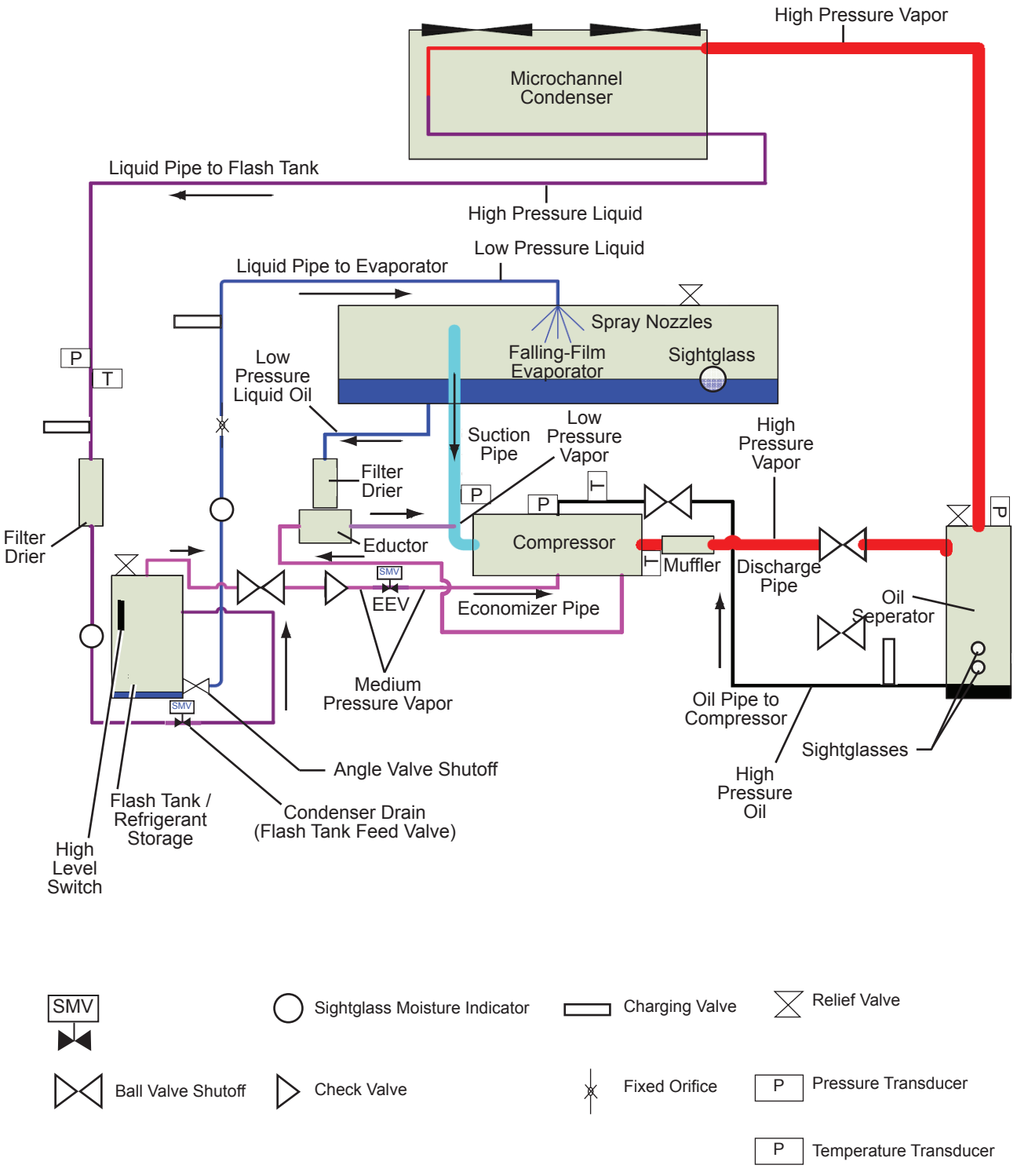


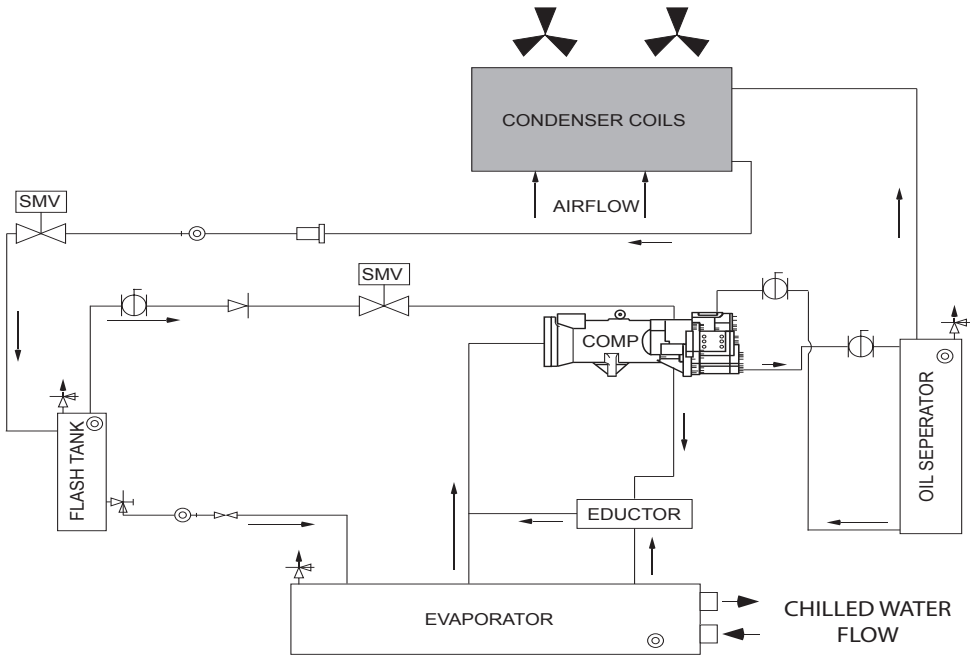
FIGURE 69 - REFRIGERANT FLOW DIAGRAM

Refrigerant Flow

Low pressure refrigerant (liquid and gas) enters the evaporator and is sprayed across the top of the tube bundle from spray nozzles. The liquid refrigerant from the nozzles gravity drains down across the tube bundle and is evaporated and superheated by the heat energy absorbed from the chilled liquid passing through the tubes. The chilled liquid may pass through the tube bundle in a one, two or three pass arrangement depending upon the chiller selection.

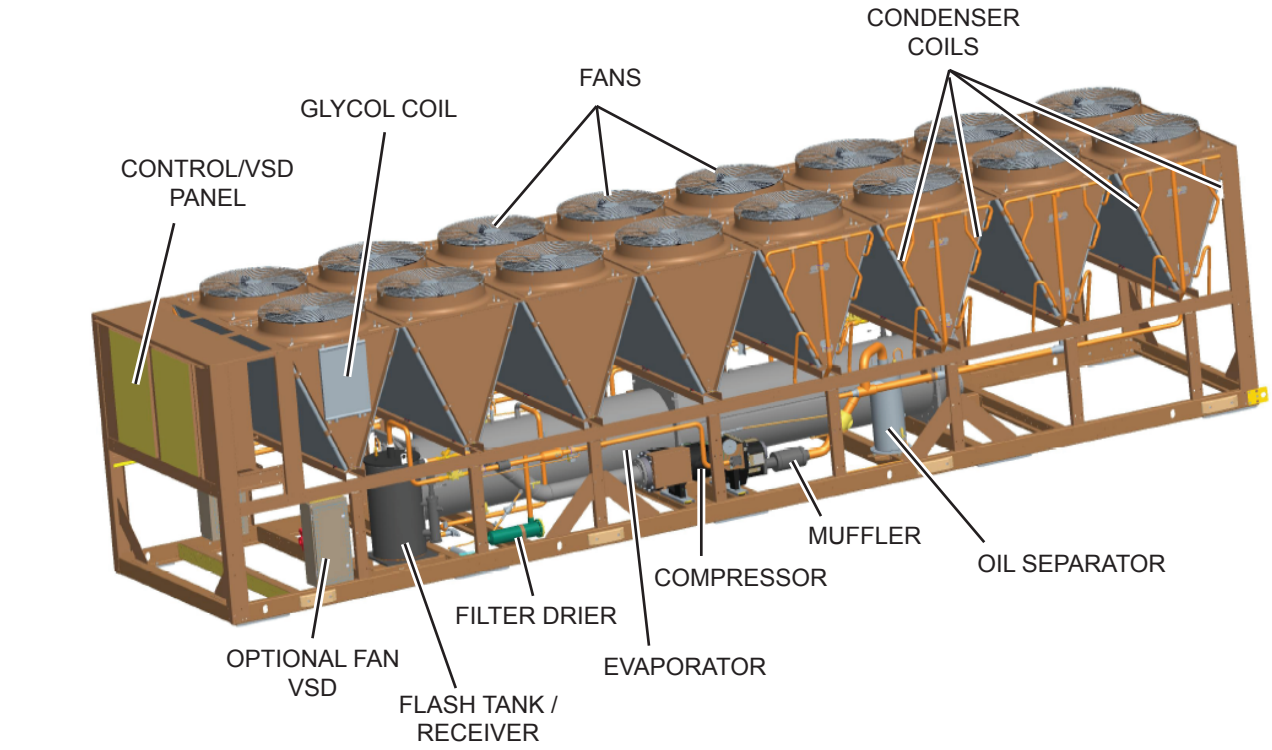
The low pressure refrigerant vapor leaves the top of the evaporator and enters the compressor where the refrigerant vapor is compressed and the pressure and superheat increased. The high pressure superheated gas enters the air cooled condenser where heat is rejected via the condenser coils and fans.

The fully condensed and subcooled liquid leaves the air cooled condenser, flows through the filter drier and enters the flash tank. The flow of refrigerant into the flash tank/refrigerant storage tank is controlled by a Flash Tank Feed Valve. This valve controls flow based on liquid sub-cooling calculated by the liquid line pressure transducer and temperature sensor signals sent back to the Chiller Control Board. In many cases the flash tank/refrigerant storage tank will run empty and level is not controlled. Should the level get too high, a high level switch in the tank will prevent the economizer from opening to avoid liquid carryover into the compressor through the economizer port. Additional sub-cooling may take place in the flash tank when the economizer solenoid is energized. Otherwise, the flash tank simply acts like a receiver. After leaving the receiver, subcooled liquid refrigerant flows through an orifice (expansion device). After passing through the orifice, pressure reduction and further cooling takes places. The low pressure refrigerant (liquid and gas) enters the evaporator.



	YVAA System Component
SMV	Stepper Motor Valve
	Ball Valve
	Relief Valve
	Stop Valve Angle, Access
	Replaceable Core Filter/Drier
	Sight Glass
	Orifice
	Check Valve

FIGURE 70 - PROCESS AND INSTRUMENTATION DIAGRAM



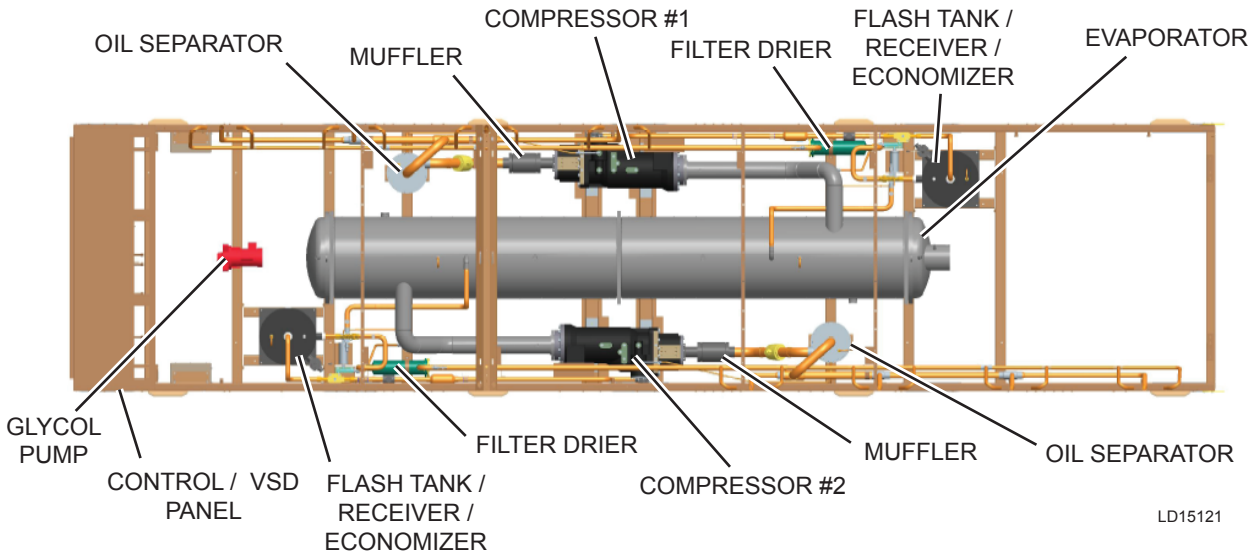


FIGURE 71 - COMPONENT LOCATIONS

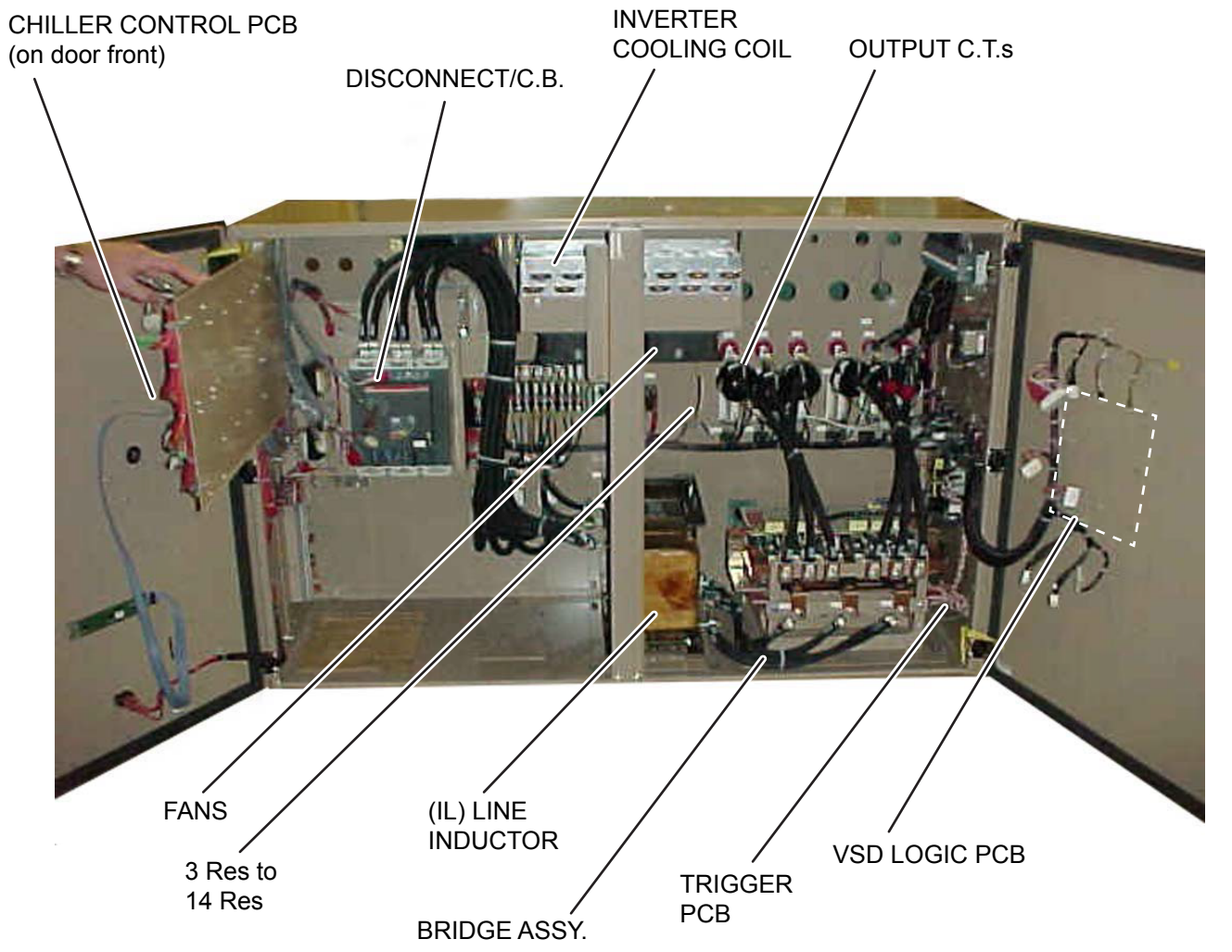
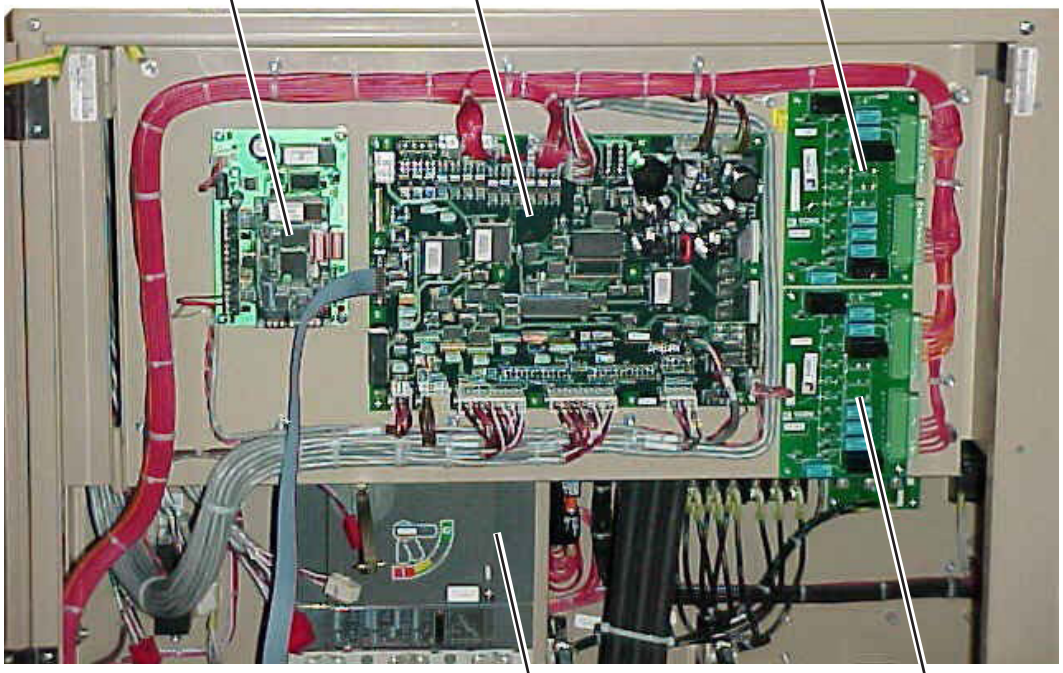


FIGURE 72 - CONTROL AND VSD CABINET COMPONENTS



Standard Unit will have terminal blocks. Input power to the chiller will be connected here (See *Figure 78 on page 162*, *Figure 79 on page 163* and *Figure 80 on page 164*).

FIGURE 73 - CHILLER CONTROL BOARD, RELAY BOARDS, E-LINK GATEWAY, AND OPTIONAL CIRCUIT BREAKER

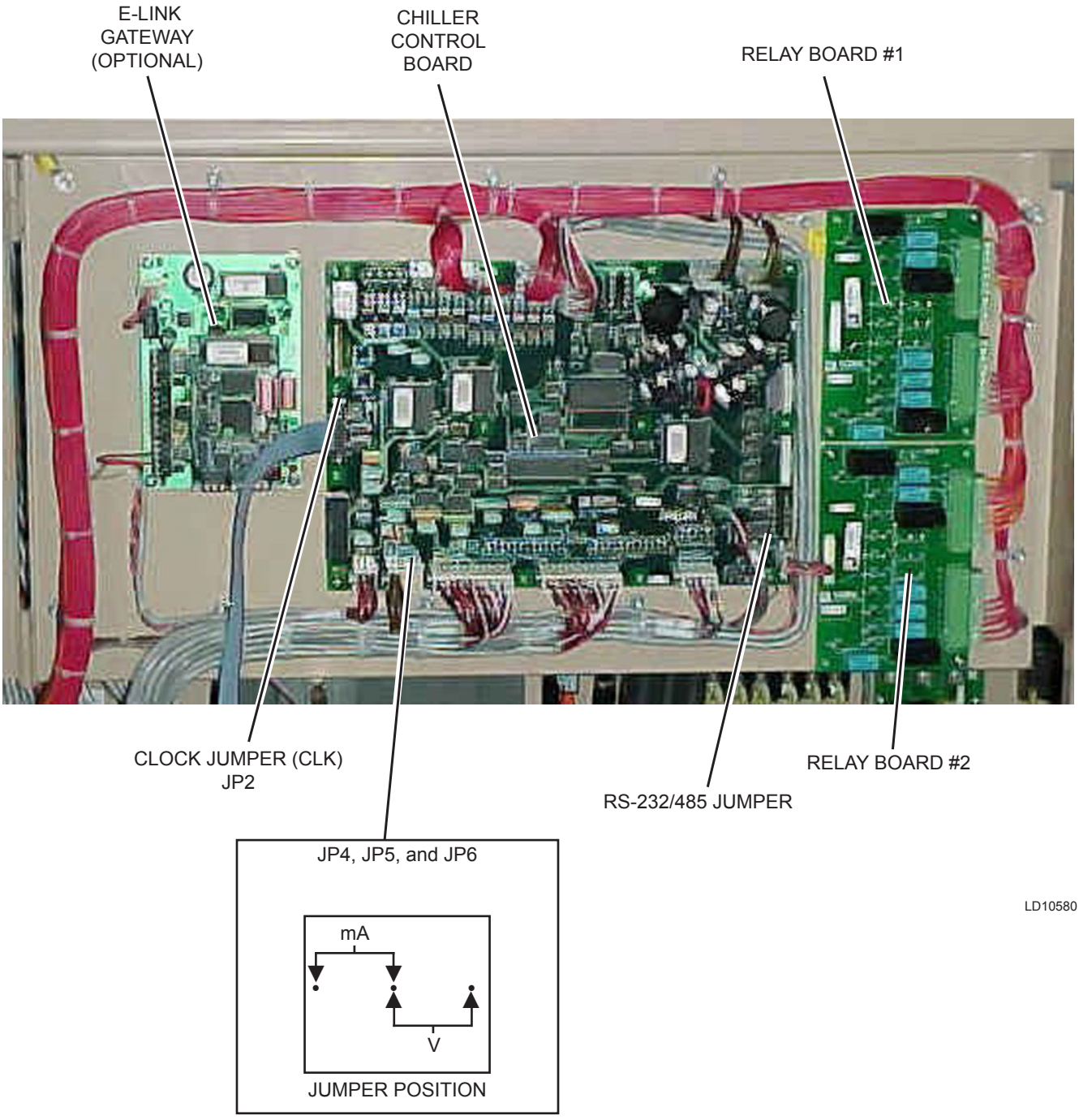


FIGURE 74 - CHILLER CONTROL BOARD, RELAY BOARDS, AND E-LINK GATEWAY, 2 COMPRESSOR

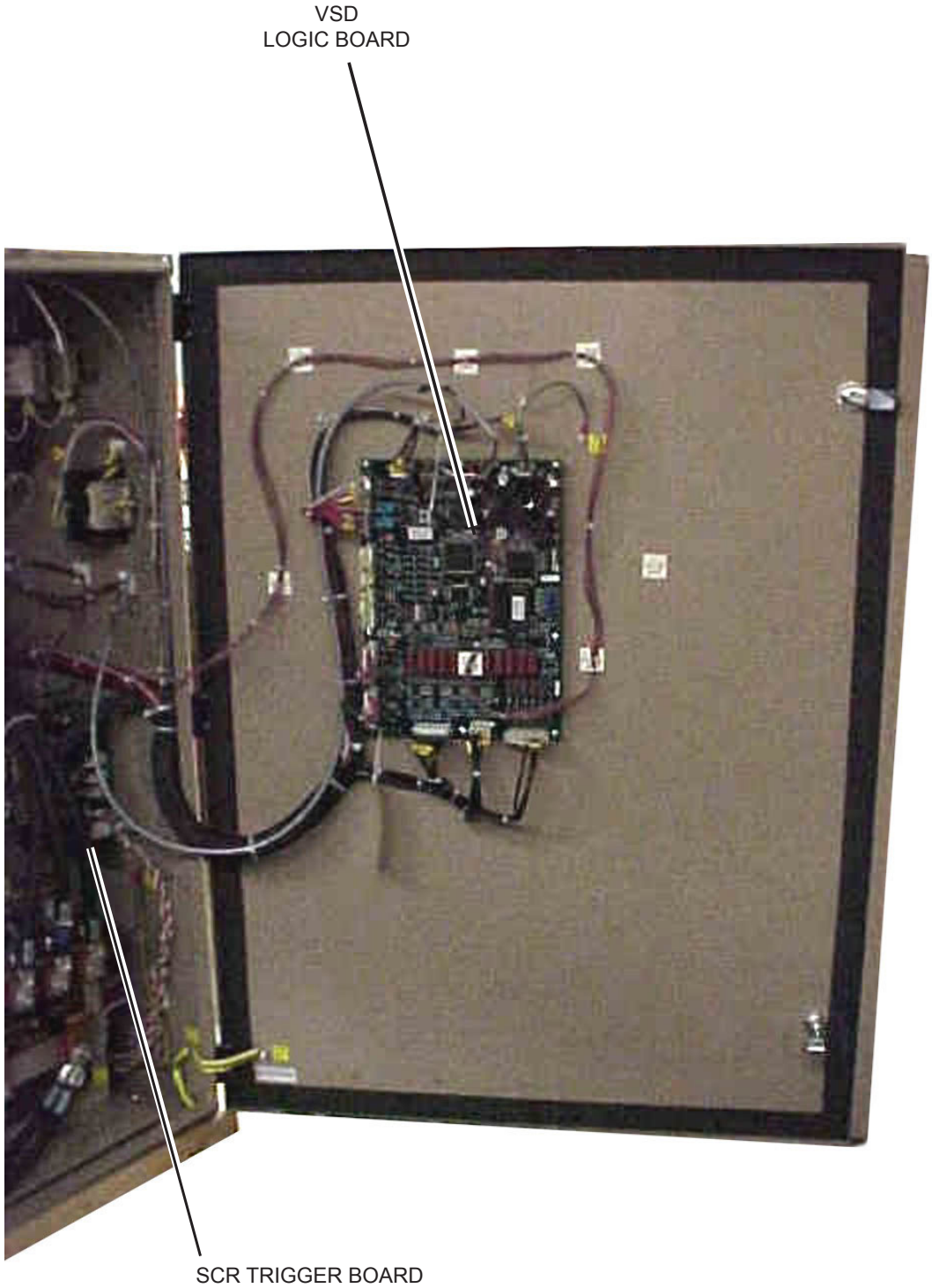


FIGURE 75 - VSD LOGIC BOARD

031-02507-999-REV G

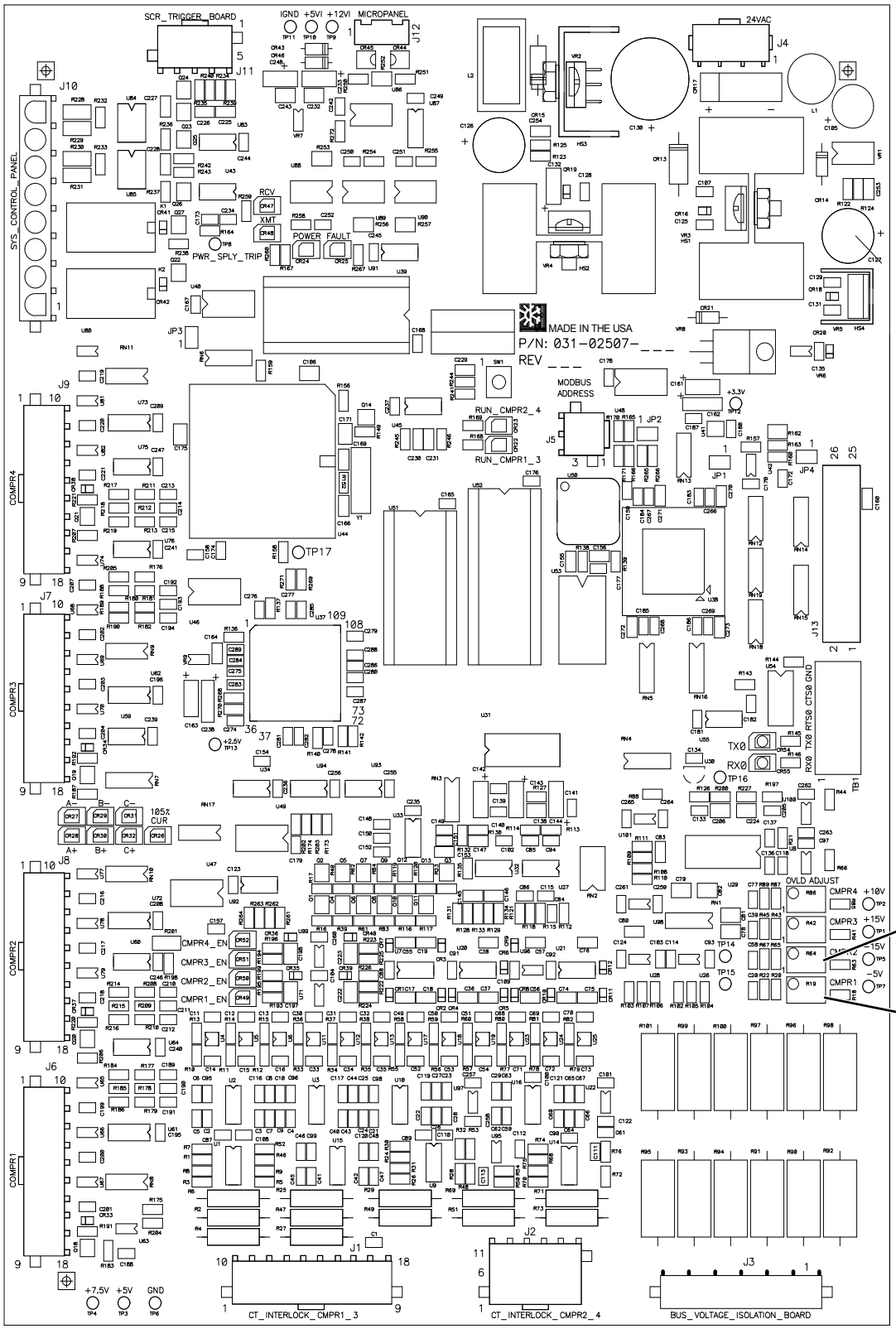


FIGURE 76 - VSD LOGIC BOARD, P/N 031-02507-XXX

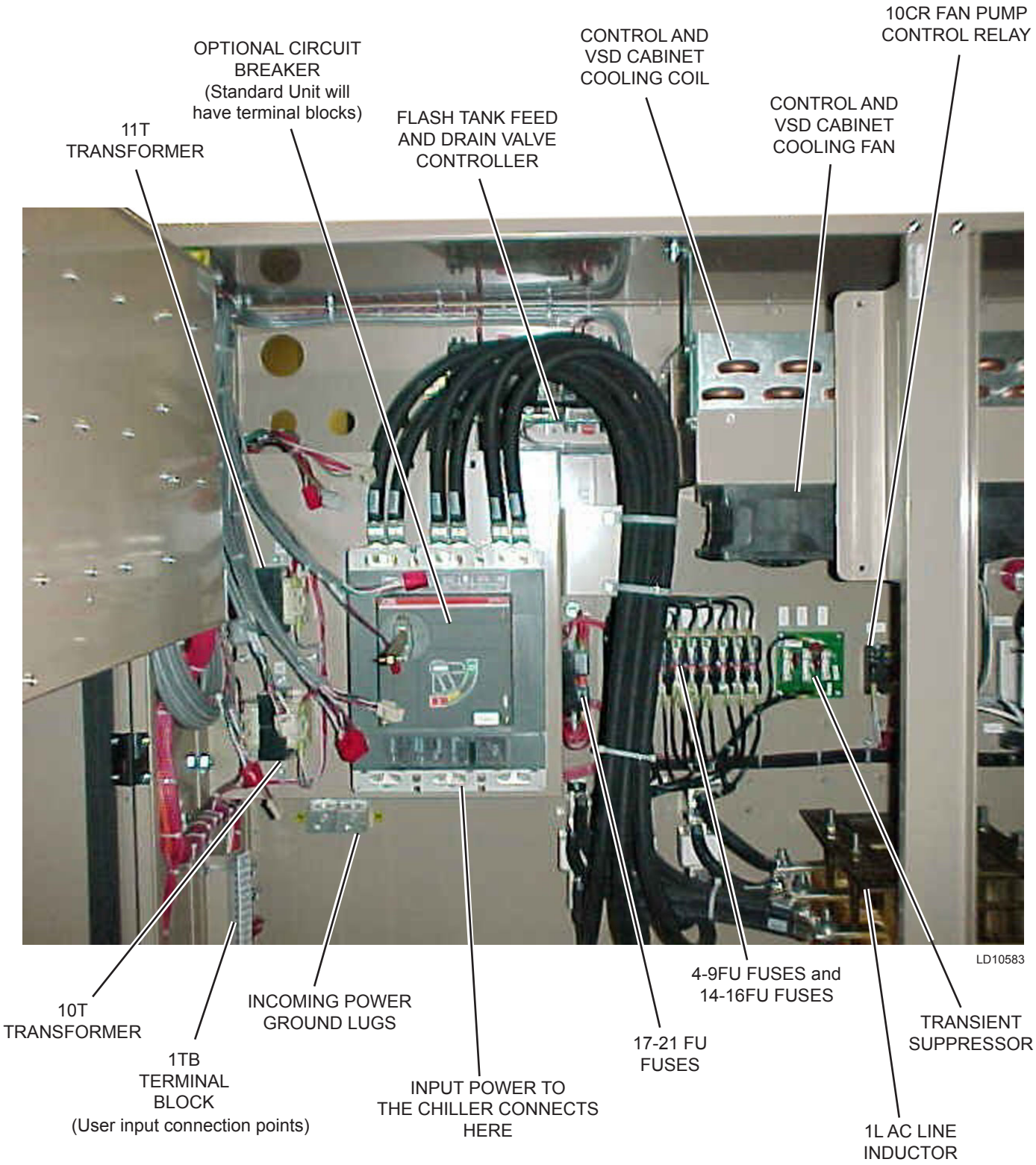


FIGURE 77 - USER CONTROL AND POWER CABLE CONNECTIONS

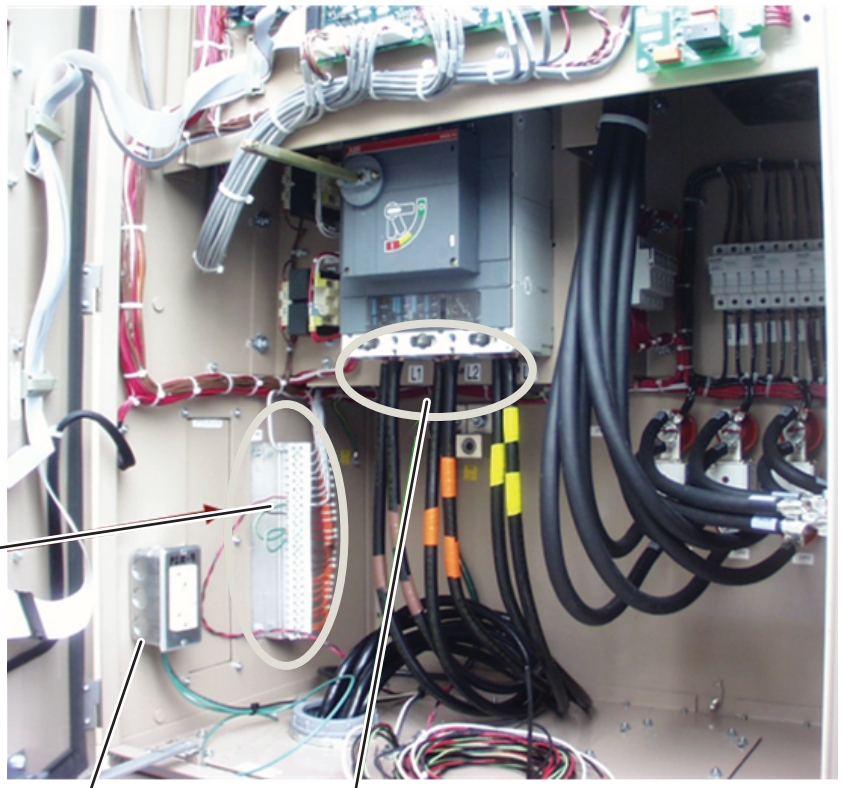


FIGURE 78 - USER CONTROL AND POWER CABLE CONNECTIONS

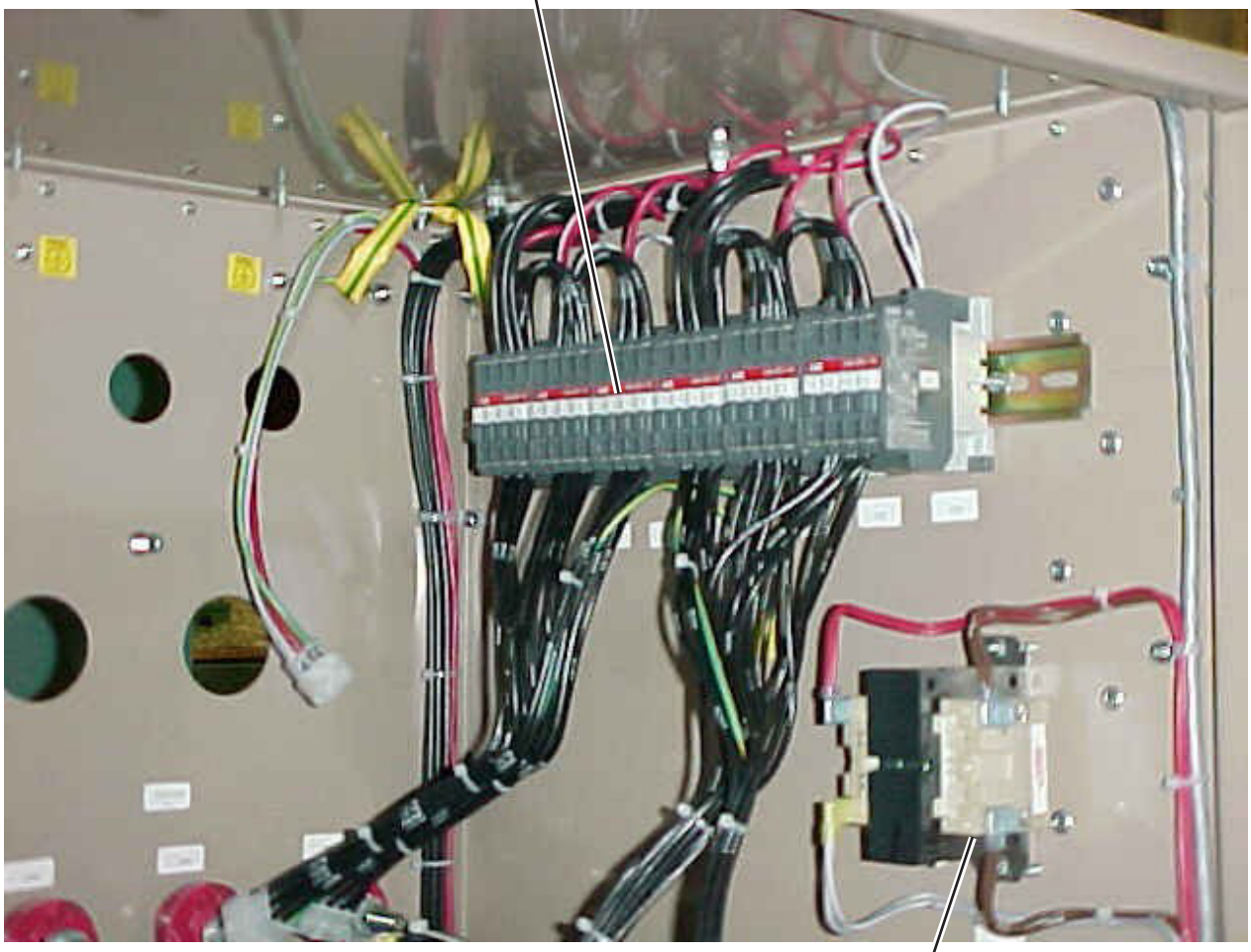


FIGURE 79 - FAN CONTACTORS AND 3T TRANSFORMER, 2 COMPRESSOR

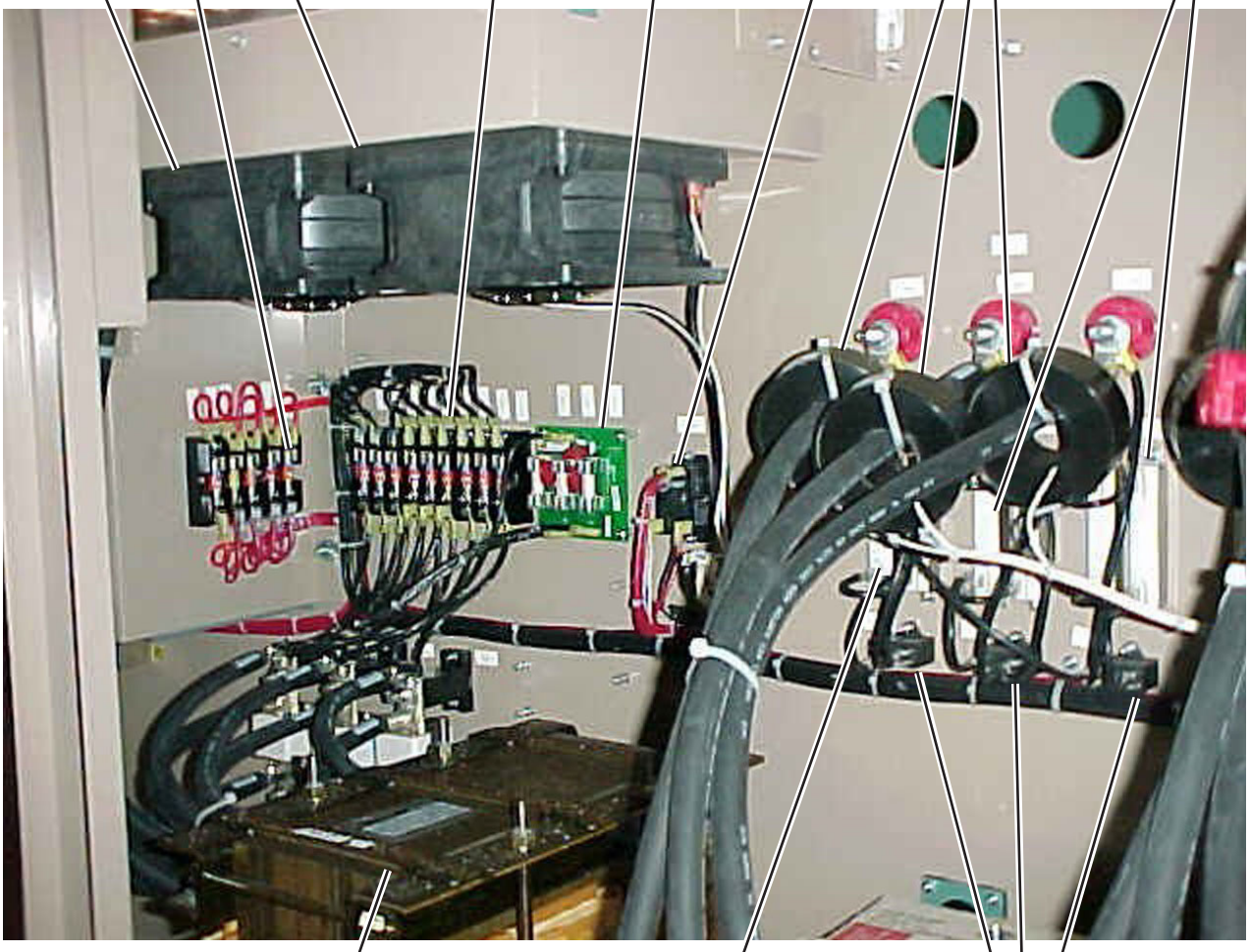


FIGURE 80 - VSD COMPONENTS

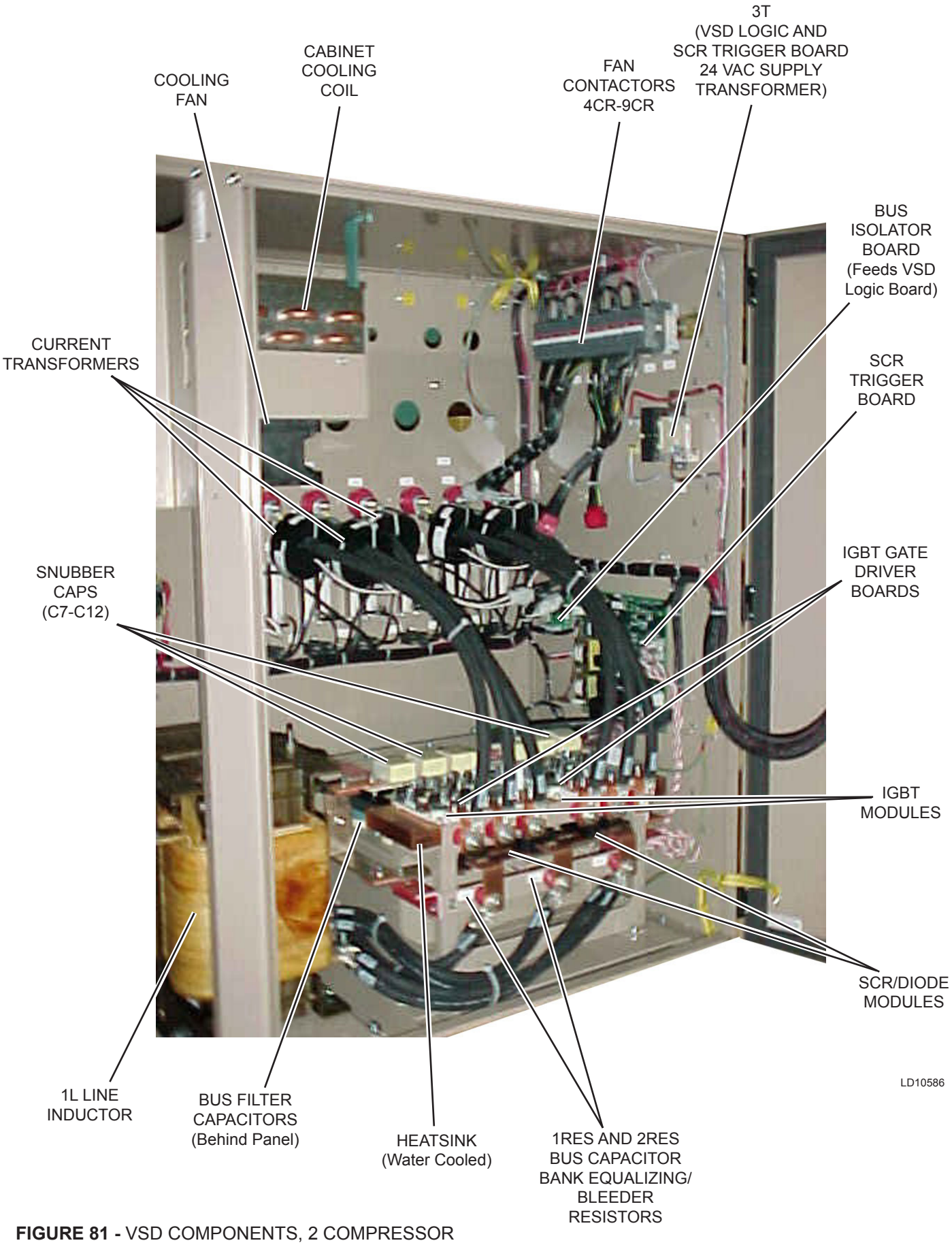


FIGURE 81 - VSD COMPONENTS, 2 COMPRESSOR

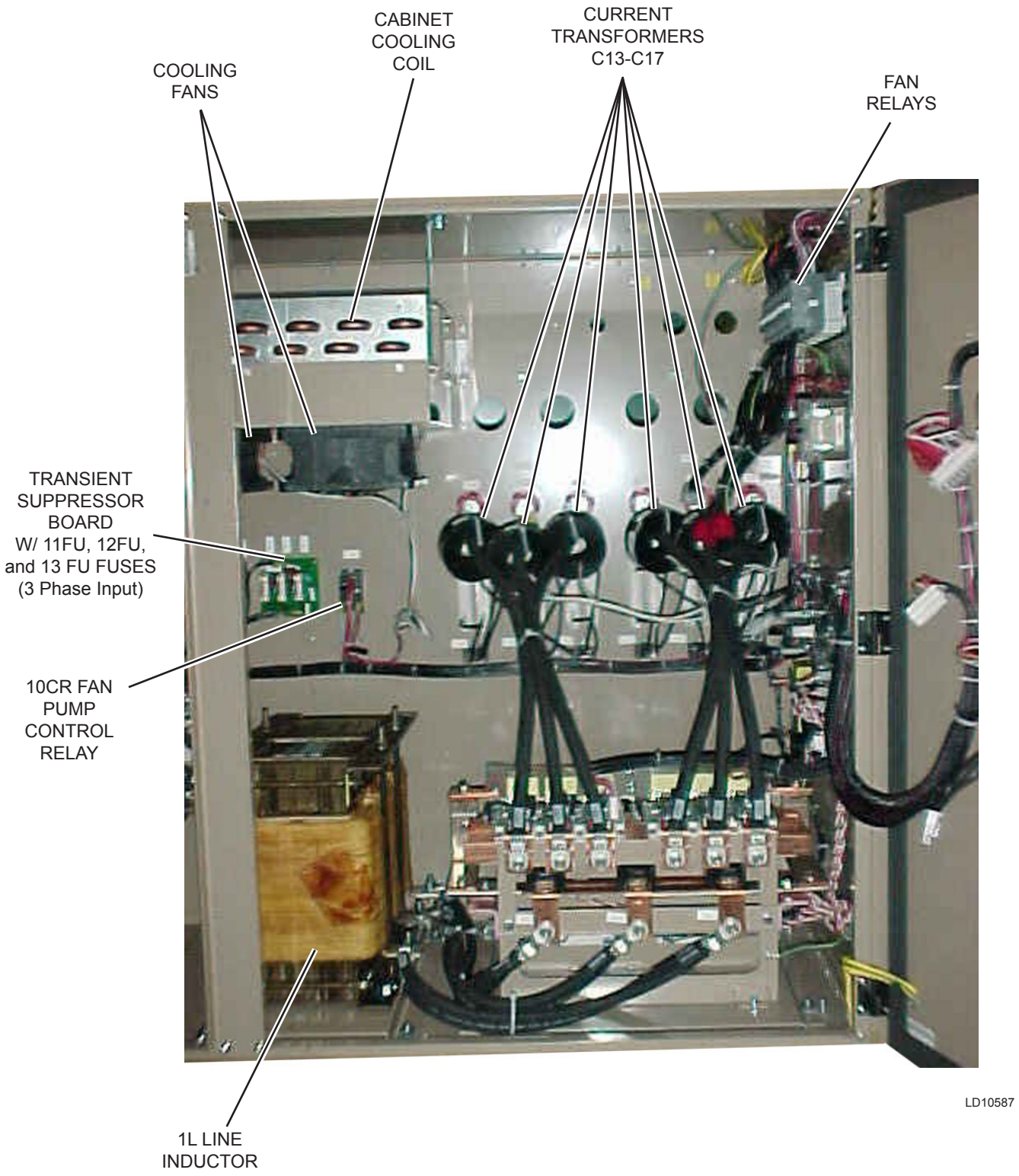
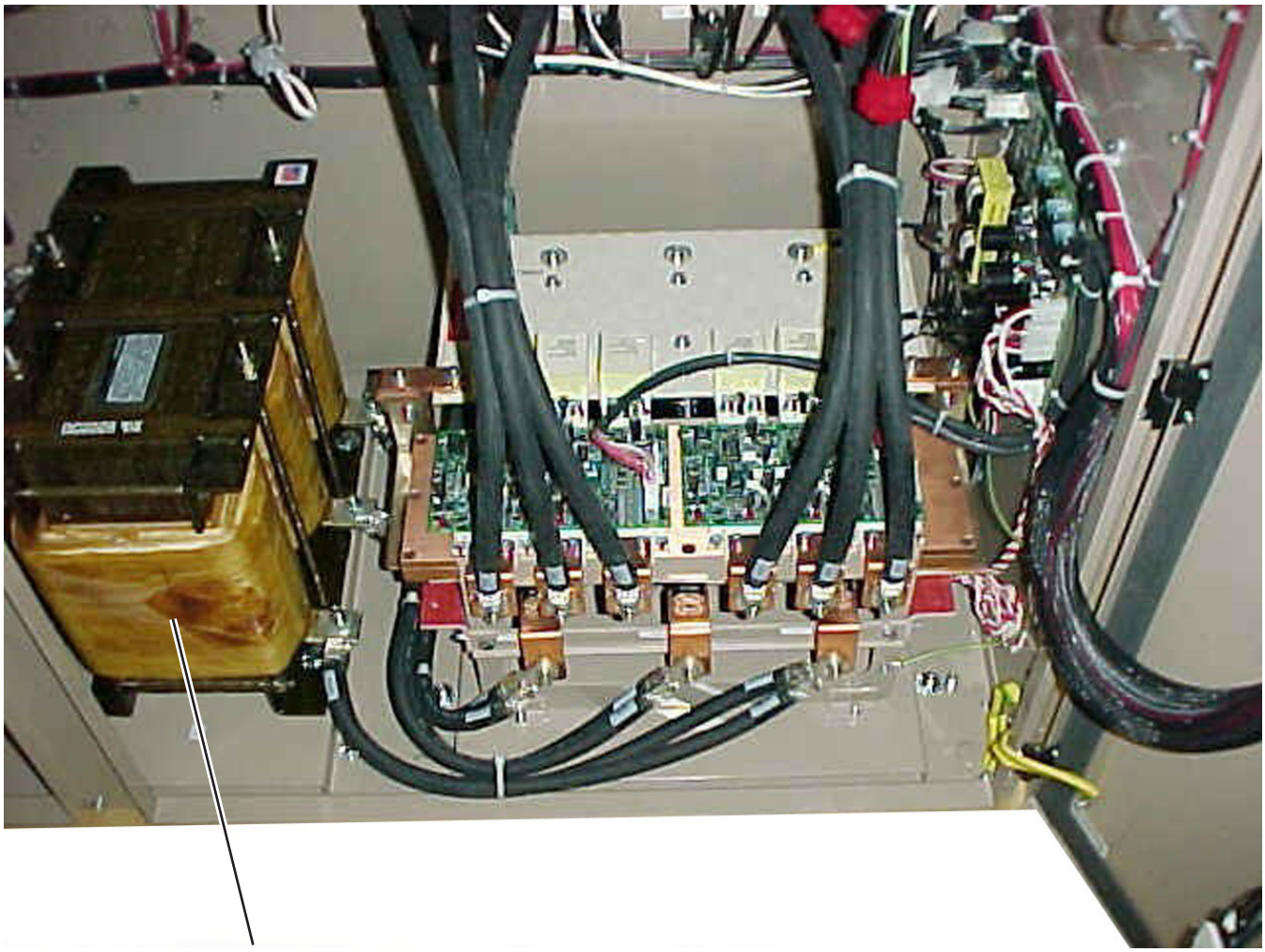


FIGURE 82 - VSD COMPONENTS, 2 COMPRESSOR

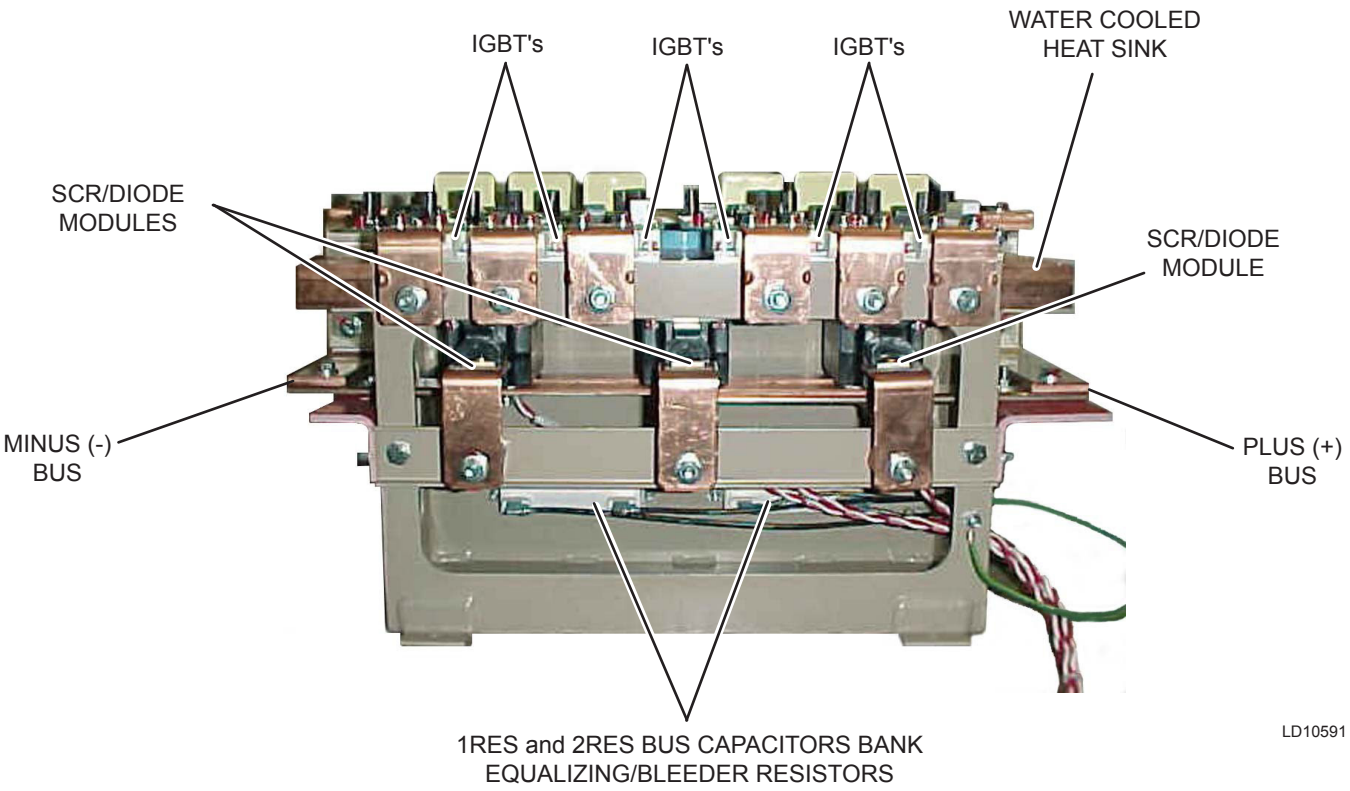


DANGER

The line inductor will reach operating temperatures of over 300° F. (148.9°C) Do not open panel doors during operation. Assure the inductor is cool whenever working near the inductor with power OFF.

LD10588

FIGURE 83 - INVERTER POWER COMPONENTS, 2 COMPRESSOR



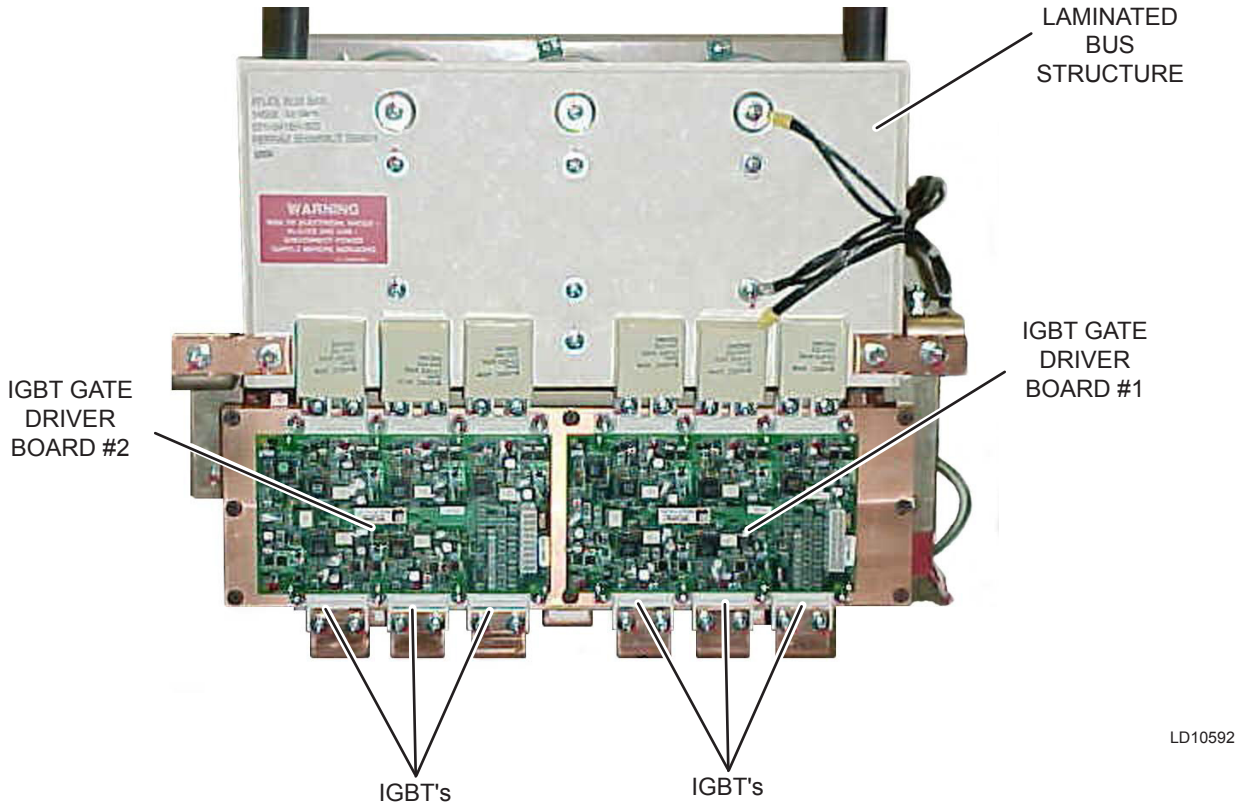
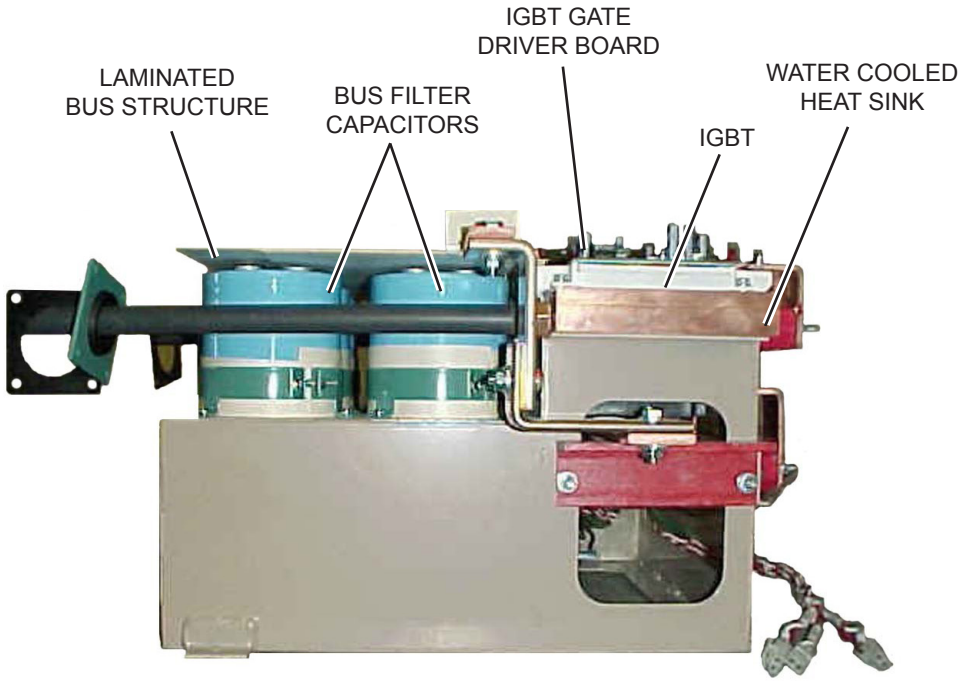
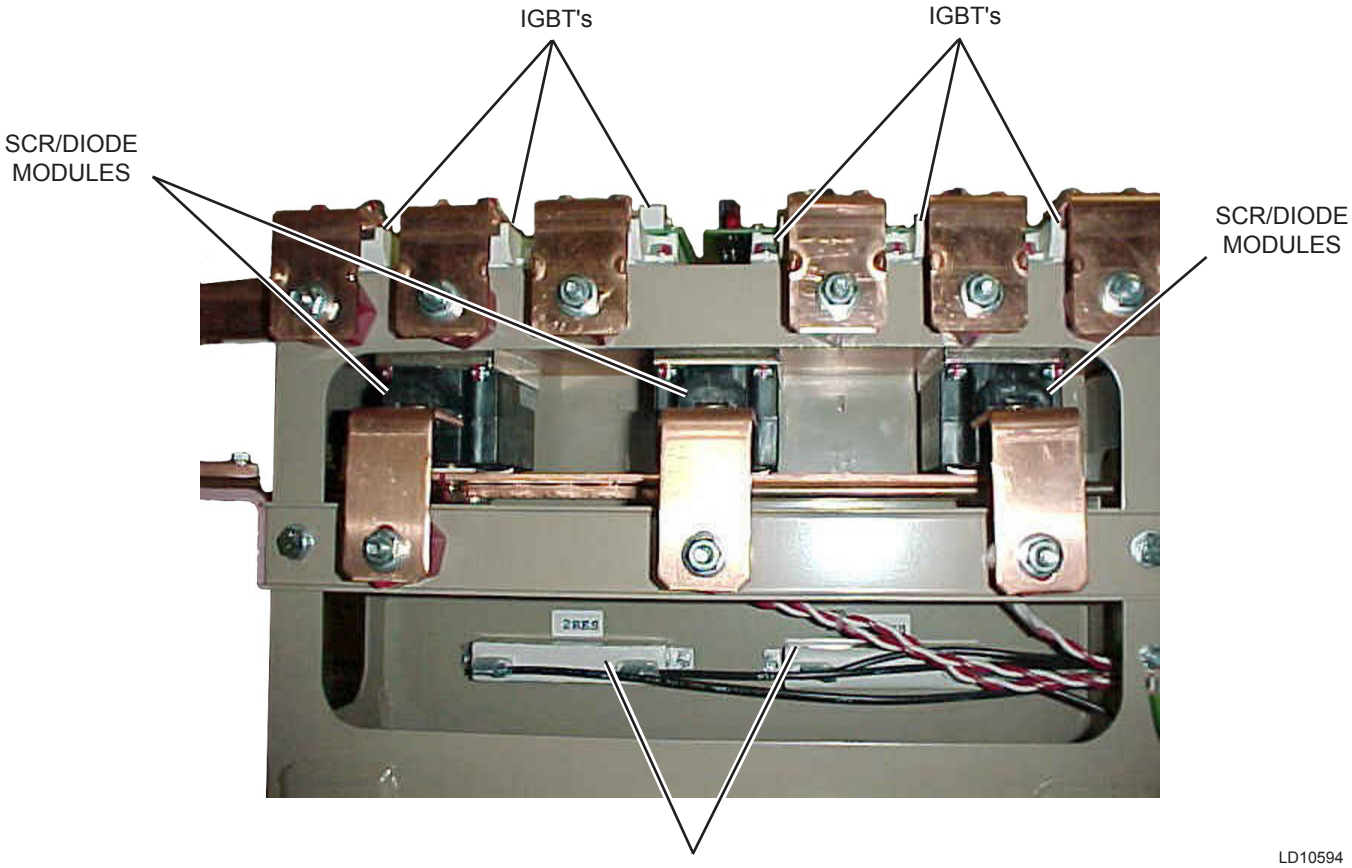


FIGURE 84 - INVERTER POWER COMPONENTS



LD10593



LD10594

FIGURE 85 - INVERTER POWER COMPONENTS

GLYCOL SYSTEM COMPONENTS

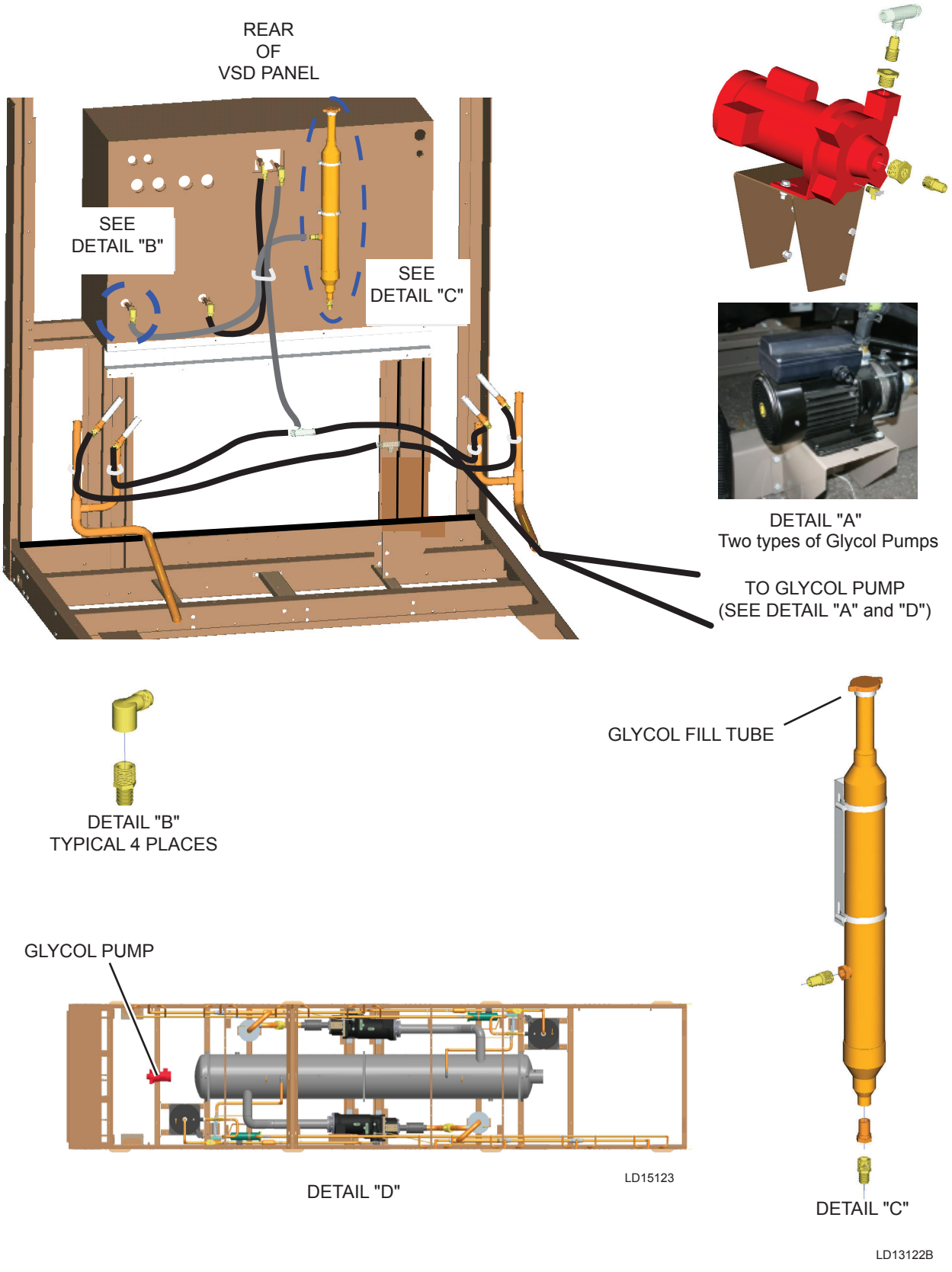


FIGURE 86 - GLYCOL PUMP AND FILL TUBE LOCATIONS

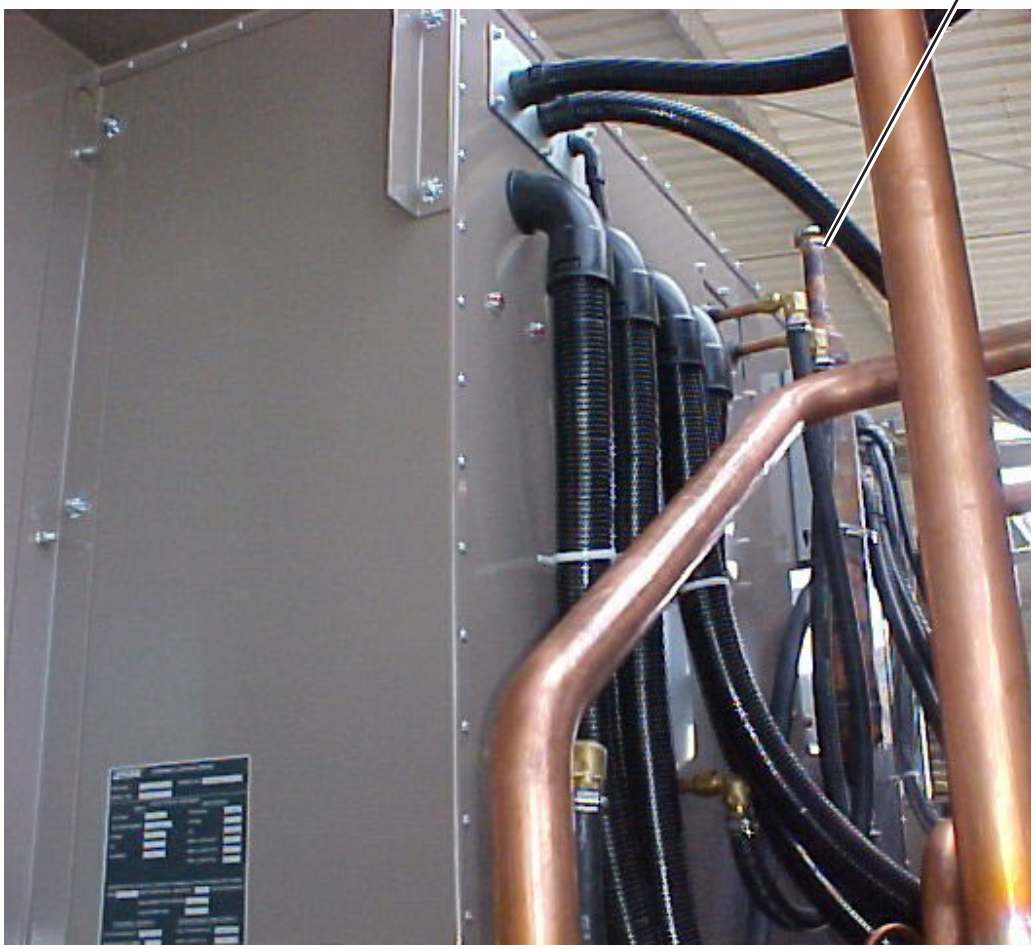


FIGURE 87 - GLYCOL PIPING AND FILL TUBE LOCATION

COMPRESSOR COMPONENTS

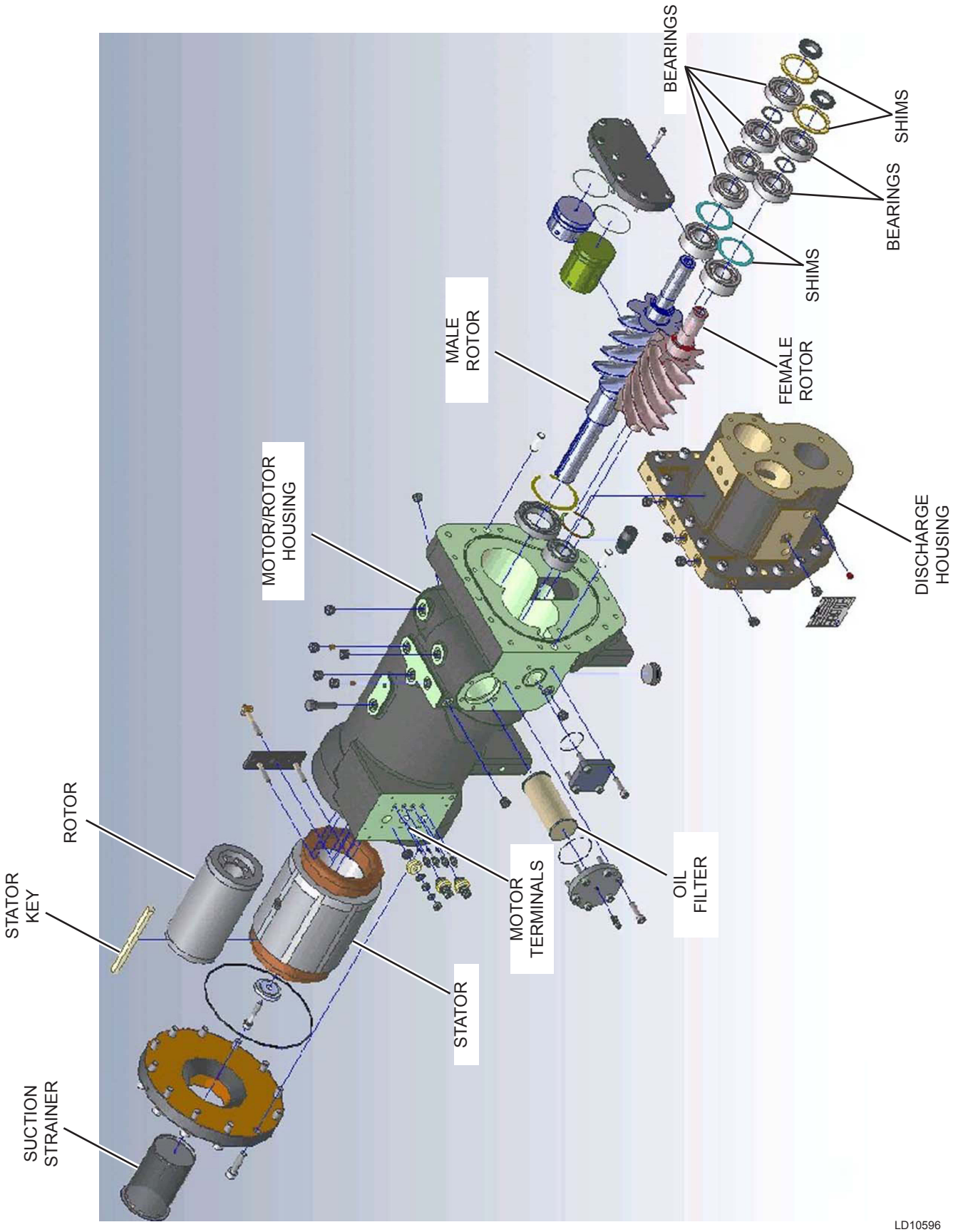
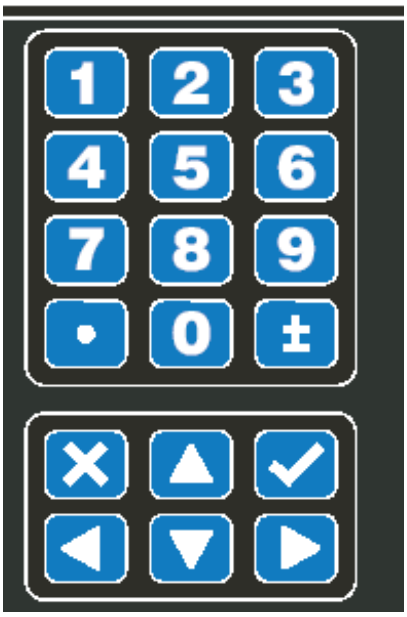


FIGURE 88 - STANDARD COMPRESSOR COMPONENTS (WITHOUT VARIABLE VI)

CHILLER ELECTRONIC COMPONENTS

Keypad

An operator keypad allows complete control of the system from a central location. The keypad offers a multitude of command keys on the left and right side of the keypad to access displays, program setpoints, history data, and initiate system commands. Most keys have multiple displays that can be accessed by repetitively pressing the key or by pressing the ▲,▼,◄, and ► (ARROW) keys. The keypad utilizes an overlay to convert the keypad to various languages.



LD10605

FIGURE 89 - KEYPAD

The keypad also contains keys in the center section for data entry in the various program modes. These keys are listed below:

0-9 Keys - NUMERIC KEYPAD

• PERIOD/DECIMAL

+/- PLUS/MINUS

✓ ENTER

✕ CANCEL

▲ UP ARROW

▼ DOWN ARROW

◄ LEFT ARROW

► RIGHT ARROW

The numeric keys allow keying numeric values into memory.

The • (PERIOD/DECIMAL) key allows keying a decimal point into numeric values.

The +/- (PLUS/MINUS) key allows making numeric values negative.

The ✓ (ENTER) key stores program changes into memory.

The **X** (CANCEL) key is used to cancel the data entry operation and returns the programmed value to the original value, before any programming changes were made, when an error is made.

The ▲ (UP ARROW) and ▼ (DOWN ARROW) keys allow scrolling backward (▲) and forward (▼) through items to be programmed under keys such as the PROGRAM or OPTIONS key.

The ▲ (UP ARROW) and ▼ (DOWN ARROW) keys also allow scrolling forward (▼) or backwards (▲) through data display keys that have multiple displays under keys such as UNIT DATA, SYSTEM DATA, HISTORY, PROGRAM, OPTIONS, and so on. The arrow keys can be used instead of repeatedly pressing the data key to see the multiple displays under a key. Once the ▲ ▼ (ARROW) keys are pressed and used for scrolling, pressing the original data key will return to the first display message displayed under the data (UNIT DATA, SYSTEM DATA, and so on) keys.

The ◄ ► (LEFT and RIGHT ARROW) keys allow scrolling between non-numeric program choices under the OPTION, DATE/TIME, and SCHEDULE keys.

The ◄ (LEFT ARROW) key allows programming the default value when programming numeric values. For changing numeric values, the ► (RIGHT ARROW) key has no function.

The ◄ ► (ARROW) keys also allow scrolling sideways between the same displays on different systems. For example, pressing the ► (RIGHT ARROW) key while viewing the system #1 suction pressure moves the display to system #2 suction pressure.

Pressing the ◄ (LEFT ARROW) key moves the opposite direction. The arrow keys also allow fast scrolling through data under keys such as HISTORY by enabling the operator to move between subgroups of data such as Unit, System, and VSD data.

Keypad Data Entry Mode

For numeric programmable items, the data entry mode is entered by pressing any of the number keys, the decimal point key, or the +/- key. When the data entry mode is entered, the data from the key press will be entered and the cursor will appear under the position where the data is being entered.

For non-numeric programmable items, data entry mode is entered by pressing the ◄ or ► (ARROW) keys. When the data entry mode is entered, the cursor will appear under the first position of the non-numeric string. The programmable choice may be changed by pressing the ◄ or ► (ARROW) keys.

To exit the data entry mode and store the programmed value, the ✓ (ENTER) key must be pressed. When the ✓ (ENTER) key is pressed, the cursor will disappear.

The data entry mode may also be exited by pressing the X (CANCEL) key. The programmed data will be returned to its original value when the X (CANCEL) key is pressed.

When the data entry mode is exited, the cursor will disappear. If any other key is pressed while in the Data Entry Mode, the following display will appear for 2 seconds indicating the user must choose between accepting or canceling the change:

```
XXXXXXXXXXX PRESS ✓  TO ACCEPT VALUE OR
        X TO CANCEL DATA ENTRY
```

If the ✓ (ENTER) key was pressed from the data entry mode and the numeric value entered was out of range, the following message will appear for 2 seconds followed by the original data display.

```
XXXXXXXXXXX OUT OF RANGE TRY AGAIN!
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
```

Display

The 80 character (2 lines of 40 characters per line) display is a Liquid Crystal Display (LCD) used for displaying unit parameters, system parameters, and operator messages. The display has an LED backlight background for night viewing and is viewable in direct sunlight.

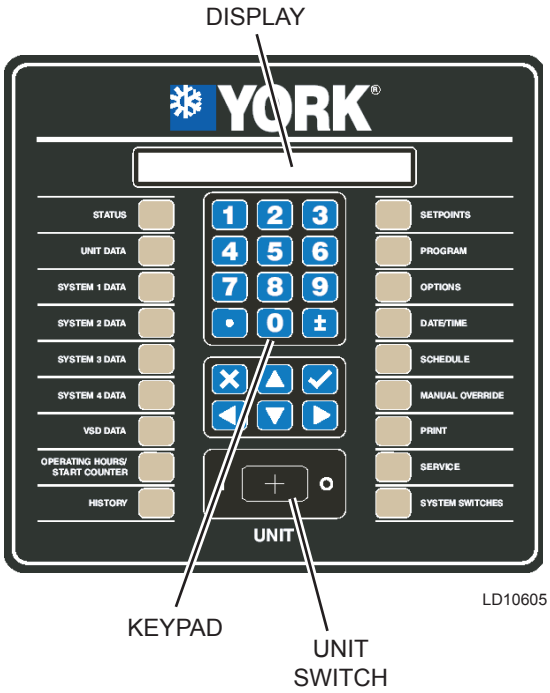
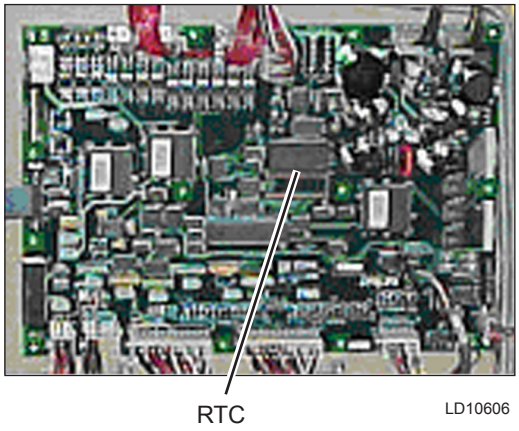


FIGURE 90 - KEYBOARD AND DISPLAY

Chiller Control Board



The Chiller Control Board is the controller and master decision maker in the control panel. The onboard microprocessor control is capable of controlling up to 4 compressors. System inputs from pressure transducers and temperature sensors are connected directly to the Chiller Control Board. The Chiller Control Board circuitry multiplexes all of the analog inputs, digitizes them, and scans the inputs to keep a constant watch on chiller operating conditions. Based on this information, the Chiller Control Board issues commands to the Relay Output Board(s), Drain/Feed Valve Controller, and VSD Logic Board to activate and de-activate contactors, solenoids, control valves, set compressor speeds, and so on, for chilled liquid and

safety control. Keypad commands are acted upon by the Chiller Control Board microprocessor to change setpoints, cutouts, scheduling, operating requirements, and to provide displays.

The Chiller Control Board contains a Real Time Clock integrated circuit chip with an internal battery back-up of 8K x 8 bit RAM. The purpose of the battery backed RAM is to assure that any programmed values (setpoints, clock, cutouts, history data and so on) are not lost during a power failure, regardless of the time involved in a power outage or shutdown period.

The Chiller Control (Microprocessor) Board contains an onboard power supply, which provides 5VDC regulated to sensors, transducers, display, and other circuit boards. The supply also provides +12VDC to the Relay Output Boards and the +34VDC to the level sensors.

The Chiller Control Board is capable of directly receiving analog inputs from temperature sensors and transducers. An analog to digital converter (A/D) with an onboard 4 channel multiplexer (MUX) allows up to 48 analog inputs to be read. The A/D Converter converts the analog signals to digital signals, which can be read by the onboard microprocessor. On a 2 system chiller, approximately half of these inputs are utilized.

Three integrated circuits on the microprocessor can be configured for digital inputs or outputs (Digital I/O). As inputs, they can read digital (2 level, ON/OFF) inputs like keypad keys, unit switch, high pressure cut-out, flow switch, and so on. As outputs they are used for controls like turning on fans, controlling compressor heaters, controlling chiller valves, or other devices requiring ON/OFF control. Up to 72 Digital I/O will be utilized to control the chiller.

The Chiller Control (Microprocessor) Board contains a dual UART (Universal Asynchronous Receiver Transmitter) for RS-485 and RS-232 communications. UART1 is configured for RCC and ISN communications on the external chiller RS-485 port. Data is sent and received at 4800 baud with 1 start bit, 8 data bits, odd parity, and 1 stop bit. The port is shared with the RS-232 interface and at startup will be initialized to RS-485 communications. UART2 is configured for VSD communications over an internal chiller RS-485 port located within the Control/Power cabinet. UART2 has a higher priority interrupt than UART1. The data is sent and received at a rate of 9600 baud and serves only as the communications between the Chiller Control Board and the VSD Logic Board. Both of these boards are located within the control/power panel.

On power-up, the Chiller Control Board will attempt to initialize communications with the VSD Logic Board. The Chiller Control Board will request the number of compressors select and VSD software version. If for some reason the information is not provided, the request will be made over and over again until it is received. Once the data has been received, the Chiller Control Board will not ask for it again. If the communications is not established, a VSD Loss of Comms fault message will appear on the STATUS display.

Two 8 channel, 8 bit Digital to Analog Converters (D/A Converter) on the Chiller Control Board supply the Valve Controller signals to allow the controller to position the Flash Tank Feed and Economizer Valves. The Feed Valve controls the liquid line sub-cooling and the economizer valve controls economizer flow to the compressor. The control voltage to the Feed and Economizer Valve Controller has a range of 0 to 10.28VDC.

Relay Output Boards

LD10607

Two or three Relay Output Boards are required to operate the chiller. These boards convert 0 to 12VDC logic levels outputs from the Chiller Control Board to 115VAC levels used by contactors, relays, solenoid valves, and so on, to control system and chiller operation. The common side of all relays on the Relay Output Board is connected to +12VDC.

The open collector outputs of the Chiller Control Board energize the DC relays on the Relay Output Board by pulling one side of the relay coil to ground. When not energized, both sides of the relay coils will be at +12VDC potential.

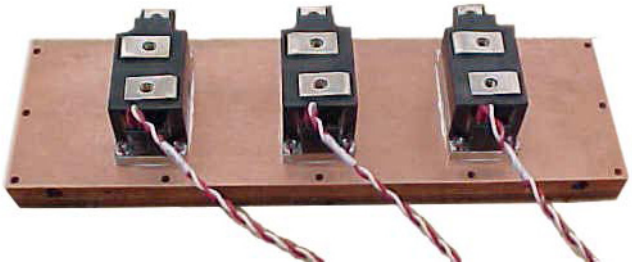
VSD (Variable Speed Drive)

The VSD is a liquid cooled, transistorized, PWM inverter packaged within the Control/Power cabinet. The inverter is composed of four major sections:

- AC to DC rectifier section with pre-charge circuit.
- DC link filter section.
- Three phase DC to AC inverter section.
- Output RC suppression network.

AC to DC Rectifier

The AC to DC Rectifier circuit utilizes a three phase semi-converter made of three SCR/diode modules in a three phase full wave bridge configuration. Each SCR/Diode module contains 1 SCR and 1 diode. The modules are mounted on a liquid cooled heatsink. This circuit rectifies the incoming AC voltage to unfiltered (pulsating) DC, which is filtered by the DC Link Filter.



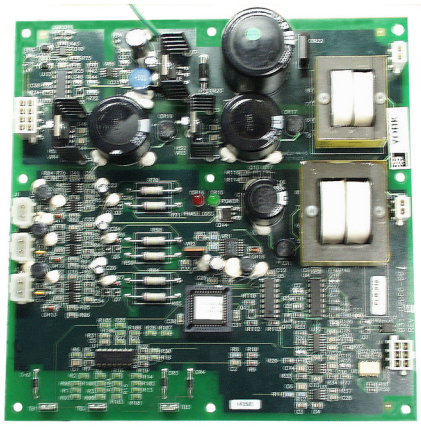
LD10608

A semi-converter (combination SCR/Diode) configuration allows utilizing a separate pre-charge circuit to limit the current in the DC link filter capacitors when the VSD is first switched ON. This is accomplished by slowly turning ON the SCR's to initially charge the DC Bus. Once charged, the SCR's remain fully gated ON during normal operation. This configuration also provides a fast disconnect from main power when the drive is switched OFF.

When the drive is called to run (leaving chilled liquid temperature is more than the Setpoint plus CR), the SCR/Diode modules are turned ON by the SCR trigger Board, allowing the DC link filter capacitors to slowly pre-charge for a period of 20 seconds.

SCR Trigger Board

The SCR Trigger Board controls the firing (gating) sequence of the Bridge SCR's.



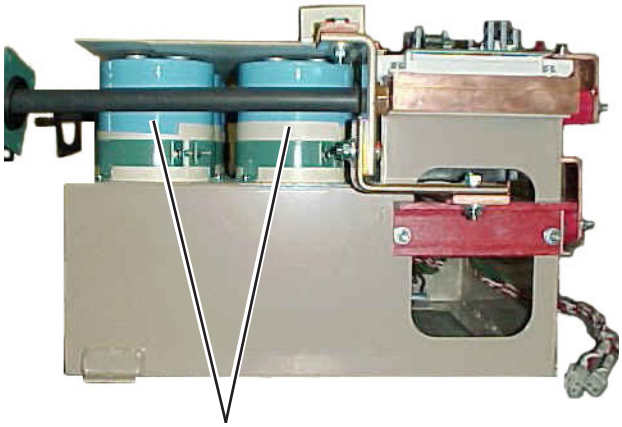
LD10609

Command for the SCR Trigger Board to begin firing the SCR's is initiated by the VSD Logic Board.

The SCR Trigger Board also monitors the three phase input voltage to detect the loss of an incoming phase.

DC Link Filter

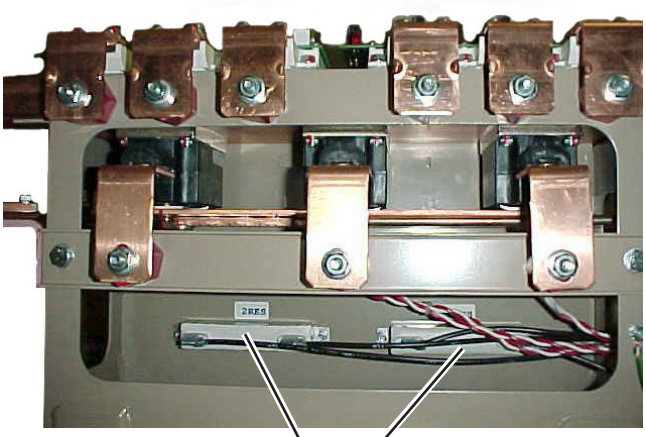
The DC Link Filter consists of a bank of electrolytic filter capacitors. The capacitors smooth (filter) ripple voltage resulting from the AC to DC rectification and provides an energy reservoir for the DC to AC inverter. The capacitor filter bank is made up of 2 banks of parallel-connected capacitors wired in series. Series banks of capacitors allow using smaller sized capacitors with lower voltage ratings.



LD10610

The capacitor bank in conjunction with the 1L Line Inductor forms a low pass LC Filter and provides further smoothing (filters ripple) to the rectified DC.

Equalizing/Bleeder resistors connected across the banks equalize the voltage between the top and bottom capacitors to avoid damaging the capacitors from over voltage. The Equalizing Bleeder resistors also provide a path for discharge of the capacitors when the drive is switched OFF. This safely discharges the capacitors in approximately 5 minutes. Always be careful, as a bleeder resistor could be open and the bus may be charged.



LD10611

EQUALIZING/BLEEDER RESISTORS

WARNING

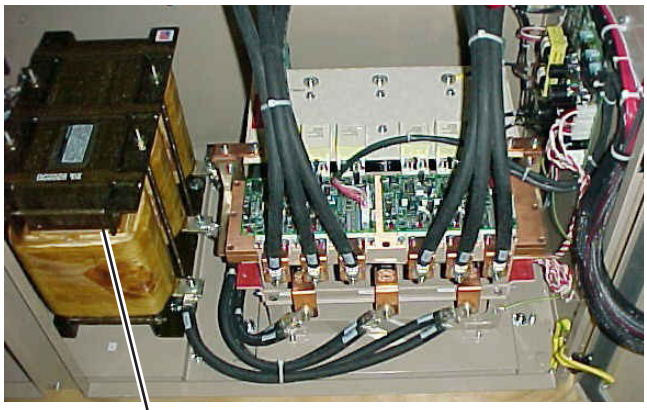
Always check the DC Bus Voltage across the top and bottom, banks of capacitors with a functioning voltmeter set correctly to the proper scale before performing service on the inverter. DO NOT rely on the Bleeder Resistors to discharge the capacitor banks without checking voltage for the purpose of safety.

NEVER short out a capacitor bank to discharge it during servicing. If a bleeder resistor is open and a capacitor bank will not discharge, immediately contact Johnson Controls Product Technical Support.

NOTE

Refer to Service Information Letter SI0223 for proper discharge procedure.

1L Line Inductor



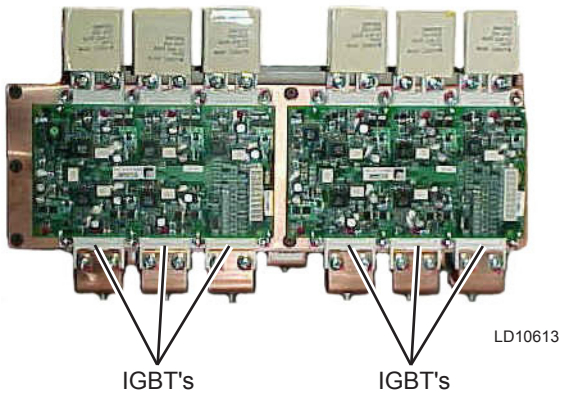
LD10612

1L LINE INDUCTOR

The 5% impedance 1L Line Inductor has multiple functions. 1L forms a low pass LC filter that filters the pulsating DC from the AC to DC converter, to smooth DC voltage. The inductance eliminates notches on the incoming AC line. The inductance also helps protect the SCR's from high voltage incoming line transients, which could damage them. 1L slows down the rate of rise of current if an internal short circuit occurs, reducing the potential damage caused by the short. 1L also reduces the input current total harmonic distortion.

DC to AC Inverter

The DC to AC Inverter section converts the rectified and filtered DC back to AC at the equivalent magnitude and frequency to run a compressor at a specific speed. Although a common DC Bus links the compressor drive outputs, each compressor has its own inverter output module. Each inverter output module consists of 6 IGBT's (3 modules) and an IGBT Gate Driver Board, which converts DC to a 3 - phase AC output. The IGBT's are mounted to the liquid cooled heatsink designed to take the heat away from the devices and remove it in the condenser. The IGBT Gate Driver Board provides gating pulses to turn the IGBT's ON and OFF.

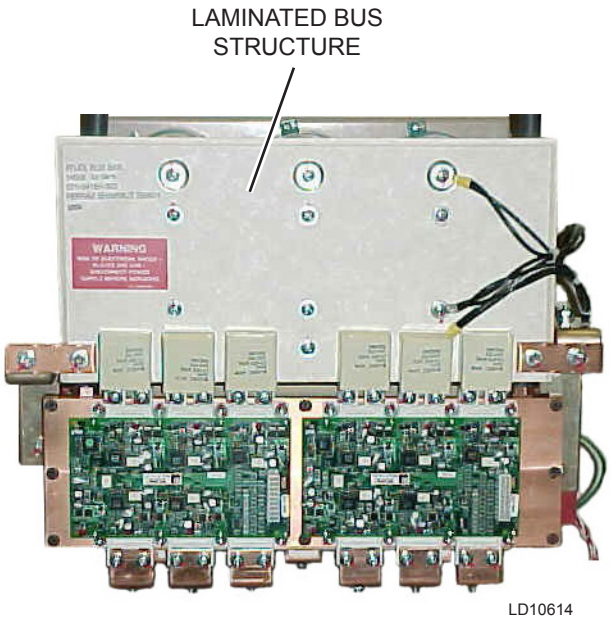


LD10613

IGBT's IGBT's

Laminated Bus Structure

The Laminated Bus Structure is a group of copper plates sandwiched together that connects the SCR/Diode Modules, Bus Filter Capacitors, and IGBT's. The purpose of the Laminated Bus Structure is to reduce the inductance that would be present in wiring or bus bars often used to connect high voltage components in VSD's. Removing inductance in the circuit reduces the voltage spike that occurs when the IGBT's turn OFF. These voltage spikes can potentially damage the IGBT's.



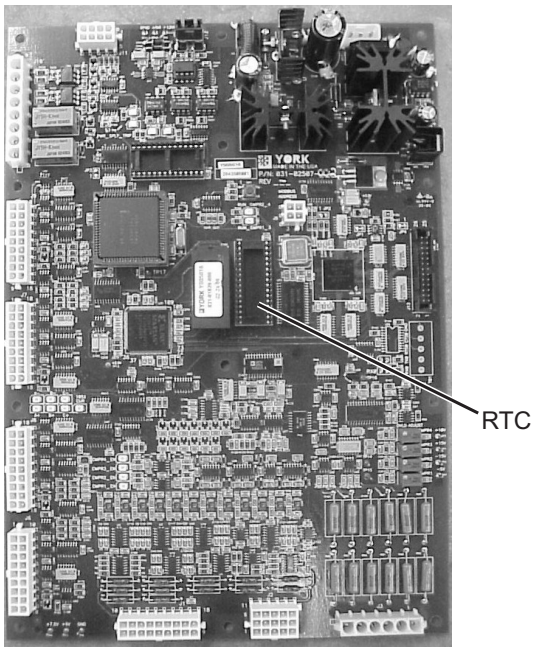
LD10614

VSD Logic Board

The VSD Logic Board controls VSD functions/operations and communicates through a serial communications line with the Chiller Control Board. Safety and shutdown information stored in the RTC (Battery backed RAM) is reported back to the Chiller Control Board via the communications link. The VSD Logic Board converts the speed and run commands from the Chiller Control Board into the necessary voltage and frequency commands to operate the inverter section. The VSD Logic Board also controls the converter section of the VSD (AC to DC conversion) by controlling the pre-charge function.

The VSD Logic Board contains a second microprocessor for motor control, which generates the PWM signals that control the IGBT's in the inverter section of the VSD.

The VSD Logic Board contains an FPGA (Field Programmable Gate Array) which handles the hardware safeties and can shut down the VSD much faster than the software safeties, since they are not dependent upon running program loops in software. The VSD handles all VSD related safeties including high motor current, overload, DC Bus voltage faults, and so on.



LD13120

FIGURE 91 - VSD LOGIC BOARD P/N 031-02507-000

Inputs to the VSD Logic Board are fed through an on-board multiplexer (MUX) before being sent to the A/D converter. These signals allow the VSD Logic Board to monitor DC Bus voltages, compressor motor currents, VSD internal ambient temperature, IGBT baseplate temperatures, and compressor overload settings. The VSD Logic Board controls the glycol pump and the cabinet cooling fans. Details on the controls are provided in the *VSD Operation and Controls on page 217*.

Control Panel to VSD Communications

Communication between the VSD Logic Board and the Chiller Control Board is made via a three-wire RS-485 opto-coupled data link. Communications between the two boards occurs at the rate of 9600 baud. UART2 of the dual UART located on the Chiller Control Board is dedicated to internal communications and has a higher priority interrupt than the external communications UART1. The Chiller Control Board will control VSD start/stop, selection of which compressors to run, and compressor speed. The VSD Logic Board will run the desired compressors at the speed requested by the Chiller Control Board. The VSD will report back to the Chiller Control Board, shutdown and safety information related to internal VSD operation and the compressor motors.

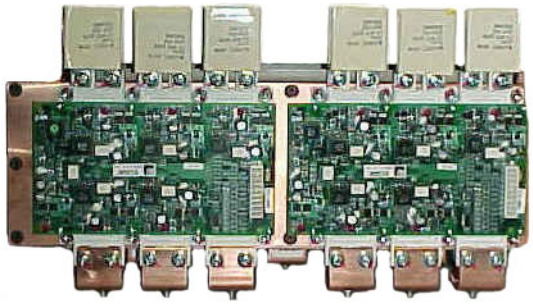
On power-up, the control panel will attempt to initialize communications with the VSD. The Chiller Control Board will request initialization data from the VSD Logic Board. The initialization data required is the number of compressors and the VSD software version. Once these data points have been received by the control panel, the unit successfully initializes.

If the Chiller Control Board does not receive initialization data from the VSD Logic Board in 8 seconds or loses communications with the VSD for 8 seconds at any time, the chiller will fault on a communications failure. The Chiller Control Board will continue to send messages to the VSD Logic Board in an attempt to establish communications while the chiller is faulted.

The VSD Logic Board will also monitor a communication lost. If the VSD Logic Board loses communications with the Chiller Microprocessor Board for 8 seconds at any time, the VSD will shut off all compressors and wait for valid communication from the Chiller Control Board.

Once communication is established, the Chiller Control Board will send a data packet on the data link once every second at 9600 baud. This data packet will include run, stop, and speed commands as well as request operating data from the VSD. Operating data returned by the VSD will include individual motor currents, motor %FLA's, output frequency, compressor motor temperature, and fault information related to internal VSD operating parameters such as DC Bus voltage, IGBT baseplate temperatures, VSD internal ambient, pre-charge relay status, power supply status, run relay status, motor overload, and supply single phase. The Chiller Control Board will poll the VSD Logic Board for information continuously while the chiller is running.

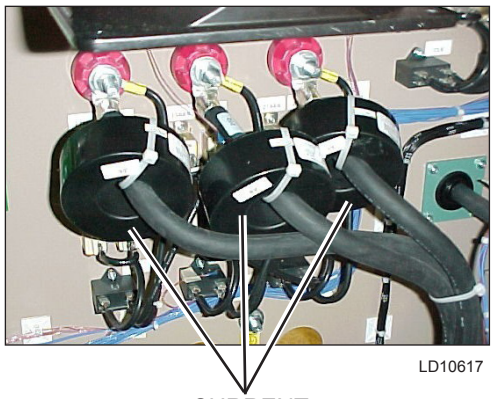
IGBT Gate Driver Boards



LD10613

The IGBT Gate Driver Boards provide the ON and OFF gating pulses to the IGBT's. The gating signals originate from the VSD Logic Board and are changed in level by the IGBT Gate Driver Board. The IGBT's in the inverter section of the VSD, change the DC Link voltage to a variable Voltage and Frequency output to the motor, to control the compressor motor speed. The IGBT Gate Driver Board also provides VCE SAT detection (short circuit detection) to safely turn OFF the IGBT's during a short circuit condition. When a short circuit occurs, the voltage (VCE SAT) across the IGBT increases as a result of the high current. The IGBT Gate Driver Board is an integral part of the IGBT assembly for each compressor.

Current Transformers



LD10617

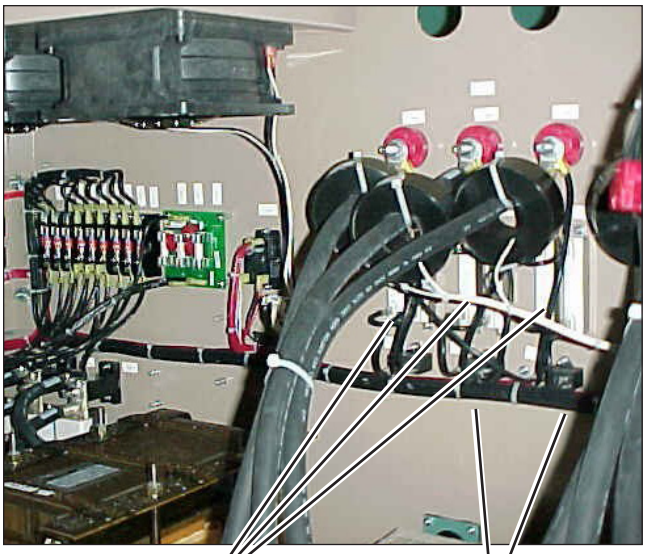
CURRENT
TRANSFORMERS

A current transformer on each phase sends current signals, proportional to motor phase current, to the VSD Logic Board. The output of each CT is buffered, scaled, and sent to RMS to DC converters. These signals are then sent to an A-D converter, scaled, and sent to the Chiller Control Board for current display and current limiting control.

The highest current is also compared to the setting of the Overload Adjustment Potentiometer on the VSD Logic Board for overload safety sensing.

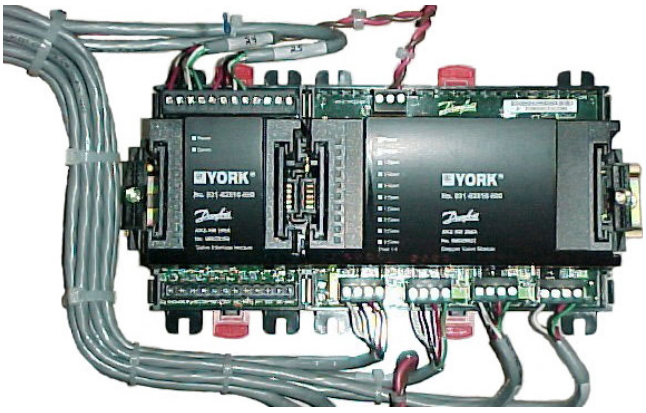
DV/DT Output Suppression Network

The dV/dT Output Suppression Network limits the rate of rise of voltage and the peak voltage of the PWM pulses applied to the motor windings. This eliminates the possibility of causing a turn-to-turn short in the motor due to winding insulation breakdown. The suppression network is made up of a 3-phase RC network.



LD10618

Flash Tank Feed (Condenser Drain Valve) and Economizer Feed Stepper Motor Valve Controller



LD10619

The Flash Tank Feed (Condenser Drain) and Economizer Feed Stepper Motor Valve Controller is a microprocessor driven controller that operates the Flash Tank Feed and Economizer Feed Stepper Motor Valve Controller, based on commands from the Chiller Control Board. The Flash Tank Feed Valve (Condenser Drain Valve) controls the sub-cooling in the Condenser. The controller is a stand-alone valve control module in the Control/VSD panel. The liquid line sub-cooling is controlled by sequencing a stepper motor valve (Flash Tank Feed Valve also known as the Condenser Drain Valve) on the inlet of the Flash Tank. The controller opens and closes the valve to control the liquid line sub-cooling based on commands from the Chiller Control Board.

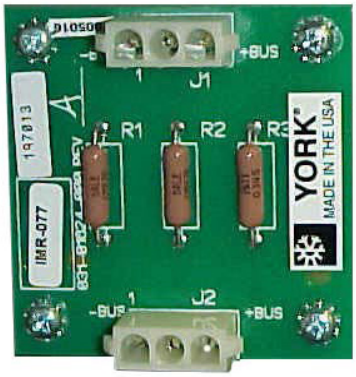
Economizer flow is controlled by sequencing a stepper motor valve on the gas outlet of the flash tank. The controller opens and closes the valve to control gas flow to the compressor based on commands from the Chiller Control Board.

Flash Tank Feed Valve (Condenser Drain Valve) control is managed by a PI control algorithm based on liquid line sub-cooling calculated in the Chiller Control Board software. The Flash Tank Feed Valve control algorithms will attempt to control the liquid line sub-cooling to the programmed setpoint.

The Economizer stepper Valve controls according to control algorithm and tries to feed as much gas as possible, whenever the speed is above 120 Hz.

The valve controller is typically located at the back of the panel behind the power wiring terminal block/circuit breaker or on the wall of the panel on the left side of the cabinet.

DC Bus Voltage Isolation Board



LD10620

The DC Bus Isolation Board allows the VSD Logic Board to read the voltage on the DC BUS without exposing the VSD Logic Board to the high voltage. Instead, the DC Bus Isolation Board contains a resistor network that forms voltage dividers with resistors on the VSD Logic Board, which steps down the voltages so that scaled down voltages proportional to the full and 1/2 bus voltages can be safely fed to the integrated circuitry on the VSD Logic Board. The DC Bus Isolation Board supplies 3 connections to the VSD Logic Board; plus bus, minus bus and half bus.

Chiller Circuit Breaker

LD10623

An Optional Circuit Breaker may be supplied on the input of the chiller. The incoming power will be fed to the terminals on the circuit breaker. If the Circuit Breaker Option is not selected, incoming power will be fed to terminal blocks. The breaker also provides ground fault protection. All chillers utilize one circuit breaker.

CHILLER CONFIGURATION JUMPERS

Chiller configuration jumpers are factory wired into wire harnesses or plugs. These jumpers typically never need to be reviewed unless in some unlikely situation, a chiller is incorrectly configured or a loose connection occurs.

Number of Compressors Configuration Jumper

The VSD Logic Board must be configured for the actual number of compressors. The chiller is configured for the number compressors through the use of jumpers, factory plugged into the J1 plug on the VSD Logic Board. This hard wiring configures the VSD Logic Board for the number of compressors on the chiller, avoiding mis-programming. The jumpers are only checked at power-up. If no jumpers are sensed, or an invalid combination is sensed and communicated to the Chiller Control Board, startup of the unit will be inhibited and an INVALID NUMBER OF COMPRESSORS SELECTED warning message will be displayed in the Status display.

The following table shows the number of compressors and the associated location of the jumpers to program the appropriate compressor configuration.

TABLE 15 - COMPRESSORS AND THE APPROPRIATE JUMPER POSITIONS

# OF COMPRESSORS	VSD LOGIC BOARD JUMPER POSITION
2	J1-10 to J1-9
N/A	J1-11 to J1-9
N/A	J1-12 to J1-9

VSD LOGIC TO CHILLER MICROPROCESSOR BOARD RS-485 COMMUNICATION CONFIGURATION JUMPERS

The Chiller Control Board and the VSD Logic Boards communicate over an RS-485 link. The communications link requires a matching address to be set up at both ends. The VSD Logic Board communications bus is configured through the use of jumpers, factory plugged into the J5 plug on the VSD Logic Board. The VSD Logic Board will only check the jumper positions once at power-up.

The following table shows the VSD Logic Board Address configuration and the associated location of the jumpers. The jumpers will vary according to the number of VSD Logic Boards installed. All YVAA chillers utilize a single VSD Logic Board and will use VSD Logic Board Address 1.

TABLE 16 - VSD LOGIC BOARD ADDRESS JUMPER

VSD LOGIC BOARD'S ADDRESS	VSD LOGIC BOARD JUMPER POSITION
1	J5-1 to J5-2 and J5-3 to J5-4
2	J5-3 to J5-4
3	J5-1 to J5-2
4	NONE

When power is applied, the Chiller Control Board will attempt to establish communications with the VSD Logic Board. When communication is made, the Chiller Control Board will request initialization data from the VSD Logic Board.

The communication of data will continue as long as power is applied. The Chiller Control Board will send commands to the VSD Logic Board instructing it to operate the required number of compressors at the required speed.

Anytime a communications loss occurs between the two boards for more than 8 seconds, the chiller will be shut down on a fault. The Chiller Control Board will continue to poll the VSD Logic Board for communications as long as power is applied in an effort to re-establish comms to operate the chiller.

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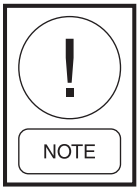
SECTION 6 - COMMISSIONING

PREPARATION

Commissioning of this unit should only be carried out by Johnson Controls Authorized personnel.

Commissioning personnel should be thoroughly familiar with the information contained in this document before starting the unit.



Commission the unit using the detailed checks outlined in the Equipment Pre - Startup Checklist and Startup Checklist found at the end of this section.

The following basic checks should be made with the customer power to the unit switched OFF.

Proper electrical lock out and tag out procedures must be followed.

Inspection

Inspect unit for installation damage. If found, take action and/or repair as appropriate.

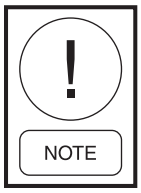
Refrigerant Charge

Packaged units are normally shipped as standard with a full refrigerant operating charge. Check that refrigerant pressure is present in both systems and that no leaks are apparent. If no pressure is present, a leak test must be undertaken, the leak(s) located and repaired.

Do not evacuate or liquid charge with static water in the evaporator. Turn the pump on. Take care to liquid charge slowly to avoid excessive thermal stress at the charging point and to assure the refrigerant temperature in the evaporator does not go below the freezing point with liquid refrigerant in the evaporator. Once the vacuum is broken, charge into the evaporator or flash tank with the Condenser Drain Valve (Flash Tank Feed) open and the chilled liquid pump ON to the full operating charge, as detailed in Section 5-Technical Data.

Correct System Refrigerant Charge

The charge on a system should always be checked when operating for several minutes at full speed with the system stable. Stable conditions are defined as operation without fan cycling, economizer cycling, VI solenoid cycling, or any other system transient conditions. Ideal refrigerant charge will be reached when the refrigerant level in the evaporator is near the middle of the evaporator sight glass.



Refrigerant should not be added or removed unless the level is at the bottom or the top of the glass. It is not necessary to weigh charge unless the entire charge has been lost. The ease of charging is possible since the microchannel coils hold only a small amount of refrigerant charge. A charging valve is located between the fixed orifice and the evaporator for adjusting charge. Charge should be added as liquid with the pump ON and liquid flowing through the evaporator. See Refrigerant Removal, Evacuation And Charging A YVAA Chiller on page 294.

Service and Oil Line Valves

Open each compressor oil, economizer, and discharge ball or service valves. If valves are of the back-seat type, open them fully (counterclockwise) then close one turn of the stem to ensure operating pressure is fed to pressure transducers.

Compressor Oil

To add oil to a circuit - connect a YORK hand oil pump (Part No. 470-10654-000) to the 1/4 inches (6.35mm) oil charging valve on the oil separator piping with a length of clean hose or copper line, but do not tighten the flare nut. Using clean oil of the correct type (“L” oil), pump oil until all air has been purged from the hose then tighten the nut. Stroke the oil pump to add oil to the oil system. While the compressor is running at full speed, the oil level should be visible in the sight glass of the oil separator. Approximately 2 to 3.1 gallons (7.5 to 11.6 liters) are present in each refrigerant system. Avoid levels above the sight glass. This may cause excessive oil carryover in the system. High oil concentration in the system may cause nuisance trips resulting from incorrect readings on the level sensor and temperature sensors. Temperature sensor errors may result in poor liquid control which will result in liquid overfeed and subsequently damage the compressor. High oil carryover may also cause liquid to be returned to the compressor, which can damage the compressor.

Fans

Check that all fans are free to rotate and are not damaged. Ensure blades are at the same height when rotated. Ensure fan guards are securely fixed.

Isolation / Protection

Verify all sources of electrical supply to the unit are taken from a single point of isolation. Check that the maximum recommended fuse sizes given in the "Technical Data" section has not been exceeded.

Control Panel

Check the panel to see that it is free of foreign materials (wire, metal chips, and so on) and clean out if required.

Power Connections

Check that the customer power cables are connected correctly to the terminal blocks or optional circuit breaker. Ensure that connections of power cables within the panels to the circuit breaker or terminal blocks are tight.

Grounding

Verify that the unit's protective ground terminal(s) are properly connected to a suitable grounding point. Ensure that all unit internal ground connections are tight.

Water System

Verify the chilled liquid system has been installed correctly, and has been commissioned with the correct direction of water flow through the evaporator. The inlet should be at the bottom connection on a two pass evaporator. Purge air from the top of the evaporator using the plugged air vent mounted on the top of the evaporator body.

Flow rates and pressure drops must be within the limits given in *SECTION 5 - TECHNICAL DATA*. Operation outside of these limits is undesirable and could cause damage.

If main power must be switched OFF for maintenance or shutdown, precautions must be taken. If there is a possibility of liquid freezing due to low ambient temperatures, the evaporator should be drained or power should be applied to the chiller. This will allow the evaporator heater to protect the evaporator from freezing down to 0°F (-17.7°C). Before placing the unit back in service, valves should be opened and power must be switched on (if power is removed for more than 8 hours) for at least 8 hours (24 hours if ambient temperature is below 86°F [30°C]) before the unit is restarted.

Flow Switch

Verify a chilled water flow switch is correctly fitted in the customer's piping on the evaporator outlet, and wired into the control panel correctly using shielded cable.

There should be a straight run of at least five pipe diameters on either side of the flow switch. The flow switch should be connected to Terminals 2 and 13 in the panel.

Temperature Sensor(s)

Ensure the leaving liquid temperature sensor is coated with heat conductive compound (Part No. 013-00890-000) and is inserted to the bottom of the water outlet sensor well in the evaporator. This sensor is part of the pump control freeze protection operation. It provides some freeze protection and must always be fully inserted in the water outlet sensor well.

Programmed Options

Verify that the options factory-programmed into the Micro Panel are in accordance with the customer's order requirements by pressing the OPTIONS key on the keypad and reading the settings from the display.

Programmed Settings

Ensure the system cutout and operational settings are in accordance with the operating requirements by pressing the PROGRAM key.

Date and Time

Program the date and time by first ensuring that the CLK jumper JP2 on the Chiller Control Board is in the ON position. Then press the DATE/TIME key and set the date and time. See *SECTION 8 - MICROPANEL, Date/Time And Schedule Keys on page 266*.

Start/Stop Schedule

Program the daily and holiday start/stop by pressing the SCHEDULE key. See *SECTION 8 - MICROPANEL, Schedule Key Operation on page 267*.

Setpoint and Remote Offset

Set the required leaving chilled liquid temperature setpoint and Control Range under the SETPOINTS key. The chilled liquid temperature control settings need to be set according to the required operating conditions.

If remote temperature reset (offset) is to be used, the maximum reset required must be programmed by pressing the SETPOINTS key. See *SECTION 8 - MICROPANEL, Setpoints Key on page 257*.

FIRST TIME START-UP

During the commissioning period there should be sufficient heat load to run the unit under stable full load operation to enable the unit controls, and system operation to be set up correctly, and a commissioning log taken. Be sure that the chiller is properly programmed and the Equipment Pre Startup and Startup Checklist (located at the end of this section) are completed.

Interlocks

Verify that liquid is flowing through the evaporator and that heat load is present. Ensure that any remote run interlocks are in the run position and that the Daily Schedule requires the unit to run or is overridden.

Unit Switch

Place the UNIT switch on the keypad to the ON position.

Startup

Press the SYSTEM SWITCHES key and place the system switch for System 1 to the ON position. There may be a few seconds delay before the first compressor starts because of the anti-recycle timer). Be ready when each compressor starts, to switch the UNIT switch OFF immediately, if any unusual noises or other adverse conditions develop.

When a compressor is running, the controller monitors oil pressure, motor current, and various other system parameters such as discharge pressure, chilled liquid temperature, and so on. Should any problems occur; the control system will immediately take appropriate action and display the nature of the fault.

Oil Pressure

When a compressor starts, press the relevant “System Pressures” key and verify that oil differential pressure (oil pressure-suction pressure) develops immediately. If oil pressure does not develop, the automatic controls will shut down the compressor. Under no circumstances should a restart attempt be made on a compressor, which does not develop oil pressure immediately. Switch the UNIT switch to the OFF position.

Loading

Once the unit has been started, all operations are fully automatic. After an initial period at minimum capacity, the control system will adjust the unit load depending on the chilled liquid temperature and rate of temperature change. If a high heat load is present, the controller will increase the speed of the compressor(s).

Condenser and Fan Rotation

Once a compressor is running, discharge pressure rises as refrigerant is pumped into the air-cooled condenser coils. This pressure is controlled by stages of fans to ensure maximum unit efficiency while maintaining sufficient pressure for correct operation of the condensers and the lubrication system.

As discharge pressure rises, the condenser fans operate in stages or ramp up in speed to control the pressure. Verify that the fans operate in the correct direction of rotation and operation is correct for the type of unit.

System Charge

Check system charge at steady full compressor load only. It is important that all fans are running for the system. The refrigerant level in the evaporator should be about in the middle of the sight glass. Unless levels are at the bottom or the top of the sight glass, they should not cause concern or require adding or removing charge.

GENERAL OPERATION

After completion of the above checks for System 1, switch OFF the SYS 1 switch on the keypad and repeat the process for each subsequent system. When all run correctly, stop the unit, switch all applicable switches to the ‘ON’ position and restart the unit.

Assure all checks are completed in the *Equipment Pre - Startup and Startup Checklist (Form 201.28-CL2)*. The chiller is then ready to be placed into operation.

Operation in Sub-freezing Conditions

The YVAA may be operated in sub-freezing conditions if the following freeze protections are taken :

A. A suction service valve electric actuator is installed. Chiller software will operate the actuator in order to protect against freezing due to evaporator refrigerant migration.

-or-

B. No suction service valve is installed but the water circuit valves are kept open, there is continuous power to the chiller and pump for chilled water pump control, and the pump will operate and circulate water through the evaporator whenever commanded by the chiller.

The above operation is only advised if uninterrupted power can be ensured. Unforeseen power interruptions can damage the evaporator in a very short time frame if the temperature falls below freezing.

If there is potential for power loss, Johnson Controls recommends the water in the chilled water circuit be replaced with an appropriate water-to-glycol concentration.

Unit Maintenance and Shutdown in Sub-freezing Conditions

If the YVAA is maintained or shutdown and will be subjected to sub-freezing conditions, it is critical to protect against evaporator and waterbox freeze damage. Johnson Controls recommends the following options (in order of freeze protection level) be performed on each circuit.

A. Glycol: Replace water with an appropriate water to glycol concentration of antifreeze.

-or-

B. Drain: Remove power to the waterbox heaters. Close the water valves, drain the evaporator, leave the evaporator drain valves open.

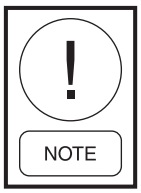
-or-

C. Refrigerant Valve - Off: Close the water valves, close flash tank drain valves, close the suction service valves and leave power to the chiller for evaporator heater mat and waterbox heater operation. For units without a suction service valve, close the discharge and compressor oil valves.

-or-

D. Pump Control: Keep power to the chiller in order to have control over chilled water pumps and heater operation and leave the water circuit valves open. This will enable water to circulate through the evaporator to avoid freezing.

Options A and B are the recommended processes for unit maintenance and shutdown. Unforeseen power interruptions can damage the evaporator in a very short time frame if the temperature falls below freezing.



Failure to follow Johnson Controls freeze protection recommendations can void the warranty.

Supersedes: 201.28-CL2 (817)

Form 201.28-CL2 (1017)

YORK

MODEL YVAA

EQUIPMENT PRE-STARTUP AND STARTUP CHECKLIST

CUSTOMER: _____ LOCATION: _____

ADDRESS: _____ CUSTOMER ORDER NO: _____

PHONE: _____ JCI CONTRACT NO: _____

JOB NAME: _____

CHILLER MODEL NO: _____ **UNIT SERIAL NO:** _____

The work (as checked below) is in process and will be completed by: _____ / _____ / _____
MM DD YYYY

The following work must be completed in accordance with the installation instructions:

PRE-STARTUP UNIT CHECKS (NO POWER)

The following basic checks should be made with the customer power to the unit switched OFF.

WARNING: Proper electrical lock out and tag procedures must be followed.

Check the system 24 hours prior to initial start:

1. Inspect the unit for shipping or installation damage. Repair as needed. ☐
2. Has all piping been completed? ☐
3. Are there refrigerant or water piping leaks? Repair as needed. ☐
4. Open each system liquid shut off valve, economizer shut off valve, discharge shut off valve and oil line ball valve. ☐
5. Adjust spring isolators (if installed) and assure they are not bottomed out. ☐
6. Are water pumps on? Check and adjust water pump flow rate preferably using an ultra sonic flow meter. Otherwise adjust pressure drop across the evaporator. ☐

   CAUTION: Excessive flow may cause catastrophic damage to the evaporator.
7. Check the control panel to ensure it is free of foreign material (wires, metal chips, tools, documents, etc.). Also check for signs of water or moisture. ☐
8. Visually inspect wiring (power and control). Wiring MUST meet N.E.C., CE, and local codes. ☐
9. Check tightness of the incoming power wiring. ☐
10. Does the field wiring match the 3-phase power requirements of the chiller (Refer to the chiller nameplate)? ☐
11. Is a flow switch is connected between Terminals 2 and 13 on the User Terminal Block 1TB in the panel? It is recommended that the auxiliary pump contacts be placed in series with the flow switch for additional protection, if the pump is turned OFF during chiller operation. Whenever the pump contacts are used, the coil of the pump starter should be suppressed with an RC suppressor (031-00808-000). ☐
12. Is all control wiring connected correctly to the user input terminals? ☐
13. Apply power to the chiller and assure the compressor heaters are turned on 24 hours prior to system startup. ☐

FORM 201.28-CL2
ISSUE DATE: 10/02/2017

EQUIPMENT STARTUP CHECKLIST

NOTE: Before proceeding with the following unit checks, verify the heaters have been run for 24 hours prior to starting the unit.

A. UNIT CHECKS (NO POWER)

The following basic checks should be made with the customer power to the unit switched OFF.

WARNING: Proper electrical lock out and tag procedures must be followed.

1. Inspect the unit for shipping or installation damage. Repair as needed. ☐
2. Has all piping has been completed? ☐
3. Are there any refrigerant or water piping leaks? Repair as needed. ☐
4. Open each system liquid shut off valve, economizer shut off valve, discharge shut off valve and oil line ball valve. If optional eductor and suction valves are installed, be sure to open them. Failure to open the eductor valve will result in "Eductor Clog" faults. ☐
5. Is the oil separator oil level(s) maintained so that an oil level is visible in the sight glass when a compressor is running at full speed for 15 to 30 minutes? An oil level may not be visible in the sight glass when the compressor is OFF or running below full speed; and it may be necessary to run the compressor at full speed to obtain a level. In shutdown situations and at some load points, much of the oil may be in the evaporator and the level in the separator may fall below the bottom sight glass. ☐

   Sight glasses will vary in type depending upon the manufacturer. One type will have balls that float in the sight glasses to indicate level. Another type will have a bulls' eye glass. The bulls' eye glass will tend to appear to lose the lines in the bulls' eye when the level is above the glass. Be careful when viewing the sight glass not to confuse a full sight glass with an empty sight glass. Oil level should be visible, but not above the top of the sight glass after operating at full speed for 15 to 30 minutes. In the rare situation where oil levels are high, drain the oil to lower the level until it is visible in the sight glass. This should be done while operating at full speed. Oil levels in the oil separator above the top of the sight glass should be avoided and may cause excessive oil carryover in the system. High oil concentration in the system may cause nuisance trips resulting from low discharge superheat, low solution pressure and incorrect readings from temperature sensors. Temperature sensor errors may result in poor refrigerant control and liquid overfeed to the compressor. Excessive oil will also reduce evaporator performance.

   In the unlikely event it is necessary to add oil, connect a YORK oil pump to the charging valve on the oil separator, but do not tighten the flare nut on the delivery tubing. With the bottom (suction end) of the pump submerged in oil to avoid entrance of air, operate the pump until oil drips from the flare nut joint, allowing the air to be expelled, and tighten the flare nut. Open the compressor oil charging valve and pump in oil until it reaches the proper level as described above.
6. Are water pumps are ON? Check and adjust water pump flow rate preferably using an ultra sonic flow meter. Otherwise adjust pressure drop across the evaporator. ☐

   CAUTION: Excessive flow may cause catastrophic damage to the evaporator.
7. Check the control panel to ensure it is free of foreign material (wires, metal chips, tools, documents, etc.). Also check for signs of water or moisture. Ensure door gasket seals are sealing properly and incoming power wiring conduit is caulked. ☐
8. Visually inspect wiring (power and control). Wiring MUST meet N.E.C., CE, and local codes. ☐
9. Check tightness of the incoming power wiring inside the power panel and inside the motor terminal boxes. ☐
10. Check for proper size fuses in control circuits. ☐
11. Does the field wiring match the 3-phase power requirements of the chiller? (Refer to chiller nameplate) ☐
12. Are all water temperature sensors inserted completely in their respective wells and coated with heat conductive compound? ☐
13. Is the liquid line temperature sensor tightly strapped on the liquid line and insulated? ☐
14. Is the glycol level in the VSD cooling system 9 to 15 inches (23 to 28 cm) from the top of the fill tube? This check should be performed prior to running the pump. ☐

CAUTION: Never run the glycol pump without coolant! Running the glycol pump without coolant may damage the pump seals.

Always fill the system with approved YORK coolant (P/N 013-03344-000) to avoid damage to the pump, cooling system heat sinks and the chiller. Overheating of the heat sinks and power panel will also occur.

FORM 201.28-CL2
ISSUE DATE: 10/02/2017

15. Are the remote start/stop for Sys #1 on Terminals 2 to 15 and Sys #2 on Terminals 2 to 16 closed on the User Terminal Block 1TB to allow the systems to run? If remote cycling devices are not utilized, place a wire jumper between these terminals. ☐

16. Is a flow switch connected between Terminals 2 and 13 on the User Terminal Block 1TB in the panel? Throttle back flow to ensure the flow switch opens with a loss of flow at the minimum recommended flow. It is recommended that auxiliary pump contacts be placed in series with the flow switch for additional protection, if the pump is turned OFF during chiller operation. Whenever the pump contacts are used, the coil of the pump starter must be suppressed with an RC suppressor (031-00808-000). ☐

B. STARTUP

PANEL CHECKS (POWER ON – BOTH SYSTEM SWITCHES OFF)

WARNING: You are about to turn power on to this machine. SAFETY IS NUMBER ONE! Only qualified individuals are permitted to service this product. The qualified individual furthermore is to be knowledgeable of, and adhere to, all safe work practices as required by NEC, OSHA, and NFPA 70E. Proper personal protection is to be utilized where and when required.

1. Is the chiller OFF/ON UNIT switch at the bottom of the keypad is OFF? ☐

   CAUTION: DO NOT apply power to the chiller unless the system is filled with water or glycol. If the chiller is equipped with the -20°F option, applying power to an empty chilled liquid system will cause the evaporator immersion heaters to fail.

2. Apply 3-phase power to the chiller. Turn ON the optional panel circuit breaker if supplied ☐

3. Is the control panel display illuminated ☐

4. Are the system switches under the SYSTEM SWITCHES key in the OFF position? This ensures the compressors from starting. ☐

5. Does the voltage supply correspond to the unit requirement and is it within the limits given in Section 5 - Technical Data in *Form 201.28-NM1.1*? ☐

6. Are the heaters on each compressor ON using a clamp-on ammeter? Heater current draw is approximately 3A. ☐

7. Are the "Factory Set" overload potentiometers on the VSD Logic Board set correctly? Press the VSD DATA key and use the arrow keys, to scroll to the compressor overload settings. In the unlikely event that they are not set correctly, adjust the potentiometers until the desired values are achieved. ☐

   WARNING: The VSD is powered up and live. High voltage exists in the area of the circuit board on the bus bars, VSD Pole Assemblies, and wiring to the input inductor.

   Adjust the potentiometers, if needed, using *Table 20 Compressor Motor Overload Settings* in the IOM *(Form 201.28-NM1.1)* The potentiometers are System 1=R19 and System 2=R64.

   Record the Overload Potentiometer settings below:
   R19 = System 1 = _____ Amps
   R64 = System 2 = _____ Amps

   CAUTION: Incorrect settings of the potentiometers may cause damage to the equipment.

8. Press the STATUS key. If the following message appears, immediately contact Johnson Controls Product Technical Support. The appearance of this message may mean the chiller has lost important factory programmed information. The serial number and other important data may need to be reprogrammed. ☐

UNIT WARNING: INVALID SERIAL NUMBER
ENTER UNIT SERIAL NUMBER

NOTE: Changing the programming of this feature requires the date and time to be set on the chiller prior to p rogramming. Additional information regarding this message and how to enter the serial number with the factory provided password is outlined in the Serial Number Programming.

9. Program the required options into the Panel for the desired operating requirements (Refer to Section 8 in *Form 201.28-NM1.1*). Record the values below: ☐

   Display Language = _____
   Chilled Liquid Mode = _____
   Local/Remote Mode = _____
   Display Units = _____
   Lead/Lag Control = _____
   Remote Temperature Reset = _____
   Remote Current Reset = _____
   Remote Sound Limit _____
   Low Ambient Cutout _____

CAUTION: Damage to the chiller could result if the options are improperly programmed.

C. PROGRAMMED VALUES

1. Program the required operating values into the microprocessor for cutouts, safeties, etc., and record them below (Refer to Section 8 in *Form 201.28-NM1.1*). ☐

Suction Pressure Cutout = _____ PSIG (kPa)

Low Ambient Cutout = _____ °F

Leaving Chilled Liquid Temperature Cutout = _____ °F

Motor Current Limit = _____ % FLA

Pulldown Current Limit = _____ % FLA

Pulldown Current Limit Time = _____ MIN

Subcooling Setpoint = _____ °F

Remote Unit ID # = _____

Sound Limit Setpoint = _____ %

Eductor Differential = _____ °F

Eductor Safety Time = _____ MIN

Motor Temp Unload = _____ °F

D. CHILLED LIQUID SETPOINT

Program the Chilled Liquid Setpoint/Range and record: ☐

1. Local Cooling Setpoint = _____ °F
2. Local Cooling Range = _____ to _____ °F
3. Maximum Remote Temperature Reset = _____ to _____ °F

E. DATE/TIME, DAILY SCHEDULE, AND CLOCK JUMPER

1. Set the date and time. ☐
2. Program the Daily Schedule start and stop times. ☐
3. Place the panel in Service Mode and turn on each fan stage one by one. Ensure the fans rotate in the correct direction, so air flow exits the top of the chiller. ☐
4. Remove the cap on the fill tube and run the glycol pump to verify the level in the fill tube. Ensure the glycol level in the VSD cooling system is 9 to 15 inches (23 to 28 cm) from the top of the fill tube while running. The pump can be run by placing the chiller in the Service Mode. Be sure to re-install the cap before stopping the glycol pump to avoid overflowing the fill tube when the glycol pump is turned OFF. The glycol system holds about 3.5 to 5.5 gallons of coolant (P/N 013-03344-000). ☐
5. Check the optional fan VSD programming (if equipped). ☐

F. INITIAL STARTUP

After the control panel has been programmed and the compressor heaters have been energized for at least 8 hours (ambient temperature more than 96°F or 24 hours (ambient temperature less than 86°F, the chiller may be placed into operation.

1. Turn on the UNIT switch and program the system switches on the keypad to the ON position. ☐
2. If cooling demand permits, the compressor(s) will start and a flow of refrigerant will be noted in the sight glass, after the anti recycle timer times out and the precharge of the DC Bus is completed. After several minutes of operation, the bubbles in the liquid line sight glass will disappear and there will be a solid column of liquid when the Condenser Drain (Flash Tank Feed) Valves stabilize. ☐
3. Allow the compressor to run a short time, being ready to stop it immediately if any unusual noise or adverse conditions develop. Immediately at startup, the compressor may make sounds different from its normal high-pitched sound. This is due to the compressor coming up to speed and the initial lack of an oil film sealing the clearances in the rotors. This should be of no concern and lasts for only a short time. ☐
4. Check the system operating parameters. ☐

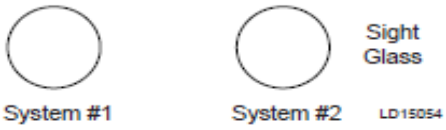
G. REFRIGERANT CHARGE

1. Record the level of refrigerant in the evaporator sight glass with each system operating at full speed for 15 to 30 minutes. A refrigerant level should be visible in each evaporator sight glass. ☐

2. Remove charge if the level is above the sight glass and add charge if the level is below the sight glass. ☐

H. OIL LEVELS

Record the oil level in the oil separator sight glass with each system operating at full speed for 15 to 30 minutes. An oil level should be visible in the sight glass, but not above the sight glass.



I. LIQUID LINE SUBCOOLING

Record the liquid Line Subcooling from the panel display after operating at full speed for 15 to 30 minutes.

Sys 1 Liquid Subcooling _____ °F

Sys 2 Liquid Subcooling _____ °F

J. LOG READINGS

Record the following temperatures and pressures from the panel display:

Chilled Liquid Temperature: _____ °F

VSD Frequency: _____ Hz

Sys 1 Oil Pressure: _____ PSIG

Sys 1 Discharge Pressure: _____ PSIG

Sys 1 Suction Pressure: _____ PSIG

Sys 1 Condenser Liquid Pressure: _____ PSIG

Sys 1 Oil Temperature: _____ °F

Sys 1 Eductor Temperature: _____ °F

Sys 1 Condenser Liquid Temp: _____ °F

Sys 1 Subcooling: _____ °F

Sys 1 Saturated Liquid Temp: _____ °F

Sys 1 Discharge Temp: _____ °F

Sys 1 Discharge Superheat: _____ °F

Sys 1 SAT Discharge Temp: _____ °F

Sys 1 Flash Tank Level: _____ %

Sys 1 Economizer Valve: _____ %

Sys 1 Condenser Subcooling: _____ °F

Sys 1 Condenser Drain Valve: _____ %
(Flash Tank Feed Valve)

Sys 1 Condenser Fans # ON: _____

SYS 1 VSD Fan Speed: _____ %

Sys 1 VI Step Solenoid 1: _____

Sys 1 VI Step Solenoid 2: _____

Sys 1 Run Time: ____D____HR___MIN___SEC

Sys 2 Oil Pressure: _____ PSIG

Sys 2 Discharge Pressure: _____ PSIG

Sys 2 Suction Pressure: _____ PSIG

Sys 2 Condenser Liquid Pressure: _____ PSIG

Sys 2 Oil Temperature: _____ °F

Sys 2 Eductor Temperature: _____ °F

Sys 2 Condenser Liquid Temp: _____ °F

Sys 2 Subcooling: _____ °F

Sys 2 Saturated Liquid Temp: _____ °F

Sys 2 Discharge Temp: _____ °F

Sys 2 Discharge Superheat: _____ °F

Sys 2 SAT Discharge Temp: _____ °F

Sys 2 Superheat: _____ °F

Sys 2 SAT Discharge Temp: _____ °F

Sys 2 Flash Tank Level: _____ %

Sys 2 Economizer Valve: _____ %

Sys 2 Condenser Subcooling: _____ °F

Sys 2 Condenser Drain Valve: _____ %
(Flash Tank Feed Valve)

Sys 2 Condenser Fans # ON: _____

SYS 2 VSD Fan Speed: _____ %

Sys 2 VI Step Solenoid 1: _____

Sys 2 VI Step Solenoid 2: _____

Sys 2 Run Time: ___D____HR____MIN___SEC

K. LEAK CHECKING

1. Leak check compressors, fittings, and piping to ensure there are not any leaks. ..... ☐

If the chiller is functioning satisfactorily during the initial operating period with no safety trips; and the chiller controls chilled liquid temperature; the chiller is now ready to be placed into service.

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SECTION 7 - OPERATION

OPERATING CONTROLS

Anti-recycle Timer

A typical 5 or 10 minute anti-recycle timer is not necessary to allow compressor motor cooling, due to the VSD's ability to provide a low current inrush start. The system does utilize a fixed 120 second anti-recycle timer to prevent short cycling of systems and to allow positioning the Flash Tank Feed and Economizer Valves to a zero (closed) position by the Valve Controller in the event of a power failure.

On power-up of the control panel, the anti-recycle timer for each system will be set to 120 seconds and must time out before a compressor is allowed to start.

Whenever a system starts, the anti-recycle timer for all systems will be set to 120 seconds and will count down from the time the motor starts. The timer must time out before another compressor is allowed to start.

Whenever a system shuts down, the anti-recycle timer for that system will be set to 120 seconds. The timer must time out before the system is allowed to restart.

Evaporator Pump Control

The evaporator pump dry contacts are energized when any of the following conditions are true:

- If a Low Leaving Chilled Liquid Fault occurs.
- Whenever a compressor is running.
- The Daily Schedule is ON and the UNIT switch is ON.

Even if one of the above is true, the pump will not run if the panel has been powered up for less than 30 seconds or if the pump has run in the last 30 seconds to prevent pump motor overheating.

Evaporator Heater Control

The evaporator heater is controlled by ambient air temperature. If no systems are running and the ambient temperature drops below 40°F, the heater is turned ON. If no systems are running and the temperature rises above 45°F the heater is turned OFF. Whenever a system is running, the evaporator heater is turned OFF. Both evaporator heater outputs will always be turned ON and OFF together. An under voltage condition will keep the heater OFF until full voltage is restored to the system.

Pumpdown Control

The VSD assures a smooth slow compressor start. As a result of this, neither pumpdown on startup nor pumpdown on shutdown is required. The Flash Tank Feed Valve (Condenser Drain Valve) will close when a compressor stops. This is a similar to a liquid line solenoid valve closing on a conventional chiller.

Compressor Heater Control

Each compressor has its own heater. The purpose of the heater is to assure refrigerant does not condense in the compressor. There is no oil sump, but refrigerant could possibly condense in the rotors or the motor housing. The heater will be OFF whenever the respective compressor is running. As soon as the compressor shuts OFF, the heater will turn ON as long as all motor temperature sensors in the compressor read less than 158°F (70°C). The heater will turn OFF, if any internal compressor motor temperature sensor reads more than 160°F (71.1°C).

Alarms

Each system has its own alarm. The Alarm output is ON (dry contact closed) when no fault condition is present and OFF (dry contact open) to indicate an alarm situation. The Alarm will be activated (contacts open), if any of the following are true.

- A System is faulted or inhibited from starting for more than 5 seconds.
- The Unit is faulted or inhibited from starting for more than 5 seconds.
- A System is locked out.
- The Unit is locked out.
- Power is removed from the chiller.

Chiller Run Contact

The Chiller Run dry contact is closed whenever any system is running. It is open when all systems are shut OFF.

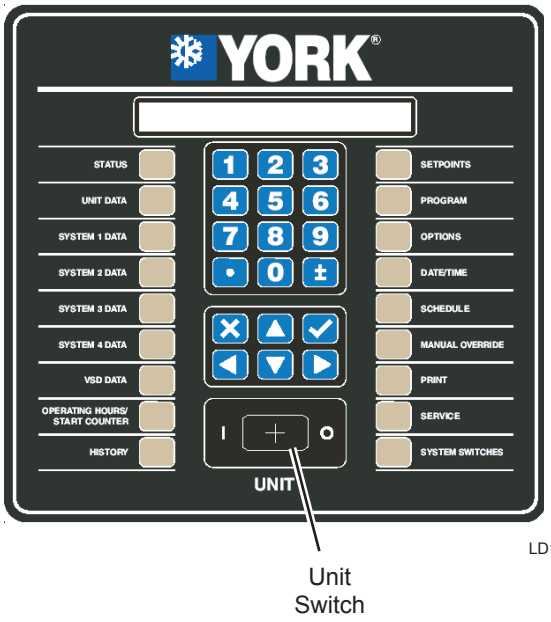
Flow Switch Control

A flow switch must be installed in the chilled liquid system to indicate to the control panel that adequate flow is present. When the flow switch is open, the chiller will not be permitted to run. The chiller will shutdown, if running, when the flow switch opens for more than 1 second. The flow switch connection point is between terminals 2 and 13 of 1TB in the control panel.

Run Permissive Control

Each system utilizes a run permissive input. These inputs must come from an external dry contact. It is possible to not utilize these inputs by installing a jumper across the input terminals. The run permissive connection for system 1 is between terminals 2 and 15 of 1TB. The run permissive input for system 2 is between terminals 2 and 16 of 1TB. If a run permissive input is open, the respective system will not run. If a run permissive input opens while the system is running for more than one second, the respective system will shut down.

Unit Switch



A double pole single throw ON/OFF rocker switch on the front of the control panel is used to turn the entire chiller ON and OFF. When the switch is placed in the OFF position, the entire unit shuts down immediately and all systems will be disabled. One pole of the UNIT switch contacts is wired to the Run Signal input and the Chiller Control Board "UNIT switch X" digital input (X equals System 1 or 2). Separate System Fuses are also wired in series with each set of UNIT switch contacts. If either fuse is pulled or blown, only the system with the good fuse (Input is high) will run. When both inputs are high, the entire chiller will be enabled to run. When both inputs are low, the chiller will be disabled as a UNIT switch OFF Shutdown.

NOTE

The UNIT switch should never be used to shut down the chiller except in an emergency. When the switch is thrown, the compressors will immediately shut down. Since the compressors are not permitted to come to a controlled stop, the rotors may back-spin more than normal, which may result in some unusual compressor noise. The back-spin will not hurt the compressors, but should be avoided.

NOTE

It is suggested that the System Switches on the keypad be used whenever possible to turn a system OFF and allow the compressor to complete a controlled shutdown.

BASIC OPERATING SEQUENCE

Start Sequence and Loading

To initiate the start sequence of the chiller, the following conditions must be satisfied before the pre-charge of the DC Bus will take place:

- UNIT SWITCH must be ON.
- At least one System Switch is ON.
- Run permissive inputs (Remote Cycling Contacts) must be closed.
- No unit faults exist.
- No unit start inhibits exist.
- At least one system not faulted or inhibited.
- The Daily Schedule is calling for the chiller to run.
- The Flow Switch is closed.
- Leaving Chilled Liquid Setpoint is above the Setpoint plus CR (Setpoint High Limit).

Once the pre-charge takes place, if the anti-recycle timer is timed out the chiller control system on the Chiller Control Board will select the number of compressors to start and begin operation of the compressors. The compressor(s) speed will be ramped to the minimum start frequency and increase speed as needed in an effort to regulate the leaving chilled liquid temperature to meet the desired Setpoint.

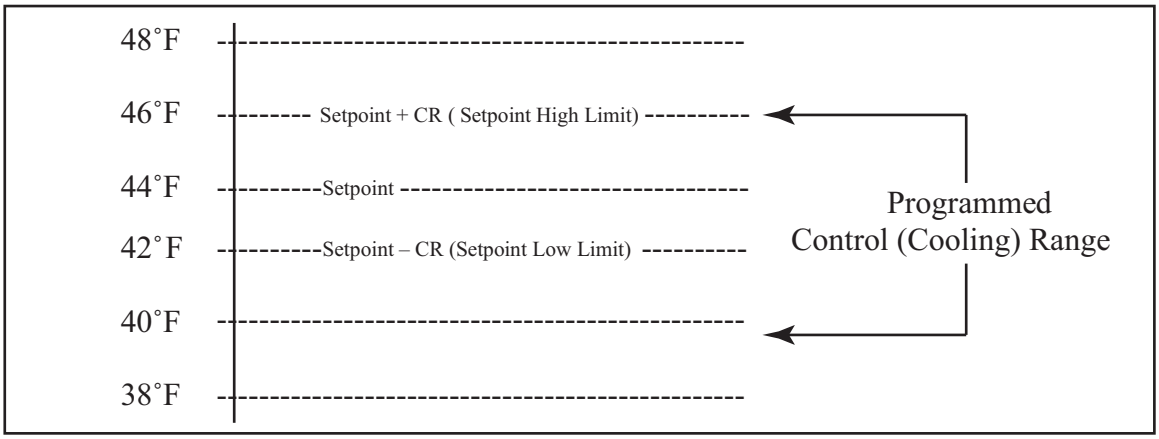


FIGURE 92 - CHILLER CONTROL (COOLING) RANGE

When a compressor starts, the Flash Tank Feed Valve on the system will immediately begin to control subcooling and the Chiller Control Board microprocessor will begin to regulate the speed on the VSD to bring the chilled liquid temperature to within the Control Range (CR). The microprocessor will regulate the speed of the compressor(s) primarily based on temperature offset as the loading timer permits.

The Setpoint is the Leaving Chilled Liquid Temperature midpoint of the Control (Cooling) Range. The Setpoint High Limit is the Setpoint plus the Control Range. The Setpoint Low Limit is the Setpoint minus the Control Range. The chiller will attempt to control within the temperature range programmed by the Setpoint plus or minus CR.

Starting and stopping of compressors will be handled by the Optimized IPLV Capacity Control Routine. Loading and unloading will be controlled by temperature offset and rate by the Fuzzy Logic Control Routine.

A graphical representation of the Setpoint and high and low limit (plus or minus CR) are shown in the previous figure.

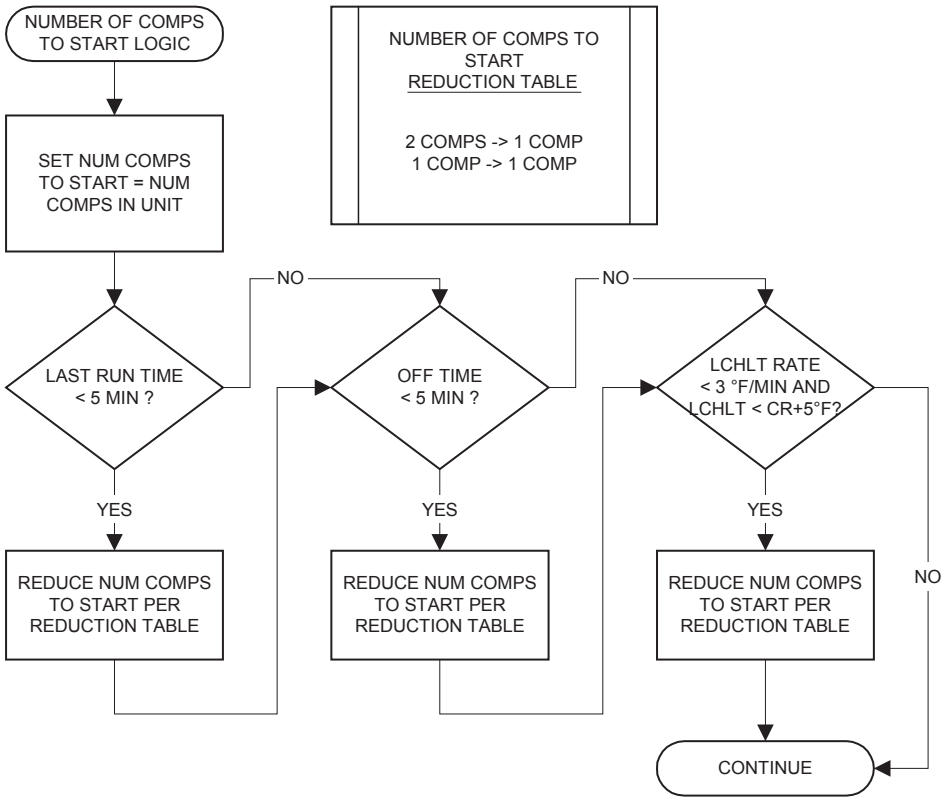


FIGURE 93 - NUMBER OF COMPRESSORS TO START

NUMBER OF COMPRESSORS TO START

General

The number of compressors to start is determined by control algorithms that provide "smart" anticipatory control to determine how many compressors need to be started to satisfy the current load. The "smart" logic is capable of reducing short cycling, and reducing loading time on a hot water start, and starting all compressors at the same time. See *Figure 93 on page 195*.

The Number of compressors to Start Logic will be used to determine how many compressors should be run when the unit starts from the all compressors stopped state. This routine will try to run all the compressors unless it is determined that less will be needed due to light load.

The first step in the sequence is for the microprocessor to set the number of compressors to start equal to the number of compressors in the chiller. The microprocessor will look at two prior conditions relating to the compressor operating time the previous time it ran, how long the last compressor has been OFF, and two indicators of chilled liquid load requirements (rate of change of chilled liquid temperature and deviation from setpoint). Temperature deviation is the amount of error compared to the setpoint high limit (Setpoint plus CR). Based on this information, the microprocessor will then determine the number of compressors to start. The flowchart in *Figure 93 on page 195* describes the compressor starting decision process.

It is desirable to run as many compressors as possible for increased efficiency. Optimized logic will keep as many compressors on line and reduce speed in an effort to optimize the use of the entire evaporator tube surface.

MINIMUM VSD COMPRESSOR START/RUN FREQUENCY

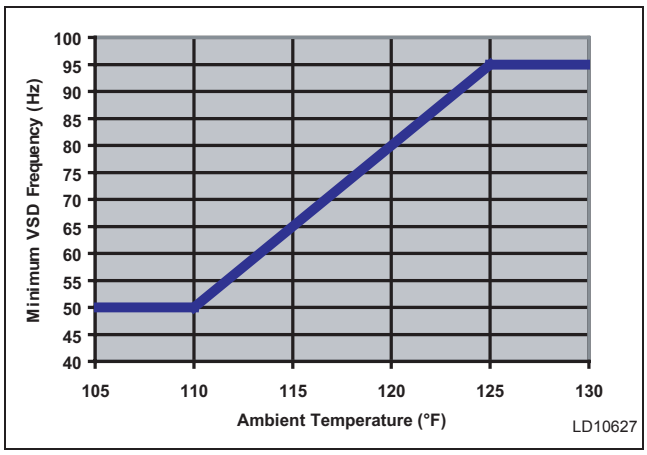
Minimum VSD Start Frequency

The Minimum VSD Compressor Start Frequency is based on ambient temperature and determines the frequency (speed) the compressor(s) is ramped to at start. At higher ambients, higher speeds are needed to provide adequate motor cooling. At low ambients, higher motor speeds are needed to develop oil pressure differential at start. The temperature ranges and the associated start frequency are determined by the following guidelines:

- If the ambient temperature is 25°F or less, the minimum VSD Start Frequency will be 70 Hz.
- If the ambient temperature is between 26 and 40 °F (-3 and 4°C), the Minimum VSD Start Frequency is 60 HZ.
- If the ambient temperature is between 41 and 110 °F (5 and 43°C), the Minimum VSD Start Frequency will be 50 Hz.
- If the ambient is between 110 and 125 °F (43 and 52°C), the Minimum VSD Start Frequency is scaled according to the following formula:

  (3 x Ambient Temperature) - 280°F.
- Above 125°F, the minimum VSD Start Frequency is 95 Hz.

A graphical representation of this formula is shown in *Figure 94 on page 196*.



NOTE: The graph above also illustrates the scaled frequency:

FIGURE 94 - MINIMUM VSD START FREQUENCY

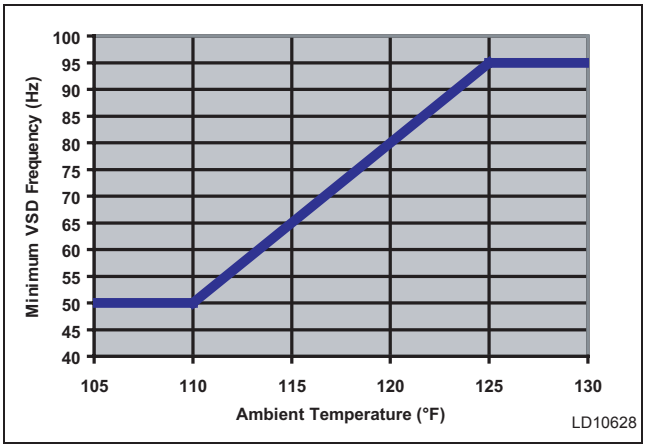
Minimum VSD Run Frequency

The Minimum VSD Compressor Run Frequency is based on ambient temperature and determines the minimum frequency (speed) the compressor(s) is permitted to run as the system unloads. At high ambients, higher motor speeds are needed to cool the compressor motor. The temperature ranges and the associated start frequency follows the guidelines below:

- If the ambient temperature is less than 110°F, the Minimum VSD Run Frequency will be 50 Hz.
- If the ambient is between 110 and 125°F (43 and 52°C), the Minimum VSD Run Frequency is scaled according to the following formula:

  (3 x Ambient Temperature) - 280°F
- If the ambient temperature is more than 125°F, the Minimum VSD Run Frequency will be 95 Hz.

A graphical representation of this formula is shown in *Figure 95 on page 197*.



NOTE: The graph above also illustrates the scaled frequency.

FIGURE 95 - MINIMUM VSD RUN FREQUENCY

ACCELERATION/DECELERATION RATE WHEN STARTING/STOPPING COMPRESSORS

VSD Acceleration and Deceleration Rates

The acceleration rate changes with frequency and follows the guidelines below:

- Between 0 and 50 Hz, the acceleration is 10 Hz/sec.
- Between 50 and 203 Hz, the acceleration is 30.4 Hz/sec. Even though the acceleration rate of 30.4 Hz/sec is possible up to 203 Hz, the frequency (speed) is limited by the minimum start frequency and the add a compressor frequency calculation performed by the microprocessor when bringing on an additional compressor.

When decelerating, the deceleration rate changes with frequency and follows the guidelines below:

- Between 203 and 100 Hz, the deceleration time is 30.4 Hz/sec.
- Between 100 and 0 Hz, the deceleration time is 10 Hz/sec.

When a compressor stops, back-spin of the compressor will often occur as the pressure differential between discharge and suction equalizes. This should not be a cause of concern.

CAPACITY CONTROL

Loading/Unloading and Starting Additional Compressors

Optimized capacity control is integrated into the chiller software. Its purpose is to control compressors as effectively as possible, optimizing control of both the compressors and condenser fans. If the LWT is more than the programmed Setpoint plus CR, the Chiller Control Board microprocessor will follow the flow chart (*Figure 93 on page 195*) to determine the number of compressors to start based on the last run time, time OFF, and the rate of change of chilled liquid temperature. The compressor(s) will start at the minimum start frequency based on ambient temperature (*Figure 94 on page 196*). The respective system Feed Valve will immediately begin to control the sub-cooling.

When compressors start, the load and unload timers will be set to 30 seconds. During the first 30 seconds of operation after a compressor reaches the start frequency, loading/unloading is inhibited. After 30 seconds, the control logic looks at the LWT temp, compares it to the Setpoint plus CR, and makes a decision to load or unload.

For precise capacity control, the Chiller Control Board microprocessor loads and unloads compressors quickly, as fast as every 2 seconds, in increments of 0.1 to 1 Hz each time a load or unload change is required. Fixed load and unload timers of 2 sec. are set, after a speed change of 0.1 to 1 Hz, to minimize undershoot and overshoot.

As additional cooling is required (LCHLT more than Setpoint plus CR), the Chiller Control Board microprocessor will increase the speed of the compressor at the rate of 1Hz every 2 seconds until the load is satisfied. Loading will continue to occur as long as leaving chilled liquid temperature is above the Setpoint plus CR.

The Chiller Control Board will be making decisions regarding speed changes under conditions where the "error" and "rate" conflict. Under these conditions, loading/unloading follows the guidelines described in the "Fuzzy Logic Control" section. See *Table 17 on page 199*.

If chilled liquid temperature is not satisfied and above Setpoint plus CR, the microprocessor looks to see if the lag compressor is not running. If any compressor is OFF, the Chiller Control Board microprocessor looks at the VSD output frequency. If the VSD output frequency is greater than the Add Compressor Frequency

plus 15 Hz or equal to the maximum chiller speed (frequency), the microprocessor starts an additional compressor. The Add Compressor Frequency is calculated as:

$$\text{Add Compressor Frequency} = \frac{a \times (b + 1)}{b}$$

Where: a = Minimum Start Frequency
b = Number of Compressors Running

Example: A single compressor had been running without satisfying cooling demands. Assume the minimum VSD start frequency based on ambient is 50 Hz for this example. The number of compressors running in the formula will equal to 1. Placing the values into the formula: 50 Hz x (1+1)/1 = 100 Hz. The add compressor frequency will equal 100 Hz. Since the controls are designed to add a compressor at a frequency 15 Hz above this point, a compressor will be added if the speed reaches 115 Hz.

When a compressor is to be added, the Chiller Control Board microprocessor decelerates the compressor VSD frequency to 5 Hertz. This enables the differential between discharge and suction pressure to be reduced to a point where it will not affect motor current when the compressor is restarted. It also reduces the chance for backspin on the running compressor. The next compressor is activated and all compressors are accelerated to the Start Frequency. The Start Frequency is calculated as:

$$\text{Start Frequency} = \frac{c \times (b - 1)}{b}$$

Where: c = Current VSD Frequency
b = Number of Compressors Running

With 2 compressors now running and a current VSD frequency of 115 HZ, the start frequency will be computed as:

$$\frac{115 \text{ Hz} \times (2-1)}{2} = \frac{115}{2} = 58 \text{ Hz}$$

When the compressors restart, loading and unloading is inhibited for 30 seconds after the compressor(s) reaches the start frequency, as is the case on any compressor start. The anti-recycle timer will be set to 120 sec.

In a situation where a single compressor on a 2 compressor chiller is running and is in load limiting for any reason, and LCHLT more than Setpoint plus CR for less than 5 minutes, but more than 30 seconds, the microprocessor will reset the load/unload timers to 2 seconds every “potential” load cycle. When LCHLT more than Setpoint plus CR for more than 5 minutes, the microprocessor will enable the lag compressor just as it were not satisfied and determine a second compressor was required to handle the load, since the lead compressor is load limited.

If the cooling capacity exceeds the demand (LCHLT less than Setpoint – CR/2) and multiple compressors are operating, the Chiller Control Board microprocessor will decrease the speed of the compressors at the rate of 0.1 to 1 Hz every 2 seconds until the LCHLT rises to within the Control Range. If temp remains below Setpoint – CR/2, rate is falling, and speed falls to the minimum VSD frequency as determined by the ambient, the VSD will decelerate all compressors to 5 Hertz. The last lag compressor will be shut down. The remaining compressors will be restarted minus the lag compressor. The lead compressor will restart and accelerate to the Stop Comp Freq designated as:

$$\text{Stop Comp Freq} = \frac{d \times (b + 1)}{b}$$

Where: d = Minimum VSD Frequency
b = Number of Compressors Running

Example: Number of Compressors running = 1
Minimum VSD frequency = 50 Hz

Therefore, in this example, one compressor will restart at 100 Hz as indicated in the formula below:

$$\frac{50 \text{ Hz} \times (1+1)}{1} = 100 \text{ Hz}$$

The load timer will also be set to 30 seconds and the unload timer will be set to 10 seconds.

When the system is only operating a single (lead) compressor, if temperature continues to stay below the Control Range (Setpoint minus CR), the Chiller Control Board microprocessor will unload the compressor at the rate of 1Hz every 2 seconds. This will continue until the frequency drops below the Minimum VSD Frequency determined by the ambient temperature. At this point, the lead compressor will be shut down.

Fuzzy Logic Control

The fuzzy logic control in software makes decisions to load or unload according to the error or deviation from Setpoint, and the rate of change of chilled liquid temperature. Before making a change in speed, the logic will look at the load and unload timers to assure they are timed out. It also looks to assure there is no load limiting in effect. Each time a change

is made, the incremental change in speed is still 0.1 to 1 Hz, unless temperatures fall near the leaving chilled liquid cutout.

In most situations, when the chilled liquid temperature is above the Setpoint plus CR, the Chiller Control Board microprocessor will continue to increase the speed of the compressor(s) to load the chiller until temperature drops in the general range of the Setpoint High Limit. As the temperature drops and approaches the Setpoint High Limit (Setpoint plus CR), the microprocessor's fuzzy logic will begin factoring in the rate of change before continuing to load. If the rate of change is dropping too fast and there is potential for overshoot, the Chiller Control Board microprocessor may elect not to continue to increase speed.

In cases where temperature is dropping too fast, when temperature is within the desired Control Range, the Chiller Control Board microprocessor will be required to make decisions regarding speed changes under conditions where the "error" and "rate" conflict. For example, the Chiller Control Board microprocessor may elect to reduce the speed of the compressor(s) if the error is "0" (temperature is at Setpoint); while the rate of change of chilled liquid temperature is "negative" (falling). The Chiller Control Board microprocessor may also elect to hold capacity when error is "positive" (temperature is above Setpoint, but not above Setpoint plus CR) because the rate of change of chilled liquid is "negative" (falling). The following table illustrates these conditions.

TABLE 17 - FUZZY LOGIC LOADING/UNLOADING VS. ERROR

	NEGATIVE ERROR	ZERO ERROR	POSITIVE ERROR
NEGATIVE RATE	UNLOAD	UNLOAD	HOLD
ZERO RATE	UNLOAD	HOLD	HOLD
POSITIVE RATE	HOLD	LOAD	LOAD

When temperature is significantly below the Setpoint minus CR/2, the Chiller Control Board microprocessor will reduce the speed of the compressor(s) to unload the chiller by 2.0 Hz every 2 seconds. If temperature drops to within 1.0°F above the Low Chilled Liquid Temperature Cutout, the Chiller Control Board microprocessor will unload at the rate of 4.0 Hz every 2 seconds.

As the temperature rises toward Setpoint minus CR, the Chiller Control Board microprocessor's fuzzy logic will begin factoring in the rate of change before continuing to unload. If the rate of change is rising too fast and there is potential for overshoot, the Chiller Control Board microprocessor may elect not to decrease speed.

In cases where temperature is rising too fast, when temperature is within the desired Control Range, the Chiller Control Board microprocessor will be required to make decisions regarding speed changes under conditions where the "error" and "rate" conflict. For example, the Chiller Control Board microprocessor may elect to increase the speed of the compressor(s) if the error is "0" (temperature is at Setpoint), while the rate of change of chilled liquid temperature is "positive" (rising). The Chiller Control Board microprocessor may also elect to hold capacity when error is "negative" (temperature is below Setpoint) because the rate of change of chilled liquid is "positive" (rising). Table 13 illustrates these conditions and the response from the Chiller Control Board microprocessor.

Hot Water Starts

On a hot water start under "best" case conditions, assuming power has not been removed and the 120 sec timer does not inhibit starting, the design of the control algorithm for a 2 compressor chilled liquid capacity control allows full loading of a chiller in slightly more than 6 minutes after start, regardless of the number of compressors, if all the compressors start at the same time. This time period assumes load limiting does not affect the loading sequence and the ambient is above 40°F.

LOAD LIMITING CONTROL

Load Limiting

The Load Limiting Controls are intended to prevent a system from reaching a safety trip level. Load limiting controls prevent loading or unload compressors to prevent tripping on a safety. Limiting controls operate for Motor Current %FLA, Suction Pressure, Discharge Pressure, VSD Baseplate Temperature, and VSD Internal Ambient Temperature.

All running system's load limit control values are checked every 2 seconds. Load limiting prevents a system from loading (no increase even though cooling demand requires loading) when the specific operating parameter is within a specific range of values. If the value is above the range where loading is inhibited, the logic will unload the chiller based on the amount (%) the

limit has been exceeded. Load limiting affects all compressors, even though only one system may be affected.

If more than one operating parameter is exceeding the value where unloading is required, the value with the highest amount of unloading will determine the unloading. All load limiting controls are active at start-up except suction pressure limiting.

Motor Current Load Limiting/Unloading

Motor current load limiting helps prevent the system from tripping on the motor overload safety. The motor "Current Limit Setpoint" is based on %FLA motor current and is programmable under the PROGRAM key or may be set by a remote device. Motor current load limiting prevents the system from loading even though increased loading may be required when the current is between the "Current Limit Setpoint minus 2%" and the "Current Limit setpoint". Between the "Current Limit Setpoint" and the "Current Limit Setpoint plus 5%", the system will unload every 2 seconds according to the amount current is exceeding the "Current Limit Setpoint". At the "Current limit Setpoint", 0 Hz reduction in speed will take place and at the "Current Limit Setpoint plus 5%", a 10 Hz speed reduction will take place. Between the "Current Limit Setpoint" and "Current Limit Setpoint plus 5%", unloading will occur according to the following table.

TABLE 18 - CURRENT LIMIT LOAD LIMITING/ UNLOADING

CURRENT LIMIT SETPOINT	UNLOADING
Current Limit Setpoint -2% to +0%	0 Hz
Current Limit Setpoint +1%	2 Hz
Current Limit Setpoint +2%	4 Hz
Current Limit Setpoint +3%	6 Hz
Current Limit Setpoint +4%	8 Hz
Current Limit Setpoint +5%	10 Hz

Discharge Pressure Load Limiting/Unloading

Discharge pressure load limiting protects the condenser from experiencing dangerously high pressures. A system is permitted to load normally as long as the discharge pressure is below the High Discharge Pressure Cutout minus 20 PSIG. Between Cutout minus 20 PSIG and Cutout minus 15 PSIG loading is inhibited even though increased loading may be required. Between Cutout minus 15 PSIG and the Discharge Pressure Cutout, forced unloading is performed every 2 seconds according to the following table. The discharge pressure unload point is fixed at 255 PSIG.

TABLE 19 - DISCHARGE PRESSURE LOAD LIMITING/UNLOADING

DISCHARGE PRESSURE	UN-LOADING
Discharge Pressure Cutout- 20 PSIG and Discharge Pressure Cutout- 15 PSIG	0 Hz
Discharge Pressure Cutout- 13.5 PSIG	1 Hz
Discharge Pressure Cutout- 12 PSIG	2 Hz
Discharge Pressure Cutout- 10.5 PSIG	3 Hz
Discharge Pressure Cutout- 9 PSIG	4 Hz
Discharge Pressure Cutout- 7.5 PSIG	5 Hz
Discharge Pressure Cutout- 6 PSIG	6 Hz
Discharge Pressure Cutout- 4.5 PSIG	7 Hz
Discharge Pressure Cutout- 3 PSIG	8 Hz
Discharge Pressure Cutout- 1.5 PSIG	9 Hz
Discharge Pressure Cutout- 0 PSIG	10 Hz

Suction Pressure Load Limiting/Unloading

Suction pressure load limiting helps to protect the evaporator from freezing. A system is permitted to load normally as long as the Suction Pressure is above the Suction Pressure Cutout plus 2 PSIG. Between Cutout plus 2 PSIG and the Cutout, loading is inhibited, even though increased loading is required. Between the Suction pressure Cutout and Suction Pressure Cutout minus 10 PSIG, forced unloading is performed every 2 seconds according to *Table 20 on page 201*. This situation would occur if the suction pressure cutout transient override control is in effect (See *Low Suction Pressure Cutout (Software) Fault on page 235*). The suction pressure cutout is programmed under the PROGRAM key. The default Suction Pressure Cutout is set at 24.0 PSIG.

Suction pressure load limiting is active at startup, to only prevent loading of the compressors. Suction pressure limit unloading will not occur until the system run time reaches 5 minutes of operation to allow the system to stabilize.

TABLE 20 - SUCTION PRESSURE LOAD LIMITING/ UNLOADING

SUCTION PRESSURE	UN-LOADING
Suction Pressure is betweenn: Cutout +2 PSIG and Suction Pressure Cutout	0 Hz
Suction Pressure Cutout- 1 PSIG	1 Hz
Suction Pressure Cutout- 2 PSIG	2 Hz
Suction Pressure Cutout- 3 PSIG	3 Hz
Suction Pressure Cutout- 4 PSIG	4 Hz
Suction Pressure Cutout- 5 PSIG	5 Hz
Suction Pressure Cutout- 6 PSIG	6 Hz
Suction Pressure Cutout- 7 PSIG	7 Hz
Suction Pressure Cutout- 8 PSIG	8 Hz
Suction Pressure Cutout- 9 PSIG	9 Hz
Suction Pressure Cutout- 10 PSIG	10 Hz

VSD Internal Ambient Temperature Load Limiting

VSD Internal Ambient temperature limiting helps prevent the unit from tripping on the high internal cabinet temperature safety. A system is permitted to load normally as long as the VSD Internal Ambient is below the VSD Internal Ambient Cutout minus 3°F. Between VSD Internal Ambient Cutout minus 3°F and the VSD Internal Ambient Cutout minus 2°F, loading is inhibited, even though increased loading is required. Between the VSD Internal Ambient Cutout minus 2°F and the VSD Internal Ambient Cutout, forced unloading is performed every 2 seconds according to the following *Table 21 on page 201*. The VSD Internal Ambient Safety Cutout is 158°F.

TABLE 21 - VSD INTERNAL AMBIENT LOAD LIMITING/UNLOADING

VSD INTERNAL AMBIENT TEMPERATURE	UN-LOADING
Internal Ambient Temp. is between Cutout- 3ºF and Internal Ambient Cutout- 2ºF	0 Hz
Internal Ambient Cutout- 1.8ºF	1 Hz
Internal Ambient Cutout- 1.6ºF	2 Hz
Internal Ambient Cutout- 1.4ºF	3 Hz
Internal Ambient Cutout- 1.2ºF	4 Hz
Internal Ambient Cutout- 0ºF	5 Hz
Internal Ambient Cutout- 0.8ºF	6 Hz
Internal Ambient Cutout- 0.6ºF	7 Hz
Internal Ambient Cutout- 0.4ºF	8 Hz
Internal Ambient Cutout- 0.2ºF	9 Hz
Internal Ambient Cutout	10 Hz

VSD Baseplate Temperature Load Limiting

VSD Baseplate load limiting helps protect the unit from tripping on the high VSD Baseplate Temp Safety. A system is permitted to load normally as long as the VSD Baseplate temperature is below the VSD Baseplate Temperature Cutout minus 8°F. Between the VSD Baseplate Temperature Cutout minus 8°F and the VSD Baseplate Temperature Cutout minus 4°F, loading is inhibited, even though increased loading is required. Between the VSD Baseplate Temperature Cutout minus 4°F and the cutout, forced unloading is performed every 2 seconds according to *Table 22 on page 201*.

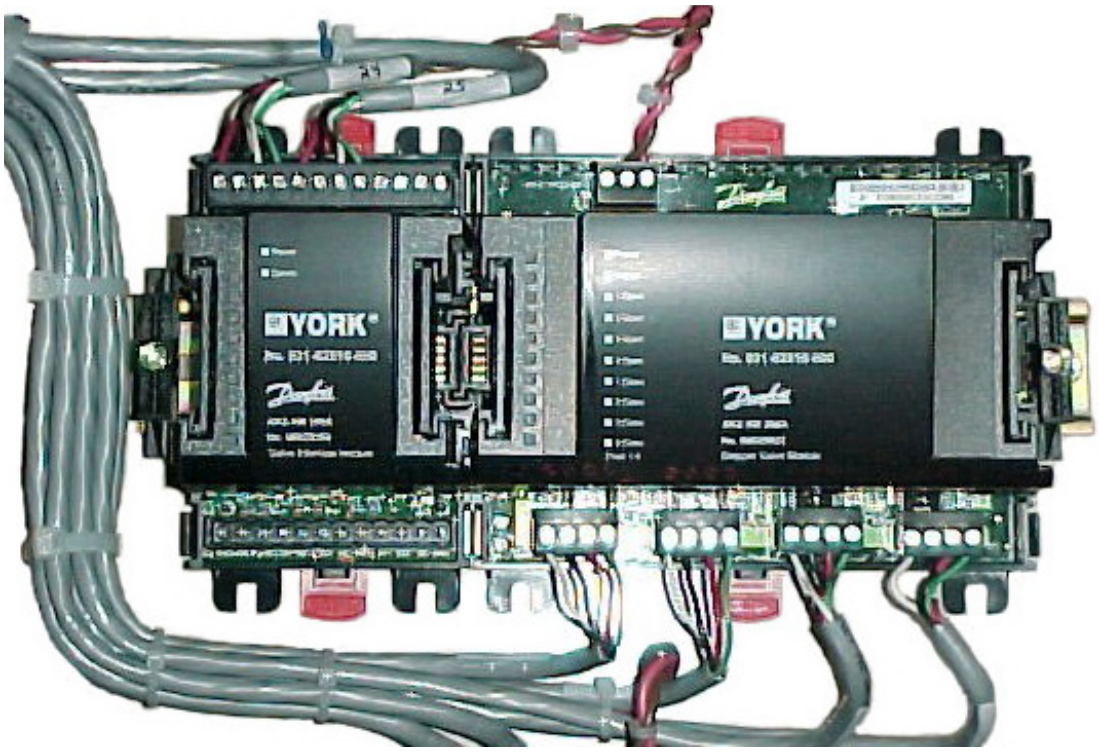
TABLE 22 - VSD BASEPLATE TEMPERATURE LOAD LIMITING/UNLOADING

VSD BASEPLATE TEMPERATURE	UN-LOADING
Baseplate Temp. is between Cutout- 8ºF and Cutout- 4ºF	0 Hz
Baseplate Temp. Cutout- 3.6ºF	1 Hz
Baseplate Temp. Cutout- 3.2ºF	2 Hz
Baseplate Temp. Cutout- 2.8ºF	3 Hz
Baseplate Temp. Cutout- 2.4ºF	4 Hz
Baseplate Temp. Cutout- 2.0ºF	5 Hz
Baseplate Temp. Cutout- 1.6ºF	6 Hz
Baseplate Temp. Cutout- 1.2ºF	7 Hz
Baseplate Temp. Cutout- 0.8ºF	8 Hz
Baseplate Temp. Cutout- 0.4ºF	9 Hz
Baseplate Temp. Cutout	10 Hz

FLASH TANK FEED VALVE (CONDENSER DRAIN VALVE) AND ECONOMIZER VALVE CONTROLLER

The Flash Tank Feed Valve (Condenser Drain Valve) and Economizer PI Controller supplies drive signals to control opening and closing of two stepper valves in each circuit. The Flash Tank Feed Valve (Condenser Drain Valve) controls condenser liquid line sub-cooling, while the Economizer Valve controls gas fed to the compressor economizer port from the liquid in the flash tank gassing off. The gassing off of the liquid in the Flash Tank also further subcools the liquid refrigerant fed through the orifice to the evaporator.

The Chiller Control Board control algorithm in the Chiller Control Board software determines the open % for the valves. A D/A converter on the Chiller Control Board converts the 0 to 110.0% signal to an output voltage between 0VDC and 10.28VDC and sends it to the Valve Controller. This voltage is then converted to a



LD10619

FIGURE 96 - FLASH TANK FEED VALVE (CONDENSER DRAIN VALVE) AND ECONOMIZER VALVE CONTROLLER

valve position by the Valve Controller and a 2 phase (4 wire), signal drives the Valve open or closed. Power for the Valve Controller comes from a 30VDC supply from the Chiller Control Board.

FLASH TANK FEED VALVE (CONDENSER DRAIN VALVE) OPERATION

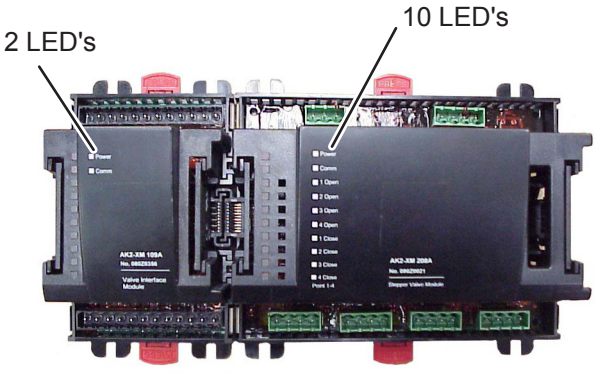
The Flash Tank Feed Valve (Condenser Drain Valve) meters refrigerant into the flash tank/receiver as needed to control liquid line sub-cooling. Sub-cooling is calculated in the control algorithm as Saturated Condenser Liquid Temperature minus Condenser Liquid Temperature. A programmable sub-cooling setpoint is available under the PROGRAM Key and allows the setpoint to be set from 0 to 20°F. Typically, the setpoint should be programmed between 5 and 7°F. The default setpoint is 5°F.

The valve position is checked every 2 seconds. The control algorithm looks at the sub-cooling setpoint and opens and closes the valve as needed based on the error between the sub-cooling setpoint and the calculated sub-cooling. The VSD frequency is also used to determine the amount of changed required.

Valve Controller LED's

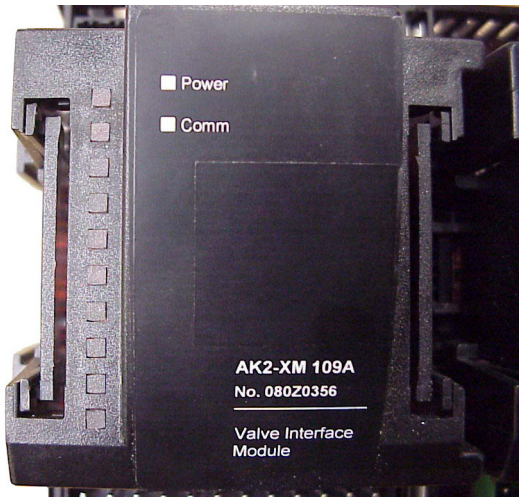
The Flash Tank Feed (Condenser Drain) and Economizer stepper valve motor controller is equipped with a pair of LED's on the left side of the module and 10 LED's in the center of the module as shown in the *Figure 96 on page 202*. These LED's may be useful during troubleshooting.

A pair of LED's on the left side of the module shown in *Figure 97 on page 202* indicate when the module is powered. The Power LED should be lit at all times.



LD10629

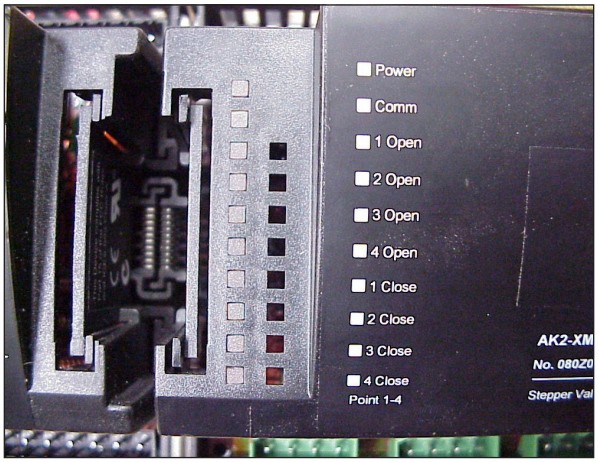
FIGURE 97 - LED LOCATIONS



LD10630

FIGURE 98 - POWER AND COMMS LED'S

A column of 10 LED's runs from top to bottom on the left side module (shown in *Figure 99 on page 203*).



LD10631

FIGURE 99 - POWER, COMMS AND SYSTEM OPEN/CLOSE LED'S

A pair of LED's on the top of the module (*Figure 99 on page 203*) indicates when the module is powered and when the module is communicating with the Chiller Control Board. The Power LED should be lit at all times.

The Open and Close LED's on each system indicate when the Feed and Economizer valves are being driven open or closed in an effort to control liquid line subcooling and economizer feed. The valve LED's will light "momentarily" when the valves are being pulsed. In most cases other than startup, they may appear to not light at all. The valves that are controlled by the outputs associated with the LED's are decoded as follows:

1. Open = System #1 Flash Tank Feed Valve (Condenser Drain Valve) Open
2. Open = System #1 Economizer Feed Valve Open
3. Open = System #2 Flash Tank Feed Valve (Condenser Drain Valve) Open
4. Open = System #2 Economizer Feed Valve Open
5. Close = System #1 Flash Tank Feed Valve (Condenser Drain Valve) Close
6. Close = System #1 Economizer Feed Valve Close
7. Close = System #2 Flash Tank Feed Valve (Condenser Drain Valve) Close
8. Close = System Economizer Feed Valve Close

Due to the short duration of the open and close stepper pulses, LED lighting will be difficult to observe. In rare cases where validation of the controller output and valve movement needs to be checked, the valves can be operated in Service Mode. When operated in Service Mode, visual indication of the LED's lighting will be more obvious. Generally, no audible noise is evident as the valves open and close, unless the valve is being run against its stop. It is possible to obtain an indication of valve movement by touch, or by viewing the sight glass on the valve to determine when a valve is opening or closing.

CAUTION

Manually operating the Flash Tank Feed Valve (Condenser Drain Valve) in the Service Mode will affect the liquid line sub-cooling when a system first starts. The Flash Tank Feed Valve may close more than normal until the Chiller Control Board brings the condenser liquid line sub-cooling under control. The Flash Tank Level Switch may also open due to a high level in the Flash Tank created by opening the valve and draining liquid refrigerant out of the condenser. This will cause the economizer valve to remain closed, but will not affect other aspects of the system operation. These conditions should only be temporary until the refrigerant is redistributed throughout the system.

Economizer Feed Valve Control

The economizer feed to the compressor is controlled by an electronic stepper valve. This valve modulates the economizer flow to the compressor as needed to improve system capacity without overheating the compressor motor.

When the compressor starts, the economizer valve is closed. The valve remains closed until the compressor speed reaches 120 Hz. Above 120 Hz, the valve is permitted to modulate open. If the valve is open and the compressor speed drops below 100 Hz, the valve is driven closed. Above 120 Hz, the valve is allowed to modulate open in 1% increments every 2 seconds unless the level in the Flash Tank opens the level switch.

There are various operating situations that cause the economizer valve to do one of the following:

- Open 1%
- Close (step closed as needed)
- Hold Position
- Close Partially
- Close Completely.

A description of each is as follows:

Open 1%

The economizer valve will open 1% every 2 seconds if all of the following conditions are met:

- The flash tank level is below the high limit.
- The compressor motor current is below the current limit setting minus 2%.
- The compressor motor temperature is below the unload temperature minus 10°F.

Close (Step closed as needed)

The economizer valve will close as needed until it reaches a point where the compressor motor current reaches the active current limit setpoint or the motor temperature reaches the unload temperature if the following conditions are met:

- The flash tank level is below the high limit.
- The compressor motor current reaches the active current limit setpoint plus 5% FLA.

OR

The compressor motor temperature reaches the unload setting plus 10°F.

The valve will then hold position and the microprocessor will continue monitoring the two control parameters (motor current and temperature).

Hold

The economizer valve position will hold position if the following conditions are met:

- The flash tank level is below the high limit.
- The compressor motor current is between the active current limit setting and the active current limit setting plus 5% FLA.

OR

The compressor motor temperature is between the compressor motor temperature unload setting and the compressor motor temperature unload setting plus 10°F.

Close Partially

If the flash tank level switch detects a high flash tank level (switch opens), the valve is driven closed at the rate of 10% every 2 seconds. Once the level drops below the high flash tank level (switch closes), the economizer valve position will stop closing and a 5 minute timer will inhibit opening the economizer valve any further.

Close Completely

If the compressor speed drops below 100 Hz, the economizer valve will be driven completely closed.

Eductor Clog Protection

To sense a loss of oil return to the compressor, an eductor clog detection safety is utilized. The safety monitors the temperature of the line between the eductor and the suction line.

The control algorithm looks at the eductor line temperature once a second. At the start, a clog timer is set at 600 seconds. If the eductor line temperature is less than the saturated suction temperature plus 10°F each time the control circuit looks at the temperature, the clog timer is reset to 600 seconds.

If the eductor line temperature is greater than the saturated suction temperature plus 10°F, the clog timer is decremented one second. If the temperature remains above the saturated suction temperature plus 10°F for 600 seconds, the clog timer will count to "0" and the system will shut down and lock out. The status fault will indicate an eductor clog fault.

EDUCTOR CLOG FAULT

Whenever this fault occurs, the eductor filter should be changed.

The clog timer resets to 600 seconds whenever the control algorithm sees the eductor line temperature is less than the saturated suction pressure plus 10°F. This prevents nuisance eductor clog faults.

Optional VI Step Solenoids (Variable Volume Index Control)

Compressors are optionally equipped with two Variable Volume Index Control (VI) solenoids to improve part and full load efficiency. These solenoids will be activated as step 1 and step 2 on each compressor.

The purpose of these solenoids is to match the gas pressure leaving the compressor, which is determined by the compression ratio to the system discharge pressure. The discharge pressure is determined by the ambient temperature and condenser size. The control algorithm will monitor the saturated discharge temperature and adjust the VI of the compressor as needed for optimum operation at all speeds of compressor operation. The normal VI for the compressor is 3.2.

The VI solenoids will be de-energized (OFF) when a compressor is OFF. The VI solenoids will not be permitted to energize at compressor startup. The VI must be initially below the calculated ON setpoint for a specific VI solenoid for 5 minutes before a solenoid is permitted to energize. Once it is energized, the solenoids are permitted to cycle ON and OFF based on the setpoint and deadband (4) as frequently as the temperature changes.

The VI Step 1 solenoid will be activated (ON/energized) when saturated discharge temperature minus the saturated suction temperature is less than a saturated discharge temperature setpoint of 71°F minus the deadband of 4°F equals 67°F. It will turn OFF (de-energize) when the saturated discharge temperature minus the saturated suction temperature is greater than the saturated discharge temperature setpoint of 71°F. The VI will be reduced to a medium VI when this solenoid is energized.

The VI Step 2 solenoid will be activated (ON/energized) when saturated discharge temperature minus the saturated suction temperature is less than a saturated discharge temperature setpoint of 71°F minus an offset of 27°F equals 44°F, minus the deadband of 4°F equals 40°F. It will turn OFF (de-energize) when the saturated discharge temperature minus the saturated suction temperature is greater than the saturated discharge temperature setpoint of 71°F minus an offset of 27°F equals 44°F. The VI will be reduced to a low VI when this solenoid is energized.

The following chart illustrates the VI operation:

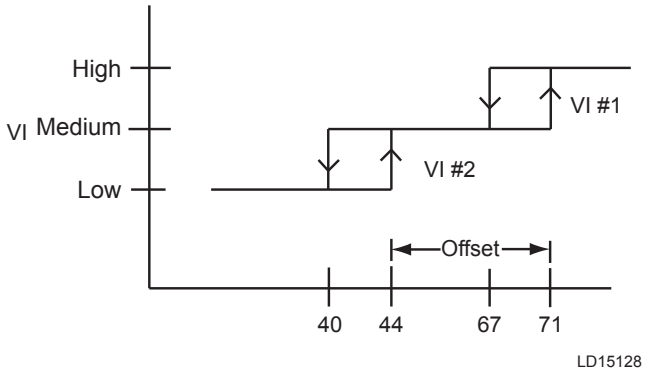


FIGURE 100 - SAT DISCHARGE TEMPERATURE - SAT SUCTION TEMPERATURE

Optimized Fan VSD Control

Optimized VSD fan control utilizes compressor speed to determine the optimum fan speed for improved efficiency and reduced noise. One VSD on each system controls all fans for the respective system. A 1 to 6VDC speed control signal is sent to the VSD for speed control.

Overrides in the control algorithm increase fan speed to control excessive discharge pressure as well as reduce fan speed to prevent low discharge pressure. These overrides attempt to maintain a minimum Discharge to Suction differential of 100 PSIG and a minimum Oil to Suction differential of 60 PSIG.

At high discharge pressures, the maximum discharge pressure limit for speed control is set well below the pressure unloading point to assure the fans reach full speed before unloading a compressor.

At low discharge pressures, to ensure adequate lubrication, a minimum pressure differential between oil pressure and suction is maintained. Low discharge pressure will also affect the flow through the liquid control valve, orifice and evaporator refrigerant nozzles. Controls assure that minimum pressure differential does not interfere with refrigerant flow.

Figure 101 on page 206 is the operating map for optimized fan speed control showing the normal operating range and the override points:

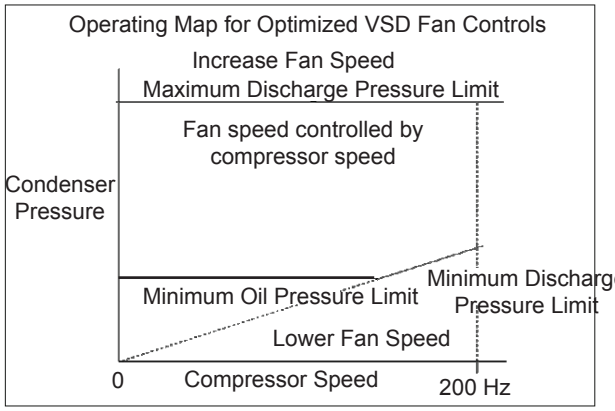


FIGURE 101 - OPTIMIZED FAN SPEED CONTROL

The fan speed % is based on the percentage of full speed 50hz or 60Hz operation and can be calculated any time the system is not in override by the fan speed equation:

$$\% \text{ Fan Speed} = (103.5 \times \text{Coil Loading Factor} + 35.5) \times \text{fan speed multiplier.}$$

A graphical representation is shown in below.

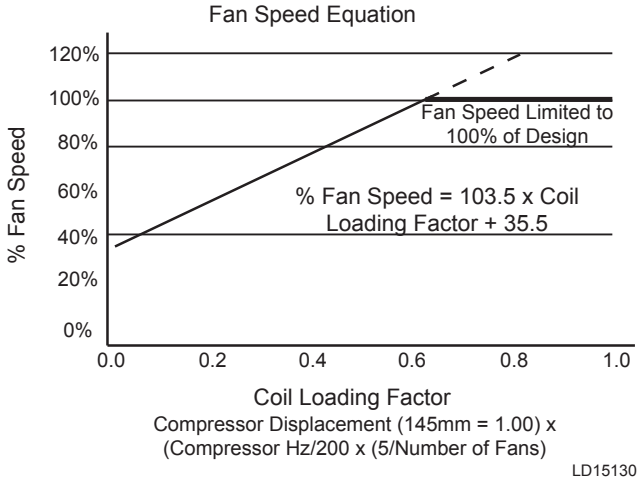


FIGURE 102 - FAN SPEED EQUATION

The speed equation is affected by the type of the fans installed (Fan Speed Multiplier), the compressor size (Compressor Relative Displacement) and the number of fans installed on each system and programmed under the Unit Setup Mode.

The speed multiplier is based on the type of fan blade and fan motor installed from the following Fan Speed Multiplier *Table 23 on page 206*. The standard 60Hz low noise 2 HP fan assembly has a multiplier of "1".

TABLE 23 - FAN SPEED MULTIPLIER

FAN APPLICATION	FAN BLADE	SPEED MULTIPLIER
60 Hz Ultra Low Noise 2hp 8-pole motor	35.2/3 3LP/34°/ PPG/6WL/ Orifice Plate	1.05
60 Hz Standard Low Noise Fan 2hp	35.2/3-3LP/26°/ PPG/6WL/ Orifice Plate	1.00
60 Hz High Ambient 3hp	35.2/5-5/28°/ PPG/6WL/ Orifice Plate	0.86
60 Hz High Static 5hp - CFM calculation w/0.4" ESP	35.2/5-5/28°/ PPG/6WL/ Orifice Plate	0.80
50 Hz Ultra Low Noise 8-pole motor	35.2/5-5LP/33°/ PPG/6WL/ Orifice Plate	1.11
50 Hz Standard Low Noise Fan 2hp	35.2/4-4LP/32°/ PPG/6WL/ Orifice Plate	1.00
50 Hz High Ambient 3hp	35.2/6-6/35°/ PPG/6WL/ Orifice Plate	0.83
50 Hz High Static 3hp - CFM calculation w/0.4" ESP	35.2/6-6/35°/ PPG/6WL/ Orifice Plate	0.82

The coil loading factor is based on the displacement of the compressor installed from the Compressor Relative Displacement *Table 24 on page 206*.

TABLE 24 - COMPRESSOR RELATIVE DISPLACEMENT

COMPRESSOR SIZE	RELATIVE DISPLACEMENT
MTS70	TBD
MTS51	TBD
MTS45	1.00
MTS36	0.82
MTS24	0.62

The number of fans per system must be programmed for the number of fans on either system. This is preprogrammed by the factory under the Unit Setup Mode.

The VSD's must be properly programmed to control fan speed using the keypad and display shown in *Figure 103 on page 207* and *Figure 104 on page 207*. The VSD's are pre-programmed at the factory. For correct programming of the VSD, see "Checking the VSD Programming" beginning on this page.

FIGURE 103 - INVERTER WITH KEYPAD AND DISPLAY INSTALLED

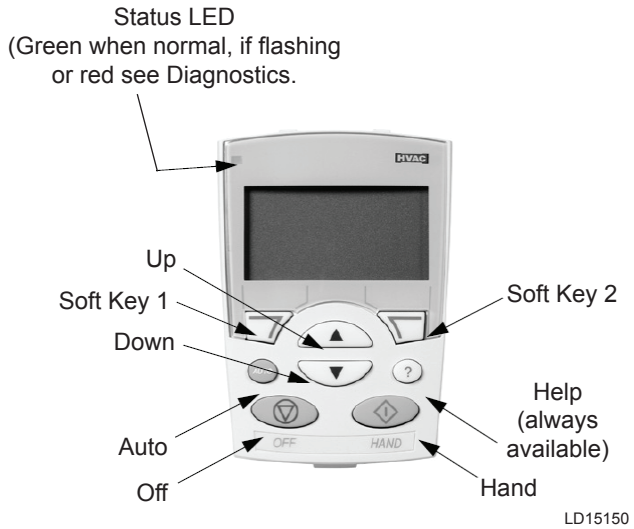


FIGURE 104 - INVERTER KEYPAD

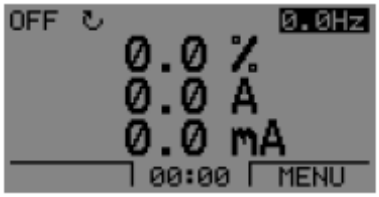
Checking the VSD Programming

It is often desirable, especially at startup commissioning, to assure the VSD on a system's fan control is programmed correctly. This should be done to assure the fans will be properly controlled to avoid nuisance faults. The following procedure should be used along with *Table 25 on page 209* and *Table 26 on page 210* to program the drives on each system as required.

NOTE

Do not change other programming parameters in the drive or set the system up with non factory approved values. This can cause system nuisance tripping or chiller damage.

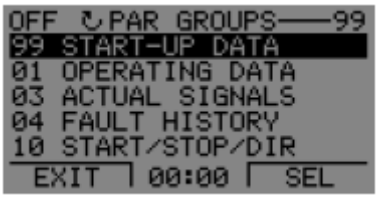
To begin checking the VSD Programming, assure the inverter is displaying the operating menu screen below. This display should be visible after power-up.



If the inverter is not displaying this menu, press the Soft Key 1 multiple times as needed to display this screen.

Press Soft Key 2 and scroll up or down as needed until the PARAMETERS text is highlighted on the menu.

Press Soft Key 2 again and the Parameter Groups are displayed on the screen as indicated below:



Note the numbers that appear on the left side of the screen (99, 01, 03, 04 and 10). These numbers correspond to programming parameters that need to be verified.

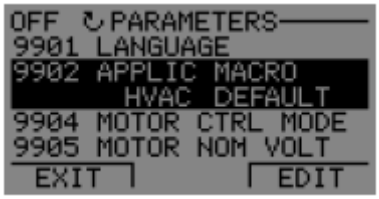
In the example above, the “99” highlighted corresponds to the group of parameters numbers 9901 to 9909 that will need to be checked. The “10” displayed at the bottom of the list will be the menu group where 1003 will reside, which is another parameter that will need to be checked.

Each of the following parameter groups will need to be scrolled to with the UP or Down arrow keys.

99, 10, 11, 13, 20, 22, 26, 31, and 34.

Pressing either the UP or DOWN arrow keys a single time advances the highlighted parameter group on the screen one parameter group at a time, up or down as needed. If faster scrolling is required, the UP or DOWN arrow key can be depressed and held to speed up the scrolling.

Once the desired parameter group is highlighted, use Soft Key 2 to select a parameter group such as “99”. The following display will appear:



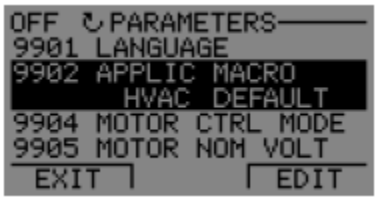
Using the UP or DOWN arrow keys, scroll to the desired parameter, such as 9902. As an example, pressing Soft Key 2 would display a programmed selection such as the one below:

Coincidentally, HVAC is the desired selection that we want for the YVAA chiller. Were it not the correct selection, the following procedure would be used to change the selection:

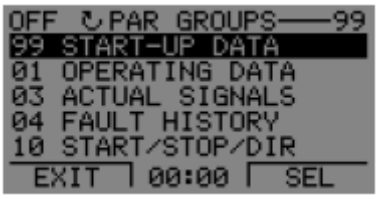
1. Press the UP or DOWN arrow key to scroll through the available selections.
2. Once the desired program selection is displayed, press Soft Key 2 to save it.
3. Once a selection is made and Soft Key 2 is pressed, the display will return to the original parameter selected as shown below.

Use this procedure to change any parameter that is required.

Since the previous selection is correct for the application, simply press Soft Key 2 to return to the original parameter list as shown below:



Other parameters in the immediate group that need to be checked or programmed can be selected by scrolling up or down with the UP and DOWN arrow keys. To go to the next parameter group, press Soft Key 1 and the display will return to the listing of parameter groups as shown next:



Using *Table 25 on page 209*, select each required parameter group as indicated in the table and assure each designated parameter within the group is properly programmed. Values will change depending upon the model, so follow the directions in the table notes to program highlighted values in the table that will vary from chiller to chiller. When the last parameter is programmed, press Soft Key 1 three times to return to the display below:

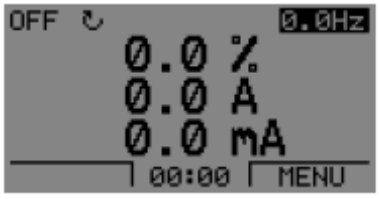


TABLE 25 - PROGRAMMED VALUES

PARAMETER GROUP	PARAMETER #	PARAMETER DESCRIPTION	SYSTEM #1 SELECTION	SYSTEM #2 SELECTION
99	9901	LANGUAGE	ENGLISH	ENGLISH
99	9902	APPLOC MACRO	HVAC DEFAULT	HVAC DEFAULT
99	9904	MOTOR CTRL MODE	SCALAR:FREQ	SCALAR:FREQ
99	9905	MOTOR NOM VOLT	XXX V (See Note 1)	XXX V (See Note1)
99	9906	MOTOR NOM CURR	XX.X A (See Note 2)	XX.X A (See Note 2)
99	9907	MOTOR NOM FREQ	XX Hz (See Note 3)	XX Hz (See Note 3)
99	9908	MOTOR NOM SPEED	XXX rpm (See Note 4)	XXX rpm (See Note 4)
99	9909	MOTOR NOM POWER	XX hp (See Note 2)	XX hp (See Note 2)
10	1003	DIRECTION	FORWARD	FORWARD
11	1101	KEYPAD REF SEL	REF 1 (Hz/rpm)	REF 1 (Hz/rpm)
11	1103	REF 1 SELECT	AI 1	AI 1
11	1104	REF 1 MIN	0.0 Hz	0.0 Hz
11	1105	REF1 MAX	XX.X Hz (See Note 3)	XX.X Hz (See Note 3)
13	1301	MMINIMUM AI1	10.0 %	10.0 %
13	1302	MAXIMUM AI1	60.0%	60.0 %
20	2003	MAX CURRENT	XX.X A (See Note 2)	XX.X A (See Note 2)
20	2006	UNDERVOLT CONTROL	DISABLE	DISABLE
20	2007	MINIMUM FREQUENCY	0.0 Hz	0.0 Hz
20	2008	MAXIMUM FREQUENCY	XX.X Hz (See Note 3)	XX.X Hz (See Note 3)
22	2202	ACCELER TIME	30.0 s	30.0 s
22	2203	DECELER TIME	30.0 s	30.0 s
26	2603	IR COMP VOLT	0.0 V	0.0 V
26	2604	IR COMP FREQ	10%	10%
26	2605	U/F RATIO	SQUARED	SQUARED
26	2606	SWITCHING FREQUENCY	4 kHz	4 kHz
31	3103	DELAY TIME	10 s	10 s
31	3106	AR UNDRVOLTAGE	ENABLE	ENABLE

TABLE 25 - PROGRAMMED VALUES (CONT'D)

PARAMETER GROUP	PARAMETER #	PARAMETER DESCRIPTION	SYSTEM #1 SELECTION	SYSTEM #2 SELECTION
34	3401	SIGNAL 1 PARAM	OUTPUT FREQ	OUTPUT FREQ
34	3402	SIGNAL 1 MIN	0.0 Hz	0.0 Hz
34	3403	SIGNAL 1 MAX	XX Hz (See Note 3)	XX Hz(See Note 3)
34	3404	OUTPUT 1 DSP FORM	9	9
34	3405	OUTPUT 1 UNIT	Hz	Hz
34	3408	SIGNAL 2 PARAM	CURRENT	CURRENT
34	3409	SIGNAL 2 MIN	0.0 A	0.0 A
34	3410	SIGNAL 2 MAX	35.0 A	35.0 A
34	3411	OUTPUT 2 DSP FORM	9	9
34	3412	OUTPUT 2 UNIT	A	A
34	3415	SIGNAL 3 PARAM	OUTPUT VOLT	OUTPUT VOLT
34	3416	SIGNAL 3 MIN	0 V	0 V
34	3417	SIGNAL 3MAX	600 V	600 V
34	3418	OUTPUT DSP FORM	9	9
34	3419	OUTPUT DSP UNIT	V	V

Note 1: Program using chiller voltage code, designated by the data plate Pin numbers 12 and 13 in the model number:
- -17, -28, -46 = 460V
- -40 = 380V
- -50 = 400V

Note 2: Use Table 22 for the appropriate value based on the number of fans in the system.

Note 3: Program using chiller voltage code, designated by the data plate Pin numbers 12 and 13 in the model number:
- -17, -28, -40 and -46 = 60 Hz
- -50 = 50 Hz

Note 4: Program based on the type of fan installed, designated by the data plate Pin number 52 in the model number and Pin numbers 12 and 13:
- Low Sound Fans: -17, -28, -40 and -46 = 1150 RPM
  -50 = 950 RPM
- Ultra Quiet Fans: -17, -28, -40 and -46 = 850 RPM
  -50 = 690 RPM

TABLE 26 - 9906, 9909 AND 2003 PARAMETER PROGRAMMING

PARAMETER #	NUMBER OF FANS PER REFRIGERANT SYSTEM										
	4	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
9906	14.4 A	18 A	21.6 A	25.2 A	28.8 A	32.4 A	36 A	39.6 A	43.2 A	46.8 A	50.4 A
9909	8.0 HP	10.0 HP	12.0 HP	14.0 HP	16.0 HP	18.0 HP	20.0 HP	22.0 HP	24.0 HP	26.0 HP	28.0 HP
2003	15.8 A	19.8 A	23.8 A	27.7 A	31.7 A	35.6 A	39.6 A	43.6 A	47.5 A	51.5 A	55.4 A

TABLE 27 - FAN STAGING

FAN STEP	NUMBER OF FANS											FAN OUTPUT ENERGIZED
	4	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	
1	0 fans on	0	0	0	0	0	0	0	0	0	0	0
2	1 fan on	1	1	2	2	2	2	2	3	3	3	1
3	2 fans on	2	3	3	4	4	5	5	6	6	7	1 and 2
4	3 fans on	3	4	5	6	6	7	8	9	9	10	1,2 and 3
5	4 fans on	5	6	7	8	9	10	11	12	13	14	1,2,3 and 4

Optimized IPLV Contactor Fan Control By Discharge Pressure

Contactor fan cycling by discharge pressure allows for 5 stages of fan cycling designed to control discharge pressure at a minimum value for higher efficiency. In some cases, fans will be shared on a coil "V" bank where one coil is dedicated to each system. Fan staging will always utilize a 5 second delay between stages regardless of whether a stage is energized or de-energized.

Figure 97 on page 202 illustrates the fan cycling points based on ambient temperature and discharge pressure. The ON pressure will vary according to the ambient temperature and ranges from 135 to 150 PSIG. Whenever a fan stage cycles ON, the ON pressure is ramped from 20 PSIG over the original value, down to the original value over the next 20 seconds.

The fan OFF pressure will always be set at 85 PSIG. Whenever a fan stage cycles OFF, the ON pressure is ramped from 20 PSIG below the original value, up to the original value over the next 20 seconds.

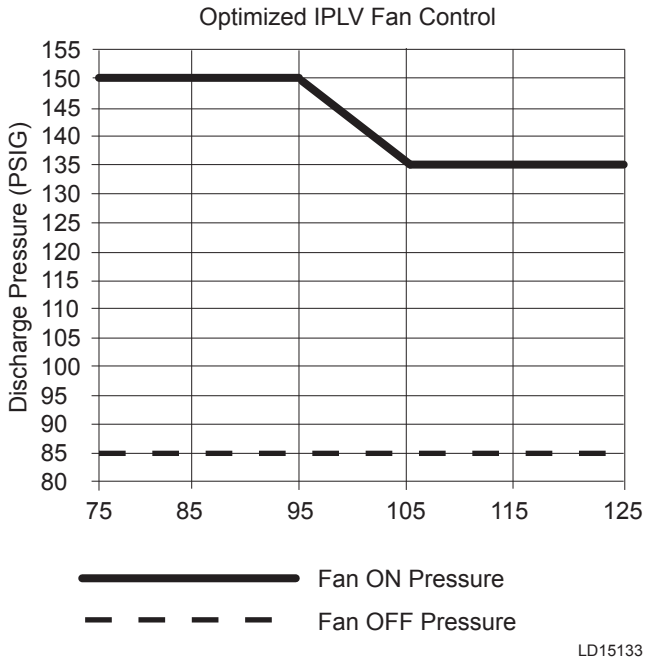


FIGURE 105 - OPTIMIZED IPLV FAN CONTROL PRESSURE

The fan staging will always step through the 5 stages of cycling of steps 0 thru 4. The number of fans energized will be determined by the number of fans on a system and the wiring of the fans (See *Table 27 on page 210*).

High VSD Cabinet Ambient Temperature Fan Operation

All condenser fans on all systems will run when the chiller is OFF and enabled to run, if the VSD internal ambient temperature is higher than 5°F below the VSD Cabinet Ambient Temperature Cutout of 158°F (158°F minus 5°F equals 153 °F). When the fans turn on in this situation, the fan outputs will cycle one at a time with a 100 ms delay between fan starts. When the VSD internal ambient falls below the "Restart Temperature" (158°F Cutout minus 10°F equals 148 °F), the fans will all be turned OFF without a delay. The glycol pump and VSD cabinet cooling fans will always run during high cabinet ambient conditions.

VSD TEMPERATURE CONTROL, OPERATION OF THE COOLANT PUMP, AND VSD CABINET COOLING FANS

The Coolant pump and VSD Cabinet Cooling Fans will run to cool the VSD whenever any of the following conditions are met:

- VSD Comp IGBT Baseplate Temperature on a 2 compressor unit is greater than 10°F (5.6°C) below the cutout (Cutout 218°F [103.3°C] minus 10°F [5.6°C] equals 208°F [97.8°C]). When the VSD internal ambient falls below the restart temperature (Cutout 218°F [103.3°C] minus 15°F [8.3°C] equals 203°F [95°C]), the fans and pump will turned OFF without a time delay.
- Pre-charge Enable 1 from the Chiller Logic Board is ON.
- Pre-charge Enable 2 from the Chiller Logic Board is ON.
- VSD Internal Ambient Temp more than 158°F (70.0°C) (Cutout) minus 10°F (5.6°C) equals 148°F (64.4°C). When the Internal Ambient Temp falls to less than 158°F (70.0°C) (Cutout) minus 15°F (8.3°C) equals 143°F (61.7°C) the VSD cooling fans and glycol pump will turn OFF.
- Condenser Fans (as needed) and VSD coolant pump/fans will run whenever a compressor is running. Under these conditions, the condenser fans will run to control discharge pressure and the VSD coolant pump/fans will run to cool the IGBT baseplate and internal cabinet. Additional condenser fans will be brought ON, if the IGBT

baseplate temperatures or internal cabinet ambient rises to 5°F (2.8°C) below the cutout. Condenser fans will turn OFF, if the compressor turns OFF provided VSD cooling is not required. The glycol pump and cabinet fan may continue to run, if VSD cooling is required.

- Glycol Pump and Cabinet Cooling Fans will also run in the Service Mode if the Fan/Pump Run Bit is Set.

REMOTE TEMPERATURE RESET CONTROL

Temperature Reset Control

Temperature Reset Control is used to reset the actual LCHLT (Leaving Chilled Liquid Temperature) setpoint used in capacity control. There are several ways to change the LCHLT setpoint. The first is by re-programming the Local Cooling Setpoint under the SETPOINTS key. This is the value the unit will control the LCHLT to if neither of the other methods is active.

Remote Temperature Limit Reset is only possible if the option is enabled by both the OPTIONS key selection and in the factory programmable password protected Unit Setup Mode.

Remote BAS Setpoint Control

The Remote Leaving Chilled Liquid Setpoint Cooling Setpoint can be set via the BAS comms. The control panel will only accept a remote setpoint from the BAS if the control panel is in Remote Control Mode (under the OPTIONS key). If the control panel is in Local Control Mode, the BAS setpoint will be ignored and the Remote Cooling Setpoint is set to the Local Cooling Setpoint. The minimum and maximum allowable reset values will be the same as the minimum and maximum allowable programmable values for the Local Cooling Setpoint. If these values are exceeded by the BAS, the minimum or maximum value will be used.

Contact a local Johnson Controls Representative for details on BAS controls and capabilities.

Remote Temperature Reset

The Remote Leaving Chilled Liquid Cooling Setpoint can be reset via the Remote Temperature Reset analog input. A zero signal input (0% input) equates to a 0°F offset to the Local Cooling Setpoint. A full scale signal input (100% input) equates to a "positive" offset to the Local Cooling setpoint equal to the programmable Maximum Remote Temp Reset. The offset is linear and may be adjusted anywhere between the 0% and 100% points. The maximum setpoint allowed is the maximum programmable Local Cooling Setpoint and will be capped at this value, if the calculated setpoint with temperature offset exceeds this value.

This input may be used either in Local or Remote Control Mode. This feature will only operate if enabled under the UNIT SETUP and the OPTIONS key. The input will be ignored if the Remote Temp Reset is disabled under the OPTIONS key or if there are valid BAS comms while in Remote Control Mode. Once a change to the input is registered, a timer is set to the value of the Remote Inputs Service Time as programmable under the Unit Setup Mode at the factory for the default value of 15 minutes. The low limit is 5 minutes and the high limit is 60 minutes. The Remote input will be ignored until this timer expires. The timer assures that rapid changes in a remote reset signal don't result in poor temperature control or excessive compressor cycling. In most instances, this timer will not need to be changed, since reset more often than 15 minutes will create problems with chilled liquid temperature control. Factory Service should be contacted if a timer change is required.

Control Board jumper JP4 must be positioned correctly to receive either a voltage (0 through 10VDC or 2 through 10VDC) or current (0 through 20mA or 4 through 20mA) signal. Place the jumper in the "V" position for a voltage signal or mA for a current signal (See *Figure 75 on page 159*). The software must be configured under the OPTIONS key for the specific type of input signal to be used.

The maximum temperature reset is achieved at either 10VDC or 20mA. Sending the minimum signal (0VDC, 2VDC, 0mA, or 4mA based on the OPTIONS key setting) causes the setpoint to revert back to its local programmed value. If the setpoint reset causes the setpoint to go over the maximum programmable value, it will be set to the maximum programmable setpoint.

0 through 10VDC Reset Input

A 0VDC signal produces a 0°F reset. A 10VDC signal produces the maximum remote temp reset (programmable under the SETPOINTS key). The setpoint reset is ramped linearly between these limits as the input varies between 0VDC and 10VDC. In order for this input to work properly, the Remote Temperature Reset must be programmed for 0 through 10VDC input (OPTIONS key) and Chiller Control Board jumper JP4 placed in the "V" position.

2 through 10VDC Reset Input

A 0 - 2VDC signal produces a 0°F reset. A 10VDC signal produces the maximum remote temp reset (programmable under the SETPOINTS key). The setpoint reset is ramped linearly between these limits as the input varies between 2VDC and 10VDC. In order for this input to work properly, the Remote Temperature Reset must be programmed for 2 through 10VDC input (OPTIONS key) and Chiller Control Board jumper JP4 placed in the "V" position.

0 through 20mA Reset Input

A 0mA signal produces a 0°F reset. A 20mA signal produces the maximum remote temp reset (programmable under the SETPOINTS key). The setpoint reset is ramped linearly between these limits as the input varies between 0mA and 20mA. In order for this input to work properly, the Remote Temperature Reset must be programmed for 0 through 20mA input (OPTIONS key) and Chiller Control Board jumper JP4 placed in the "mA" position.

4 through 20mA Reset Input

A 0 - 4mA signal produces a 0°F reset. A 20mA signal produces the maximum remote temp reset (programmable under the SETPOINTS key). The setpoint reset is ramped linearly between these limits as the input varies between 4mA and 20mA. In order for this input to work properly, the Remote Temperature Reset must be programmed for 4 through 20mA input (OPTIONS key) and Chiller Control Board jumper JP4 placed in the "mA" position.

Local Current Limit Control

Local Current Limit Control is used to set the actual Current Limit Setpoint and is done by changing the Local Current Limit Setpoint under the PROGRAM key. This is the value at which the unit will begin to current limit and override capacity control if remote reset is not actively overriding this control. If any other current limit methods are active, the lowest value is used.

Keep in mind that limiting current may interfere with capacity control, pulling down chilled liquid temperatures on hot water starts, and maintaining chilled liquid setpoints.

Pulldown Current Limit Setpoint

The Pulldown Current Limit Setpoint can be set under the PROGRAM key. This current limit setpoint is only active on startup for the time defined by the Pulldown Current Limit Time under the PROGRAM key. After the run time has exceeded this time, the Pulldown Current Limit Setpoint is ignored.

This control is useful in limiting current pulldown demand during peak usage periods where electric costs are highest.

Keep in mind that limiting current may interfere with capacity control, pulling down chilled liquid temperatures on hot water starts, and maintaining chilled liquid setpoints.

REMOTE CURRENT LIMIT RESET CONTROL

Remote Current Limit Reset is used to reset the actual current limit setpoint used in current limit control. There are several ways to change the current limit setpoint. The first is by reprogramming the Local Current Limit Setpoint under the PROGRAM key. This is the value the unit will control the current limit to if neither of the other methods is active.

This current limit control does not limit based on input current to the VSD. It limits on actual outlet motor current. Current limit control does linearly control input current to the chiller or speed of the compressors. For linear speed control limiting and reasonably linear input current control use Sound Limiting.

Remote Current Limit Reset is only possible if the option is enabled by both the OPTIONS key selection and in the factory programmable password protected Unit Setup Mode.

Remote ISN Current Limit Setpoint

The BAS Current Limit Setpoint is set via BAS communications. The control panel will only accept a Current Limit Setpoint from the BAS if the control panel is in Remote Control Mode (under the OPTIONS key). If the control panel is in Local Control Mode, the BAS setpoint will be ignored. The minimum and maximum allowable values will be the same as the minimum and maximum allowable reset values for the Current Limit Setpoint under the PROGRAM key. If these values are exceeded, the minimum or maximum value will be used.

Contact a local Johnson Controls Representative for details on BAS controls and capabilities.

Remote Current Limit Reset

The Current Limit Setpoint can be set or reset via the Remote Current Limit analog input. A zero signal input (0% input) equates to the maximum current limit setpoint as defined under the PROGRAM key Current

Limit Setpoint. A full scale signal input (100% input) equates to the minimum current limit setpoint as defined under the PROGRAM key Current Limit Setpoint. The current limit value may be adjusted anywhere between the maximum and minimum points of 0 (no offset) and 100% (max. current limiting).

This input may be used either in Local or Remote Control Mode. This input will be ignored if the Remote Current Limit is disabled under the OPTIONS key. Once a change to the input is registered, a timer is set to the value of the Remote Inputs Service Time as programmable under the Unit Setup Mode at the factory for the default value of 15 minutes. The low limit is 5 minutes and the high limit is 60 minutes. The Remote input will be ignored until this timer expires. The timer assures that rapid changes in a remote reset signal don't result in poor temperature control or excessive compressor cycling. In most instances, this timer will not need to be changed, since reset more often than 15 minutes will create problems with chilled liquid temperature control. Factory Service should be contacted if a timer change is required.

Control board jumper JP5 must be positioned correctly to receive either a voltage (0 to 10VDC or 2 to 10VDC) or current (0 to 20mA or 4 to 20mA) signal. Place the jumper in the "V" position for a voltage signal or mA for a current signal (See *Figure 75 on page 159*). The software must be configured under the OPTIONS key for the type of input signal to be used.

The minimum current limit setpoint is achieved at either 10VDC or 20mA. Sending the minimum signal (0VDC, 2VDC, 0mA, or 4mA based on the OPTIONS key setting) causes the current limit to revert back to its maximum value.

0 through Reset Input

A 0VDC signal sets the current limit to the maximum value. A 10VDC signal sets the current limit to the minimum value. The current limit is ramped linearly between these limits as the input varies between 0VDC and 10VDC. In order for this input to work properly, the Remote Current Limit must be programmed for 0 through 10VDC input (OPTIONS key) and Chiller Control Board jumper JP5 placed in the "V" position.

2 through 10VDC Reset Input

A 0 - 2VDC signal sets the current limit to the maximum value. A 10VDC signal sets the current limit to the minimum value. The current limit is ramped linearly between these limits as the input varies between 2VDC and 10VDC. In order for this input to work properly, the Remote Current Limit must be programmed for 2 through 10VDC input (OPTIONS key) and Chiller Control Board jumper JP5 placed in the "V" position.

0 through 20mA Reset Input

A 0mA signal sets the current limit to the maximum value. A 20mA signal sets the current limit to the minimum value. The current limit is ramped linearly between these limits as the input varies between 0mA and 20mA. In order for this input to work properly, the Remote Current Limit must be programmed for 0 through 20mA input (OPTIONS key) and Chiller Control Board jumper JP5 placed in the "mA" position.

4 through 20mA Reset Input

A 4mA signal sets the current limit to the maximum value. A 20mA signal sets the current limit to the minimum value. The current limit is ramped linearly between these limits as the input varies between 4mA and 20mA. In order for this input to work properly, the Remote Current Limit must be programmed for 4 through 20mA input (OPTIONS key) and Chiller Control Board jumper JP5 placed in the "mA" position.

SOUND LIMIT CONTROL

(Local and Remote Reset Control)

Sound Limiting and Local Sound Limit Setpoint

Sound limit control to reduce overall chiller noise levels at specified times of the day is accomplished by setting a Sound Limit Setpoint. Sound reduction is accomplished by limiting the maximum speed of compressors. This is also useful for limiting the maximum chiller input current when power limitations are required or a generator is used as the power source. There are several ways to set the Sound Limit Setpoint. The first is by changing the Local Sound Limit Setpoint under the PROGRAM key. This is the value the unit will use for sound limiting, if neither of the other methods is active. If any other sound limit methods are active, the lowest value will be used. A sound limit of 0% will allow the unit to run up to the unit's maximum frequency. A sound limit of 100% will not allow the unit to run above the minimum frequency. All other sound limit values are linear between these 2 points.

A sound limit schedule must be programmed under the SCHEDULE key when sound limiting is utilized. The schedule defines the time period that sound limiting will be active.

Sound Limiting is only possible if the option is enabled by both the OPTIONS key selection and the factory programmable password protected Unit Setup Mode.

If Sound Limiting is disabled under the Unit Setup Mode, nothing relating to Sound Limiting will show up on any display screen or printout.

BAS Sound Limit Setpoint

The BAS Sound Limit Setpoint can be set via the BAS II comms. The control panel will only accept a Sound Limit Setpoint from the BAS if the control panel is in Remote Control Mode. If the control panel is in Local Control Mode, the BAS setpoint will be ignored. The minimum and maximum allowable values will be the same as the minimum and maximum allowable values for the Sound Limit Setpoint under the PROGRAM key. If these values are exceeded, the minimum or maximum value will be used.

Contact a local Johnson Controls Representative for details on BAS controls and capabilities.

Remote Sound Limit

The Sound Limit Setpoint can be set via the Remote Sound Limit analog input. A zero signal input (0% input) equates to the minimum sound limit setpoint as defined under the PROGRAM key Sound Limit Setpoint. A full scale signal input (100% input) equates to the maximum sound limit setpoint as defined under the PROGRAM key Sound Limit Setpoint. The input is linear and may be adjusted between 0% (minimum sound limiting) and 100% (maximum sound limiting) points.

This input may be used either in Local or Remote Control Mode. The input will be ignored if the Remote Sound Limit is disabled under the OPTIONS key. Once a change to the input is registered, a timer is set to the value of the Remote Inputs Service Time as programmable under the Unit Setup Mode at the factory for the default value of 15 minutes. The low limit is 5 minutes and the high limit is 60 minutes. The Remote input will be ignored until this timer expires. The timer assures that rapid changes in a remote reset signal don't result in poor temperature control and excessive compressor cycling. In most instances, this timer will not need to be changed, since reset more often than 15 minutes will create problems with chilled liquid temperature control. Factory Service should be contacted if a timer change is required.

Control board jumper JP6 must be positioned correctly to receive either a voltage (0 to 10VDC or 2 to 10VDC) or current (0 to 20mA or 4 to 20mA) signal. Place the jumper in the "V" position for a voltage signal or mA for a current signal *(*See *Figure 75 on page 159)*. The software must be configured under the OPTIONS key for the type of input signal to be used.

The maximum sound limit is achieved at either 10VDC or 20mA. Sending the minimum signal (0VDC, 2VDC, 0mA, or 4mA based on the OPTIONS key setting) causes the sound limit to be set to its minimum (no limiting) value.

0 through 10VDC Reset Input

A 0VDC signal produces a 0% sound limit (no change to max VSD freq). A 10VDC signal produces a 100% sound limit (max VSD freq equals min VSD freq). The sound limit is ramped linearly between these limits as the input varies between 0VDC and 10VDC. In order for this input to work properly, the Remote Sound Limit must be programmed for 0 through 10VDC input (OPTIONS key) and Chiller Control Board jumper JP6 placed in the "V" position.

2 through 10VDC Reset Input

A 0 through 2VDC signal produces a 0% sound limit (no change to max VSD freq). A 10VDC signal produces a 100% sound limit (max VSD freq equals min VSD freq). The sound limit reset is ramped linearly between these limits as the input varies between 2VDC and 10VDC. In order for this input to work properly, the Remote Sound Limit must be programmed for 2 through 10VDC input (OPTIONS key) and Chiller Control Board jumper JP6 placed in the "V" position.

0 through 20mA Reset Input

A 0mA signal produces a 0% sound limit (no change to max VSD freq). A 20mA signal produces a 100% sound limit (max VSD freq equals min VSD freq). The sound limit reset is ramped linearly between these limits as the input varies between 0mA and 20mA. In order for this input to work properly, the Remote Sound Limit must be programmed for 0 through 20mA input (OPTIONS key) and Chiller Control Board jumper JP6 placed in the "mA" position.

4 through 20mA Reset Input

A 0 through 4mA signal produces a 0% sound limit (no change to max VSD freq). A 20mA signal produces a 100% sound limit (max VSD freq equals min VSD freq). The sound limit reset is ramped linearly between these limits as the input varies between 4mA and 20mA. In order for this input to work properly, the Remote Sound Limit must be programmed for 4 through 20mA input (OPTIONS key) and Chiller Control Board jumper JP6 placed in the “mA” position.

SECTION 8 - MICROPANEL

VSD OPERATION AND CONTROLS

VSD Logic Board

The VSD Logic Board communicates with the Chiller Control Board via comms and controls the VSD functions. It converts the frequency and run commands from the Chiller Control Board into the necessary voltage and frequency commands to operate the inverter section. It also controls the converter section of the drive (AC Line to DC Bus conversion) by controlling the pre-charge function.

The VSD Logic Board contains a 2nd microprocessor (motor controller) that generates the PWM signals that control the IGBT outputs in the inverter section of the VSD.

An FPGA handles the hardware safeties that can shut down the VSD much faster than the software safeties. The VSD Logic Board handles all of the VSD related safeties, which includes motor current, BUS voltage, and other safeties.

The VSD Logic Board reports shutdown information back to the Chiller Control Board via the RS-485 communication link.

VSD Start/run Initiation

Following a successful pre-charge of the DC Bus and a run command from the Chiller Control Board, the VSD Logic Board microprocessor will determine the motor output voltage (% modulation) and the output frequency required based on the operating frequency command from the Chiller Control Board. This information will then be sent to the PWM generator located on the VSD Logic Board.

On startup, the output frequency from the VSD to the motor(s) will be increased from 0 Hz to the operating frequency commanded by the Chiller Control Board. The rate of change of the frequency will also be controlled by the VSD Logic Board.

The rate of change of the output frequency at startup, during acceleration is 10 Hz/sec between 0 and 50 Hz and 30.4 Hz/sec above 50 hertz. The maximum rate of change of the output frequency during deceleration between 200 and 100 Hz is 30.4 Hz/sec, and 100 and 0 Hz is 10 Hz/sec.

The VSD Logic Board and its PWM generator will receive operating frequency and voltage commands from the Chiller Control Board based on the load.

When a frequency (speed) change is requested from the Chiller Control Board, the chiller microprocessor will send the change to the VSD Logic Board and the VSD Logic Board will acknowledge it accepted the change. Loading and unloading will take place at the rate of 0.1 to 1Hz every 2 seconds.

PWM Generator Type and Carrier Frequency

The PWM generator is responsible for providing asymmetrical uniform sampled PWM waveforms to the compressor motor at a carrier frequency of 3125 Hz by turning ON an OFF the inverter IGBT's. The waveform generated is equivalent to a specific V/F ratio at a given speed based on the voltage and frequency commands from the Chiller Control Board. The PWM Generator receives operating frequency and voltage commands from the VSD Logic Board control processor.

Short Circuit Protection Minimum Output Pulse Width and Interlock Delay

The PWM generator is programmed to drop all "ON" pulses in less than 10 microseconds (and all matching "OFF" pulses in the mirrored waveform) to permit time for the IGBT gate drivers to detect and self extinguish an inverter short circuit condition.

Modulating Frequency

The modulating frequency range will range from 0 to 200 Hz. The modulating frequency waveform consists of a sinusoidal waveform summed together with 16.66% of the third harmonic component of the sinusoidal waveform. Utilization of this waveform as the modulating waveform will permit the drive to generate a fundamental line to line voltage equal to the DC Bus voltage divided by 1.414.

Maximum VSD Frequency

The maximum VSD frequency will vary for each chiller model. The microprocessor board determines the frequency according to jumpers' factory installed in the wiring on the J7 plug of the microprocessor board. The location of these jumpers' is interpreted as a binary value, which presently allows 7 speed selections plus a default. The maximum frequency may vary from 178

to 200 Hz. If the J7 plug is not installed, the speed will default to 178 Hz. Details on the location of the jumpers' and the associated maximum speed are provided in the *Chiller Configuration Jumpers on page 181*.

VSD % Modulation

The voltage and frequency commands issued by the VSD Logic Board microprocessor are determined by the frequency command from the Chiller Control Board. The VSD output is a PWM signal (FIG. 2), which has effects on the motor comparable to an AC voltage sinusoidal waveform. To change the speed of an AC motor, the frequency of the AC voltage must be changed. Whenever frequency is changed, the voltage is changed in a linear ratio. Maintaining a relatively constant V/F ratio as speed changes assures motor losses and overheating do not occur.

The output voltage of the VSD is not a sinusoidal waveform. Instead, the PWM generator provides an output that simulates a true AC waveform by repetitively turning ON and OFF the voltage to the motor to create an average voltage that is equal to a lower AC voltage at lower frequencies and a higher voltage at higher frequencies. The PWM generator also changes the % modulation of the waveform to simulate the frequency change to maintain the V/F ratio with motor speed changes.

The PMW generator is programmed to essentially operate a linear volts/Hz ratio over the 0 to 200 Hz frequency range. The complex control algorithm modifies the voltage command to boost the voltage of the V/F ratio at lower speeds to provide additional torque.

The 100% modulation operating point occurs at a fundamental frequency of 189.6 Hz. As the output frequency increases above 189.6 Hz, the drive operates in an over-modulated mode. For example, at 200 Hz fundamental modulating frequency the PWM waveform is over-modulated by approximately 18%. This will yield a fundamental output line to line voltage applied to the motor terminals at maximum output frequency that is equal to the input line to line voltage applied to the drive (provided the DC Bus current remains continuous).

VSD Cooling and Cooling Loop

The VSD generates heat in the IGBT power modules and the SCR/Diode assemblies, which must be removed. The heat not only heats the modules but also the Micro/VSD cabinet.

The VSD is cooled by a glycol loop and circulating pump. The glycol cooling loop feeds a liquid cooled heatsink called a chillplate that cools the IGBT's and SCR/Diode modules. The coolant is pumped by a circulator pump through the heatsink where it absorbs heat in several passes of tubes on the lower rows of the inside condenser coils where the condenser fans remove the heat picked up from the modules. The coolant is then pumped back to the modules. The glycol loop also provides cooling for the Micro/VSD cabinet. The baseplates of the power components are mounted to the glycol cooled heatsinks in the cooling loop. The cooling loop also circulates the glycol through a cooling coil in the cabinet. A fan blows air from the cabinet across the cooling coil to cool the electronics in the cabinet.

Never run the glycol pump without coolant! Running the glycol pump without coolant may damage the pump seals.

Always fill the system with approved coolant to avoid damage to the pump seals and other components.

Heat transfer characteristics of the coolant are very critical. Substituting coolant or adding water will result in cooling loop performance loss and chiller shutdown.

The glycol coolant level in the VSD cooling system should be maintained between 9 and 15 inches (23 and 38 cm) from the top of the fill tube. This check should be performed prior to running the pump. The pump can be test run by placing the chiller in Service Mode. It is advisable to fill the tube to the required level before starting the glycol pump because it may empty when the pump starts. The level should be topped off as needed while running. Be sure to re-install the cap before stopping the glycol pump to avoid overflowing the fill tube when the glycol pump is turned OFF.

Glycol coolant has a defined operating life. System coolant should be changed 5 years from date of shipment of the equipment. Mixing other coolants or water with the special glycol will reduce the life of the coolant, and cause VSD overheating and damage.

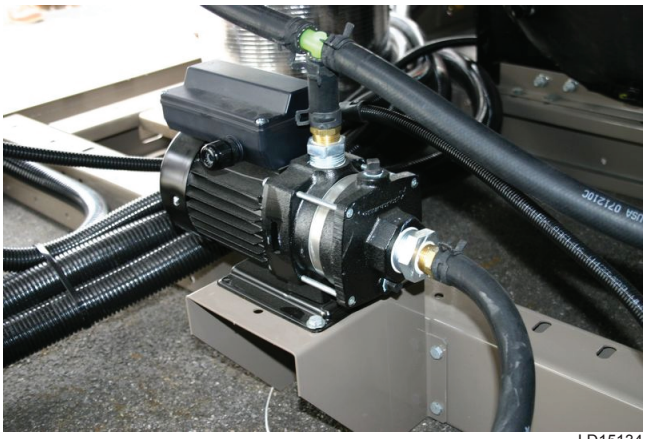


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FIGURE 106 - VSD GLYCOL PUMP

The VSD fan and glycol pump will run if any of the following conditions listed below are true, provided the VSD has been powered up for less than 30 seconds and the pump has not run in the last 30 seconds. The 30 second limitations prevent pump motor overheating.

- Compressor Baseplate temp is more than Cutout (218°F) minus 10°F.
- Pre-charge Enable 1 from the Chiller Logic Board is ON.
- VSD Internal Ambient Temp more than Cutout minus 10°F.
- Any compressor is running.
- Service Mode Fan/Pump Run is enabled.

The VSD fan/glycol pump will turn OFF when ALL of the following conditions are true:

- Compressor 1 IGBT Baseplate temp is less than Cutout minus 15°F.
- Compressor 2 IGBT Baseplate temp is less than Cutout minus 15°F.
- Pre-charge Enable 1 from the Chiller Logic Board is OFF.
- VSD Internal Ambient Temp less than Cutout minus 15°F.
- No compressors are running.
- Service Mode Fan/Pump is disabled.

NOTE

In some cases, the condenser fans may be turned on by the microprocessor, when no compressors are running, to keep the power components and Control/VSD Cabinet from overheating.

IGBT Module Baseplate Temperature Sensing

Each IGBT module has an internal 5Kohm thermistor built in to measure the temperature of the module. Up to 4 thermistors are connected to the VSD Logic Board (one per compressor). The highest module temperature of compressors 1 and 2 are sent to the logic board. If the temperature exceeds the software trip point, the unit will shut down on a safety. See *High Baseplate Temperature (Software) Fault on page 223* for details.

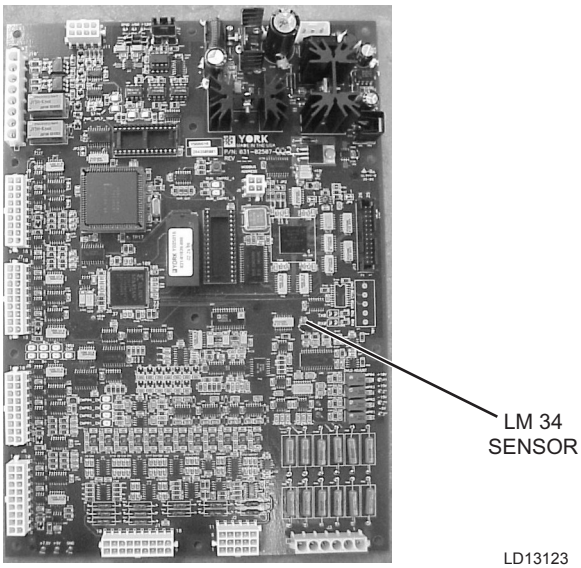

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FIGURE 107 - NEW BOARD - P/N 031-02507-XXX

VSD Internal Ambient Temperature Sensing

A National LM34 temperature sensor located on the VSD Logic Board (shown in the previous figure) is used to measure the internal ambient temperature of the Control Panel/VSD enclosure. It has an output voltage that is linearly proportional to the temperature in degrees Fahrenheit. If the temperature exceeds the software trip point, the unit will shut down on a safety. See *High VSD Internal Ambient Temperature (Software) Fault on page 224* for details.

Pre-charge

When cooling is required (LCWT is more than SPHL), leaving chilled liquid temp is greater than the setpoint high limit, the chiller Control Board will send a Pre-Charge Enable via comms to the VSD Logic Board. The VSD's DC Bus voltage(s) across the Bus Filter Capacitors will slowly be increased to the proper level (more than 500VDC) through firing of the SCR Trigger Board(s) and the associated pre-charge enable control signal(s). The pre-charge time interval is fixed at 20 seconds. The purpose of the pre-charge is to limit current when charging an uncharged capacitor bank.

When uncharged, the capacitor bank looks like an electrical short. The bus is brought up slowly by only turning ON the SCR's during the trailing half of the + and – portion of the incoming AC sine wave. Following is the status message displayed while the pre-charge is taking place.

• S YS X VSD DC BUS Pre-charge

Following successful completion of the pre-charge interval, the SCR's on the AC to DC semi-converter (SCR/Diode Modules) will be gated fully ON by the SCR Trigger Board and the DC Bus will be brought up to its full potential. After pre-charge has been successfully completed, the SCR's will stay fully ON until the Chiller Control Board turns off the Pre-Charge Enable via comms.

The pre-charge will only take place when all of the following conditions are true, otherwise it is disabled:

- Daily Schedule is ON.
- UNIT switch is ON.
- System Switch(es) are ON.
- Run Permissive(s) are Enabled.
- Flow Switch indicates flow.
- LCHLT more than Setpoint High Limit.
- Unit not faulted / locked out.
- Any system not faulted, locked out

Run Mode / Unit Restart

In order to initiate a system run, two conditions must be met. At least 1 of the 2 systems run signals from the control panel must be present and at least 1 of the 4 possible Compressor RUN bits must be set in the serial communications link between the VSD Logic Board and the Chiller Control Board. Following successful completion of pre-charge and receipt of the system run signals, the motor output voltage (% modulation) and output frequency commands will be determined by the VSD microprocessor located on the VSD Logic Board. These two parameters will be sent to the PWM generator located on the VSD Logic Board for waveform processing at a rate of once every 10 msec.

The voltage and frequency commands issued by the VSD microprocessor are determined by the operating frequency command received on the communications link from the Chiller Control Board and by the present operating frequency of the drive. Upon receipt of a legitimate run command communication, the VSD's output frequency will be increased from 0 Hz to the operating frequency command from the communications link.

DC Bus Voltage Sensing and Scaling

Full DC Bus voltage and ½ DC Bus voltages are sensed for up to 2 DC Buses. The 2 compressor chillers share a common DC Bus. The DC Bus is wired to the DC Bus Isolation Board, the voltage is divided down through a resistance voltage divider, and the reduced voltage is fed to the VSD Logic Board for safety monitoring.

Current Sensing and Scaling

Individual current transformers on each leg sense three phases of output current on each compressor. These signals are buffered, divided by 2, and filtered by an RMS to DC converter. The highest of the currents in the three phases of each compressor leaving the RMS converters is then sent to an A-D converter scaled, monitored by the VSD Logic Board overload and high current protection circuitry, and sent to the Chiller Control Board for display as the compressor current.

In order to set the motor overload level (determined by the setting of the overload ADJUST potentiometer on the VSD Logic Board), the voltage level on the wipers of the four overload ADJUST potentiometers is continuously sensed by the VSD Logic Board for current protection and sent to the Chiller Control Board for both display purposes and for current limiting control. This parameter is the 105% FLA value.

VSD Transmitted Operating Parameters

VSD operating parameters will be transmitted to the Chiller Control Board over the RS-485 communications link between the 2 boards. These values will be displayed on the control panel display. The data and display format are outlined in *Table 28 on page 221*.

VSD SAFETIES (FAULTS)

VSD operating conditions are monitored by both software algorithms and hardware circuitry. Both types exist as a result of the need for both extremely fast protection requirements such as a short circuit condition or a slow reacting trip such as a slow rising overload condition. To eliminate nuisance unit trips, the sensor inputs for the VSD's operating parameters are averaged four times before "Software" generated unit/system fault trips from the VSD Logic Board are initiated. These faults cause single compressor or total unit controlled

"ramped" shutdown. Other parameters that are not fed to the VSD Logic Board microprocessor are protected by "Hardware" generated fault trips. Hardware trips involve electronic circuitry that measures voltages or currents and activate level sensitive comparators connected to programmable gate arrays on the VSD Logic Board FPGA (Field Programmable Gate Array). These safeties operate extremely fast and provide "immediate" shutdown, because they are not dependent upon software program loops that operate in seconds or fractions of a second. Outputs from the gate arrays provide a digital signal to indicate whether a safety threshold has been reached.

Immediate Fault shutdowns are often accompanied by audible motor backspin due to equalizing of the differential between discharge and suction when the compressor is turned OFF while rotating at high speeds. This should not cause concern and will not damage the chiller.

Each fault outlined in the descriptions that follow will indicate whether it is a hardware or software generated fault.

It will be noted the "ramped" shutdown results in minimal compressor backspin and noise associated with backspin. "Immediate" shutdowns will result in compressor backspin and a higher noise level based upon the differential pressure between discharge and suction.

When a VSD fault occurs, the VSD Logic Board captures VSD data in the onboard battery backed RAM. At the same time, the VSD Board "Fault Relay" will open, signaling the Chiller Control Board microprocessor to save a snapshot of system data. The VSD Logic Board then transmits the fault data to the Chiller Control Board microprocessor on the next comms between the two boards. If the Chiller Control Board receives the comms fault indication before the Fault Relay signal, it will immediately save a snapshot of system data when the comms fault is recognized. This also enables the microprocessor to capture fault data if the Fault relay fails. Both the system and VSD fault data are then stored in the Chiller Control Board history buffers. Any additional faults that may occur during shutdown on the first fault or between the first fault and the next comms will also be stored and transmitted to the Chiller Control Board along with the original fault data. This data will be stored as "ALL FAULT" data.

When the control panel acknowledges a fault (via the fault acknowledge bit in comms) the fault relay will be reset (closed) by the VSD Logic Board and the fault indication flag (in comms) will be reset.

The fault relay will not open when a non-running fault occurs. In this case, the system will be inhibited from running until the fault condition is corrected. An inhibit message will be displayed on the panel display indicating the system is not allowed to run. Examples of this type of fault would be the High Internal Ambient fault and the VSD CT Plug Fault. When the chiller receives the transmitted fault data via comms, it will save a snapshot of system data in the history buffer even though the chiller is not running.

Some faults will be unit faults; other faults will be system (specific compressor or compressor pairs) faults, depending upon the number of compressors in the chiller. Most faults will shut down the unit/ system and allow restart once the fault clears and the 120 sec anti-recycle timer times out. These faults will allow up to 3 faults within 90 minutes before locking out the unit/ system. Other faults lock out the unit/system after only a single fault. Details on individual faults are provided in the following explanations.

TABLE 28 - VSD OPERATING DISPLAY PARAMETERS

DATA	DISPLAY FORMAT
Highest Phase of Compressor Motor Current in Amperes RMS (per Compressor)	XXX Amps
VSD Output Frequency	XXX.X Hz
Motor Overload Setting (105% FLA potentiometer setting) in amperes RMS (per Compressor)	XXX Amps
DC Bus Voltage in DC Volts (maximum of 2)	XXX Volts
VSD Internal Ambient Temperature	XXX.XºF (or ºC)
IBGT Power Assembly Power Module Highest Baseplate Temperature (maximum of 2)	XXX.XºF (or ºC)
Pre-Charge Enable Signal (maximum of 2)	On or OFF
VSD cooling Fan/Pump	On or OFF
Compressor Run Status (maximum of 4)	On or OFF

A start inhibit will take place if a VSD fault condition exists and a compressor that is not running is called to start. The start inhibit will be cleared when the fault condition goes away and the compressor will be permitted to start.

Pre-charge Low DC Bus Voltage (Software) Fault

On standard 200V, 230V, 460V and 575V chillers the DC Bus voltage must reach at least 41VDC within four seconds and 500VDC within 19 seconds after the pre-charge signal has been asserted. If not, the unit/system will shut down on a fault. On 380-400VAC chillers the voltage must reach 41VDC in 4 seconds and 414VDC in 19 seconds.

This is auto-restart safety will lock out on the third fault within 90 minutes. The fault will be a unit fault. The Status display fault message is shown below:

```
UNIT YYYYYYYY
 PRE-CHARGE - LOW DC BUS VOLTAGE
```

Pre-charge DC Bus Voltage Imbalance (Software) Fault

The 1/2 DC Bus voltage magnitude must remain within plus or minus 100VDC of the total DC Bus voltage divided by two during the pre-charge interval. If not, the unit/system shall shut down on a fault.

This safety will lock out on the 1st fault. The fault will be a unit fault. The Status display fault message is shown below:

```
UNIT YYYYYYYY
 PRE-CHARGE - DC BUS VOLTAGE IMBALANCE
```

High DC Bus Voltage (Hardware) Fault

The high DC Bus voltage trip level is determined by hardware on the VSD Logic Board and is designed to trip the unit at 766 plus or minus 30VDC. If the DC Bus exceeds this level, the unit/system will fault and shut down immediately.

This safety is an auto-restart safety that will lock out on the 3rd fault in 90 minutes. The fault will be a unit fault. Two key presses of the STATUS KEY are required to show the fault on both systems. Below is the control panel Status display fault message:

```
UNIT YYYYYYYY
 HIGH DC BUS VOLTAGE
```

Low DC Bus Voltage (Software) Fault

The low DC Bus voltage trip level is set at 500VDC on 200V, 230V, 460V and 575V chillers. If the DC Bus drops below this level the unit/system will fault and immediately shut down. On 380V and 400V chillers the trip point will be 414VDC.

The low DC Bus voltage cutout is an auto-restart safety that will lock out on the 3rd fault in 90 minutes. The fault is a unit fault. Below is an example of the Status display fault message:

```
UNIT YYYYYYYY
 LOW DC BUS VOLTAGE
```

DC Bus Voltage Imbalance (Software) Fault

The 1/2 DC Bus voltage magnitude must remain within plus or minus 100VDC of the total DC Bus voltage divided by two. If the 1/2 DC Bus magnitude exceeds the plus or minus 100VDC tolerances, the unit/system will fault and immediately shut down.

This safety will lock out on the first fault. The fault will be a unit fault. Below is the Status display fault message:

```
UNIT YYYYYYYY
 DC BUS VOLTAGE IMBALANCE
```

High Motor Current (Hardware) Fault

The three output lines to each phase of the compressor motor are monitored via three current transformers within the VSD. The unit's three phases of instantaneous output current will be compared to a predetermined limit, which is contained in hardware.

The nominal peak current trip level is:

- 575.5 Amps (554 Amps minimum, 597 Amps maximum).
- 380VAC, 60Hz and 400VAC, 50Hz nominal peak current trip level is 649.5 Amps (626 Amps minimum, 674 Amps maximum).
- VAC units, nominal peak current load is 863.3 Amps (831 Amps minimum, 896 Amps maximum).

The variation in trip point is the result of component tolerances on the VSD Logic Board. If the peak current limit is exceeded, the unit will fault and shutdown immediately.

This fault is an auto-restart safety that will lock out system on the 3rd fault in 90 minutes. The fault will be an individual system/compressor fault for all units. Following is a sample Status display fault message:

SYS X YYYYYYYY HIGH MOTOR CURRENT

The X indicates the system and YYYYYYY indicates the system is in a “FAULT” condition and will restart or “LOCKOUT” and will not restart until the operator clears the fault using the keypad.

Motor Current Overload (Software) Fault

The Motor Current Overload will compare the highest of the 3 phases of motor current per compressor to the compressor’s 105 % FLA ADJUST (overload) potentiometer setting on the VSD Logic Board. If the current exceeds the setting continuously for 20 seconds, the compressor will trip.

This safety will lock out a system on the 1st fault and shut down with a controlled ramped shutdown. The fault will be an individual system/compressor fault for all systems. A sample Status display fault is shown below:

SYS X YYYYYYYY MOTOR CURRENT OVERLOAD

The X indicates the system and YYYYYYY indicates the system is in a “LOCKOUT” condition and will not restart until the operator clears the fault using the keypad.

Motor Current Overload (Hardware) Fault

The Motor Current Overload will compare the highest of the 3 phases of motor current per compressor to the compressor’s overload ADJUST potentiometer setting. If the current exceeds the setting continuously for 30 seconds, all compressors will fault and shut down immediately.

The fault will be a unit fault and will lock out all systems on the first fault. A sample Status display fault is shown below:

UNIT YYYYYYYY
MOTOR CURRENT OVERLOAD

YYYYYYYY indicates the unit is in a "Lockout" condition and will not restart until the operator clears the fault using the keypad.

IGBT Gate Driver (Hardware) Fault

The unit’s phase bank assembly(s) contains one IGBT gate driver control board per compressor. These boards monitor the saturation voltage drop across each of the six IGBT’s while gated ON. If the IGBT’s saturation voltage exceeds the prescribed limit, the gate driver will make the determination that a short circuit is present. This in turn will cause the system to trip. During normal operation, the voltage drop across a saturated IGBT is low. When a short or shoot occurs, the extremely high current causes the voltage across the device to increase. When the electronic hardware on the IGBT Gate Driver Board senses the current rise, it immediately turns OFF all IGBT’s in the module and the system will shut down immediately.

Additionally, if the IGBT’s Gate Driver board’s power supply voltage falls below the permissible limit, this same fault will be generated.

This is an auto-restart safety that will lock out on the third fault within 90 minutes. The fault will be a system fault for all units. Following is the Status display fault messages for all systems.

SYS X YYYYYYYY GATE DRIVER

The X indicates the system and YYYYYYY indicates the system is in a “FAULT” condition and will restart or “LOCKOUT” and will not restart until the operator clears the fault using the keypad.

High Baseplate Temperature (Software) Fault

Each phase bank assembly contains one liquid cooled heatsink to cool both the inverter power modules and the converter SCR/Diode modules. Each compressor’s inverter power module (6 IGBT’s and Gate Driver Board) contains an internal temperature sensor (5K ohm at 25 Deg. °C) to monitor the baseplate temperature.

On two compressor chillers, the outputs from System 1 and System 2 sensors are each compared in software to a limit of 218°F (226°F for 380 and 400VAC). If either sensor exceeds this limit, the unit will fault and shut down with a controlled ramped shutdown.

This is an auto-restart safety that will lock out on the third fault within 90 minutes. The fault will be a system fault for all units. Below are the Status display fault messages for all systems.

SYS X YYYYYYYY HIGH VSD BASEPLATE TEMP

The X indicates the system and YYYYYYY indicates the system is in a “FAULT” condition and will restart when the fault clears or “LOCKOUT” and will not re-start until the operator clears the fault using the keypad.

After a fault, the fan(s) and water pump will remain energized until the inverter power module base plate temperature(s) falls below 165°F. The system will be allowed to restart when the inverter power module base plate temperatures drop below this value.

It is possible for an internal sensor to fail and not sense temperature without causing a high baseplate sensor fault.

High VSD Internal Ambient Temperature (Software) Fault

The VSD Logic board contains a temperature sensor, which monitors the unit’s internal ambient temperature. If the VSD internal ambient temperature rises above the cutout of 158°F, the unit will fault and shut down with a controlled ramped shutdown.

This safety will not cause a lockout. The fault will be a unit fault for all units. Following is the Status display fault message.

UNIT YYYYYYYY
HIGH VSD INTERNAL AMBIENT TEMP

The unit will be allowed to restart when the internal ambient temperature drops 10°F below the cutout.

YYYYYYYY indicates the unit is in a "Fault" condition and will restart when the condition clears.

Single Phase Input (Hardware) Fault

The VSD’s SCR Trigger Control board contains circuitry that checks the three phase mains for the presence of all three-line voltages. If any of the line voltages are not present, the system will immediately shut down on a fault.

This fault will not cause a lockout. The fault will be a unit fault. Below is the Status display fault message.

Power Supply (Hardware) Fault

Various DC power supplies which power the VSD Logic Board are monitored via hardware located on the logic board. If any of these power supplies fall outside their allowable limits, the unit will immediately shut down on a fault.

This is an auto-restart safety that will restart after the fault clears and lock out on the 3rd fault in 90 minutes. The fault will be a unit fault for all units. Below is the Status display fault message.

UNIT YYYYYYYY
VSD LOGIC BOARD POWER SUPPLY

YYYYYYY indicates the system is in a “FAULT” condition and will restart when the fault clears or “LOCKOUT” and will not restart until the operator clears the fault using the keypad.

Run Relay (Software) Fault

Upon receipt of either of the two types of run commands (hardware and software) a 5 second timer will commence timing. The hardware run signal comes from the SYS X VSD Run Signal to the VSD Logic Board. The software run signal comes through the comms from the Chiller Control Board. If the missing run signal is not asserted within the 5-second window, the system will fault. In addition, if either run signal is disabled while the VSD is running, the remaining run signal must be disabled within 5 seconds after the VSD is shut down or the system will fault. If running, the unit will fault and shut down with a controlled ramped shutdown.

This is an auto-restart safety that will autostart after the 120 second anti-recycle timer times out and will lock out on the 3rd fault in 90 minutes. The fault will be a system fault.

VSD Logic Board Failure (Software) Fault

Upon receipt of the voltage and frequency commands, the PWM generator will acknowledge receipt of the command. If the system microprocessor does not receive the handshake within 1.5 seconds of issuing the command, the unit will trip. This safety is only active during pre-charge and during running of a compressor. It is not active when all the compressors are shut down and the pre-charge is disabled. If the VSD Logic Board Fault occurs while the chiller is running, all systems will immediately shut down on a fault.

This is an auto-restart safety that will auto restart after the 120 second anti-recycle timer times out and lock out on the 3rd fault in 90 minutes. The fault is a unit fault for all units. Following is the fault message.

UNIT YYYYYYYY
VSD LOGIC BOARD FAILURE

VSD CT Plug (Hardware) Fault

Jumpers are installed in each CT plug on the VSD Logic Board to feed back signals to indicate if the plugs are installed or not. If either plug is not installed, a low value is read on the digital input and the unit will immediate shutdown on a fault or will not run if OFF.

This is an auto-restart safety that will restart after the 120 second anti-recycle timer times out and lock out on the 3rd fault in 90 minutes. The fault is a unit fault for all units. Following is the fault message.

UNIT YYYYYYYY
VSD CT PLUG FAULT

YYYYYYYY indicates the system is in a “FAULT” condition and will restart or "LOCKOUT" and will not restart until the operator clears the fault using the keypad.

VSD Fault Data

When a fault has occurred, the VSD Logic Board will capture fault data. This data will be stored in the onboard battery backed RAM for safekeeping and transferred to the panel via the communications link as soon as possible.

A fault code will be set for the fault that initiated the system shutdown. This fault will appear as a specific fault in the Status message.

Any faults that occur after the initial fault, which occur within the comms transmission time frame following the inception of the first fault, will be stored and transmitted to the Micro Logic Board together with the first fault data. These faults will appear in the "All Fault" display in the History.

A snapshot of the operating parameters of the VSD is continuously updated in battery-backed memory once every program loop. Upon receipt of a first fault, the snapshot of the operating parameters will be stored in memory and are transmitted to the panel as the fault data.

Fault Relay/Fault Acknowledge Bit

Control of the Fault Relay is from the VSD Logic Board. The Fault Relay on the VSD will be closed during a non-fault condition.

When a running or pre-charge fault occurs on the VSD, the fault relay will immediately open. The relay will not open for non-running faults that occur.

When the Chiller Control Board sees the VSD fault relay open, it will immediately take a snapshot of system data and save it to the history buffer.

A fault acknowledge bit from the Chiller Control Board is sent to the VSD via comms after receiving valid fault data from the VSD. When the VSD Logic Board receives the fault acknowledge via comms from the panel it will reset (close) the Fault Relay. The fault acknowledge is reset by the Chiller Control Board after the Fault Relay is closed by the VSD Logic Board.

VSD Fault Compressor Start Inhibit

If a VSD fault condition exists while the compressor is not running or pre-charging, the Chiller Control Board will not try to start the faulted compressor(s). The start inhibit will be automatically cleared when the fault condition goes away.

VSD Logic Board Test Mode

The VSD Logic Board contains a manual "TEST" pushbutton, which enables the service person to perform gate testing of the IGBT's Gate Drivers in the VSD by observing the LED'S on the IGBT Gate Driver Board and the VSD Logic Board.

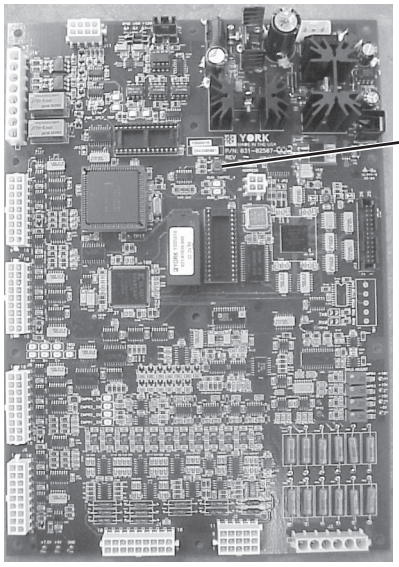


FIGURE 108 - VSD LOGIC BOARD

CAUTION

This should only be used when it is believed a VSD problem exists.

Once the test mode is enabled, the VSD Logic Board Processor will enable all compressor run signals. When the "TEST" push button is pressed, the PWM generator on the VSD Logic Board is programmed to pulse the output phase LED'S on the VSD Logic Board for all compressors in the following order:

- Upper 3 phases (+ LED's) for 1 second.
- All phases (+ and - LED's) for 1 second.
- Lower 3 phases (-LED's) for 1 second.
- All phases for 1 second.

At the same time, the 6 LED's on the GATE Driver Boards will alternate between dim and bright as the signals are sequenced.

The chiller will only be permitted to enter the "Test" mode under certain circumstances. The following conditions must exist:

- Pre-charge Enable 1 signal is disabled.
- Pre-charge Enable 2 signal is disabled.
- The system is not in the Run Mode.
- No system faults exist.
- DC Bus Voltage 1 is less than 50VDC.
- DC Bus Voltage 2 is less than 50VDC.
- No VSD Inhibits exist.

If the chiller is operating, the conditions required to allow the "Test" mode to be utilized require all systems to be manually shut down with the system switches and all faults must be cleared. After the DC Bus voltage bleeds down for several minutes, the "Test" mode can be utilized.

The "Test" pushbutton MUST be held down during the entire test. During the time the test takes place, the STATUS display message will indicate the systems are "shutting down". An example is shown below:

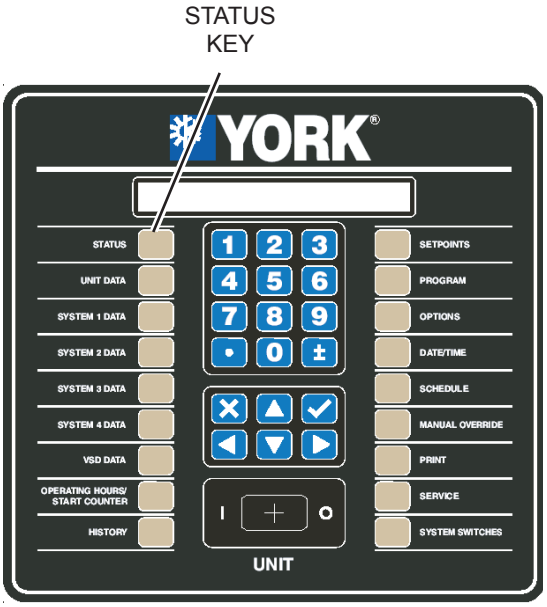
```
SYSTEM 1 SHUTTING DOWN
SYSTEM 2 SHUTTING DOWN
```

No History will be created for a shutdown in the "Test" mode.

UNIT WARNINGS

Unit Warning Operation

Unit warnings are caused when a condition is present requiring operator intervention to restart the unit. All setpoints, program values, and options should be checked before operating the unit. Warnings are not logged to the history buffer. If a unit warning is in effect, the message will be displayed to the operator when the STATUS key is pressed.



LD10605

Low Battery Warning

The LOW BATTERY WARNING can only occur at unit power-up. On micropanel power-up, the RTC battery is checked to see if it is still operational. If it is, normal unit operation is allowed. If the battery voltage is determined to be low, the following warning message is displayed indefinitely.

```
UNIT WARNING: !! LOW BATTERY !!
CHECK SETPOINTS/PROGRAM/OPTIONS/TIME
```

If a low battery condition exists, all programmed setpoints, program values, time, schedule, and history buffers will have been lost. These values will all be reset to their default values, which may not be the desired operating values. Once a bad battery is detected, the unit will be prevented from running until the MANUAL OVERRIDE key is pressed. Once the MANUAL OVERRIDE key is pressed, the anti recycle timers will be set to the programmed default anti recycle time to allow the operator sufficient time to check setpoints, program values, and so on.

If a low battery is detected, it should be replaced as soon as possible. The programmed values will all be lost and the unit will be prevented from running on the next power interruption. The RTC/Battery is located on the Chiller Logic Board shown as follows:

MICROBOARD (331-03478-XXX)

The 331-03478-xxx microboard was developed as a direct replacement for the 031-02478-xxx line of microboards. No adapter harness is required when replacing a 02478 with the new 03478. The 03478 uses the IPUII processor card and provides some new features for the chillers that the 02478 did not have. The 03478 program resides in flash memory instead of EPROM. Program updates are accomplished by loading the new program from an SD card inserted into the SD card reader/writer. This same SD card reader/writer also allows the user to datalog the operating parameters to an SD card every 5 seconds. This information is invaluable when troubleshooting unit and system problems since it allows the service technician to view operating parameters prior to a unit fault. Details on the new datalogging capability are explained in the OPTIONS Key area of this manual. A Real Time Clock/BRAM keeps time and setpoints during power outtages.

Power Supplies and LEDs

The 03478 has LEDs to indicate various states of operation of the microboard.

STATUS – Flashes every ½ second to indicate that the base board processor is running its program.

POWER – On solid indicates that the base board +12V and +5V power supplies are operational.

TX1 – Red LED flashes when transmitting data out Port 1 TB3 (Future native communications BAS port)

RX1 – Green LED flashes when receiving data in Port 1 TB3 (Future native communications BAS port)

TX2 – Red LED that flashes when transmitting data out Port 2 (E-Link TB2 or printer TB1)

RX2 – Green LED that flashes when receiving data in Port 2 (E-Link TB2 or printer TB1)

VSD_TX – Red LED that flashes when transmitting data out Port 3 to the VSD Logic board

VSD_RX – Green LED that flashes when receiving data in Port 3 from the VSD Logic board

24VAC power is applied to the 331-03478-xxx microboard connector J12 and is then used to create the various DC power sources required by the microboard circuitry. If the chiller control is malfunctioning, the power supply test points should be measured to determine the status of the microboard.

Power Supply Test Points

TP1 GND (Measure TP2, TP3, TP4 and TP5 in reference to this Test Point)

TP2 +3.3V [3.2 to 3.4VDC] provides power to the processors

TP3 +5V [4.8 to 5.2VDC] power communication ports 2,3 and 4 and analog sensors

TP4 +12V [11.64 to 12.36VDC] powers the display and backlight and is regulated to become the +5V

TP5 +15V [11.3 to 16.6VDC] powers the analog outputs to the EEV valves

Configuration Jumpers

The same configuration jumpers that existed on the 02478 are provided on the 03478.

JP4 Remote Temp Reset jumper position Pins 1 to 2 (left) = 4-20 mA, Pins 2 to 3 (right) = 0-10VDC

JP5 Remote Current Limit jumper position Pins 1 to 2 (left) = 4-20 mA, Pins 2 to 3 (right) = 0-10VDC

JP6 Remote Sound Limit jumper position (Pins 1 to 2 (left) = 4-20 mA, Pins 2 to 3 (right) = 0-10VDC

BUILDING AUTOMATION SYSTEM (BAS) COMMUNICATIONS

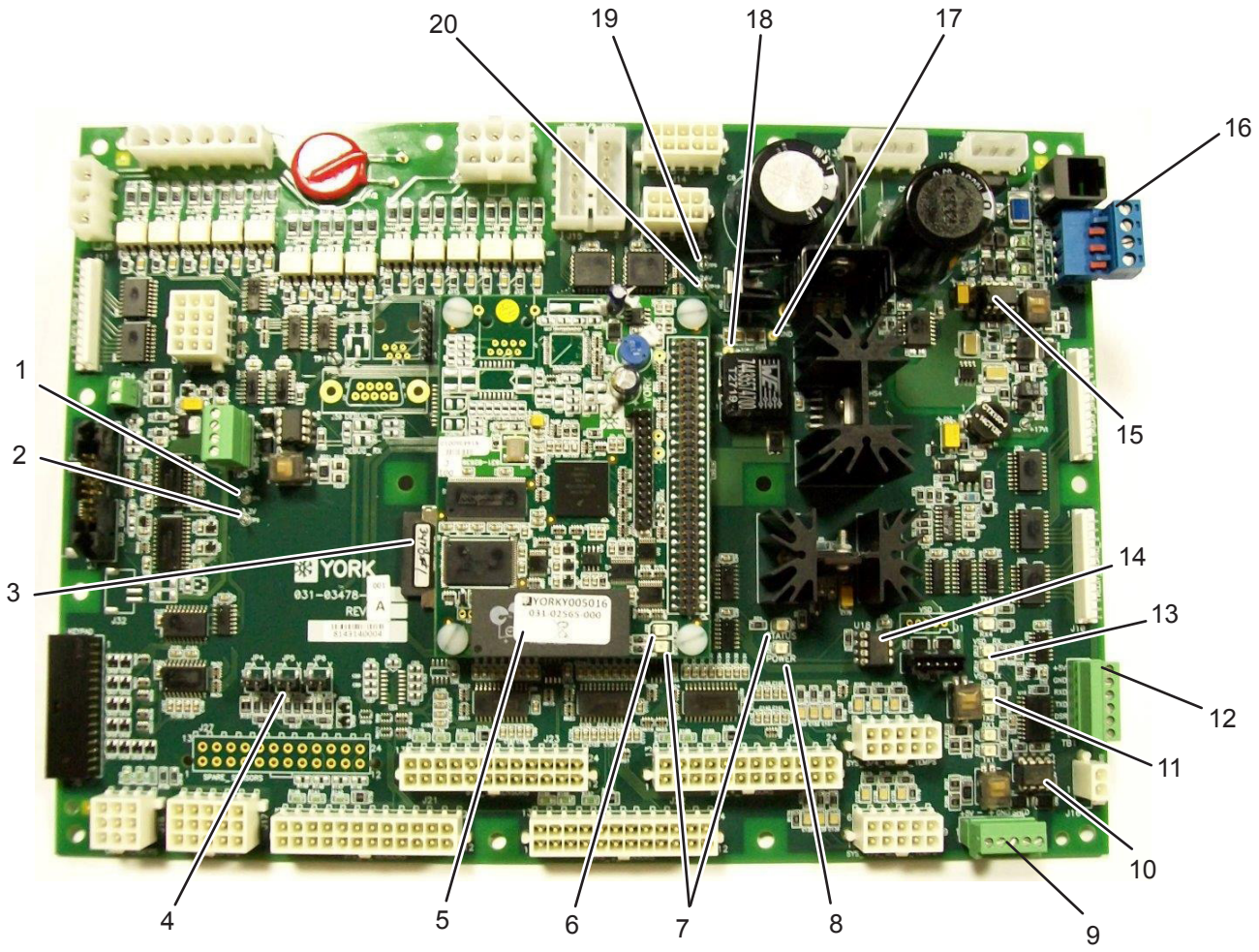
There are three different ways the chiller communicates to the BAS.

- Via board Native Communication protocol
- Using an E-Link Gateway
- Using an SC-EQ Communication Card

Using Communications Protocol

TB3 Port 1 Native BAS RS-485.

SW1 RS-485 Biasing Switch for Port. Set to ON if chiller is in an End of Line position on the network.



LD19331

FIGURE 109 - NEW 331-03478-XXX MICROBOARD

NUM	DESC	NUM	DESC	NUM	DESC	NUM	DESC
1	TP3 +5V	**6**	Power LED	**11**	Port 2 RX2, TX2	**16**	Port 1 Native BAS
2	TP2 +3.3V	**7**	Status LED	**12**	PORT 2 RS-232 Printer or Modbus	**17**	TP1 GND
3	SD Card	**8**	Power LED	**13**	VSD RX VSD-TX	**18**	TP4+12V
4	JP4, JP5, JP6 Remote Setpoint Jumpers	**9**	Port 2 RS485 to E-Link/ SC-EQ or Modbus	**14**	U18 VSD RS-485 Driver	**19**	TP5 + 15V
5	U5 RTC/BRAM	**10**	U23 Port 2 RS-485 Driver	**15**	U26 PORT 1 RS-485 Driver	**20**	TP10 + 24V

U26 is the Port 1 RS-485 Driver Chip. It is socketed to allow field replacement. RX1 and TX1 LEDs illuminate to indicate Port 1 communications activity.

YVAA Native Communication Setup

Native communication is applicable to three types of protocols, they are BACnet, N2 and Modbus RTU. It requires IPU II Microboard (331-03478-101) and software version Y.ACS.20.02 or later.

BACnet MS/TP Setup Port 1 (TB3)

To setup the BACNET MS/TP Port 1, follow the steps below:

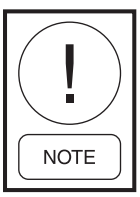
1. Connect the BACnet MS/TP Network to Port 1 on the IPU II I/O Board.
2. Set up the YVAA Port 1 (P1) for BACnet Communications as shown in *Figure 109 on page 228*.

To access the Port communication parameters:

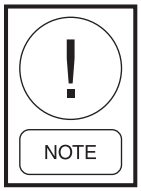
1. Press the PROGRAM key once
2. Enter password 5255
3. Press the ✓ (ENTER) key to display the Port 1 (P1) settings.

Set the following parameters:

1. DE Modifier Address (number entered is multiplied by 100): set as required by network.
2. DE Modifier Offset (number entered is added to DE Modifier Address): set as required by network (see NOTE below).
3. P1 Protocol: set to BACNET (Default Setting).
4. P1 Manual MAC Address: set to 1 (Default Setting).
5. P1 Baud rate: set as required by network. If not-known set to AUTO.
6. P1 Parity: set to NONE (Default Setting).
7. P1 Stop Bits: set to 1 (Default Setting).



You must always cycle power to the microboard following port setting changes.



The BACnet DE Instance (Device Instance)is determined by adding the [DE MODIFIER ADDRESS x 100] with the DE MODIFIER OFFSET. That is, if the desired DE Instance address is 5023, set the DE Modifier Address to 50, and then set the DE Modifier Offset to 23 (50 X 100 + 23 = 5023). DE Instances must be limited to values between 1 and 4,194,303 and every device in the network must have a unique Device Instance.

N2 Metasys Setup Port 1 (TB3)

1. Connect the N2 Network to Port 1 on the IPU II I/O Board as shown in *Figure 109 on page 228*.
2. Set up the YVAA Port 1 (P1) for N2 Communications.

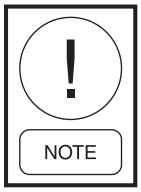
To access the Communication parameters:

1. Press the PROGRAM key once
2. Enter password 5255
3. Press ✓ (ENTER) to display the Port 1 (P1) settings.

Set the following parameters:

1. DE Modifier Address: N/A
2. DE Modifier Offset; N/A
3. P1 Protocol : Set to N2
4. P1 Manual MAC Address: Set to 0-127 as required by the parameters set in the BAS network.
5. P1 Baud Rate : 9600
6. P1 Parity: None (Default Setting)
7. P1 Stop Bits1: (Default Setting)

MODBUS Setup Port 2



The YVAA 03478 microboard supports Modbus RS232 or RS485 communications for Port 2 communications. Port 2 communications can be directed to either TB1 for RS232 or TB2 for RS485.

To connect to the network:

1. Connect your Modbus Network to Port 2 on the IPU II I/O Board as shown in *Figure 109 on page 228*.

2. Set up the YVAA Port 2 (P2) for ModbusCommunications.

To access the communication parameters:

1. Press the PROGRAM key once.
2. Enter the password 5255.
3. Press the ✓ (ENTER) key to display the Port 1 (P1) settings.

Set the following parameters:

1. DE Modifier Address: Set to 1
2. DE Modifier Offset: Set to 0
3. P1 Protocol: Set to API
4. P2 Protocol: Set to Modbus Server
5. P2 Manual MAC Address: Set to 0-127 (as required by Modbus network)
6. P2 Baud rate: Set to 19.2K (or as required by the Modbus network)
7. P2 Parity: Set to NONE (or as required by Modbus network)
8. P2 Stop Bits: Set to 1
9. P2 Hw Select Bit: Set to RS-485 or RS-232 (as required by Modbus network)
10. Cycle power to the Microboard following port setups.

J13-5 Remote Stop Start must be closed for BAS remote commands to take effect. If this input is open the unit will shut down and the panel will display the message:

REMOTE STOP - NO RUN PERMISSIVE.

E-LINK OR SC-EQ INTERFACE

Communications to a LON network requires a LON E-Link and Port 2 set for YorkTalk 2. Connected Services requires a SC-EQ and Port 2 set for YorkTalk 2. To connect to the network:

1. Connect the E-Link or SC-EQ to Port 2 on the IPU II I/O Board as shown in *Figure 109 on page 228*.
2. Set up the YVAA Port 2 (P2) for YorkTalk 2 Communications.

To access the communication parameters:

1. Press the PROGRAM key once
2. Enter the password 5255
3. Press the ✓ (ENTER) key to display the Port 1 (P1) settings.

Set the following parameters:

1. DE Modifier Address: Set to -1
2. Chiller ID: 0

Cycle power to the Microboard following port setups.

Communication Ports

TB3 Port 1 Native BAS RS-485.

SW1 RS-485 Biasing Switch for Port. Set to ON if Chiller is in an End Of Line position on the network.

U26 is the Port 1 RS-485 Driver Chip. It is socketed to allow field replacement. RX1 and TX1 LEDs illuminate to indicate Port 1 communications activity.

E-Link

SW2 RS-485 Biasing Switch for E-link Port 2, should be in the OFF position.

TB2 is the Port 2 RS-485 E-Link Communications Port. RX2 and TX2 LEDs illuminate to indicate the Port 2 communications activity. U23 is the Port 2 RS-485 Driver Chip. It is socketed to allow field replacement. J16 provides +12VDC to power the E-Link.

VSD

J2 VSD#1 and J1 VSD#2 connections headers for RS-485 communications to the Variable Speed Drive(s).

VSD RX and VSD TX LEDs illuminate to indicate the VSD communications activity. U18 is the VSD Port RS-485 Driver Chip. It is socketed to allow field replacement.

PROGRAM UPDATE

The Application software and BACnet database are stored in the IPU II Flash memory. Copying a new version of software and/or database from the SD Flash card changes the IPU II Flash. The new application software must be named SOFTWARE.ELF. The new BACnet database must be named DATABASE.BIN. These files must be located in the root directory of the SD Flash card. The software can be updated without updating the database. In this case, the existing database will be used with the new software. The database cannot be updated without updating the software. Be sure to allow enough time for the softare to update properly.

To update the program:

1. Copy the new software in to the root directory of the SD card.
2. Rename this new program file SOFTWARE.ELF.
3. Turn the Unit Switch OFF.
4. Insert the SD card in to the SD card Reader/Writer slot.
5. Press the OPTIONS key and then press the Down Arrow key until FLASH CARD UPDATE DISABLED is displayed.
6. Press the RIGHT ARROW key to change the DISABLED to ENABLED
7. Press the ENTER key to start the update. Once pressed the message:

   FLASH CARD UPDATING PLEASE WAIT...

   is displayed until the update has been completed. The keypad and display will not respond during the flash update. After the software is finished updating, the controller will automatically reboot.
8. If an error occurs during the update, an error message will be displayed where XX is the Error Code. See Table 15 for error code definitions.
9. After the update is completed and the controller reboots, the keypad and display will return to full-functionality. The SD card may be left in place for datalogging or else replaced with another SD card dedicated for datalogging.
10. To remove the SD card, GENTLY press the card inslightly then release the pressure. The card will pop out slightly to allow removal.

Never reset or power down the chiller until the update is finished. Interrupting the flash update procedure can corrupt the program file and render the control board inoperative.

TABLE 29 - FLASH CARD UPDATE ERROR XXXXX

FLASH CARD UPDATE ERROR CODE	DEFINITION
0	Okay
10	Flash card not found.
11	SOFTWARE.ELF file not found.
14	SOFTWARE.ELF file larger than expected.
15	RAM to IPU Flash transfer of DATABASE.BIN failed.
16	RAM to IPU Flash transfer of SOFTWARE.ELF failed.
17	Could not allocate sufficient memory to read or write file.
99	Internal software error.

DATA LOGGING

A 2GB SD card (p/n 031-03466-000) may be inserted into the 03478 IPUII SD card slot to record the chiller operating parameters at 5 second intervals. The data is stored in a folder named RMYYYYMM where YYYY is the year and MM is the month the data was recorded. The controller creates a file for each day within this folder with the format YYYYMMDD.csv where DD equals the day of the month in addition to the Y Year and M Month fields. For example: The folder named RM201503 is a folder created in March of 2015. Within this folder would be a file for each day of that month that the datalogging is running. If a review of the History Report shows that an abnormal event occurred on March 3rd at 2:05pm, the user can import the 20150303.csv file into Excel and look at the system parameter details leading up to the 2:05pm event.

Follow all JCI Safety Directives when inserting or removing the SD card since the card is located inside the control cabinet.

To start the Data Logging, insert the SD card into the SD card slot on the 03478 IPUII board. The label on the SD card should be facing outwards.

Once the SD card is inserted and the unit is powered up, press the OPTIONS key. Then press the Down Arrow key to advance to the DATA LOG TO FLASHCARD selection. Next press the Right Arrow key to select ON then press the ENTER key to start the Data Log. A 2GB SD card will hold about 8 months worth of data. A smaller card may be used that will hold less data but should be tested for compatibility. The controller operating system does not support SD cards larger than 2GB. When the SD card becomes full, the oldest date file is automatically deleted and a new day log file is written in its place.

To stop the data logging and retrieve the SD card, press the OPTION key and then the Down Arrow key to display the DATA LOG TO FLASHCARD option and then use the Right Arrow key to select OFF then press the ENTER key.

Again, follow the JCI Safety Directives to stop the chiller, power off the unit and open the control cabinet door to retrieve the SD card.

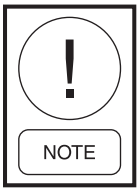
Once inside the control cabinet, lightly press in on the SD card and then release the pressure. The SD card should pop out slightly to allow removal. You may then copy the files to a PC for analysis or email the file to someone. The files are saved as a CSV format which can be read by Excel. Below is a sample of some of the data imported from a YCIV Chiller. Once the file is read in to Excel, you can hide unrelated columns or plot desired parameters to analyze the data.

Invalid Number of Compressors Warning

The INVALID NUMBER OF COMPRESSORS SELECTED Warning will occur after the VSD has been initialized, if no ”Number of Compressors Select” jumpers are installed or if more than 1 jumper is installed. The following warning message will be displayed indefinitely.

UNIT WARNING:
INVALID NUMBER OF COMPRESSSORS SELECTED

To clear this warning, both the control panel and VSD control voltage must be turned OFF and the jumpers properly installed in the VSD wiring harness.



These jumpers are factory installed in the wire harness plug and should not require changes.

Invalid Serial Number Warning

If the INVALID SERIAL NUMBER message appears, immediately contact Johnson Controls Product Technical Support. The appearance of this message may mean the chiller has lost important factory programmed information. The serial number can be entered using the SERVICE key.

UNIT WARNING: INVALID SERIAL NUMBER
ENTER UNIT SERIAL NUMBER

This status message can be bypassed to view additional messages under the STATUS key by pressing the STATUS key repeatedly to scroll through as many as three STATUS messages that could possibly be displayed at any time.

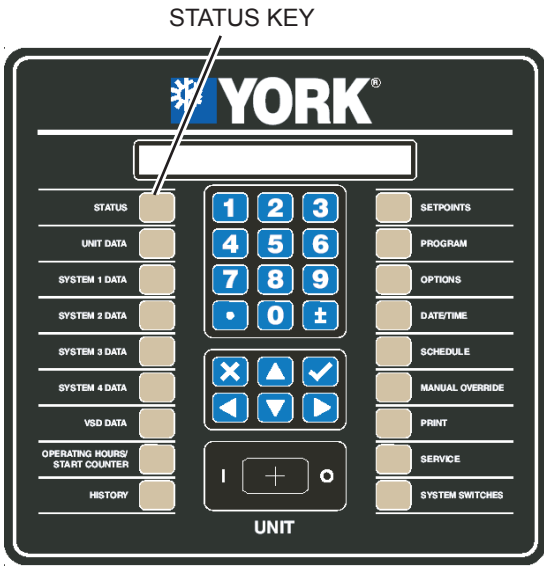
UNIT SAFETIES

Unit Safety Operation

Unit faults are safeties that cause all running compressors to be shut down, if a safety threshold is exceeded for 3 seconds. Unit faults are recorded in the history buffer along with all data on the unit and system operating conditions. Unit faults are auto reset faults where the unit will be allowed to restart automatically after the fault condition is no longer present. The only exception is any of the VSD related unit faults. If any 3 VSD unit faults occur within 90 minutes, the unit will be locked out on the last fault. A VSD lockout condition requires a manual reset using the system switches. Both system switches must be cycled OFF and ON to clear a VSD unit lockout fault. If a unit safety is in effect, the message will be displayed to the operator when the STATUS key is pressed.

TABLE 32 - DATA LOGGING

HOUR	MIN	SEC	SYS 1 SUCT PRESS	SYS 1 DSCH PRESS	SYS 1 OIL PRESS	SYS 1 SUCT TEMP	SYS 1 SAT SUCT TEMP	SYS 1 SUCT SHEAT	SYS 1 MTR CURR FLA	SYS 1 DSCH TEMP	SYS 1 SAT DSCH TEMP	SYS 1 DSCH SHEAT	SYS 1 OIL TEMP	SYS 1 COMP STATUS	SYS 1 ECON	SYS 1 FAN STAGE	SYS 1 MOTOR TEMP1
			PSIG	PSIG	PSIG	°F	°F	°F	AMPS	°F	°F	°F	°F				°F
0	0	10	82.6	84.4	84.4	93	77.5	15.5	0	83	78.6	4.4	82	OFF	OFF	0	107.9
11	0	15	82.6	84.4	84.4	93	77.5	15.5	0	83	78.6	4.4	82	OFF	OFF	0	107.9
11	22	20	82.6	84.4	84.4	93	77.5	15.5	0	83	78.6	4.4	82	OFF	OFF	0	107.9
11	22	25	82.6	84.4	84.4	93	77.5	15.5	0	83	78.6	4.4	82	OFF	OFF	0	107.9
11	22	30	82.6	84.4	84.4	93	77.5	15.5	0	83	78.6	4.4	82	OFF	OFF	0	107.9
11	22	35	82.5	84.4	84.4	93	77.4	15.6	0	83	78.6	4.4	82	OFF	OFF	0	107.9



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In the descriptions of the fault displays that follow, the fault message will show a YYYYYYY to indicate that a system is in a "FAULT" condition and will restart when the fault clears or LOCKOUT" and will not restart until the operator clears the fault using the keypad.

If a control panel safety occurs after the VSD fault, but before the fault is reset, the control panel fault is an ALL FAULT of the VSD fault, meaning it will be registered as such in the History because it occurred while the VSD was shutting down or while the systems were shut down. All faults do not store operating data at the time of the fault.

If a "VSD" fault occurs during the fault rampdown or while the systems are shut down, the VSD fault will be registered as a new fault. The reason for this is the belief any VSD fault should be registered with a full account of the systems data at the time of the fault.

High Ambient Temp Fault

If the ambient temperature rises above 55°C (131°F), the chiller will shut down with a controlled ramped shutdown. Restart will automatically occur, if demand allows, when temperature falls 1.1°C (2°F) below the cutout (53.9°C[129°F]). This fault cannot cause a lockout. The fault display message will be present only during the time when the ambient temperature is causing a fault condition. A sample display is shown below:

```
UNIT YYYYYYY
HIGH AMBIENT TEMP
```

The unit will also be inhibited from starting any time the temperature is above 53.9°C (129°F).

Low Ambient Temp Fault

If the ambient temperature falls below the programmable Low Ambient Temp Cutout the chiller will shut down with a controlled ramped shutdown. This fault will only occur if the Low Ambient Cutout is "ENABLED" under the OPTIONS key. Restart can occur, if demand allows, when temperature rises 2°F above the cutout. This fault cannot cause a lockout. The fault display message will be present only during the time when the ambient temperature is causing a fault condition. A sample display is shown below:

```
UNIT YYYYYYY
LOW AMBIENT TEMP
```

The unit is also inhibited from starting any time the temperature is below the cutout plus 2°F.

Low Leaving Chilled Liquid Temp Fault

The Low Leaving Chilled Liquid Temp Cutout helps to protect the chiller from an evaporator freeze-up should the chilled liquid temp drop below the freeze point. This situation could occur under low flow conditions or if the Micro Panel setpoint values are improperly programmed. Any time the leaving chilled liquid temperature (water or brine) drops below the programmable cutout point, the chiller will fault and shutdown with a controlled ramped shutdown. Restart can occur, if demand allows, when chilled liquid temperature rises 4°F above the cutout. This fault cannot cause a lockout. A sample shutdown message is shown below:

```
UNIT YYYYYYY
LOW LEAVING CHILLED LIQUID TEMP
```

The unit is inhibited from starting any time the chilled liquid temperature is below the cutout plus 4°F.

VSD Communications Failure Fault

The VSD Communications Failure is to prevent the unit from trying to run, if the Chiller Control Board never initializes communications with the VSD Logic Board. The unit will also shut down with a controlled ramped shutdown if the Chiller Control Board loses communications with the VSD Logic Board while the chiller is operating.

On power-up, the Chiller Microprocessor Board will attempt to initialize communications with the VSD Logic Board. The control panel will request data from the VSD, which includes the number of compressors and the VSD software version. Once these data points have been received by the Chiller Control Board, and

have been successfully initialized, the Chiller Control Board will not request them again. If the comms connection fails to occur and a reply from the VSD Logic Board does take place in 8 seconds, the Chiller Control Board will prevent the chiller from operating and a fault message will be displayed.

During normal operation, if the control panel Chiller Control Board receives no valid response to messages for 8 seconds, the unit will shut down all compressors on a Comms fault. The Chiller Control Board will continue to send messages to the VSD while faulted. The unit will be inhibited from starting until communications is established. The fault will automatically reset when the Chiller Control Board receives a valid response from the VSD for a data request. Shown below is an example of a Comms Failure fault message:

UNIT YYYYYYYY
VSD COMMUNICATIONS FAILURE

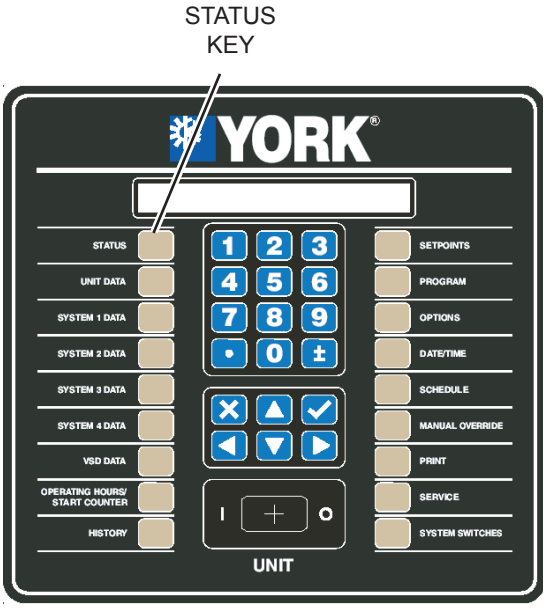
SYSTEM SAFETIES (FAULTS)

System Safety (Fault) Operation

System safeties are faults that cause individual systems to be shut down if a safety threshold is exceeded for 3 seconds. System faults are auto reset faults in that the system will be allowed to restart automatically after the 120 second anti-recycle timer times out. The only exception is after any 3 faults on the same system occur within 90 minutes, that system will be "locked out" on the last fault. The lockout condition requires a manual reset using the system switch. The respective system switch must be cycled OFF and ON to clear the lockout fault. See *Table 33 on page 246* for the programmable limits for many of the cutouts.

When multiple systems are operating and a system fault occurs, the running systems will ramp down and the faulted system will be shut OFF and the previously operating will restart if required after the fault clears and/or the 120 second anti-recycle timer times out.

In the descriptions of the fault displays that follow, the fault message will show a YYYYYYYY to indicate that a system is in a "FAULT" condition and will restart when the fault clears, or "LOCKOUT" and will not restart until the operator clears the fault using the keypad. If a system safety is in effect, the message will be displayed to the operator when the STATUS key is pressed.



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In some cases, a control panel fault will occur after a VSD fault, possibly during system shutdown or at some later time. This is known as an "ALL FAULT" and these faults will be recorded as such under the HISTORY information stored at the instant of the primary fault. In some cases, this information may be valuable in troubleshooting the primary fault. An example of the "ALL FAULT" history message is shown on Page 249 under the HISTORY key. When an "ALL FAULT" occurs, associated history information will not be stored. If an additional fault does not occur, the "ALL FAULTS" display will indicate NONE. In cases where a VSD fault occurs during the rampdown of a control panel fault (that is, low suction pressure, low water temp, and so on), the VSD fault will be stored as a new fault with the associated fault information stored at the instant the VSD fault occurred (that is, IGBT Gate Drive, Single Phase Input, VSD CT Plug, and so on). The control panel fault that occurred prior to the VSD fault will be stored with the associated complete data related to the fault as a numerically lower numbered history in the history buffers.

High Discharge Pressure Cutout (Software) Fault

The High Discharge Pressure Cutout is a software fault. A system will fault and shut down with a controlled ramped shutdown on high discharge pressure when the discharge pressure rises above 325 PSIG for 0.5 seconds. The system will be allowed to restart when the discharge pressure falls to 295 PSIG. The system will also be inhibited from starting if the pressure is above 295 PSIG. The fault message for this safety is shown below:

SYS X YYYYYYYY HIGH DISCHARGE PRESSURE

The X indicates the system and YYYYYYYY indicates the system is in a "FAULT" condition and will restart when the 120 second anti-recycle timer times out, or "LOCKOUT" and will not restart until the operator clears the fault using the keypad.

High Discharge Pressure Cutout (HPCO) (Hardware) Fault

The mechanical High Pressure Cutout protects the system from experiencing dangerously high discharge pressure. A system will fault and shut down immediately when the mechanical high pressure cutout contacts open. The fault will occur immediately and not wait 3 seconds, which is typical of most system faults. The HPCO is wired in series with the VSD Run Signal and will only be checked by the Chiller Control Board when the system is running. The mechanical cutout opens at 337 plus or minus 8 PSIG and closes at 252 plus or minus 10 PSIG. The Status display fault message for this system is shown below:

SYS X YYYYYYYY HPCO FAULT

The X indicates the system and YYYYYYY indicates the system is in a "FAULT" condition and will restart when the 120 second anti-recycle timer times out or "LOCKOUT" and will not restart until the operator clears the fault using the keypad.

Low Suction Pressure Cutout (Software) Fault

The programmable Low Suction Pressure Cutout is a secondary back-up for the flow switch and protects against operation with low refrigerant charge, which helps protect the chiller from an evaporator freeze-up, should the system attempt to run with a low refrigerant charge. The Status display fault message for this cutout is shown below:

SYS X YYYYYYYY LOW SUCTION PRESSURE

The X indicates the system and YYYYYYY indicates the system is in a "FAULT" condition and will restart when the 120 second anti-recycle timer times out or "LOCKOUT" and will not restart until the operator clears the fault using the keypad. Typically, the cutout will be set at 24 PSIG for chilled water applications. The cutout is ignored for the first 30 seconds of system run time. During the next 3 minutes of run time the cutout point is linearly ramped from 10% of the cutout value up to the programmed cutout point. If at any time during the first 3 minutes of operation the suction pressure falls below the ramped cutout point, the system will shut down with a controlled ramped shutdown.

The cutout pressure during operating periods of 30 seconds to 210 seconds is ramped and can be calculated by:

$$\text{Cutout} = \frac{(\text{Programmed Cutout} \times \text{Run Time})}{200} - 1.2 \text{ PSIG}$$

After the first 3 minutes and 30 seconds of run time, if the suction pressure falls below the cutout as a result of a transient in the system, a transient timer is set at 30 seconds and a linearly ramped cutout is set starting at 10% of the programmed cutout. If over the next 30 seconds, the suction pressure does not stay above the ramped cutout, which ramps between 10% of the cutout and the programmed cutout over the 30 second period, the system will fault on low suction pressure.

8

Low Motor Current Cutout Fault

The Motor Current Cutout shuts the system down with a controlled ramped shutdown when the microprocessor detects the absence of motor current (less than 10% FLA), usually indicating that a compressor is not running. This safety is ignored for the first 10 seconds of operation.

The status display fault message for this safety is shown below:

SYS X YYYYYYYY LOW MOTOR CURRENT

The X indicates the system and YYYYYYY indicates the system is in a "FAULT" condition and will restart when the 120 second anti-recycle timer times out or "LOCKOUT" and will not restart until the operator clears the fault using the keypad.

High Differential Oil Pressure Cutout Fault

The High Differential Oil Pressure Cutout protects the compressor from low oil flow and insufficient lubrication, possibly from a dirty oil filter. A system will fault and shut down with a controlled ramped shutdown when its Discharge to Oil Differential Pressure rises above the cutout of 65 PSIG. This safety is ignored for the first 90 seconds of run time. This safety measures the pressure differential between discharge and oil pressure, which is the pressure drop across the oil filter. The Status display fault message for this safety is shown below:

SYS X YYYYYYYY HIGH DIFF OIL PRESSURE

The X indicates the system and YYYYYYY indicates the system is in a "FAULT" condition and will restart when the 120 second anti-recycle timer times out or "LOCKOUT" and will not restart until the operator clears the fault using the keypad.

Low Differential Oil Pressure Cutout Fault

The Low Differential Oil Pressure Cutout protects the compressor from low oil flow and insufficient lubrication. A system will fault and shut down with a controlled ramped shutdown when it's differential between oil and suction pressure falls below the cutout. This safety assures that the compressor is pumping sufficiently to push oil through the oil cooling circuit and through the internal compressor lubrication system. The Status display fault message for this safety is shown below:

SYS X YYYYYYYY LOW DIFF OIL PRESSURE

The X indicates the system and YYYYYYY indicates the system is in a "FAULT" condition and will restart when the 120 second anti-recycle timer times out or "LOCKOUT" and will not restart until the operator clears the fault using the keypad.

The safety is ignored for the first 60 seconds of run time. After the first 60 seconds of operation, the cutout is linearly ramped from 0 PSIG to 30 PSIG in 5 to 10 minutes based on ambient temperature. See the following table for the ramp times for the given ambient temperatures.

TABLE 30 - LOW DIFFERENTIAL OIL PRESSURE CUTOUT

AMBIENT TEMPERATURE	RAMP TIME
more than 50ºF	5 Minutes
more than 45ºF	6 Minutes
more than 40ºF	7 Minutes
more than 35ºF	8 Minutes
more than 30ºF	9 Minutes
more than or equal to 30ºF	10 Minutes

A 30 second safety bypass below 50 Hertz is employed during rampdown. The bypass is primarily needed under conditions where another compressor is being brought on and the running compressor is being ramped down to 5 Hertz to add the additional compressor due to load requirements. Under these conditions, the slow speed of the running compressors causes the oil differential to become very low, especially if the water temperature is high and the suction pressure is high. The bypass assures the compressors will not trip on a nuisance low oil differential fault.

High Discharge Temperature Cutout Fault

The High Discharge Temperature Cutout protects the motor and compressor from overheating. A system will fault and shut down with a controlled ramped shutdown when its Discharge Temperature rises above 250°F. A system will also be inhibited from starting if the discharge temperature is above 200°F. The Status display fault message for this safety is shown below:

SYS X YYYYYYYY HIGH DISCHARGE TEMP

The X indicates the system and YYYYYYY indicates the system is in a "FAULT" condition and will restart when the 120 second anti-recycle timer times out or "LOCKOUT" and will not restart until the operator clears the fault using the keypad.

Low Discharge Superheat Cutout Fault

The Low Discharge Superheat safety helps protect the compressor from liquid floodback through the economizer line due to a high flash tank level. It also helps protect the compressor from excessive oil in circulation due to excess oil charge in the system. Excessive oil in circulation brings back liquid refrigerant which is entrained in the oil. The liquid then drops out once it enters the compressor.

The safety is ignored for the first 10 minutes of operation if the system economizer feed valve is closed (0%) and for 5 minutes of operation if the economizer feed valve is open greater than 0%. If the discharge superheat falls below 5.0°F for 5 minutes under either condition, the system will shut down.

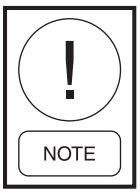
The X indicates the system and YYYYYYY indicates the system is in a "FAULT" condition and will restart when the 120 second anti-recycle timer times out or "LOCKOUT" and will not restart until the operator clears the fault using the keypad.

Sensor Failure Cutout Fault

The Sensor Failure Cutout prevents the system from running when a critical sensor (transducer, level sensor, or motor winding temp sensor) is not functioning properly and reading out of range. This safety is checked at startup and will prevent the system from running if one of the sensors has failed.

The sensor failure safety will also fault and shutdown a system while in operation, if a safety threshold is exceeded or a sensor reads out of range (high or low). Following is the Status display fault message.

SYS X YYYYYYY SENSOR FAILURE:
ZZZZZZZZZZZZ



The X indicates the specific system. YYYYYYY will either indicate the system is in a "FAULT" condition and will restart when the fault clears, or "LOCKOUT" after 3 faults and will not restart until the operator clears the fault using the keypad.

ZZZZZZZZZZZ indicates the failed sensor below:

- SUCT PRESS
- OIL PRESS
- DSCH PRESS
- MOTOR TEMP X *

*The Unit Setup Mode allows a specific motor temperature sensor to be ignored, if it fails.

The start inhibit thresholds for each sensor are shown in the following table.

TABLE 31 - START INHIBIT SENSOR THRESHOLDS

SENSOR	LOW THRESHOLD	HIGH THRESHOLD
SUCTION TRANSDUCER	0.3VDC	4.7VDC
OIL TRANSDUCER	0.3VDC	4.7VDC
DISCHARGE TRANSDUCER	0.3VDC	4.7VDC
MOTOR TEMP. SENSOR	0ºF	240ºF

High Motor Temperature Cutout Fault

The High Motor Temperature Cutout prevents a compressor from running when its motor temperature is too high. A system will fault and shut down when any compressor motor temperature sensor rises above 250°F. The system will be inhibited from starting if its motor temperatures sensors indicate temperatures above 240°F. If any single temperature sensor is being ignored under the Unit Set-up Mode, that sensor will not be utilized when evaluating motor temperature.

Below is a sample Status display fault message:

SYS X YYYYYYY HIGH MOTOR TEMP

The X indicates the system and YYYYYYY indicates the system is in a "FAULT" condition and will restart when the fault clears or "LOCKOUT" and will not restart until the operator clears the fault using the keypad.

System Control Voltage Cutout Fault

The System Control Voltage Cutout alerts the operator the 115VAC Control voltage to one of the systems is missing. This could be due to a system fuse that has been removed or is blown. The affected system will fault and shut down immediately when the 115VAC supply is lost.

The safety will "not" shut down a system if the UNIT switch is OFF, which electrically removes the 115VAC to "all" systems. The safety is only used to indicate a situation where a single system is missing the 115VAC. The safety will not cause a lockout and the system fault will reset when power is returned. A sample message is shown below:

SYS X YYYYYYY CONTROL VOLTAGE

The X indicates the system and YYYYYYY indicates the system is in a "FAULT" condition and will restart when the fault clears or "LOCKOUT" and will not restart until the operator clears the fault using the keypad.

Eductor Clog Fault

To sense a loss of oil return to the compressor, an eductor clog detection safety is utilized. The safety monitors the temperature of the line between the eductor and the suction line.

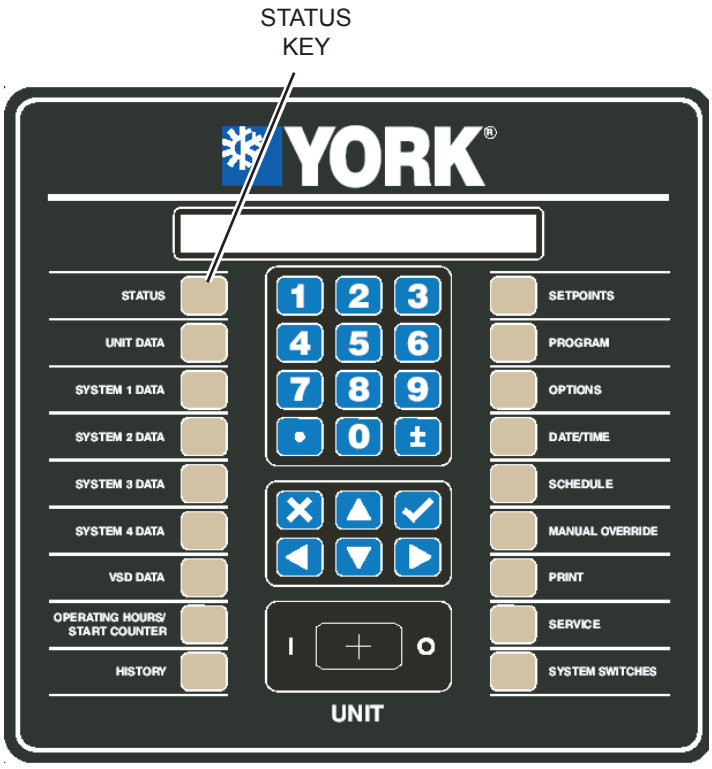
The control algorithm looks at the eductor line temperature once a second. At start, a clog timer is set at 600 seconds. If the eductor line temperature is less than the saturated suction temperature plus 10°F each time the control circuit looks at the temperature, the clog timer is reset to 600 seconds.

If the eductor line temperatures is greater than the saturated suction temperature plus 10°F, the clog timer is decremented one second. If the temperature remains above the saturated suction temperature plus 10°F for 600 seconds, the clog timer will count to “0” and the system will shut down and lock out. The status fault will indicate an eductor clog fault.

EDUCTOR CLOG FAULT

Whenever this fault occurs, the eductor filter should be changed. The clog timer resets to 600 seconds whenever the control algorithm sees the eductor line temperature is less than the saturated suction pressure plus 10°F. This prevents nuisance eductor clog faults.

STATUS KEY



LD10605

Status Key Operation

The STATUS key displays the current chiller or system operational status. The messages displayed include running status, cooling demand, system faults, unit faults, VSD faults, unit warnings, external device status, load limiting, anti-recycle timer, status of unit/system switches, and a number of other messages. Pressing the STATUS key will enable the operator to view the current status of the chiller. The display will show one message relating to the "highest priority" information as determined by the microprocessor. There are three types of status data, which may appear on the display:

- General Status messages
- Unit Safeties
- System Safeties.

When power is first applied to the control panel, the following message displaying York International Corporation, the EPROM version, date, and time will be displayed for 2 seconds, followed by the appropriate general status message:

(C)2004 YORK INTERNATIONAL CORPORATION
C.XXX.XX.XX 18-SEPT-2010 12:45: AM

Unit status messages occupy 2 lines of the Status message display. If no unit status message applies, individual status messages for each system will be displayed.

Any time the STATUS key is pressed or after the EPROM message disappears at power-up, a status display indicating chiller or system status will appear.

Multiple STATUS messages may appear and can be viewed by pressing the STATUS key repeatedly to allow scrolling through as many as three STATUS messages, which could possibly be displayed at any time on a 2 compressor chiller.

Examples of the typical Status messages are shown in the next topic

General Status Messages

UNIT STATUS
MANUAL OVERRIDE

This message indicates the chiller is operating in MANUAL OVERRIDE mode. This message is a priority message and cannot be overridden by any other STATUS message. When in Manual Override, no other status message will ever be present.

UNIT STATUS
UNIT SWITCH OFF SHUTDOWN

This message indicates the UNIT SWITCH is in the OFF position and not allowing the unit to run.

UNIT STATUS
DAILY SCHEDULE SHUTDOWN

This message indicates that either the daily or holiday schedule programmed is keeping the chiller from running.

UNIT STATUS
REMOTE CONTROLLED SHUTDOWN

This message indicates that either an ISN or RCC has turned the chiller OFF and is not allowing it to run.

UNIT STATUS
FLOW SWITCH SHUTDOWN

This message indicates the flow switch is not allowing the chiller to run. There is a 1 second delay on this safety to assure the flow switch did not momentarily open.

UNIT STATUS
VSD COOLING SHUTDOWN

This message indicates the chiller is shutdown, but running all the condenser fans, VSD glycol pump, and VSD fan in an effort to bring the internal VSD ambient temperature down to an acceptable level before allowing the chiller to start.

SYS X REMOTE RUN CONTACT IS OPEN

This message indicates the remote start/stop contact between 2 and 15 or 2 and 16 of the 1TB terminal block is open. There is a 1 second delay on this safety to assure the remote contacts did not momentarily open.

SYS X SYSTEM SWITCH IS OFF

This message indicates the system switch (software via keypad) is turned OFF. The system will not be allowed to run until the system switch is turned ON via the keypad.

SYS X NOT RUNNING

This message indicates the system is not running because the chilled liquid is below the setpoint or the micro has not loaded the lead system far enough into the loading sequence to bring the lag system ON. This message will be displayed on the lag system until the loading sequence is ready for the lag system to start.

SYS X COOLING DEMAND SHUTDOWN

This message is only displayed in the Normal Shutdown History display to indicate a capacity control shutdown.

SYS X COMPRESSOR RUNNING

This message indicates the system is running as a result of cooling demand.

SYS X SHUTTING DOWN

The compressor shutting down message indicates the respective system is ramping down in speed prior to shutting OFF. This message is displayed after the software run signal is disabled until the VSD notifies the Chiller Control Board the compressor is no longer running.

SYS X ANTI-RECYCLE TIMER = XXX SEC

This message indicates the amount of time left on the respective system anti-recycle timer and the system is unable to start until the timer times out.

SYS X DISCHARGE PRESSURE LIMITING

The Discharge Pressure Limiting message indicates the discharge pressure load limit or discharge pressure unloading is in effect.

SYS X SUCTION PRESSURE LIMITING

The Suction Pressure Limiting message indicates the suction pressure load limit or suction pressure unloading is in effect.

SYS X MOTOR TEMP LIMITING

The Motor Temp Limiting message indicates the motor temp load limit or motor temp unloading is in effect.

SYS X MOTOR CURRENT LIMITING

The motor current limiting message indicates the motor current load limit or motor current unloading is in effect.

SYS X PULLDOWN MOTOR CURRENT LIMITING

The pulldown motor current limiting message indicates the pulldown motor current load limit or pulldown motor current unloading is in effect based on the programmed setpoint.

SYS X ISN CURRENT LIMITING

The ISN Current Limiting message indicates the motor current load limit or motor current unloading is in effect through the use of the YORKTalk setpoint.

SYS X REMOTE MOTOR CURRENT LIMITING

The Remote Motor Current Limiting message indicates the motor current load limit or motor current unloading is in effect through the use of the remote setpoint offset. The setpoint may be offset using a remote voltage or a current signal. The remote current limit must be activated for this function to operate.

SYS X VSD BASEPLATE TEMP LIMITING

The VSD Baseplate Temp Limiting message indicates the VSD Baseplate temp is high and load limit or unloading is in effect.

SYS X VSD INTERNAL AMBIENT TEMP LIMITING

The VSD Internal Ambient Temp Limiting message indicates the VSD internal ambient temp is high and load limit or unloading is in effect.

SYS X SOUND LIMITING

The sound limiting message indicates the sound load limit is in effect based on the locally programmed sound limit from the keypad. The sound limit must be activated for this function to operate.

SYS X ISN SOUND LIMITING

The ISN sound limiting message indicates the sound load limit is in effect based on the ISN transmitted sound limit setpoint. The sound limit must be activated for this function to operate.

SYS X REMOTE SOUND LIMITING

The Remote sound limiting message indicates the sound load limit is in effect based on the Remote controlled sound limit setpoint. The setpoint may be offset using a remote voltage or current signal. The sound limit option must be activated for this function to operate.

Unit Safety (Fault) Status Messages

A complete listing of the unit safeties and the corresponding status messages is provided in *Unit Safeties on page 232*.

System Safety (Fault) Status Messages

A complete listing of the system safeties and the corresponding status messages is provided in *System Safeties (Faults) on page 234*.

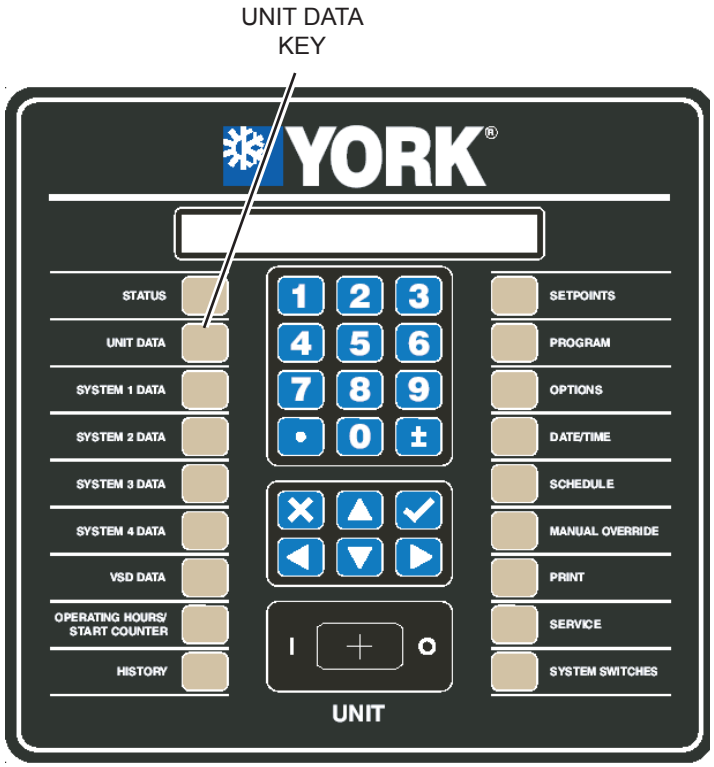
VSD Safety (Fault) Status Messages

A complete listing of VSD safeties and the corresponding status messages is provided in *VSD Safeties (Faults) on page 220*.

Unit Warning Messages

A complete listing of the unit warnings and the corresponding status messages is provided in *Unit Warnings on page 226*.

UNIT DATA KEY



LD10605

General

The UNIT DATA key provides the user with displays of unit temperatures, and unit related data. Displays can be selected by repeatedly pressing the UNIT DATA key or the▲ or ▼ Arrow Keys.

Unit Data Key Operation

The first key press displays Evaporator Leaving and Return Chilled Liquid Temperatures.

```
UNIT  CHILLED  LIQUID  LEAVING = XXX.X °F
                       ENTERING = XXX.X °F
```

The next key press of the UNIT DATA key or the ▼ (ARROW) key displays the ambient air temperature.

```
UNIT
  OUTSIDE  AMBIENT  AIR  TEMP = XXX.X °F
```

The next key press will display the time remaining on the load and unload timers.

```
UNIT          LOAD  TIMER = XXX SEC
              UNLOAD  TIMER = XXX SEC
```

The next key press displays the error in temperature between the actual leaving chilled liquid temperature and the setpoint temperature. The display also shows the rate of change of the chilled liquid temperature.

```
UNIT          TEMP  ERROR = XXX.X °F
              RATE = XXX.X °F/M
```

The next key press displays the system designated as the lead system and the Flow Switch status (ON or OFF).

```
UNIT  LEAD SYSTEM NUMBER = X
                FLOW SWITCH = XXX
```

The next key press displays the status of the evaporator pump and heater, where XXX is either ON or OFF.

```
UNIT          EVAP PUMP RUN = XXX
              EVAP HEATER = XXX
```

The next key press displays the status of Active Remote Control.

```
UNIT  ACTIVE REMOTE CONTROL = XXXXXX
 TYPE: RCC ISN CURR TEMP SOUND
```

XXXXX is either ACTIVE or NONE.

If no remote keys are active, the items on the second line are all blanked out. Any remote items that are active will be displayed, while the inactive items will be blanked out.

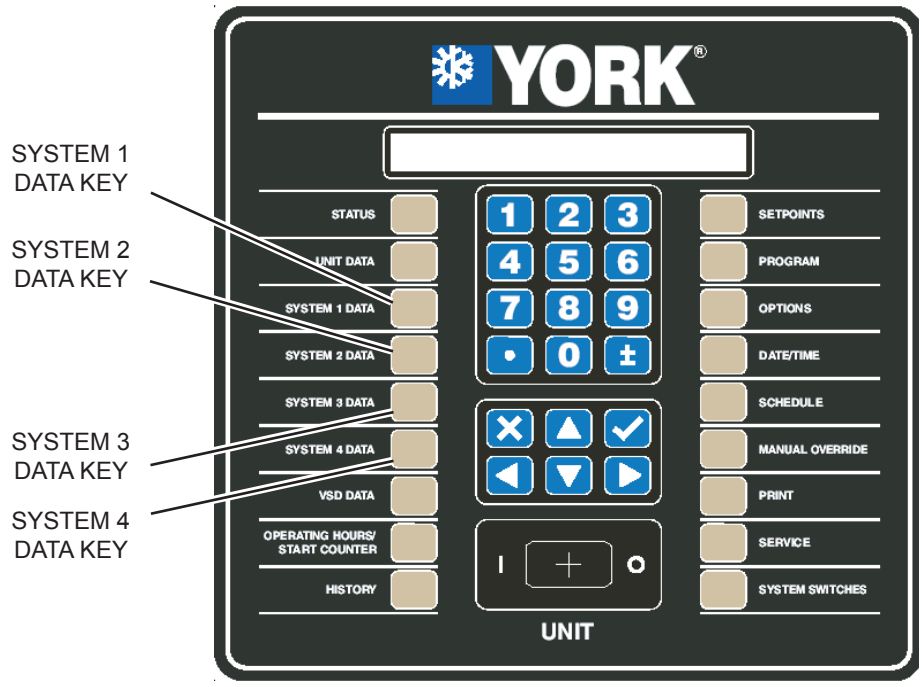
The types of remote control are listed as follows:

- NONE - No remote control is actively controlling the chiller; however, remote monitoring by a remote device may still be active.
- RCC - A Remote Control Center is providing remote control. The chiller is in remote mode.
- ISN - YorkTalk via ISN. The chiller in remote mode.
- CURR - Remote Current Limiting is enabled.
- TEMP - Remote Temperature Reset is enabled.
- SOUND - Remote Sound Limiting is enabled.

The next key press displays the sound limit values as set under the PROGRAM key by the Local, ISN, and the Remote Sound Limit Inputs. Any sound limits that are inactive will display XXX instead of a numeric value.

UNIT SOUND LIMIT	**LOCAL = XXX %**
ISN = XXX	**REMOTE = XXX %**

SYSTEM DATA KEYS 1 THROUGH 4



LD10605

General

The data keys provide the user with many displays of individual system temperatures, pressures, and other operating data. These keys have multiple displays, which can be seen by repeatedly pressing the SYSTEM DATA or the ▲ or ▼ (Arrow) keys. An explanation of each key and its messages is provided below.

System 1 Data Key Operation

The SYSTEM 1 DATA key provides the user with access to System 1 operating parameters. The following is a list of the data in the order in which it appears.

The first key press of the SYSTEM X DATA key displays all of the measured system pressures (oil and discharge).

SYS 1 PRESSURES	OIL = XXXX PSIG
	DISCHARGE = XXXX PSIG

The second key press of the SYSTEM DATA key or the ▼ (DOWN ARROW) key displays system suction and condenser liquid pressure.

SYS 1 PRESSURES	SUCTION = XXXX PSIG
	CONDENSER LIQUID = XXXX PSIG

The next key press displays system oil and eductor temperatures.

SYS 1 TEMPERATURES	OIL = XXX.X °F
	EDUCTOR = XXX.X °F

The next key press displays system condenser liquid temperature, liquid line sub-cooling and saturated discharge temperature on the liquid line.

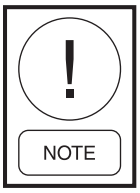
SYS 1 CONDENSER LIQUID TEMP = XXX.X °F	
SUB-COOLING = XXX.X	SAT TEMP = XXX.X °F

The next key press displays discharge temperature, discharge superheat and saturated discharge pressure at the compressor.

SYS 1 DISCHARGE	TEMP = XXX.X °F
SUPERHEAT = XXX.X	SAT TEMP = XXX.X °F

The next key press displays the System 1 motor thermistor temperatures.

SYS 1 MOTOR TEMPS	T1 = XXX.X °F
T2 = XXX.X °F	T3 = XXX.X °F



If any motor temp sensor is being ignored, (selectable under Unit Set-up Mode), that sensor's value will be displayed as XXXXX.

The next key press displays the compressor speed in % (0 to 100%) and the compressor heater status (ON or OFF).

SYS 1 COMPRESSOR	SPEED = XXX.X %
	HEATER = XXX

The next key press indicates the flash tank level low/high and the economizer valve % open.

SYS 1	FLASH TANK LEVEL = XXXX
	ECONOMIZER VALVE = XXX.X %

The next key press displays the condenser liquid line sub-cooling and the drain valve position.

SYS 1	CONDENSER SUB-COOLING = XXX.X °F
	CONDENSER DRAIN VALVE = XXX.X %

The next key press indicates the number of condenser fans steps that are enabled (1 to 4), if the fans are not operating on a VSD.

SYS 1	CONDENSER FANS ON = X

If the fans are controlled by an optional VSD, the display will indicate fan speed signal control voltage to the VSD and the fan speed (0 to 100%).

SYS 1	CONDENSER FANS ON = X
	VSD FAN SPEED = XX.X V = XXX %

The next key press will indicate the state of the optional VI solenoids where XXX indicates ON or OFF.

SYS 1	VI STEP SOLENOID 1 = XXX
	VI STEP SOLENOID 2 = XXX

The next key press displays the system run time in days, hours, minutes and seconds.

SYS 1 RUN TIME			
XX DAYS	XX HOURS	XX MINUTES	XX SECONDS

The next key press indicates the status of the RUN Relay where XXX is ON or OFF, the status of the RUN Permissive signal (flow switch/remote start/stop circuit 2 and 15 of 1TB, SYS 1) or 2 and 16 of 1TB, SYS 2) and whether the internal software is telling the system to run (ON or OFF).

SYS 1 RUN SIGNALS	RELAY = XXX
RUN PERM = XXX	SOFTWARE = XXX

System 2 Data Key Operation

System 2 keys function the same as the SYSTEM 1 DATA key except that it displays data for System 2.

On a 2 compressor system, the SYSTEM 3 and SYSTEM 4 data keys will display the following messages:

SYS 3 DATA NOT AVAILABLE

SYS 4 DATA NOT AVAILABLE

Sensor Displays

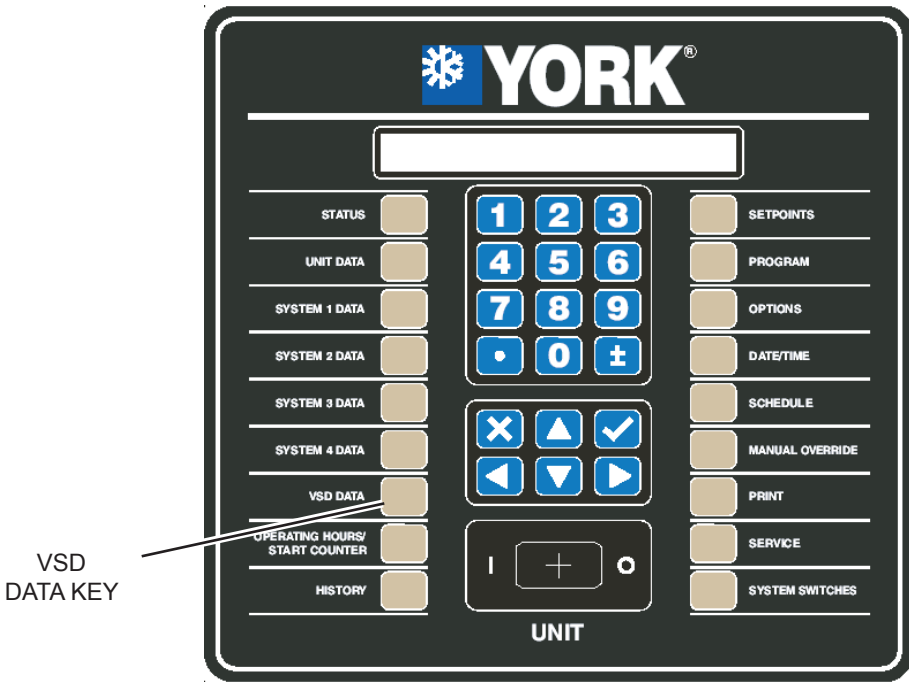
Table 29 lists all the sensors attached to the control board associated with system data keys. The minimum and maximum values displayed on the micro display are provided.

If values exceed the limits in the table, a < (less than) or > (more than) sign will be display along with the minimum or maximum value.

TABLE 33 - SENSOR MIN/MAX OUTPUTS

SYSTEM SENSOR			
SENSOR / INPUT	**TYPE**	**MINIMUM VALUE**	**MAXIMUM VALUE**
Suction Pressure	Transducer	0.0 PSIG	125.0 PSIG
Condenser Liquid Pressure	Transducer	0.0 PSIG	400.0 PSIG
Discharge Pressure	Transducer	0.0 PSIG	400.0 PSIG
Oil Pressure	Transducer	0.0 PSIG	400.0 PSIG
Flash Tank Level	Switch	Low	High
Condenser Liquid Temp	Thermistor	-4.1 °F (-20.06 °C)	155.6 °F (68.67°C)
Leaving Chilled Liquid Temp	Thermistor	-19.1 °F (-28.49°C)	110.2 °F (43.44°C)
Return Chilled Liquid Temp	Thermistor	-19.1 °F (-28.49°C)	110.2° F (43.44°C)
Eductor Temp	Thermistor	-4.1° F (-20.06°C)	132.8 °F (56.00°C)
Ambient Air Temp	Thermistor	-4.6 °F (-20.33°C)	137.9° F (58.83°C)
Compressor Motor Temp	Thermistor	-30.2 °F (-34.56°C)	302.0° F (150.00°C)
Discharge Temp	Thermistor	40.3 °F (4.61°C)	302.6 °F (150.33°C)
Remote Temp Reset	4 to 20ma, 0 to 10VDC, 0 to 20ma or 2 to 10VDC	0%	100%
Remote Current Limit	4 to 20ma, 0 to 10VDC, 0 to 20ma or 2 to 10VDC	0%	100%
Remote Sound Limit	4 to 20ma, 0 to 10VDC, 0 to 20ma or 2 to 10VDC	0%	100%

VSD DATA KEY



LD10605

General

The VSD DATA key provides the user with displays of VSD temperatures, voltages, currents, and other operating data. This key has multiple displays, which can be seen by repeatedly pressing the VSD DATA or the ▲ or ▼ (Arrow) keys. An explanation of each message is provided below.

VSD Data Key Operation

The first VSD DATA key press displays the actual VSD Output Frequency and Command Frequency.

VSD FREQUENCY	ACTUAL = XXX.X HZ
	COMMAND = XXX.X HZ

The second key press of the VSD DATA key or the ▼ (ARROW) key displays the calculated compressor % FLA and measured motor currents in amps for systems 1 and 2. When measuring motor current keep in mind that measuring inverter PWM current is difficult and meter error can be significant.

VSD COMP 1 = XXX AMPS	= XXX %FLA
COMP 2 = XXX AMPS	= XXX %FLA

The next key press displays the current limit values set locally on the panel under the PROGRAM key, remotely by an ISN, and remotely by the Current Limit input. Any current limits that are inactive will display "XXX" instead of a numeric value.

VSD CURRENT LIMIT	LOCAL = XXX %FLA
ISN = XXX	REMOTE = XXX %FLA

The next key press displays DC Bus voltage.

VSD	DC BUS VOLTAGE = XXX VDC

The next key press displays the Control Panel/VSD Internal Ambient Temperature and VSD Cooling Pump/ Fan Status. YYY will indicate ON or OFF.

VSD	INTERNAL AMBIENT TEMP = XXX.X °F
	COOLING SYSTEM STATUS = YYY

The next key press displays the IGBT highest baseplate temperature.

VSD IGBT BASEPLATE TEMPS	T1 = XXX °F
	T2 = XXX °F

The next key press displays the state of the Pre-charge signal, where XXX is either ON or OFF.

VSD PRE-CHARGE SIGNAL = XXX

The next key press displays the setting of the VSD's 105% FLA overload potentiometer for Compressor #1 and 2.

The settings are determined by the adjustment of the overload potentiometers on the VSD Logic Board. These pots are factory set and should not require changing unless the circuit board is replaced. See Table 34 on page 248 for factory settings.

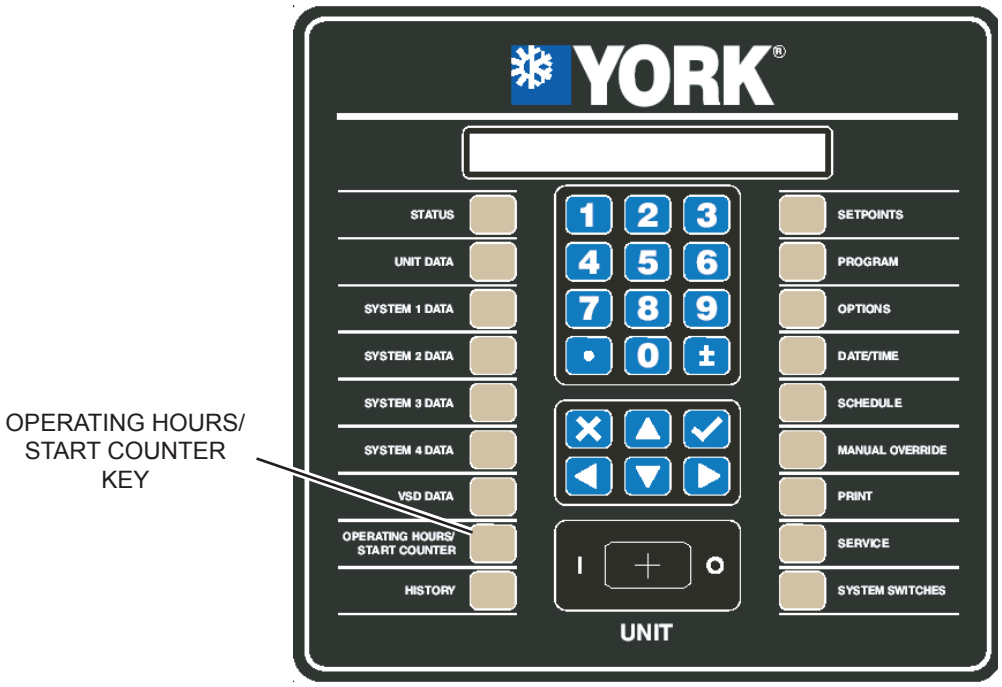
VSD COMP 1 MOTOR OVERLOAD = XXX AMPS
COMP 2 MOTOR OVERLOAD = XXX AMPS

TABLE 34 - COMPRESSOR MOTOR OVERLOAD SETTINGS

		380V-60HZ		400V-50HZ		460V-60HZ (see note 1)	
MODEL		SYS # 1	SYS # 2	SYS # 1	SYS # 2	SYS # 1	SYS # 2
50/60 HZ TONS	50/60 HZ KW	OL SETTING	OL SETTING	OL SETTING	OL SETTING	OL SETTING	OL SETTING
YVAA0153	YVAA0543	225	225	225	225	175	175
YVAA0165	YVAA0565	225	225	225	225	175	175
YVAA0178	YVAA0588	225	225	225	225	175	175
YVAA0183	YVAA0643	283	236	283	231	225	175
YVAA0195	YVAA0665	283	236	283	231	225	175
YVAA0198	YVAA0688	283	236	283	231	225	175
YVAA0200	YVAA0700	300	300	283	283	236	236
YVAA0213	YVAA0743	283	283	283	283	225	225
YVAA0215	YVAA0765	283	283	283	283	225	225
YVAA0218	YVAA0788	283	283	283	283	225	225
YVAA0233	YVAA0843	338	300	338	283	283	236
YVAA0245	YVAA0865	338	300	338	283	283	236
YVAA0248	YVAA0888	338	300	338	283	283	236
YVAA0263	YVAA0943	338	338	338	338	283	283
YVAA0273	YVAA0963	338	338	338	338	283	283
YVAA0275	YVAA0965	338	338	338	338	283	283
YVAA0278	YVAA0988	334	334	317	317	276	276
YVAA0295	YVAA1015	412	334	412	317	392	276
YVAA0303	YVAA1093	412	334	412	317	392	276
YVAA0305	YVAA1065	412	334	412	317	392	276
YVAA0308	YVAA1088	412	334	412	317	392	276
YVAA0318	YVAA1188	412	334	412	317	392	276
YVAA0323	YVAA1143	412	412	412	412	392	392
YVAA0333	YVAA1173	412	412	412	412	392	392
YVAA0343	YVAA1193	412	412	412	412	392	392
YVAA0345	YVAA1215	412	412	412	412	392	392
YVAA0368	YVAA1288	720	338	720	338	590	283
YVAA0373	YVAA1343	720	338	720	338	590	283
YVAA0375	YVAA1315	720	338	720	338	590	283
YVAA0398	YVAA1388	720	412	720	412	590	392
YVAA0413	YVAA1443	720	412	720	412	590	392
YVAA0425	YVAA1515	720	412	720	412	590	392
YVAA0428	YVAA1488	720	412	720	412	590	392
YVAA0443	YVAA1543	720	720	720	720	590	590
YVAA0475	YVAA1665	720	720	720	720	590	590
YVAA0483	YVAA1693	720	720	720	720	590	590
YVAA0500	YVAA1700	720	720	720	720	590	590
YVAA0523	YVAA1843	720	720	720	720	590	590

NOTE 1 For 200V, 230V, and 575V chillers, use the 460V selection.

OPERATING HOURS / START COUNTER KEY

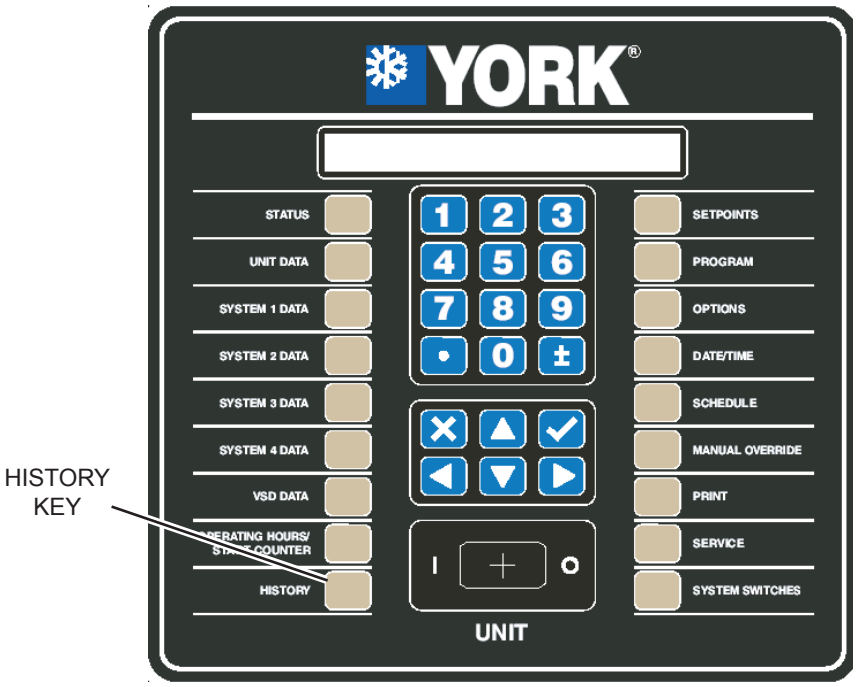


LD10605

Compressor operating hours and compressor starts are displayed with a single key press. The maximum value for both hours and starts is 99,999, at which point they will roll over to 0. A single display is available under this key and is displayed below.

```
HOURS 1=XXXXX,  2=XXXXX
START 1=XXXXX,  2=XXXXX
```

HISTORY KEY



LD10605

History Key Operation

The HISTORY key provides the user access to many unit and system operating parameters captured at the instant a unit or system safety (fault) shutdown occurs. The history buffer will also capture system data at the time of normal shutdowns such as cycling shutdowns. When the HISTORY key is pressed the following screen is displayed:

```
HISTORY          CHOOSE HISTORY TYPE
◄ ►    XXXXXXXXXXXXXXXXXXXXXXXXXXXX
```

The ◄ and ► (ARROW) keys allow choosing between NORMAL SHUTDOWNS and FAULT SHUTDOWNS. “Fault” shutdowns provide information on safety shutdowns, while “Normal” shutdowns provide chiller cycling information on temperature (demand), cycling, remote, system switch, and so on, shutdowns that are non-safety related shutdowns. Once the selection is made, the ✓ (ENTER) key must be pressed to enter the selection.

Normal Shutdowns History

If the NORMAL SHUTDOWNS History is selected, the following screen will be displayed:

```
NORM HIST XX  18-JUN-2004 10:34:58 AM
YYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYY
```

XX is the normal shutdown number. The display will provide date and time of the shutdown and the reason for the cycling shutdown (YYY….).

The operator can view any of the stored 20 single display normal shutdown history buffers. History buffer number 1 provides the most recent shutdown information and buffer number 20 is the oldest safety shutdown information saved. The ◄ and ► (ARROW) keys allow scrolling between each of the history buffers. The ► (ARROW) key scrolls to the next normal history shutdown and the ◄ (ARROW) key scrolls to the previous normal history shutdown.

The following display will typically be displayed on a normal shutdown due to shutdown on lack of cooling demand.

```
NORM HIST XX  18-JUN-2004 10:34:58 AM
SYS X COOLING DEMAND SHUTDOWN
```

Fault Shutdowns History

If the FAULT SHUTDOWNS History is selected, the following screen will be displayed:

```
FAULT HIST XX  18-JUN-2004 10:34:58 AM
YYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYY
```

XX is the FAULT HISTORY shutdown number. The display will provide the date, time, and a description of the specific type of fault that occurred (YYY….).

The operator can view any of the stored 10 fault history buffers. History buffer number 1 provides the most recent safety shutdown information and buffer number 10 is the oldest safety shutdown information saved. The ◄ and ► arrow keys allow scrolling between each of the FAULT HIST buffers 1 through 10. The ▲ (UP) and ▼ (DOWN) arrow keys can be used to scroll forwards and backwards through the data in a specific history buffer, once it is displayed.

There is a large amount of data provided under each history. Rather than scroll sequentially through the data in a history, which is possible using the ▼ arrow key, the use of a combination of the ◄, ►, ▲, and ▼ arrow keys allows fast scrolling to specific data the user desires to view. To use this feature, the user needs to be aware the ◄ and ► arrow keys allow scrolling to the top of the data subgroups. Once a specific history is selected, the history data is divided under the subgroups of Unit Data, VSD Data, System Data, Hours/Starts, Setpoints, Options, and Program data. The ◄ and ► arrow keys allow moving to the first display under the next or previous subgroup at any time. Once the first display of a subgroup is displayed, the ▲, and ▼ arrow keys allow scrolling though the data in the subgroup. The ▼ arrow key allows scrolling though the data from first to last. When the last piece of data is displayed, the next press of the ▼ arrow key scrolls to the first piece of data in the next subgroup. The ▲ arrow key allows going to the previous display.

Listed below is a description of the fault data displays and their meaning. Data will be displayed in a specific order starting with the Status Display (System Faults only), Fault Display, All Fault Display, Unit Data, VSD Data, System Data, Operating Hours/Starts, Setpoints, Options, and Program Values at the time of the fault.

Status Fault Type

```
SYS X COMPRESSOR RUNNING
SYS X YYYYYYYY HIGH DIFF OIL PRESSURE
```

This message indicates the type of system fault. This screen is skipped if a UNIT Fault caused the shutdown.

Unit Fault Type

```
UNIT FAULT
 LOW AMBIENT TEMP
```

This message indicates the type of unit fault. This screen is skipped if a SYSTEM Fault caused the shutdown.

All Fault Data

```
FAULT HIST XX ALL FAULTS ZZ OF WW
YYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYYY
```

The ALL FAULT display indicates whether a fault occurred while the unit is shutting down on another fault.

If a control panel fault occurred while the unit is shutting down on a VSD fault before it is reset, the control panel fault is an ALL FAULT of the VSD fault.

If another VSD fault occurs while the unit is shutting down on a VSD fault, the next VSD fault will be registered as an ALL FAULT of the VSD fault.

If a VSD fault occurs during the ramp down shutdown of a control panel fault, the VSD fault is registered as a new fault, not an ALL FAULT.

XX is the history number, YYY is the ALL FAULT description, ZZ is the ALL FAULT number and WW is the total number of All Faults for the current history. Sometimes, multiple faults may occur during the shutdown and multiple displays will be observed when scrolling through the data using the ▼ arrow. In most cases, the ALL FAULT display will indicate NONE. The ALL FAULT display will only indicate the cause of the fault. No additional chiller information will be displayed under the ALL FAULT, since a snapshot of all chiller data was taken at the time of the first fault.

Unit Data

Evaporator Leaving and Entering Chilled Liquid Temperatures

```
UNIT CHILLED LIQUID LEAVING = XXX.X °F
                    ENTERING = XXX.X °F
```

This message indicates the leaving and entering chilled liquid temperatures at the time of the fault.

Ambient Air Temperature

```
UNIT
  OUTSIDE  AMBIENT  AIR  TEMP = XXX.X °F
```

This message indicates the ambient air temperature at the time of the fault.

Load / Unload Timers

```
UNIT          LOAD  TIMER = XXX SEC
            UNLOAD  TIMER = XXX SEC
```

This message indicates remaining time on the load and unload timers at the time of the fault.

Chilled Liquid Temperature Error and Rate of Change

```
UNIT          TEMP  ERROR = XXX.X °F
                      RATE = XXX.X °F/M
```

This message indicates the temperature error between the actual and the programmed setpoint at the time of the fault and the rate of temperature change.

Programmed Lead System Selection and Flow Switch Status

```
UNIT    LEAD  SYSTEM  NUMBER = X
                FLOW  SWITCH = XXX
```

This message indicates the designated lead system at the time of the fault and whether the flow switch was ON (Closed) or OFF (Open) at the time of the fault.

Evaporator Pump and Evaporator Heater Status

```
UNIT          EVAP  PUMP  RUN = XXX
                EVAP  HEATER = XXX
```

This message indicates the status of the evaporator pump and the evaporator heater at the time of the fault. XXX indicates ON or OFF.

Active Remote Control Status

```
UNIT  ACTIVE  REMOTE  CONTROL = XXXXXX
```

This message indicates whether the system was operating under Active Remote Control (RCC, ISN, LOAD, TEMP, or SOUND) or standard control (NONE) at the time of the fault.

```
UNIT  SOUND  LIMIT      LOCAL = XXX %
          ISN = XXX    REMOTE = XXX %
```

This message indicates that sound limiting was in effect, the amount, and whether it was local or remotely limited.

VSD Data

VSD Actual and Command Frequency

```
VSD  FREQUENCY      ACTUAL = XXX.X HZ
                  COMMAND = XXX.X HZ
```

This message indicates the VSD actual operating frequency and the command frequency at the time of the fault. Actual and command may not match due to load/unload timers, limitation of 1 Hz per load/unload increment, and to allowable acceleration/deceleration of the motor.

Compressor Amps and %FLA

The message indicates the compressor %FLA and motor currents for systems 1 and 2 at the time of the fault.

```
COMP  1   = XXX  AMPS        = XXX %FLA
COMP  2   = XXX  AMPS        = XXX %FLA
```

VSD Current Limit

```
VSD  CURRENT  LIMIT   LOCAL = XXX %FLA
  ISN = XXX          REMOTE = XXX %FLA
```

This message displays the current limit values as set locally, by an ISN, or a remote current limiting input at the time of the fault.

DC BUS Voltage

```
VSD          DC  BUS  VOLTAGE = XXX  VDC
```

This message displays the DC Bus voltage at the time of the fault.

VSD Internal Ambient Temp

```
VSD    INTERNAL  AMBIENT  TEMP = XXX.X °F
       COOLING  SYSTEM  STATUS = YYY
```

This message displays the VSD/Microprocessor internal ambient cabinet temperature and the cooling system status (ON or OFF) at the time of the fault.

IGBT Baseplate Temperature

```
VSD IGBT BASEPLATE TEMPS T1 = XXX °F
                         T2 = XXX °F
```

This message displays the IGBT highest baseplate temperature for 2 and 3 compressor units at the time of the fault. 4 compressor units display temperatures for 1/3 (T1) and 2/4 (T2).

Pre-charge Signal Status and VSD Cooling Status

```
VSD    PRE-CHARGE SIGNAL = XXX
```

This display provides the state of the pre-charge signal, where XXX is either ON or OFF at the time of the fault.

Compressor #1 and #2, 105% FLA Motor Overload Current Setting

```
VSD    COMP 1 MOTOR OVERLOAD = XXX AMPS
       COMP 2 MOTOR OVERLOAD = XXX AMPS
```

This message displays the setting of the VSD's 100% FLA potentiometer for Compressor #1 and #2 at the time of the fault.

System Data

System #1 Pressures

```
SYS 1 PRESSURES          OIL = XXXX PSIG
                   DISCHARGE = XXXX PSIG
```

This message displays the measured system oil and discharge pressures at the time of the fault.

```
SYS 1 PRESSURES      SUCTION = XXXX PSIG
               CONDENSER LIQUID = XXXX PSIG
```

This message displays the measured system suction and condenser liquid line pressure at the time of the fault.

System # 1 Temperatures

```
SYS 1 TEMPERATURES       OIL = XXX.X °F
                    EDUCTOR = XXX.X °F
```

This message displays the measured system oil and eductor temperatures at the time of the fault.

```
SYS 1 CONDENSER LIQUID TEMP = XXX.X °F
SUB-COOLING = XXX.X  SAT TEMP = XXX.X °F
```

This message displays the condenser liquid, liquid line sub-cooling and saturated discharge temperatures at the time of the fault.

```
SYS 1 DISCHARGE          TEMP = XXX.X °F
SUPERHEAT = XXX.X    SAT TEMP = XXX.X °F
```

This message displays the system discharge, discharge superheat and saturated discharge temperatures at the time of the fault.

Compressor Speed and Heater Status

```
SYS 1 COMPRESSOR      SPEED = XXX.X %
                     HEATER = XXX.X °F
```

This message indicates the compressor speed in % and the heater status at the time of the fault.

System #1 Motor Temperatures

```
SYS 1 MOTOR TEMPS        T1 = XXX.X °F
        T2 = XXX.X       T3 = XXX.X °F
```

This message displays the System 1 motor thermistor temperatures at the time of the fault.

Flash Tank Level and Economizer Position

```
SYS 1          FLASH TANK LEVEL Y 512 ADC
                ECONOMIZER VALVE = XXX.X %
```

This message displays the flash tank level and the economizer valve position in % at the time of the fault.

Condenser Sub-cooling and Condenser Drain Valve Position

```
SYS 1    CONDENSER SUB-COOLING = XXX.X °F
          CONDENSER DRAIN VALVE = XXX.X %
```

This message displays the condenser sub-cooling and the Condenser Drain Valve position at the time of the fault.

Condenser Fans

```
SYS 1                CONDENSER FANS ON = X
```

```
SYS 1                CONDENSER FANS ON = X
              VSD FAN SPEED XX.X V = XXX %
```

This message displays the number of condenser fans ON or the optional VSD fan control speed signal to the inverter and the % of full speed.

VI Step Solenoid

```
SYS 1                    VI STEP SOLENOID 1 = XXX
                         VI STEP SOLENOID 2 = XXX
```

This message displays whether the VI solenoids were ON or OFF at the time of the fault.

Compressor #1 Run Time

```
SYS 1 RUN TIME
XX DAYS XX HOURS XX MINUTES XX SECONDS
```

This message displays the system run time since the last start in days, hours, minutes, and seconds at the time of the fault.

System #1 Run Signals

```
SYS 1 RUN SIGNALS          RELAY = XXX
 RUN PERM = XXX          SOFTWARE = XXX
```

This message displays the System Run Signal Relay (Relay Output Board) status, Run Permissive Input status, and the Internal Software (microprocessor command) ON/OFF Start status. The status of each will indicate either ON or OFF.

System 2 Data

Data for the system 2 at the time of the fault is displayed in the same sequence as the system #1 data.

Compressor Operating Hours and Starts

```
HOURS 1=XXXXX, 2=XXXXX
START 1=XXXXX, 2=XXXXX
```

This message displays compressor operating hours and compressor starts at the time of the fault.

Chilled Liquid Setpoint Cooling Setpoints

```
SETPOINTS
LOCAL COOLING SETPOINT     = XXX.X °F
```

This message displays the programmed cooling setpoint at the time of the fault.

```
SETPOINTS
LOCAL CONTROL RANGE        = +/- X.X °F
```

This message displays the programmed Control Range at the time of the fault.

Remote Setpoint and Range

```
SETPOINTS REMOTE SETPOINT = XXX.X °F
    REMOTE CONTROL RANGE = +/- X.X °F
```

This message displays the remote setpoint and Control Range at the time of the fault.

Maximum Remote Temperature Setpoint

```
SETPOINTS
MAXIMUM REMOTE TEMP RESET = XXX.X °F
```

This message displays the maximum remote reset programmed at the time of the fault.

Options

Display Language

```
OPTIONS        DISPLAY LANGUAGE
◄ ►        XXXXXXXXXXXXXXXXXXX
```

This message displays the language selected at the time of the fault.

Chilled Liquid Cooling Mode

```
OPTIONS        CHILLED LIQUID COOLING MODE
◄ ►            WATER COOLING
```

This message displays the chilled liquid temperature mode (water or glycol) selected at the time of the fault.

Local / Remote Control Mode

```
OPTIONS        CHILLED LIQUID COOLING MODE
◄ ►            GLYCOL COOLING
```

This message indicates whether Local or Remote Control Mode was selected at the time of the fault.

```
OPTIONS    LOCAL / REMOTE CONTROL MODE
◄ ►        XXXXXXXXXXXXXXXXXXX
```

When Remote Control Mode is selected, control of the Chilled Liquid Setpoint is from a remote device such as an ISN/BAS controller.

Display Units Mode

```
OPTIONS    DISPLAY UNITS
◄ ►        XXXXXXXXXXXXXXXXXX
```

This message indicates whether SI (°C, Barg) or Imperial units (°F, PSIG) was selected at the time of the fault.

System Lead/Lag Control Mode

```
OPTIONS    LEAD / LAG  CONTROL  MODE
◄ ►        XXXXXXXXXXXXXXXXXXXX
```

This message indicates the type of lead lag control selected at the time of the fault. Three choices are available:

- Automatic
- Sys 1 Lead
- Sys 2 Lead

The default mode will be AUTOMATIC.

Remote Temperature Reset

```
OPTIONS          REMOTE  TEMP  RESET  INPUT
◄ ►                                 XXXXXXXX
```

This message indicates whether temperature reset was active or disabled at the chiller keypad at the time of the fault and if active, the type of reset signal selected.

If the option is not factory enabled, the option will not appear.

Remote Current Reset

```
OPTIONS          REMOTE  CURRENT  LIMIT  INPUT
◄ ►                                 XXXXXXXXXXX
```

This message indicates whether remote current reset was active or disabled at the chiller keypad at the time of the fault and if active, the type of reset signal selected.

If the option is not factory enabled, the option will not appear.

Remote Sound Limit Selection

```
OPTIONS          REMOTE  SOUND  LIMIT  INPUT
◄ ►                                 XXXXXXXXXXX
```

This message indicates whether remote sound limit was active or disabled at the chiller keypad at the time of the fault and if active, the type of reset signal selected.

If the option is not factory enabled, the option will not appear.

Program Values

Suction Pressure Cutout

```
PROGRAM
SUCTION  PRESSURE  CUTOUT  = XXX.X  PSIG
```

This message indicates the he suction pressure cutout programmed at the time of the fault.

Low Ambient Cutout

```
PROGRAM
LOW   AMBIENT  TEMP  CUTOUT = XXX.X °F
```

This message displays the low ambient temp cutout programmed at the time of the fault.

Low Leaving Chilled Liquid Temp Cutout

```
PROGRAM
 LEAVING  LIQUID  TEMP  CUTOUT  = XXX.X °F
```

This message displays the low leaving chilled liquid temperature cutout programmed at the time of the fault.

Motor Current Limit

```
PROGRAM
MOTOR  CURRENT  LIMIT          = XXX %FLA
```

This message indicates the motor current limit programmed at the time of the fault.

Pulldown Current Limit

```
PROGRAM
PULLDOWN  CURRENT  LIMIT     = XXX %FLA
```

This message indicates the pulldown current limit programmed at the time of the fault.

Pulldown Current Limit Time

```
PROGRAM
PULLDOWN  CURRENT  LIMIT  TIME    = XXX MIN
```

This message indicates the pulldown current limit time programmed at the time of the fault.

Condenser Sub-cooling Setpoint

```
PROGRAM
SUB-COOLING  SETPOINT = XXX.X °F
```

This message indicates the liquid sub-cooling setpoint programmed at the time of the fault.

Unit ID Number

```
PROGRAM
REMOTE UNIT ID NUMBER= X
```

This indicates the unit ID # programmed at the time of the fault.

Sound Limit Setpoint

```
PROGRAM
SOUND LIMIT SETPOINT = XXX %
```

This indicates the sound limit setpoint programmed at the time of the fault, if the sound limit option is activated at the factory. If the option is not factory activated, the display will not appear.

Eductor Differential Temperature

```
PROGRAM  ◄DEF XXXXX LO XXXXX HI XXXXX
EDUCTOR DIFFERENTIAL = XXX °F
```

This message indicates the programmed eductor differential temperature at the time of the fault.

Eductor Safety Time

```
PROGRAM  ◄DEF XXXXX LO XXXXX HI XXXXX
EDUCTOR SAFETY TIME  = XXX MIN
```

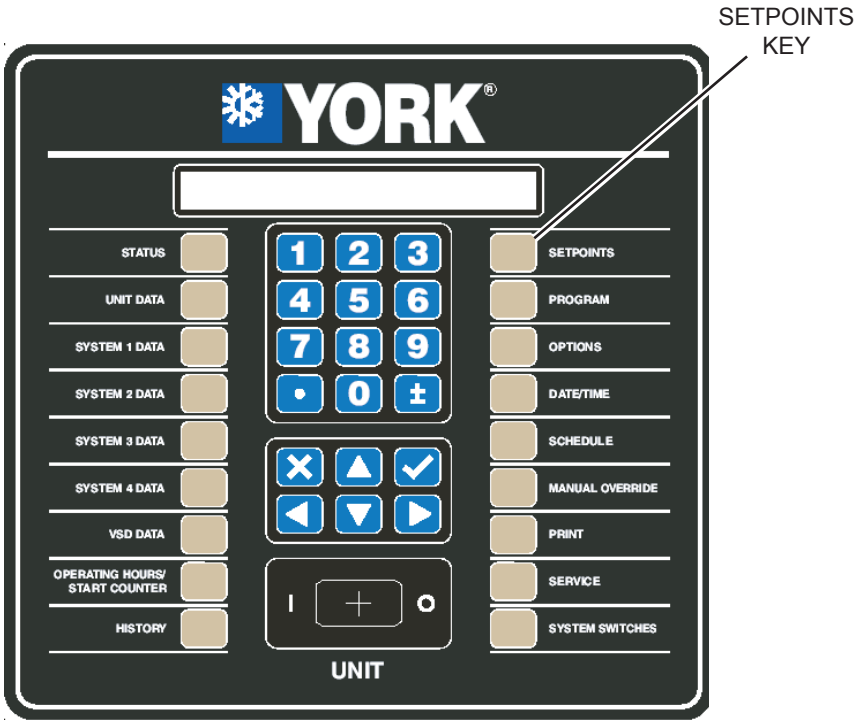
This message indicates the eductor safety time programmed at the time of the fault.

Motor Temperature Unload

```
PROGRAM ◄DEF XXXXX LO XXXXX HI XXXXX
MOTOR TEMPERATURE UNLOAD = XXX °F
```

This message indicates the motor temperature programmed at the time of the fault.

SETPOINTS KEY



LD10605

Setpoints Key Operation

Cooling setpoints and ranges may be programmed by pressing the SETPOINTS key. The first setpoint entry screen will be displayed as shown below. The first line of the display will show the chiller default (DEF), minimum acceptable value (LO) and maximum acceptable value (HI). The second line shows the actual programmed value. *Table 35 on page 258* also shows the allowable ranges for the cooling setpoints and Control Ranges. Note that the Imperial units are exact values while the Metric units are only approximate.

```
SETPOINTS  ◄DEF XXXXX LO XXXXX HI XXXXX
LOCAL COOLING SETPOINT     = XXX.X °F
```

Pressing the SETPOINTS key a second time or the ▼ (ARROW) key will display the leaving chilled liquid Control Range, default, and low/high limits.

```
SETPOINTS  ◄DEF XXXXX LO XXXXX HI XXXXX
LOCAL CONTROL RANGE     = +/- X.X °F
```

Pressing the SETPOINTS key or the ▼ (ARROW) key a third time will display the remote setpoint and cooling range. This display automatically updates about every 2 seconds. This remote setpoint message is show below:

```
SETPOINTS REMOTE SETPOINT = XXX.X °F
     REMOTE CONTROL RANGE = +/- X.X °F
```

If there is no remote setpoint being utilized, the remote setpoint value will be displayed as XXXXXX and the remote Control Range will display XXX.

Pressing the SETPOINTS key or the Arrow key a fourth time will bring up a screen that allows the Maximum Remote Temperature Reset to be programmed. This message is show below:

```
SETPOINTS  ◄DEF XXXXX LO XXXXX HI XXXXX
MAXIMUM REMOTE TEMP RESET   = XXX.X °F
```

The values displayed under each of the key presses may be changed by keying in new values and pressing the ✓ (ENTER) key to store the new value into memory. Where more than one value may be keyed in on a display, a portion of the data that does not need updating may be skipped by pressing the ✓ (ENTER) key. The ✓ (ENTER) key must also be pressed after the last value in the display to store the data into memory.

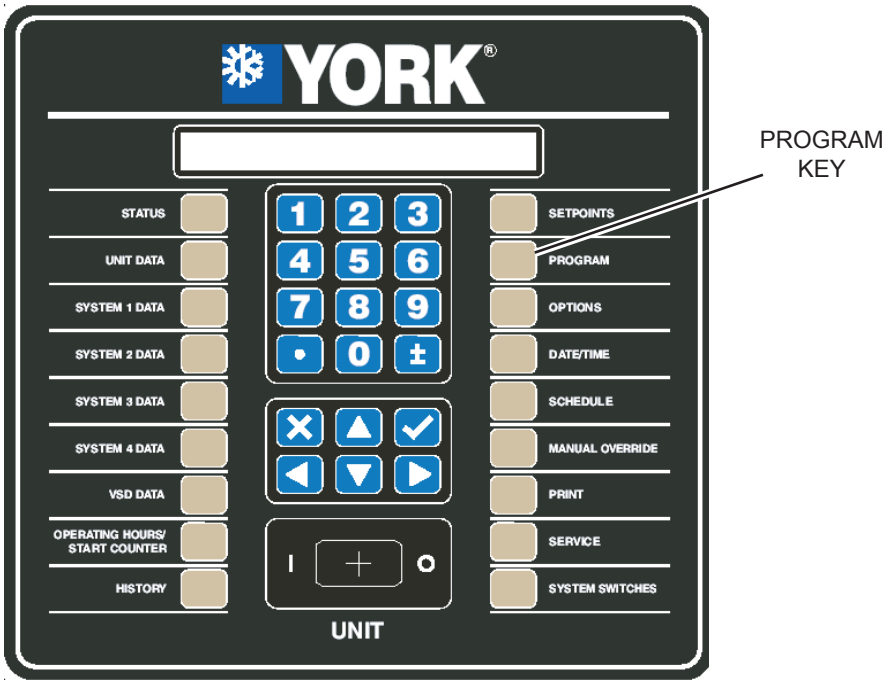
The ▲ (ARROW) key allows scrolling back through the setpoints displays.

The minimum, maximum, and default values allowed under the SETPOINTS key are provided in the following table.

TABLE 35 - SETPOINT LIMITS

PROGRAM VALUE	MODE	LOW LIMIT	HIGH LIMIT	DEFAULT
Leaving Chilled Liquid Setpoint	Water Cooling	40.0°F	60.0°F	44.0°F
		4.4°C	15.6°C	6.7°C
	Glycol Cooling	15.0°F	70.0°F	44.0°F
		-9.4°C	15.6°C	6.7°C
Leaving Chilled Liquid Control Range	-	1.5°F	2.5°F	2.0°F
		0.8°C	1.4°C	1.1°C
Max. Remote Temperature Reset	-	2°F	40°F	20°F
		1°C	22°C	11°C

PROGRAM KEY



LD10605

Program Key Operation

Various operating parameters are programmable by the user. These are modified by pressing the PROGRAM key and then the ✓ (ENTER) key to enter Program Mode. A listing of the limits of the programmable values is found below. Note that the Imperial units are exact values, while Metric units are only approximate.

The ▲ and ▼ (ARROW) keys are used to scroll through the user programmable values. A value may be changed by keying in the new value and pressing the ✓ (ENTER) key to store the new value in memory. The cursor will be displayed on the screen when a number key is pressed. The first line of each message will indicate the chiller default (DEF) value), lowest acceptable programmable value (LO), and highest acceptable programmable value (HI). The user programmable value is programmed ON in the second line of the message.

When the PROGRAM key is first pressed, the following display will appear indicating the user is in the program mode:

```
PROGRAM MODE XXXX
PRESS ENTER KEY TO CONTINUE
```

Pressing the ✓ (ENTER) key again will display the first programmable selection.

Suction Pressure Cutout

```
PROGRAM   ◄DEF XXXXX LO XXXXX HI XXXXX
SUCTION PRESSURE CUTOUT   = XXX.X PSIG
```

The suction pressure cutout protects the chiller from a low refrigerant condition. It also helps protect from a freeze-up due to low or no chilled liquid flow. However, it is only a back-up for a flow switch and cannot protect against an evaporator freeze under many conditions. This cutout is programmable and should generally be programmed for 24PSIG (1.65 Barg) for chilled water cooling.

For a R-134a system, the cutout is programmable between 24.0 and 36.0 PSIG (1.65 and 2.48 Barg) in the Water Cooling mode and 5.0 and 36.0 PSIG (0.34 and 2.28 Barg) in the Glycol Cooling mode. The default value for both modes will be 24.0 PSIG (1.65 Barg).

For a R-513A system, the cutout is programmable between 28.0 and 40.7 PSIG (1.93 and 2.80 Barg) in the water cooling mode and 7.7 and 40.7 PSIG (.53 and 2.08 Barg) in the Glycol cooling mode. The default value for both modes will be 28.0 PSIG (1.93 Barg).

Low Ambient Cutout

```
PROGRAM   ◄DEF XXXXX LO XXXXX HI XXXXX
LOW AMBIENT TEMP CUTOUT   = XXX.X °F
```

The low ambient temp cutout allows programming the outdoor temperature at which it is desired to shut down the chiller to utilize other methods of cooling.

The cutout is programmable between –2.0°F (-18.9°C) and 50°F (10.0 C) with a 25°F (-3.9°C) default.

Low Leaving Liquid Temp Cutout

```
PROGRAM   ◄DEF XXXXX LO XXXXX HI XXXXX
LEAVING LIQUID TEMP CUTOUT = XXX.X °F
```

The leaving chilled liquid temp cutout is programmed to avoid freezing the evaporator due to excessively low chilled liquid temperatures. The cutout is automatically set at 36°F (2.2 °C) in the Water Cooling mode and is programmable in the Glycol Cooling mode. In the Glycol Cooling Mode, the cutout is programmable from 11.0°F to 36.0°F (-11.7 to 2.2°C) with a default of 36.0°F (2.2°C).

Motor Current Limit

```
PROGRAM   ◄DEF XXXXX LO XXXXX HI XXXXX
MOTOR CURRENT LIMIT = XXX % FLA
```

The motor current limit %FLA is programmable. This allows the microprocessor to limit a system before it faults on high current. Typically, the limit point is set at 100%. The unload point is programmable from 30 to 100% with a default of 100%.

Pulldown Current Limit

```
PROGRAM   ◄DEF XXXXX LO XXXXX HI XXXXX
PULLDOWN CURRENT LIMIT = XXX % FLA
```

The pulldown current limit %FLA is programmable. This allows the microprocessor to limit a system on pulldown limiting for the purpose of peak time energy savings. Typically, the limit point is set at 100%. The pulldown limit point is programmable from 30 to 100% with a default of 100%. Be aware when using pulldown motor current limit, the chiller may not be able to load to satisfy temperature demand.

Pulldown Current Limit Time

```
PROGRAM   ◄DEF XXXXX LO XXXXX HI XXXXX
PULLDOWN CURRENT LIMIT TIME = XXX MIN
```

The pulldown current limit time is programmable. This allows the microprocessor to limit a system on pulldown limiting for a defined period of time for the purpose of peak time energy savings. The pulldown limit point is programmable from 0 to 255 minutes, with a default of 0 minutes.

Sub-cooling Setpoint

```
PROGRAM   ◄DEF XXXXX LO XXXXX HI XXXXX
SUB-COOLING SETPOINT = XXX.X °F
```

The liquid sub-cooling superheat setpoint is programmable from 0.0 to 20.0°F (0.0 to 11.1°C) with a 5.0°F (2.8°C) default. Typically the sub-cooling control will be programmed for 5.0 °F.

Unit ID Number

```
PROGRAM   ◄DEF XXXXX LO XXXXX HI XXXXX
REMOTE UNIT ID NUMBER = X
```

For purposes of remote communications, multiple chillers may be connected to an RS-485 communications bus. To allow communications to each chiller, a chiller ID number may be programmed into memory. On a single chiller application, the value will be “0”.

Sound Limit Setpoint

```
PROGRAM   ◄DEF XXXXX LO XXXXX HI XXXXX
SOUND LIMIT SETPOINT = XXX %
```

The sound limit setpoint is programmable from 0 to 100 % with a 0% default. 0% allows operating up to the full speed capability of the unit with no sound limiting. Typically the sound limit control setting will be programmed for 0 % unless sound limiting is utilized on the chiller. Sound limiting will only permit the unit to run to a frequency less than the maximum speed capability of the unit. Programming a value of 1% would be the minimum sound limiting that can be programmed and 100% will be the maximum. 100% will only allow the unit speed to operate at the minimum frequency. Usually, the sound limit % will be programmed somewhere between 0 and 100% according the limiting needed to satisfy the sound requirements of the site. Typically, sound limiting will be utilized in areas sensitive to noise during night-time hours. The sound limit display will only be present if the sound limit option is programmed at the factory.

Eductor Differential

PROGRAM ◄DEF XXXXX LO XXXXX HI XXXXX
EDUCTOR DIFFERENTIAL = XXX °F

The eductor temperature differential is programmable from 0.0° F to 50.0° F. The default value is 5.0°F. The programmed temperature assures the micro will sense a loss of educator oil flow, if the temperature differential rises. A small differential of 15.0°F is recommended. New versions of Software will use a 15.0°F default value.

Eductor Safety Time

PROGRAM ◄DEF XXXXX LO XXXXX HI XXXXX
EDUCTOR SAFETY TIME = XXXX MIN

The educator safety time allows programming the time period the system is permitted to run if the safety threshold is exceeded. The safety time is programmable for 10 minutes to 1000 minutes with 10 minutes as the default. This safety assures the compressor is not starved for oil for long periods of time due to the educator circuit not siphoning oil from the evaporator. A minimum time of 30 minutes is recommended as the program point. New versions of software will utilize a 30 minute default value.

Motor Temperature Unload

PROGRAM ◄DEF XXXXX LO XXXXX HI XXXXX
MOTOR TEMPERATURE UNLOAD = XXX °F

The motor temperature unload is programmable from 150.0° F (65.6° C) to 250.0° F (121.1° C). The default value is 240.0° F (115.5° C). The programmed temperature assures the micro will sense a rise in motor temperature due to a lack of compressor cooling. If the temperature rises above the programmed threshold, the system will unload the compressor by reducing speed. An unload temperature of 240.0° F (115.5° C) is recommended to assure the system does provides maximum capacity.

Default Values

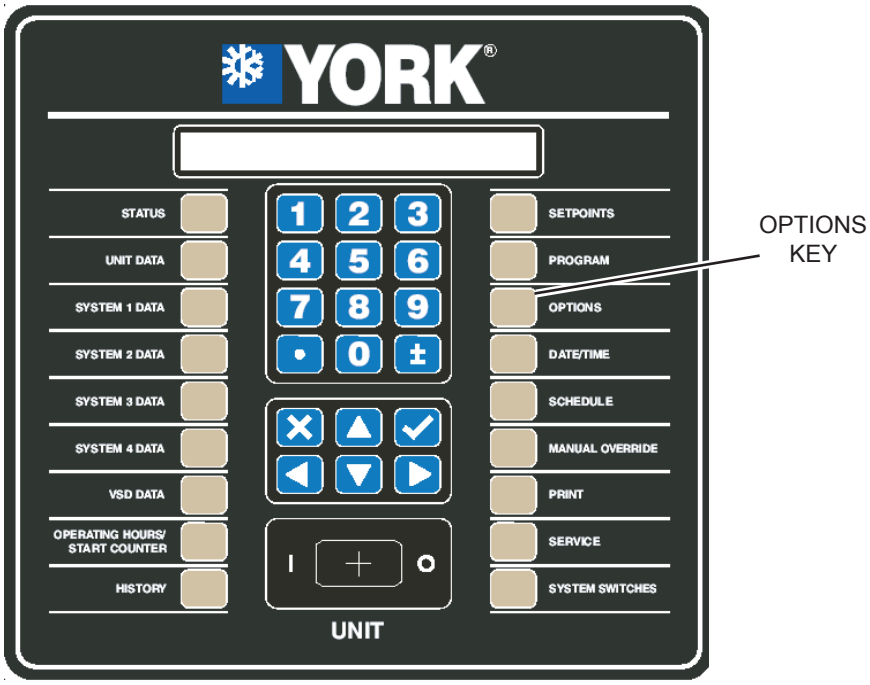
A listing of the low limits, high limits, and default values for each of the programmable values is noted in each display and can be found in Table 30. Note that the Imperial units are exact values while the Metric units are only approximate.

TABLE 36 - PROGRAMMABLE OPERATING PARAMETERS

PROGRAM VALUE	MODE	LOW LIMIT	HIGH LIMIT	DEFAULT
Suction Pressure Cutout	Water Cooling (R-134a)	24.0 PSIG	36.0 PSIG	24.0 PSIG
		1.65 Barg	2.48 Barg	1.65 Barg
	Glycol Cooling (R-134a)	5.0 PSIG	36.0 PSIG	24.0 PSIG
		0.34 Barg	2.48 Barg	1.65 Barg
	Water Cooling (R-513A)	28.0 PSIG	40.7 PSIG	28.0 PSIG
		1.93 Barg	2.80 Barg	1.93 Barg
	Glycol Cooling (R-513A)	7.7 PSIG	40.7 PSIG	28.0 PSIG
		0.53 Barg	2.80 Barg	1.93 Barg
Low Ambient Temp. Cutout	-	-2.0°F	50.0°F	25.0°F
		-18.9°C	10.0°C	-3.9°C
Leaving Chilled Liquid Temp. Cutout	Water Cooling	-	-	36.0°F
		-	-	2.2°C
	Glycol Cooling	11.0°F	36.0°F	36.0°F
		-11.7°C	2.2°C	2.2°C
Motor Current Limit	-	30% FLA	103% FLA	103% FLA
Pulldown Motor Current Limit	-	30% FLA	100% FLA	100% FLA
Pulldown Motor Current Limit Time	-	0 Min	255 Min	0 Min
Condenser Sub-cooling Setpoint	-	0.0°F	20.0°F	5.0°F
		0.0°C	11.1°C	2.8°C
Unit ID Number	-	0	7	0
Sound Limit Setpoint	Sound Limit Option Enabled	0%	100%	0%
Eductor Temp Differential	-	5.0°F	50.0°F	5.0°F*
		2.77°C	27.8°C	2.77°C*
Eductor Safety Time	-	10 Min	1000 Min	10 Min*
Motor Temperature Unload	-	150.0°F	250.0°F	240.0°F
		65.6°C	121.1°C	115.5°C

*New versions of software will have the Eductor Temp Differential default set to 15.0°F (8.3°C) and the Eductor Safety Time set to 30 minutes.

OPTIONS KEY



LD10605

Options Key Operation

The OPTIONS key provides the user with a display of unit configuration and the capability to modify the configuration. These options can only be viewed under the OPTIONS key. To view the current options settings, press the OPTIONS key. Each press of the OPTIONS key or press of the ▲ or ▼ (ARROW) keys will scroll to the next option setting. The ◄ and ► (ARROW) keys allow changing the option choices. The ✓ (ENTER) key must be pressed after a selection is made to save the change in memory.

An explanation of each option message is provided below.

Display Language Selection

The display language can be selected for English, Italian, Polish, Hungarian, German, French, Portuguese, and Spanish.

OPTIONS	DISPLAY LANGUAGE
◄ ►	XXXXXXXXXXXXXXXXX

The default language will be English.

Chilled Liquid Cooling Mode Selection

The Chilled liquid cooling mode can be selected for Water Cooling or low temperature Glycol Cooling.

OPTIONS	CHILLED LIQUID COOLING MODE
◄ ►	XXXXXXXXXXXXXXXXX

When Water Cooling is chosen, the chilled liquid temperature setpoint can only be programmed from 40°F to 70°F.

OPTIONS	CHILLED LIQUID COOLING MODE
◄ ►	WATER COOLING

When Glycol Cooling is chosen, the chilled liquid temperature setpoint can be programmed from 10°F to 70°F.

OPTIONS	CHILLED LIQUID COOLING MODE
◄ ►	GLYCOL COOLING

The default Chilled Liquid Mode will be WATER COOLING.

Local / Remote Control Mode Selection

Local or Remote Control Mode allows the user to select the chilled liquid temperature control mode.

OPTIONS	LOCAL / REMOTE CONTROL MODE
◄ ►	XXXXXXXXXXXXXXXXX

When LOCAL CONTROL mode is selected, chilled liquid control is from the keypad of the chiller. In local mode, a remote device can read system data, but not reset operating parameters.

OPTIONS	LOCAL / REMOTE CONTROL MODE
◄ ►	LOCAL CONTROL

When REMOTE CONTROL mode is selected, control of the chilled liquid setpoint is from a remote device such as an ISN/BAS controller.

OPTIONS	LOCAL / REMOTE CONTROL MODE
◄ ►	REMOTE CONTROL

The default mode will be LOCAL CONTROL.

Display Units Selection

Imperial or SI display units may be selected for data display.

OPTIONS	DISPLAY UNITS
◄ ►	XXXXXXXXXXXXXXXXX

The user may select system operating temperatures and pressures to be displayed in either SI (°C, Barg) or Imperial units (°F, PSIG).

OPTIONS	DISPLAY UNITS
◄ ►	IMPERIAL

OPTIONS	DISPLAY UNITS
◄ ►	SI

The default mode is IMPERIAL.

System Lead/Lag Control Mode Selection

The operator may select the type of lead/lag control desired.

OPTIONS	LEAD / LAG CONTROL MODE
◄ ►	XXXXXXXXXXXXXXXXX

In most cases, automatic lead/lag will be selected. When automatic lead/lag is selected, the microprocessor will attempt to balance run time by switching the lead compressor whenever all compressors are shut OFF. If a compressor is not able to run when the microprocessor attempts a start, the microprocessor will select another compressor in an effort to control chilled liquid temperature. Manual lead/lag allows selecting a specific compressor to be the lead.

OPTIONS	LEAD / LAG CONTROL MODE
◄ ►	AUTOMATIC

The default mode will be AUTOMATIC. Lag selections of individual systems will appear as:

OPTIONS	LEAD / LAG CONTROL MODE
◄ ►	MANUAL SYS 1 LEAD

OPTIONS	LEAD / LAG CONTROL MODE
◄ ►	MANUAL SYS 2 LEAD

Remote Temperature Reset Selection

Remote temperature reset from an external source may be tied directly into the chiller microprocessor board.

OPTIONS	REMOTE TEMP RESET INPUT
◄ ►	XXXXXXXXXXXXXXXXX

Selections may be made for DISABLED (no signal), 0 to 10VDC, 2 to 10VDC, 0 to 20ma, and 4 to 20ma.

OPTIONS	REMOTE TEMP RESET INPUT
◄ ►	DISABLED

OPTIONS	REMOTE TEMP RESET INPUT
◄ ►	0.0 TO 10.0 VOLTS DC

OPTIONS	REMOTE TEMP RESET INPUT
◄ ►	2.0 TO 10.0 VOLTS DC

OPTIONS	REMOTE TEMP RESET INPUT
◄ ►	0.0 TO 20.0 MILLIAMPS

OPTIONS	REMOTE TEMP RESET INPUT
◄ ►	4.0 TO 20.0 MILLIAMPS

The default setting for Remote Temp Reset is DISABLED. This display will only appear if the remote temperature limit option is enabled under the Unit Setup Mode.

Remote Current Limit Input Selection

Remote current limit from an external source may be tied directly into the chiller microprocessor board.

OPTIONS	REMOTE CURRENT LIMIT INPUT
◄ ►	XXXXXXXXXXXXXXXXXXXX

Selections may be made for DISABLED (no signal), 0 to 10VDC, 2 to 10VDC, 0 to 20ma, and 4 to 20ma.

OPTIONS	REMOTE CURRENT LIMIT INPUT
◄ ►	DISABLED

OPTIONS	REMOTE CURRENT LIMIT INPUT
◄ ►	0.0 TO 10.0 VOLTS DC

OPTIONS	REMOTE CURRENT LIMIT INPUT
◄ ►	2.0 TO 10 VOLTS DC

OPTIONS	REMOTE CURRENT LIMIT INPUT
◄ ►	0.0 TO 20.0 MILLIAMPS

OPTIONS	REMOTE CURRENT LIMIT INPUT
◄ ►	4.0 TO 20.0 MILLIAMPS

The default setting for Remote Current Reset is DISABLED. This display will only appear if the remote current limit option is enabled under the Unit Setup Mode.

Remote Sound Limit Selection

Remote sound limit from an external source may be tied directly into the chiller microprocessor board.

OPTIONS	REMOTE SOUND LIMIT INPUT
◄ ►	XXXXXXXXXXXXXXXXXXX

Selections may be made for DISABLED (no signal), 0 to 10VDC, 2 to 10VDC, 0 to 20ma, and 4 to 20ma.

OPTIONS	REMOTE SOUND LIMIT INPUT
◄ ►	DISABLED

OPTIONS	REMOTE SOUND LIMIT INPUT
◄ ►	0.0 TO 10.0 VOLTS DC

OPTIONS	REMOTE SOUND LIMIT INPUT
◄ ►	2.0 TO 10.0 VOLTS DC

OPTIONS	REMOTE SOUND LIMIT INPUT
◄ ►	0.0 TO 20.0 MILLIAMPS

OPTIONS	REMOTE SOUND LIMIT INPUT
◄ ►	4.0 TO 20.0 MILLIAMPS

The default setting for Remote Sound Limit is DISABLED. This display will only appear if the remote sound limit option is enabled under the Unit Setup Mode.

Low Ambient Cutout Enable/Disable

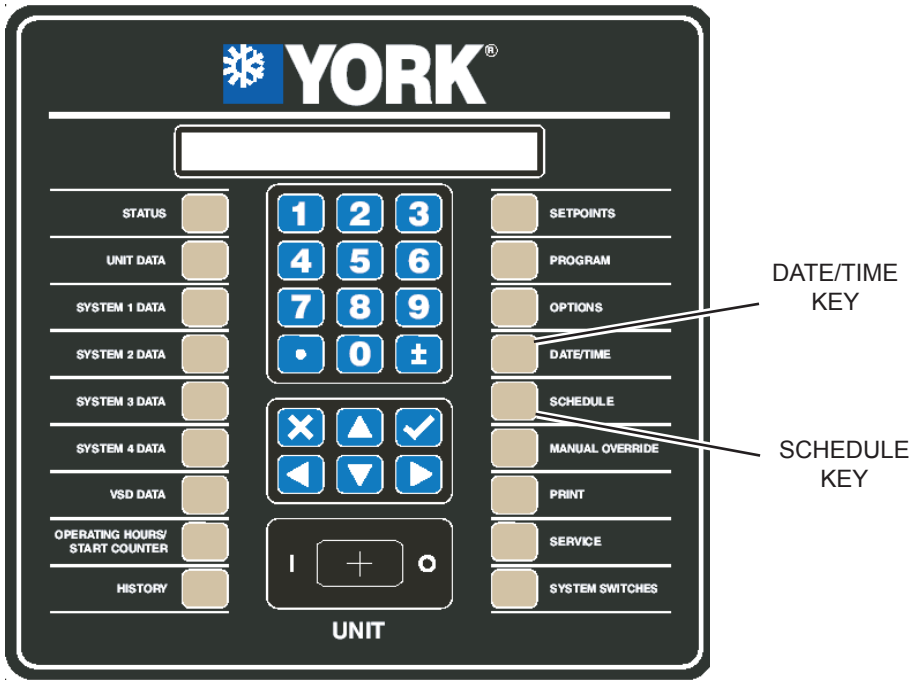
The low ambient cutout may be enabled or disabled. When enabled, the chiller will cut OFF when the low ambient cutout is reached. When disabled, the chiller will run at any temperature.

OPTIONS	LOW AMBIENT TEMPERATURE CUTOUT
◄ ►	ENABLED

OPTIONS	LOW AMBIENT TEMPERATURE CUTOUT
◄ ►	DISABLED

The default setting for the low ambient cutout will be ENABLED.

DATE/TIME AND SCHEDULE KEYS



LD10605

Date/Time Key Operation

When the DATE/TIME key is pressed, the chiller microprocessor will display the date and the time. This feature is useful and required for using the Daily Schedule. It is also a valuable tool for troubleshooting to allow a technician to determine the time of the fault, which is stored in the history memory buffers. When the DATE/TIME key is pressed, the first display screen shown below will be displayed:

```
CLOCK  FRI  18-JUN-2011  10:15:33 AM
DAY OF WEEK ◄ ►              = XXX
```

Whenever any changes are made, the ✓ (ENTER) key must be pressed to store the data.

Pressing the ▲ or ▼ (Arrow) keys allows scrolling to the next programmed item. Pressing the ▼ (DOWN ARROW) key scrolls to the next item that can be programmed and the ▲ (UP ARROW) key scrolls to the previous item.

The day of the week is the first display and can be changed by pressing either the ◄ or ► (LEFT OR RIGHT ARROW) key to select the day. After the day is selected, the ✓ (ENTER) key must be pressed to store the data.

```
CLOCK  FRI  18-JUN-2011  10:15:33 AM
DAY OF MONTH                 = XX
```

Pressing the ▼ (DOWN ARROW) key again scrolls to the day of the month:

```
CLOCK  FRI  18-JUN-2011  10:15:33 AM
DAY OF MONTH                 = XX
```

The day of the month can be selected by keying in the numerical value to select the day. After the day of the month is selected, the ✓ (ENTER) key must be pressed to store the data.

NOTE

A "0" must be typed in to select dates for days of the 1st through the 9th.

Pressing the ▼ (DOWN ARROW) key again scrolls to month:

```
CLOCK  FRI  18-JUN-2011  10:15:33 AM
MONTH ◄ ►                    = XXX
```

The month can be selected by scrolling through the months with the ◄ or ►arrow keys. After the month is selected, the ✓ (ENTER) key must be pressed to store the data.

Pressing the ▼ (DOWN ARROW) key again scrolls to the year:

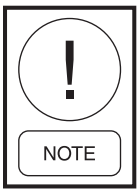
```
CLOCK   FRI   18-JUN-2011   10:15:33 AM
YEAR                                = XXXX
```

The year can be selected by keying in the numerical value to select the year. After the year is selected, the ✓ (ENTER) key must be pressed to store the data.

Pressing the ▼ (DOWN ARROW) key again scrolls to the hour:

```
CLOCK   FRI   18-JUN-2011   10:15:33 AM
HOUR                                = XX
```

The hour can be selected by keying in the numerical value for the hour. After the hour is selected, the ✓ (ENTER) key must be pressed to store the data.

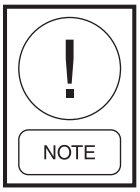


One or two "0's" must be keyed in for hours 00-09.

Pressing the ▼ (DOWN ARROW) key again scrolls to the minute:

```
CLOCK   FRI   18-JUN-2011   10:15:33 AM
MINUTE                              = XX
```

The minute can be selected by keying in the numerical value for the hour. After the minute is selected, the ✓ (ENTER) key must be pressed to store the data.



One or two "0's" must be keyed in for minutes 00 through 09.

Pressing the ▼ (DOWN ARROW) key again scrolls to AM/PM:

```
CLOCK   FRI   18-JUN-2011   10:15:33 AM
AM/PM ◄ ►                           = XX
```

AM/PM can be selected by pressing the ◄ or ► (ARROW) keys. After the meridian is selected, the ✓(ENTER) key must be pressed to store the data.

Pressing the ▼ (DOWN ARROW) key again scrolls to the time format selection:

```
CLOCK   FRI   18-JUN-2011   10:15:33 AM
TIME FORMAT ◄ ►                 = XXXXXXX
```

The time format may be displayed in either a 12 hour or 24 hour format. Selection can be changed by pressing the ◄ or ► (ARROW) keys. The ✓(ENTER) key must be pressed to store the data.

Schedule Key Operation

The Daily Schedule must be programmed for the unit start and stop times. To set the schedule, press the SCHEDULE key. The display will provide a message allowing access to 2 types of schedule information:

```
SCHEDULE      CHOOSE SCHEDULE TYPE
◄ ►           XXXXXXXXXXXXXXXXXXXXXXXX
```

The schedule types are:

- UNIT OPERATING SCHEDULE
- (Default selection)
- SOUND LIMIT SCHEDULE
  (Only if Sound Limiting is enabled by the factory when the option is installed.)

The schedule type (UNIT OPERATING SCHEDULE or SOUND LIMIT SCHEDULE) may be changed by pressing the ◄ (LEFT ARROW) or ► (RIGHT ARROW) keys followed by the ✓(ENTER) key. The selection must be entered by pressing the ✓ (ENTER) key before a schedule display will appear.

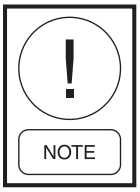
Unit Operating Schedule

The Unit Operating Schedule is used to enable/disable the chiller unit on time of day. The chiller can be enabled and disabled once each day or it can be programmed to run continuously. Any time the daily or holiday schedule shuts the chiller down, the running system(s) will go through a controlled ramped shutdown. If the UNIT OPERATING SCHEDULE is selected under the CHOOSE SCHEDULE display, the following message will appear:

```
SCHEDULE      UNIT OPERATING
MON  START = 06:00 AM   STOP = 10:00 PM
```

The line under the 0 above is the cursor. If the start time is wrong, it can be changed by keying in the new time from the numeric keypad. Once the correct values for the START hour and minute are entered, press

the ✓ (ENTER) key. The cursor will then move to the AM/PM selection. The meridian (AM/PM) value may be changed by the ◄ (LEFT ARROW) or ► (RIGHT ARROW) keys and entered by pressing ✓ (ENTER) key. Repeat this process for the STOP time. Once a schedule is entered, the schedule for the next day will appear. The start and stop time of each day may be programmed differently. To view the schedule without making a change, simply press the SCHEDULE key until the day you wish to view appears. The ▲ (UP ARROW) key will scroll backwards to the previous screen.



If at any time the schedule is changed for Monday, all the other days will change to the new Monday schedule. This means if the Monday times are not applicable for the whole week, then the exceptional days would need to be reprogrammed to the desired schedule.

To program the chiller for 24 hour operation, program the start and stop times of each day of the week for 00:00.

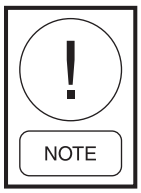
After the SUN (Sunday) schedule appears on the display, a subsequent press of the SCHEDULE or ▲ (UP ARROW) key will display the Holiday schedule. This is a two-part display. The first reads:

```
SCHEDULE       UNIT  OPERATING
HOL  START = 00:00 AM  STOP = 00:00 PM
```

The holiday times may be set using the same procedure as described above for the days of the week. Be sure to press the ✓ (ENTER) key after setting the START and STOP times to save the change in memory. Pressing the SCHEDULE key a second time, the display will show the individual days:

```
SCHEDULE       UNIT  OPERATING
S  M  T  W  T  F  S   HOLIDAY  NOTED  BY  *
```

The line below the empty space is the cursor and will move to the next or previous empty space when the ◄ (LEFT ARROW) or ► (RIGHT ARROW) keys and pressed. To set a day for the Holiday Schedule, the cursor must be moved to the space following the day of the week. The * key is then pressed and an "*" will appear in the space signifying that day as a holiday. The Holiday schedule must be programmed weekly. If there is no holiday, the "*" key is also used to delete the "*". The ✓ (ENTER) key is used to accept the holiday schedule for the entire week.



The HOLIDAY SCHEDULE is a temporary schedule. Once the schedule is executed, the selected holidays will be cleared from memory for the following week.

Sound Limit Schedule

The SOUND LIMIT SCHEDULE allows setting the day and time when the user desires using the "SILENT NIGHT" factory programmed option to limit chiller loading and fan operation for reduced audible noise in the surrounding area. If the SOUND LIMIT SCHEDULE is selected under the CHOOSE SCHEDULE display, the following message will appear:

```
SCHEDULE       SOUND LIMIT    = XXX %
MON  START = 06:00 AM    STOP = 10:00 PM
```

The Sound Limit option can be enabled and disabled once each day or the chiller can be set to run continuously in this mode for sound limiting whenever the chiller is operating. When sound limiting is enabled, the unit will be limited by the Sound Limit setpoint % as set under the PROGRAM key. XXX in the display above will show the Sound Limit Setpoint % programmed under the PROGRAM key. 0% will cause no speed reduction, while 100% only allows running at minimum speed.

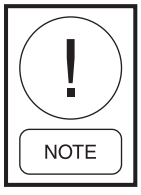
The START Time for a specific day (hour and minute) is entered using the same guidelines used for the start/stop schedules, and press the ✓ (ENTER) key to store it into memory. The cursor will then move to the AM/PM selection.

The AM/PM selection may be chosen using the ◄ (LEFT ARROW) or ► (RIGHT ARROW) keys and pressing ✓ (ENTER) key to store the value.

This process is repeated for the STOP time.

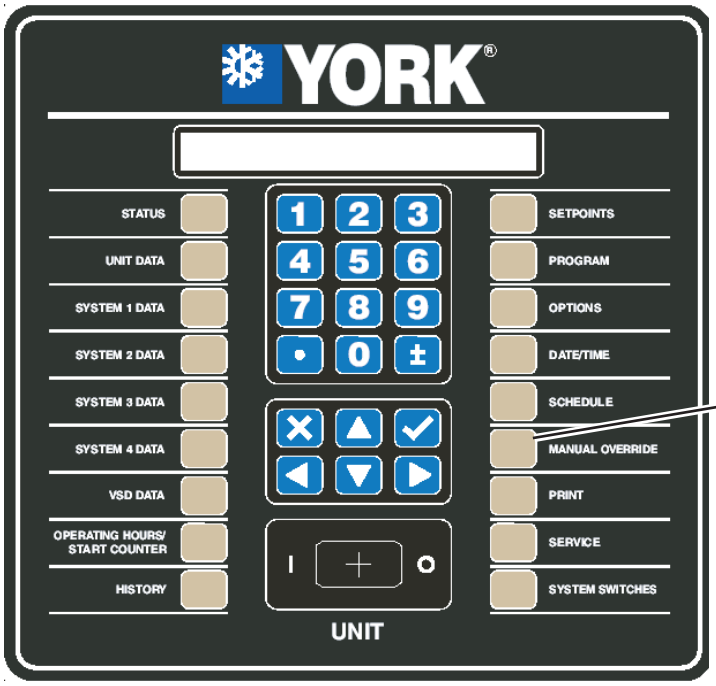
Once the schedule for a specific day is programmed and entered, the schedule for the next day will appear. The schedule for each day may be programmed the same or differently.

To view the schedule without changing it, simply press the SCHEDULE key or the ▼ (DOWN ARROW) key until the desired day is displayed. The ▲ (UP ARROW) key will scroll backwards to the previous screen.



If the schedule is changed for Monday, all other days will change to the Monday schedule. Be aware of this when programming.

MANUAL OVERRIDE KEY



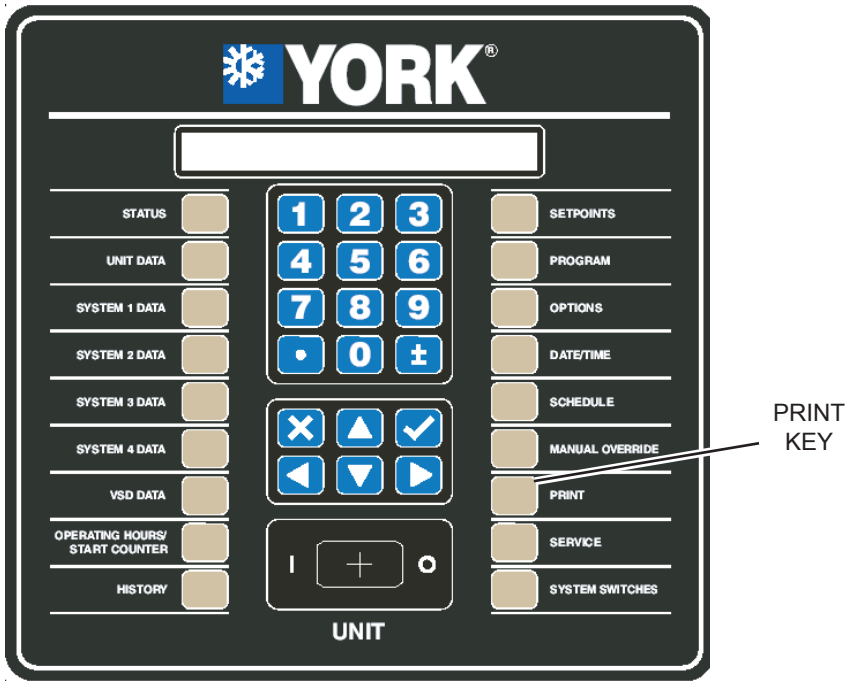
LD10605

Manual Overrride Key Operation

If the MANUAL OVERRIDE key is pressed during a schedule shutdown, the STATUS display will display the message below. This indicates that the Daily Schedule is being ignored and the chiller will start when chilled liquid temperature allows, Remote Contacts, UNIT switch and SYSTEM switches permitting. This is a priority message and cannot be overridden by anti-recycle messages, fault messages, and so on, when in the STATUS display mode. Therefore, do not expect to see any other STATUS messages when in the MANUAL OVERRIDE mode. MANUAL OVERRIDE is to only be used in emergencies or for servicing. Manual override mode automatically disables itself after 30 minutes.

MANUAL OVERRIDE

PRINT KEY



LD10605

Print Key Operation

The PRINT key is used to initiate a printout of current operating data (real time data), a complete history printout of all history (fault) buffers, a printout of all normal shutdowns (compressor cycling, chiller shutdown, and so on) or history (fault) data printout of a specific fault. History Buffer 1 will always be the most recent fault history printout. Printing may also be canceled by selecting the CANCEL PRINTING option. The following message is displayed when the PRINT key is pressed.

```
PRINT  CHOOSE PRINT REPORT
◄ ►    XXXXXXXXXXXXXXXXXXXX
```

After pressing the PRINT key, the printout type is selected by pressing the ◄ (LEFT ARROW) or ► (RIGHT ARROW) keys until the desired printout is displayed.

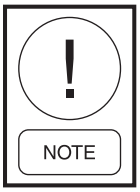
The following table shows the available printout types.

TABLE 37 - PRINTOUT TYPES

PRINTOUT TYPES
Operating Data (Default Selection)
All History Buffers
Normal Shutdowns
History Buffer 1
History Buffer 2
History Buffer 3
History Buffer 4
History Buffer 5
History Buffer 6
History Buffer 7
History Buffer 8
History Buffer 9
History Buffer 10
Cancel Printing

The specific printout is initiated by pressing the ✓ (ENTER) key.

A sample of the operating data printout is shown below. The operating data printout is a snapshot of current system operating conditions when the printout was selected. The sample shows combined printouts of 2, 3, and 4 circuit units. The actual printout will only show data for the appropriate chiller type.



Bold italic text below a line of print is not on the actual printout. Bold italic text indicates information that may not be available on all printouts or is additional information to help explain the difference in a 2/3 or 4-circuit printout.

Operating Data Printout

YORK INTERNATIONAL CORPORATION
YVAA SCREW CHILLER
OPERATING DATA
2:04:14 PM 30 DEC 11

SYS 1
NOT RUNNING
SYS 2
COMPRESSOR RUNNING

OPTIONS

CHILLED LIQUID	WATER
LOCAL/REMOTE MODE	REMOTE
LEAD/LAG CONTROL	AUTOMATIC
REMOTE TEMP RESET	DISABLED
REMOTE CURRENT LIMIT	0 TO 10 V
REMOTE SOUND LIMIT	4 TO 20 MA
(if Sound Limiting enabled)	
LOW AMBIENT CUTOUT	ENABLED

PROGRAM VALUES

SUCT PRESS CUTOUT	44 PSIG
LOW AMBIENT CUTOUT	25.0 DEGF
LEAVING LIQUID CUTOUT	36.0 DEGF
MOTOR CURRENT LIMIT	100 %FLA
PULLDOWN CURRENT LIMIT	100 %FLA
PULLDOWN LIMIT TIME	0 MIN
Sub-cooling SETPOINT	12.0 DEGF
UNIT ID NUMBER	0
SOUND LIMIT SETPOINT	100%
(if Sound Limiting enabled)	

UNIT DATA

LEAVING LIQUID TEMP	49.0 DEGF
RETURN LIQUID TEMP	58.2 DEGF
TEMP RATE	XXX.X DEGF/MIN
COOLING RANGE	42.0+/-2.0 DEGF
REMOTE SETPOINT	44.0 DEGF
AMBIENT AIR TEMP	74.8 DEGF
LEAD SYSTEM	SYS 2
FLOW SWITCH	ON
EVAPORATOR PUMP RUN	ON
EVAPORATOR HEATER	OFF
ACTIVE REMOTE CONTROL	NONE
OPERATING HOURS 1=XXXXX,	2=XXXXX
START COUNTER 1=XXXXX,	2=XXXXX
SOFTWARE VERSION	C.ACS.XX.00

VSD DATA

ACTUAL FREQUENCY	XXX.X HZ
COMMAND FREQUENCY	XXX.X HZ
DC BUS VOLTAGE	XXX VDC
INTERNAL AMBIENT TEMP	XXX.X DEGF
COOLING SYSTEM STATUS	XXX
BASEPLATE TEMPS	XXX XXX DEGF
Pre-charge SIGNAL	XXX
MOTOR OVERLOADS 1/2	XXX XXX AMPS
SOFTWARE VERSION	C.VSD.XX.00
UNIT SERIAL NUMBER	YYYY XXXZZZ

SYSTEM 1 DATA

COMPRESSOR STATUS	OFF
RUN TIME	0- 0- 0- 0 D-H-M-S
MOTOR CURRENT	0AMPS 0 %FLA
SUCTION PRESSURE	125 PSIG
DISCHARGE PRESSURE	131 PSIG
OIL PRESSURE	130 PSIG
CONDENSER LIQUID TEMP	68.4 DEGF
DISCHARGE TEMPERATURE	68.8 DEGF
OIL TEMPERATURE	68.8 DEGF
SAT SUCTION TEMP	71.8 DEGF
Sub-cooling	3.4 DEGF
SAT DISCHARGE TEMP	74.5 DEGF
DISCHARGE SUPERHEAT	6.3 DEGF
MOTOR TMP	XXX.XXXX.XXXX.XDEGF
COMPRESSOR SPEED	XXX.X %
FLASH TANK LEVEL	> 512 ADC

```
COND DRAIN % OPEN                  XXX.X %
ECONOMIZER % OPEN                  XXX.X %
CONDENSER FANS ON                       0
CONDENSER FAN SPEED           XXX % (vsd)
COMPRESSOR HEATER                      ON
VI STEP SOLENOID 1                    OFF
VI STEP SOLENOID 2                    OFF
RUN PERMISSIVE                         ON
VSD RUN RELAY                         OFF
VSD SOFTWARE RUN SIGNAL               OFF
              SYSTEM 2 DATA
COMPRESSOR STATUS                      ON
RUN TIME               0-0-15-26 D-H-M-S
MOTOR CURRENT          104 AMPS  87 %FLA
SUCTION PRESSURE                  57 PSIG
DISCHARGE PRESSURE               233 PSIG
OIL PRESSURE                     218 PSIG
CONDENSER LIQUID TEMP           42.9 DEGF
DISCHARGE TEMPERATURE          145.5 DEGF
OIL TEMPERATURE                102.8 DEGF
SAT CONDENSER TEMP              31.7 DEGF
Sub-cooling                     11.2 DEGF
SAT DISCHARGE TEMP             112.1 DEGF
DISCHARGE SUPERHEAT             33.4 DEGF
MOTOR TMP         XXX.X XXX.X XXX.X DEGF
COMPRESSOR SPEED                   XXX.X%
FLASH TANK LEVEL                < 512 ADC
COND DRAIN % OPEN                  XXX.X%
ECONOMIZER % OPEN                  XXX.X%
CONDENSER FANS ON                       3
CONDENSER FAN SPEED           XXX% (vsd)
COMPRESSOR HEATER                     OFF
VI STEP SOLENOID 1                    OFF
VI STEP SOLENOID 2                    OFF
RUN PERMISSIVE                         ON
VSD RUN RELAY                         OFF
VSD SOFTWARE RUN SIGNAL               OFF
        UNIT OPERATING SCHEDULE
S  M  T  W  T  F  S             *=HOLIDAY
MON START=00:00AM           STOP=00:00AM
TUE START=00:00AM           STOP=00:00AM
WED START=00:00AM           STOP=00:00AM
THU START=00:00AM           STOP=00:00AM
FRI START=00:00AM           STOP=00:00AM
SAT START=00:00AM           STOP=00:00AM
HOL START=00:00AM           STOP=00:00AM
          SOUND LIMIT SCHEDULE
              (if enabled)
MON START=00:00AM           STOP=00:00AM
TUE START=00:00AM           STOP=00:00AM
WED START=00:00AM           STOP=00:00AM
THU START=00:00AM           STOP=00:00AM
FRI START=00:00AM           STOP=00:00AM
SAT START=00:00AM           STOP=00:00AM
HOL START=00:00AM           STOP=00:00AM
```

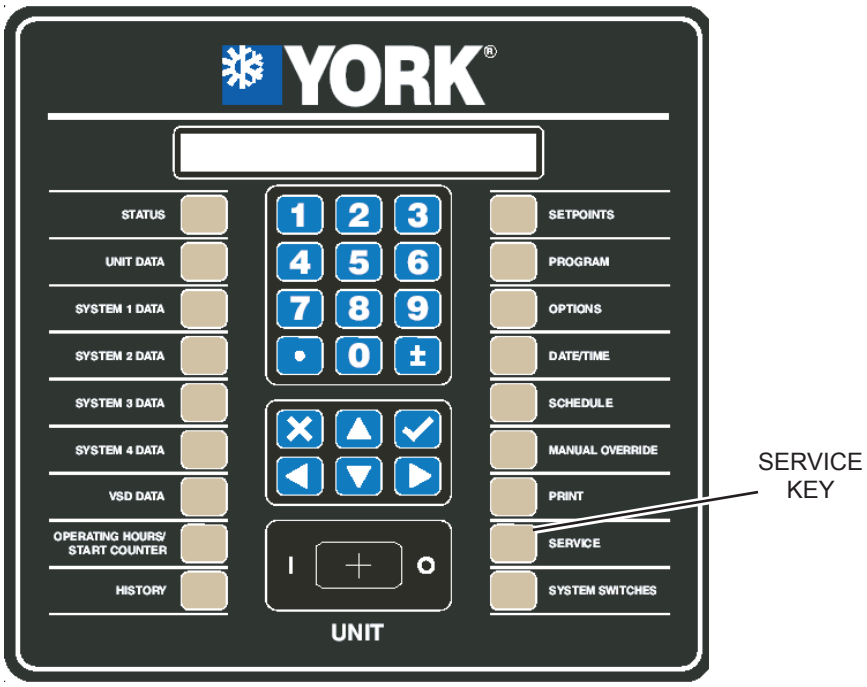
History Data Printout

History printouts, when selected, provide stored data relating to all specific system and chiller operating conditions at the time of the fault, regardless of whether a lockout occurred. History information is stored in battery-backed memory on the Chiller Control Board and is not affected by power failures or resetting of faults. Whenever a fault of any type occurs, all system operating data is stored in battery-backed memory at the instant of the fault. The history printout is similar to the operating data printout except for the change in the header information shown below:

```
      YORK INTERNATIONAL CORPORATION
            YVAA SCREW CHILLER
             HISTORY NUMBER 1
           2:04:14 PM  30 APR 11
SYS 1 YYYYYYY
         HIGH DSCH PRESS SHUTDOWN
        STATUS AT TIME OF SHUTDOWN
SYS 1 XXXXXXXXXXXXXXXXXXXXXXXXX
SYS 2 XXXXXXXXXXXXXXXXXXXXXXXXX
                ALL FAULTS
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
```

The most recent fault will always be stored as HISTORY BUFFER #1.

SERVICE KEY



LD10605

Service Key Operation

The SERVICE key allows viewing data related to the internal function of the chiller system electronics. Data such as circuit board output status as controlled by the Chiller Control software while operating can be viewed and compared to actual chiller operation in the event servicing is required. The SERVICE key allows controlling of analog and digital outputs for troubleshooting purposes when the unit is not running. The Unit Serial Number and Optimized IPLV Control mode are also entered using the SERVICE key.

The ▲▼ (ARROW) keys allow scrolling through the displays. The ▼ (ARROW) key scrolls through the displays in the forward direction.

When the SERVICE key is pressed, the following message will appear:

```
SERVICE MODE XXXX
 PRESS ENTER KEY TO CONTINUE
```

XXXX will display a password, if a numerical password is entered.

Pressing the ✓ (ENTER) key allows "view only" Service Mode operation. All control board I/O will be viewable in this mode. No outputs can be changed. For troubleshooting or startup commissioning purposes, the Chiller Micro Board and some VSD outputs can be toggled or changed by turning OFF the UNIT SWITCH, pressing the SERVICE key, entering password 9675, and pressing the ✓ (ENTER) key. Once the password is entered, the Digital Outputs (DO) can be toggled by pressing the ✓ (ENTER) key. The Analog Outputs can be programmed to output a specific value using the keypad and programming in the desired value, which will usually be noted as a % or VDC. If the UNIT SWITCH is turned back on, the chiller will revert to normal viewable only control.

Displays can be viewed by pressing the ▲and ▼ (ARROW) keys. The ▼ (ARROW) key scrolls through the displays in the forward direction.

The ◄ and ► (ARROW) keys allow jumping from data section to data section to avoid scrolling sequentially through all the data. Once in a data section, the ▲and ▼ (ARROW) keys allow scrolling through the data under the section. Pressing the ◄ and ► (ARROW) keys at any time moves to the top of the next data section.

The data sections are listed below:

- Software Versions / Unit Serial Number
- Analog Inputs

- Digital Inputs
- Digital Outputs
- Analog Outputs
- VSD Logic Digital Output

Software Version / Unit Serial Number

SERVICE	SOFTWARE VERSIONS
CONTROL = C.AXX.ZZ.YY	VSD = C.VXX.ZZ.YY

The software version of the chiller Micro Control Board and the VSD microprocessor are viewable in the first data section.

XX, YY, and ZZ will be filled in with alphanumeric characters.

Pressing the ENTER key again will display the chiller serial number.

SERVICE	UNIT S/N = YYYY XXXZZZ

Analog Inputs

The second data section displays the Analog Inputs (AI). Displays for 3 and 4 compressor chillers are skipped if the unit does not have those systems. These messages will only be displayed in English. The voltage displayed is referenced to common (return, ground) in the system. J12-3 can also be used as common, as well as chassis ground, or the common terminal point on the Chiller Control Board. See the wiring diagrams.

SERVICE AI J17-11	REMOTE TEMP RESET
X.X VDC	= XXX.X %

SERVICE AI J17-12	REMOTE CURRENT LIMIT
X.X VDC	= XXX.X %

SERVICE AI J17-13	REMOTE SOUND LIMIT
X.X VDC	= XXX.X %

The Remote Temp Reset, Remote Current Limit Reset, and Remote Sound Limit inputs have onboard voltage dividers, if the jumper is set for a voltage input. This will cause the voltage read on the display to be less than the voltage on the board header inputs between TB1-17 and 18, TB1-19 and 20, or TB1-40 and 41. To correct for this when measuring voltage at the remote device supplying voltage to the board header while troubleshooting, use the following calculation:

Voltage = 10 x VDC volts / 4.5

If the input is programmed for a current input, the voltage read by the MUX is displayed. If the input is disabled under the OPTIONS key, the voltage display will display “DISABLED”.

The analog inputs display will continue to sequence as follows. The inputs indicate voltages read between the input terminal to the Chiller Logic Board and the plug GND or Drain.

SERVICE AI J17-14	SYS 1 COND LIQUID PRS
X.X VDC	

SERVICE AI J17-15	SYS 2 COND LIQUID PRS
X.X VDC	

SERVICE AI J18-7	LEAVING LIQUID TEMP
X.X VDC	= XXX.X °F

SERVICE AI J18-8	RETURN LIQUID TEMP
X.X VDC	= XXX.X °F

SERVICE AI	J18-9 AMBIENT AIR TEMP
X.X VDC	= XXX.X °F

SERVICE AI J19-1	SYS1 MOTOR TEMP T1
X.X VDC	= XXX.X °F

SERVICE AI J19-2	SYS1 MOTOR TEMP T2
X.X VDC	= XXX.X °F

SERVICE AI J19-3	SYS1 MOTOR TEMP T3
X.X VDC	= XXX.X °F

SERVICE AI J19-6	SYS2 MOTOR TEMP T1
X.X VDC	= XXX.X °F

SERVICE AI J19-7	SYS2 MOTOR TEMP T2
X.X VDC	= XXX.X °F

SERVICE AI J19-8	SYS2 MOTOR TEMP T3
X.X VDC	= XXX.X °F

SERVICE AI	J20-1	SPARE ANALOG
	X.X VDC	

SERVICE AI	J20-2	SPARE ANALOG
	X.X VDC	

SERVICE AI	J20-3	SPARE ANALOG
	X.X VDC	

SERVICE AI	J20-6	SPARE ANALOG
	X.X VDC	

SERVICE AI	J20-7	SPARE ANALOG
	X.X VDC	

SERVICE AI J20-8	SPARE ANALOG
X.X VDC	
SERVICE AI J21-3	SYS1 OIL TEMP
X.X VDC	= XXX.X °F
SERVICE AI J21-6	SYS1 FL TANK LEVEL
X.X VDC	= XXX ADC %
SERVICE AI J21-13	SYS1 COND LIQUID TEMP
X.X VDC	= XXX.X °F
SERVICE AI J21-16	SYS1 DISCHARGE TEMP
X.X VDC	= XXX.X °F
SERVICE AI J21-20	SYS1 SUCTION PRESS
X.X VDC	= XXX.X PSIG
SERVICE AI J21-22	SYS1 OIL PRESS
X.X VDC	= XXX.X PSIG
SERVICE AI J21-24	SYS1 DISCHARGE PRESS
X.X VDC	= XXX.X PSIG
SERVICE AI J22-3	SYS2 OIL TEMP
X.X VDC	= XXX.X °F
SERVICE AI J22-6	SYS2 FL TANK LEVEL
X.X VDC	= XXX ADC %
SERVICE AI J22-13	SYS2 COND LIQUID TEMP
X.X VDC	= XXX.X °F
SERVICE AI J22-16	SYS2 DISCHARGE TEMP
X.X VDC	= XXX.X °F
SERVICE AI J22-20	SYS2 SUCTION PRESS
X.X VDC	= XXX.X PSIG
SERVICE AI J22-22	SYS2 OIL PRESS
X.X VDC	= XXX.X PSIG
SERVICE AI J22-24	SYS2 DISCHARGE PRESS
X.X VDC	= XXX.X PSIG
SERVICE AI J23-6	SPARE ANALOG INPUT
X.X VDC	
SERVICE AI J23-13	SYS1 EDUCTOR TEMP
X.X VDC	= XXX.X °F
SERVICE AI J23-16	SPARE ANALOG INPUT
X.X VDC	
SERVICE AI J23-20	SPARE ANALOG INPUT
X.X VDC	
SERVICE AI J23-22	SPARE ANALOG INPUT
X.X VDC	
SERVICE AI J23-24	SPARE ANALOG INPUT
X.X VDC	
SERVICE AI J24-3	SPARE ANALOG INPUT
X.X VDC	
SERVICE AI J24-6	SPARE ANALOG INPUT
X.X VDC	
SERVICE AI J24-13	SYS2 EDUCTOR TEMP
X.X VDC	= XXX.X °F
SERVICE AI J24-16	SPARE ANALOG INPUT
X.X VDC	
SERVICE AI J24-20	SPARE ANALOG INPUT
X.X VDC	
SERVICE AI J24-22	SPARE ANALOG INPUT
X.X VDC	
SERVICE AI J24-24	SPARE ANALOG INPUT
X.X VDC	

Digital Inputs

The third data section displays the Digital Inputs (DI) to the Chiller Control Board that can be viewed from the Service Mode. Displays for systems 3 and 4 are skipped if the systems are not present on the chiller. In this case, XXX is replaced with ON or OFF in the actual display. These messages will only be displayed in English.

SERVICE DI J4-2	UNIT SWITCH 1
	STATUS = XXX
SERVICE DI J4-3	UNIT SWITCH 2
	STATUS = XXX
SERVICE DI J4-4	SYS 1 HPCO
	STATUS = XXX
SERVICE DI J4-5	SYS 2 HPCO
	STATUS = XXX
SERVICE DI J4-6	VSD FAULT RELAY
	STATUS = XXX
SERVICE DI J5-1	SPARE DIGITAL INPUT
	STATUS = XXX
SERVICE DI J5-2	SPARE DIGITAL INPUT
	STATUS = XXX

SERVICE DI J5-3	SPARE DIGITAL INPUT STATUS = XXX
SERVICE DI J6-2	FLOW SWITCH STATUS = XXX
SERVICE DI J6-3	PRINT STATUS = XXX
SERVICE DI J6-4	SYS 1 RUN PERM STATUS = XXX
SERVICE DI J6-5	SYS 2 RUN PERM STATUS = XXX
SERVICE DI J6-6	SPARE DIGITAL INPUT STATUS = XXX
SERVICE DI J7-2	CONFIG INPUT 0 STATUS = XXX
SERVICE DI J7-4	CONFIG INPUT 1 STATUS = XXX
SERVICE DI J7-6	CONFIG INPUT 2 STATUS = XXX
SERVICE DI J7-8	CONFIG INPUT 3 STATUS = XXX
SERVICE DI J7-10	CONFIG SPARE INPUT 0 STATUS = XXX

Digital Outputs

The fourth data section displays the Digital Outputs (DO) from the Chiller Control Board that can be viewed in the Service Mode. Displays for Systems 3 and 4 are skipped if the systems are not present on the chiller. In this case, XXX is replaced with ON or OFF in the actual dispay. These messages will only be displayed in English.

SERVICE DO J9-1 RB1 TB1-20	EVAP HEATER STATUS = XXX
SERVICE DO J9-2 RB1 TB1-18	SYS 1 VSD RUN STATUS = XXX
SERVICE DO J9-3 RB1 TB1-16	SYS 1 ALARM STATUS = XXX
SERVICE DO J9-4 RB1 TB1-14	EVAP HEATER 2 STATUS = XXX
SERVICE DO J9-5 RB1 TB1-12	SYS 1 VI STEP 1 STATUS = XXX
SERVICE DO J9-6 RB1 TB1-10	SYS 1 VI STEP 2 STATUS = XXX
SERVICE DO J9-7 RB1 TB1-8	SYS 1 COND FAN OUT 4 STATUS = XXX
SERVICE DO J9-8 RB1 TB1-6	SYS 1 COND FAN OUT 1 STATUS = XXX
SERVICE DO J9-9 RB1 TB1-5	SYS 1 COND FAN OUT 2 STATUS = XXX
SERVICE DO J9-10 RB1 TB1-4	SYS 1 COND FAN OUT 3 STATUS = XXX
SERVICE DO J9-11 RB1 TB1-3	SYS 1 COMP HEATER STATUS = XXX
SERVICE DO J9-12 RB1 TB1-2	SYS 1 ECON SOL VALVE STATUS = XXX
SERVICE DO J10-1 RB1 TB1-20	EVAP PUMP RUN STATUS = XXX
SERVICE DO J10-2 RB2 TB1-18	SYS 2 VSD RUN STATUS = XXX
SERVICE DO J10-3 RB2 TB1-16	SYS 2 ALARM STATUS = XXX
SERVICE DO J10-4 RB1 TB1-14	CHILLER RUN STATUS = XXX
SERVICE DO J10-5 RB2 TB1-12	SYS 2 COND FAN OUT 4 STATUS = XXX
SERVICE DO J10-6 RB2 TB1-10	SYS 2 VI STEP 1 STATUS = XXX
SERVICE DO J10-7 RB2 TB1-8	SYS 2 VI STEP 2 STATUS = XXX
SERVICE DO J10-8 RB1 TB1-6	SYS COND 2 FAN OUT 1 STATUS = XXX
SERVICE DO J10-9 RB1 TB1-5	SYS COND 2 FAN OUT 2 STATUS = XXX
SERVICE DO J10-10 RB1 TB1-4	SYS COND 2 FAN OUT 3 STATUS = XXX
SERVICE DO J10-11 RB1 TB1-3	SYS 2 COMP HEATER STATUS = XXX
SERVICE DO J10-12 RB1 TB1-2	SYS 2 ECON SOL VALVE STATUS = XXX

SERVICE DO J11-1	SPARE DIGITAL OUTPUT
RB3 TB1-20	STATUS = XXX

SERVICE DO J11-2	SPARE DIGITAL OUTPUT
RB3 TB1-18	STATUS = XXX

SERVICE DO J11-3	SYS 4 COND FAN OUT 3
RB3 TB1-16	STATUS = XXX

SERVICE DO J11-4	SYS 4 COMP HEATER
RB3 TB1-14	STATUS = XXX

SERVICE DO J11-5	SYS 4 ECON SOL VALVE
RB3 TB1-12	STATUS = XXX

SERVICE DO J11-6	SPARE DIGITAL OUTPUT
RB3 TB1-10	STATUS = XXX

SERVICE DO J11-7	SPARE DIGITAL OUTPUT
RB3 TB1-8	STATUS = XXX

SERVICE DO J11-8	SPARE DIGITAL OUTPUT
RB3 TB1-6	STATUS = XXX

SERVICE DO J11-9	SPARE DIGITAL OUTPUT
RB3 TB1-5	STATUS = XXX

SERVICE DO J11-10	SPARE DIGITAL OUTPUT
RB3 TB1-4	STATUS = XXX

SERVICE DO J11-11	SPARE DIGITAL OUTPUT
RB3 TB1-3	STATUS = XXX

SERVICE DO J11-12	SPARE DIGITAL OUTPUT
RB3 TB1-2	STATUS = XXX

Analog Outputs

The fifth data section displays the Analog Outputs (AO) that can be viewed from the Service Mode. The Analog Output signals are typically referenced to the common (return, ground) in the system. Terminal J12-3 can also be used as common, as well as chassis ground, or the common terminal point on the Chiller Control Board. See the wiring diagrams. Displays for systems 3 and 4 are skipped if the systems are not present on the chiller. XXX is replaced with ON or OFF in the actual display. The state of these outputs is only viewable unless the password 9675 ✓(ENTER) key was entered from the initial Service Mode display with the UNIT switch in the OFF position. The chiller will not be permitted to run when the outputs are made active. The outputs can be programmed for a specific % output by keying in the value and pressing the ✓(ENTER) key. These messages will only be displayed in English.

SERVICE AO J15-1	SYS 1 COND VALVE OUT
XXX.X %	= XX.X VDC

SERVICE AO J15-3	SYS 1 ECON VALVE OUT
XXX.X %	= XX.X VDC

SERVICE AO J15-5	SYS 2 COND VALVE OUT
XXX.X %	= XX.X VDC

SERVICE AO J15-7	SYS 2 ECON VALVE OUT
XXX.X %	= XX.X VDC

SERVICE AO J14-1	SPARE ANALOG OUTPUT
XXX.X %	= XX.X VDC

SERVICE AO J14-2	SPARE ANALOG OUTPUT
XXX.X %	= XX.X VDC

SERVICE AO J14-3	SPARE ANALOG OUTPUT
XXX.X %	= XX.X VDC

SERVICE AO J14-4	SPARE ANALOG OUTPUT
XXX.X %	= XX.X VDC

SERVICE AO J25-1	SYS 1 COND FAN SPEED
XXX.X %	= XX.X VDC

SERVICE AO J25-2	SYS 2 COND FAN SPEED
XXX.X %	= XX.X VDC

SERVICE AO J25-3	SPARE
XXX.X %	= XX.X VDC

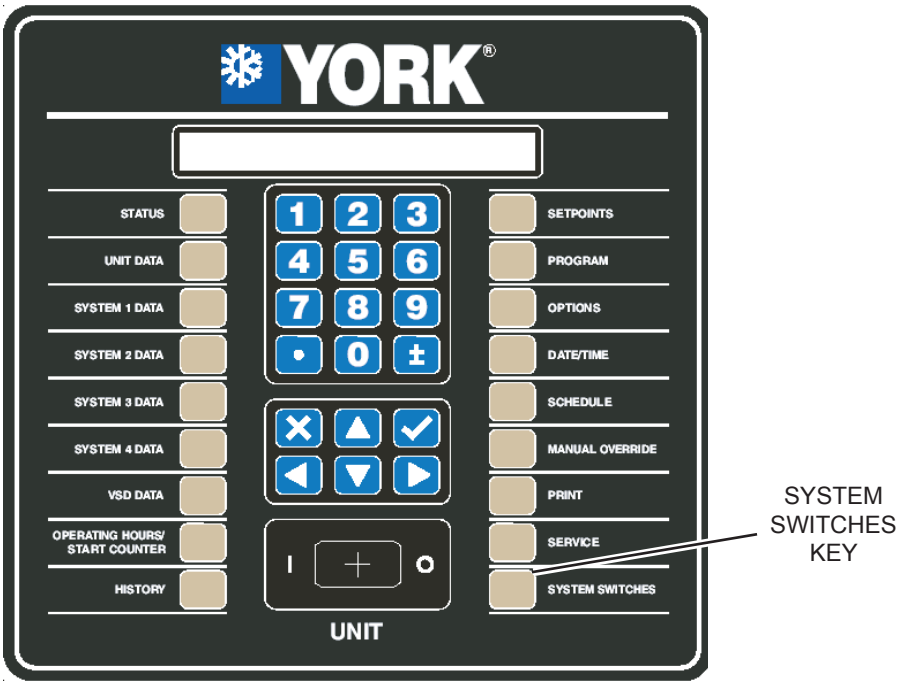
SERVICE AO J25-4	SPARE
XXX.X %	= XX.X VDC

VSD Digital Outputs

The sixth data section displays the “VSD” digital outputs (DO) that can be viewed from the Service Mode. The Digital Output signals indicate the status of the output. The 0 to 120VAC digital outputs are referenced to neutral (Wire 2).

SERVICE DO J10-2	VSD COOLING FAN/PUMP
VSD LOGIC	STATUS = XXX

SYSTEM SWITCHES KEY



LD10605

System Switches Key Operation

The SYSTEM SWITCHES key allows the operator to turn individual systems ON and OFF. Safety lock-outs are also reset by selecting the respective system switch RESET. When the SYSTEM SWITCHES key is pressed, the following message will appear:

SYSTEM SWITCHES	SYS 1 ON / OFF / RESET
◄ ►	=XXXXXXXXXXXXXXX

The display indicates the respective system and it's ON/OFF /reset switch status. The ▲▼ (ARROW) keys allow scrolling to the next and previous system switch (System 1 and 2).

SYSTEM SWITCHES	SYS 2 ON / OFF / RESET
◄ ►	=XXXXXXXXXXXXXXX

The ◄ (LEFT ARROW) or ► (RIGHT ARROW) keys allow scrolling through the choices of:

- SYSTEM OFF (default)
- SYSTEM ON
- RESET (LOCKOUT)

The switch selection is accepted into memory by pressing the ✓ (ENTER) key.

When the "RESET" selection is made and accepted, it will not change the position of the switch (either ON or OFF).

NOTE

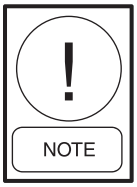
Whenever possible, except in emergencies, always use the associated system switch to turn off a compressor, which allows the compressors to go through a controlled shutdown. Avoid using the "UNIT" switch to turn off the compressors.

SERIAL NUMBER PROGRAMMING

When changing a Chiller Control Board, a Chiller Control Board EPROM, or if a situation occurs where a chiller is not programmed from the factory, the chiller serial number will need to be programmed into the chiller. The serial number is the actual serial number displayed on the unit Data Plate. The serial number will be in a format similar to RABM000000, where the first 4 characters are letters and the next 6 are numbers. The lack of a serial number programmed into the panel will not prevent a chiller from operating. The STATUS display will inform the operator a serial number problem exists by displaying the following message:

```
UNIT WARNING:          INVALID SERIAL NUMBER
ENTER UNIT SERIAL NUMBER
```

If the following message appears, immediately contact Johnson Controls Product Technical Support. The appearance of this message may also mean the chiller has lost important factory programmed information and may need to be reprogrammed. Additional STATUS messages can be viewed by pressing the STATUS key repetitively to enable the technician to view any other messages that may be preventing the chiller from operating.



Changing the programming of this feature requires the date and time to be set on the chiller prior to programming. The password is also time sensitive and must be used on the date used to calculate the password.

Johnson Controls Product Technical Support will provide a factory password to allow programming the serial number into the chiller. You will need to supply Factory Technical Support with the version of the Chiller Control Board EPROM. The version will be written on the EPROM label and typically will be in the format Version C.ACS.XX.XX.

After obtaining the password, the following steps will need to be followed to input the serial number. As the serial number is input, the characters keyed in will appear in the display indicating the panel has recognized the entry.

First press the SERVICE key. The following message will appear:

```
SERVICE MODE           XXXXX
PRESS ENTER KEY TO CONTINUE
```

Key in the 5 digit alphanumeric password provided by Product Technical Support and press the ✓ (ENTER) key. The following display will appear:

```
S/N ENTRY      UNIT SERIAL NUMBER POS 1
◄ ►            X
```

Key in the first letter (A through Z) of the serial number using the ◄ and ► (ARROW) keys and press the ✓ (ENTER) key. Press the ▼(Down ARROW) key to scroll to position 2 and the following message will appear:

```
S/N ENTRY      UNIT SERIAL NUMBER POS 2
◄ ►            X
```

Key in the second letter (A through N) of the serial number using the ◄ and ► (ARROW) keys and press the ✓ (ENTER) key. Press the ▼(Down ARROW) key to scroll to position 3 and the following message will appear:

```
S/N ENTRY      UNIT SERIAL NUMBER POS 3
◄ ►            X
```

Key in the third letter (A through Z) of the serial number using the ◄ and ► (ARROW) keys and press the ✓ (ENTER) key. Press the ▼(Down arrow) key to scroll to position 4 and the following message will appear:

```
S/N ENTRY      UNIT SERIAL NUMBER POS 4
◄ ►            X
```

Key in the fourth letter (A through Z) of the serial number using the ◄ and ► (ARROW) keys and press the ✓ (ENTER) key. Press the ▼(Down arrow) key to scroll to positions 5-7 and the following message will appear:

```
S/N ENTRY UNIT S/N = YYYY XXX ZZZ
UNIT SERIAL NUMBER POS 5-7 = XXX
```

At this point, the letters entered for the YYYY inputs should now appear in the top line of the display and should match the first 4 characters of the serial number on the unit Data Plate. The next three digits of the serial number should now be keyed in (XXX). Press the ✓ (ENTER) key to store the input. Press the ▼ (DOWN ARROW) key to scroll to positions 8 through10 and the following message will appear:

```
S/N ENTRY UNIT S/N = YYYY XXX ZZZ
UNIT SERIAL NUMBER POS 8-10 = ZZZ
```

TABLE 38 - UNIT SETUP PROGRAMMABLE VALUES

SETUP MODE VALUE	LOW LIMIT	HIGH LIMIT	DEFAULT
Sys 1 Number of Cond Fans	4	10	6
Sys 2 Number of Cond Fans	4	10	6
Compressor 1 Operating Hours	0	99,999	0
Compressor 2 Operating Hours	0	99,999	0
Compressor 1 Starts	0	99,999	0
Compressor 2 Starts	0	99,999	0
Clear History Buffers	NO	YES	-
Remote Temp Reset Option	DISABLED	ENABLED	DISABLED
Remote Current Limit Option	DISABLED	ENABLED	DISABLED
Sound Limit Option	DISABLED	ENABLED	DISABLED
Remote Inputs Service Time	5 Min.	60 Min.	15 Min.
VSD Fan Control	DISABLED	OPT VSD	DISABLED
Minimum Running Speed	50 Hertz	100 Hertz	50 Hertz
Sys 1 Compressor Displacement	See Note 1	See Note 1	See Note 1
Sys 2 Compressor Displacement	See Note 1	See Note 1	See Note 1
Maximum Compressor Speed	170 Hertz	203 Hertz	See PIN 39, 40 and 41 on chiller data plate.
Minimum Running speed	50 Hertz	100 Hertz	50 Hertz
Sys 1 Motor Sensor To Ignore	See *Unit Setup Mode on page 280*		
Sys 2 Motor Sensor To Ignore	See *Unit Setup Mode on page 280*		

NOTE 1 - For Compressor Displacement: CTS70 = 187, CTS51 = 128, CTS45 = 100, CTS36 = 82, CTS24 = 62

At this point, the letters entered for the YYYY and XXX inputs should now appear in the top line of the display and should match the first 7 characters of the serial number on the unit Data Plate. The next three digits of the serial number should now be keyed in (ZZZ). Press the ✓ (ENTER) key to store the input. The full serial number should now be displayed across the top of the display and the cursor should disappear.

Press the STATUS key to go to the next STATUS display to determine if additional Status messages are preventing the chiller from operating.

UNIT SETUP MODE

Unit Setup Mode will allow the programming all of the programmable values that the user should never change. These will either be programmed at the factory or by service personnel on the job. These values will also need to be checked when changing a Chiller Control Board or EPROM.

This mode may be entered by pressing the PROGRAM key, entering the password 4245, and pressing the ✓(ENTER) key. *Table 38 on page 280* lists the values that can be programmed in this mode. Details relating to the actual message follow the table.

For a R-513A system, make sure that you have set the "refrigerant" before starting the system. Scroll down until you find the "Refrigerant" setup, select "R-513A" using the ► (ARROW) key and press the ✓ (ENTER) key to confirm.

The following messages will be displayed for the Unit Setup Mode in the order they appear. The first group of displays relates to setup parameters that relate to unit configuration and factory setpoints.

```
SETUP  MODE   ◄ DEF XXXXX LO XXXXX HI XXXXX
SYS 1 NUMBER OF COND FANS          = X
```

```
SETUP  MODE   ◄ DEF XXXXX LO XXXXX HI XXXXX
SYS 2 NUMBER OF COND FANS          = X
```

```
SETUP  MODE   ◄ DEF XXXXX LO XXXXX HI XXXXX
COMP 1 OPERATING HOURS             = XXXXX
```

```
SETUP  MODE   ◄ DEF XXXXX LO XXXXX HI XXXXX
COMP 2 OPERATING HOURS             = XXXXX
```

```
SETUP  MODE   ◄ DEF XXXXX LO XXXXX HI XXXXX
COMP 1 STARTS                      = XXXXX
```

```
SETUP  MODE   ◄ DEF XXXXX LO XXXXX HI XXXXX
COMP 2 STARTS                      = XXXXX
```

The following setup display is selectable as YES or NO using the ◄ and ► (ARROW) keys.

```
SETUP MODE   CLEAR HISTORY BUFFERS?
◄ ►          XXXXXXXXXXXXXXXXXXXXXXX
```

The following (3) setup OPTION displays are selectable as ENABLED or DISABLED using the ◄ and ► (ARROW) keys according to the options installed on the chiller:

```
SETUP MODE   REMOTE TEMP RESET OPTION
◄ ►          XXXXXXXXXXXXXXXXXXXXXXX
```

```
SETUP MODE   REMOTE CURRENT LIMIT OPTION
◄ ►          XXXXXXXXXXXXXXXXXXXXXXX
```

```
SETUP MODE   SOUND LIMIT OPTION
◄ ►          XXXXXXXXXXXXXXXXXXXXXXX
```

The following setup OPTION display is selectable as ENABLED or DISABLED using the ◄ and ► (ARROW) keys:

```
SETUP MODE   ◄ DEF XXXXX LO XXXXX HI XXXXX
REMOTE INPUTS SERVICE TIME      = XX MIN
```

The following setup OPTION display allows programming of the type of fan control installed. This includes DISABLED (contactor fan control), STD, VSD (standard VSD) or OPT VSD (optimized) VSD). Only DISABLED and OPT VSD should be used based on whether VSD fan control is installed.

```
SETUP MODE   VSD FAN CONTROL
             XXXXXXXXXXXXXXXXXXXXXXXXX
```

The Compressor Displacement Setup option displays the compressor type installed in the respective circuits. This must be programmed per the compressor data plate information to assure the control algorithms to cycle fans, perform correctly. The following are selectable using the ◄ and ► (arrow) keys:

- CTS70 = 187
- CTS51 = 128
- CTS45 = 100
- CTS36 = 82
- CTS24 = 62

```
SETUP MODE SYS 1 COMPRESSOR DISPLACEMENT
             XXXXXXXXXXXXXXXXXXXXXXXXX
```

```
SETUP MODE SYS 2 COMPRESSOR DISPLACEMENT
             XXXXXXXXXXXXXXXXXXXXXXXXX
```

The following setup OPTION display programs the Maximum Compressor Speed of the chiller. This must be programmed based on the PIN number (model number) on the chiller data plate. See PIN number 39, 40 and 41 for the program value.

```
SETUP MODE ◄ DEF XXXXX LO XXXXX HI XXXXX
MAXIMUM COMPRESSOR SPEED   =   XXX.X HZ
```

The following setup OPTION display programs the Minimum Compressor Speed of the chiller. This is normally programmed for 50 Hz.

```
SETUP MODE ◄ DEF XXXXX LO XXXXX HI XXXXX
MINIMUM COMPRESSOR SPEED   =   XXX HZ
```

The following Motor Temp Sensor OPTION displays are selectable as ENABLED or DISABLED using the ◄ and ► (ARROW) keys. The choices are:

- NONE (default)
- TEMP SENSOR 1
- TEMP SENSOR 2
- TEMP SENSOR 3

```
SETUP MODE   SYS 1 MOTOR SENSOR TO IGNORE
◄ ►          XXXXXXXXXXXXXXXXXXXXXXXX
```

```
SETUP MODE   SYS 2 MOTOR SENSOR TO IGNORE
◄ ►          XXXXXXXXXXXXXXXXXXXXXXXX
```

If a motor temperature sensor fails, a single sensor may be ignored by making a program change in the Unit Setup Mode. The default setting is “NONE”, indicating all sensors are being monitored.

The Fan Speed Multiplier Option displays the multiplier programmed. The multiplier is based on the type of fan installed based on PIN 52 of the chiller data plate and the type of power (50 Hz or 60 Hz) applied to the chiller. The options are selectable using the ◄ and ► (arrow) keys and are listed along with the display as follows:

- 50Hz PIN 52 = M 1.11
- 60Hz PIN 52 = M 1.05
- 50/60 Hz PIN 52 = V 1.00 (default)
- 60Hz PIN 52 = K 0.86
- 50Hz PIN 52 = K 0.83

TABLE 39 - SERIAL PORT CONNECTIONS

BOARD	HEADER	PORT TYPE	PORT USE
Chiller Control Board	TB1 / TB2	RS-232 / RS-485	Printer/RCC and ISN
Chiller Control Board	J2 / J1	RS-485	Control Panel <-> VSD #1 / #2
VSD Logic Board	J12	Opto- Coupled RS-485	VSD <-> Control Panel

```
SETUP MODE   FAN SPEED MULTIPLIER
◄ ►          XXXXXXXXXXXXXXXXXXXXXXXX
```

DEFAULT PROGRAMMABLE VALUES

To quickly program or reset most of the user programmable values to their default values, press PROGRAM, 6140, ENTER. The following message will then be displayed, allowing a choice to reset the operating parameters to their default values.

```
DEFAULTS SET PROG VALUES TO DEFAULT?
◄ ►          XXX
```

YES or NO may be selected for XXX using the ◄ and ► (ARROW) keys to change the selection.

Following is a list of the operating parameters that will be reset to their default values:

- Suction Pressure Cutout = 24.0 PSIG
- Low Ambient Air Temp Cutout = 25°F
- Leaving Chilled Liquid Temp Cutout = 36°F
- High Motor Current Limit = 103%
- Pulldown Current Limit = 100%
- Pulldown Current Limit Time = 0 Min.
- Sub-cooling Setpoint = 5°F
- Sound limit Setpoint = 0%

SERIAL PORT CONNECTIONS

Table 39 on page 282 lists the serial ports and the circuit board they are located on. The serial communications lines provide communications to external devices outside the chiller and between microprocessors located in the chiller control panel.

TB2 allows connecting to a remote OptiView RCC or Microgateway. The OptiView RCC option is not yet available. The OptiView RCC and Microgateway option cannot both be used. Only one or the other is permitted to be connected to the chiller.

ANALOG INPUT CONNECTIONS

Table 34 lists the Analog inputs and the circuit board they are located on. Not all of the sensors are installed in every unit, as some of them are optional. The software must read the optional sensors if installed. The Analog input signals are typically referenced to the common (return, ground) in the system.

J12-3 can also be used as common, as well as chassis ground, or the common terminal point on the Chiller Control Board. See the wiring diagrams. The +DC Bus, -DC Bus and ½ DC Bus voltages are measured in reference to one of the other DC Bus points. For example: +DC Bus measured to ½ DC Bus.

TABLE 40 - ANALOG INPUT CONNECTIONS

CIRCUIT BOARD	PLUG	INPUT
Chiller Control Board	J17-11	Remote Temp Reset
Chiller Control Board	J17-12	Remote Current Limit
Chiller Control Board	J17-13	Remote Sound Limit
Chiller Control Board	J17-14	Sys 1 Condenser Liquid Pressure
Chiller Control Board	J17-15	Sys 1 Condenser Liquid Pressure
Chiller Control Board	J18-7	Leaving Chilled Liquid
Chiller Control Board	J18-8	Return Chilled Liquid
Chiller Control Board	J18-9	Ambient Air Temp
Chiller Control Board	J19-1	Comp 1 Motor Temp 1
Chiller Control Board	J19-2	Comp 1 Motor Temp 2
Chiller Control Board	J19-3	Comp 1 Motor Temp 3
Chiller Control Board	J19-6	Comp 2 Motor Temp 1
Chiller Control Board	J19-7	Comp 2 Motor Temp 2
Chiller Control Board	J19-8	Comp 2 Motor Temp 3
Chiller Control Board	J21-13	Sys 1 Condenser Liquid Temp
Chiller Control Board	J21-3	Sys 1 Oil Temp
Chiller Control Board	J21-16	Sys 1 Discharge Temp
Chiller Control Board	J21-6	Sys 1 Flash Tank Level
Chiller Control Board	J21-20	Sys 1 Suction Pressure
Chiller Control Board	J21-22	Sys 1 Oil Pressure
Chiller Control Board	J21-24	Sys 1 Discharge Pressure
Chiller Control Board	J22-13	Sys 2 Condenser Liquid Temp
Chiller Control Board	J22-3	Sys 2 Oil Temp
Chiller Control Board	J22-16	Sys 2 Discharge Temp
Chiller Control Board	J22-6	Sys 2 Flash Tank Level
Chiller Control Board	J22-20	Sys 2 Suction Pressure
Chiller Control Board	J22-22	Sys 2 Oil Pressure
Chiller Control Board	J22-24	Sys 2 Discharge Pressure
Chiller Control Board	J20-1	Spare
Chiller Control Board	J20-2	Spare
Chiller Control Board	J20-3	Spare
Chiller Control Board	J20-6	Spare
Chiller Control Board	J20-7	Spare
Chiller Control Board	J20-8	Spare
Chiller Control Board	J23-13	Sys 1 Eductor Temperature
Chiller Control Board	J23-3	Spare
Chiller Control Board	J23-16	Spare
Chiller Control Board	J23-6	Spare
Chiller Control Board	J23-20	Spare
Chiller Control Board	J23-22	Spare
Chiller Control Board	J23-24	Spare
Chiller Control Board	J24-13	Sys 2 Eductor Temperature
Chiller Control Board	J24-3	Spare
Chiller Control Board	J24-16	Spare
Chiller Control Board	J24-6	Spare
Chiller Control Board	J24-20	Spare
Chiller Control Board	J24-22	Spare
Chiller Control Board	J24-24	Spare
VSD Logic Board	J1-1 to J1-2	Comp 1 Phase A Motor Current
VSD Logic Board	J1-3 to J1-4	Comp 1 Phase B Motor Current
VSD Logic Board	J1-5 to J1-6	Comp 1 Phase C Motor Current
VSD Logic Board	J1-13 to J1-14	Comp 3 Phase A Motor Current
VSD Logic Board	J1-25 to J1-16	Comp 3 Phase B Motor Current
VSD Logic Board	J1-17 to J1-18	Comp 3 Phase C Motor Current
VSD Logic Board	J2-1 to J2-2	Comp 2 Phase A Motor Current
VSD Logic Board	J2-3 to J2-4	Comp 2 Phase B Motor Current
VSD Logic Board	J2-5 to J2-6	Comp 2 Phase C Motor Current
VSD Logic Board	JI-9 to JI-10	Comp 4 Phase A Motor Current
VSD Logic Board	JI-11 to JI-12	Comp 4 Phase B Motor Current
VSD Logic Board	JI-13 to JI-14	Comp 4 Phase C Motor Current
VSD Logic Board	J3-1	+DC Bus Voltage 1
VSD Logic Board	J3-2	½ DC Bus Voltage 1
VSD Logic Board	J3-3	-DC Bus Voltage 1
VSD Logic Board	J3-4	-DC Bus Voltage 2 (Future use)
VSD Logic Board	J3-5	½ DC Bus Voltage 2 (Future use)
VSD Logic Board	J3-6	+DC Bus Voltage 2 (Future use)
VSD Logic Board	J6-8	Comp 1 IGBT Baseplate Temp
VSD Logic Board	J8-8	Comp 2 IGBT Baseplate Temp
VSD Logic Board	R19	Comp1 Overload Adjust
VSD Logic Board	R64	Comp2 Overload Adjust

DIGITAL INPUT CONNECTIONS

Table 41 on page 284 lists the digital inputs and the circuit board they are located on. The Digital input signals are typically referenced to the common (return, ground) in the system.

J12-3 can also be used as common, as well as chassis ground, or the common terminal point on the Chiller Control Board. See the wiring diagrams.

TABLE 41 - DIGITAL INPUT CONNECTIONS

CIRCUIT BOARD	PLUG	INPUT
Chiller Control Board	J4-2	Unit Switch 1
Chiller Control Board	J4-3	Unit Switch 2
Chiller Control Board	J4-4	Sys 1 HPCO
Chiller Control Board	J4-5	Sys 2 HPCO
Chiller Control Board	J4-6	VSD Fault Relay 1
Chiller Control Board	J5-1	Spare
Chiller Control Board	J5-2	Spare
Chiller Control Board	J5-3	Spare
Chiller Control Board	J6-2	Flow Switch
Chiller Control Board	J6-3	Print
Chiller Control Board	J6-4	Sys 1 Run Permissive
Chiller Control Board	J6-5	Sys 2 Run Permissive
Chiller Control Board	J6-6	Spare
Chiller Control Board	J7-1 to J7-2	Max VSD Freq Jumper Config 0
Chiller Control Board	J7-3 to J7-4	Max VSD Freq Jumper Config 1
Chiller Control Board	J7-5 to J7-6	Max VSD Freq Jumper Config 2
Chiller Control Board	J7-7 to J7-8	Max VSD Freq Jumper Config 3
Chiller Control Board	J7-9 to J7-10	Spare 0
Chiller Control Board	J7-11 to J7-12	Spare 1
VSD Logic Board	J1-10	2 Compressor Select
VSD Logic Board	J1-11	Spare
Chiller Control Board	J7-11 to J7-12	Spare
VSD Logic Board	J1-10	2 Compressor Select
VSD Logic Board	J1-11	Spare
VSD Logic Board	J1-12	Spare

CIRCUIT BOARD	PLUG	INPUT
VSD Logic Board	J5-1 to J5-2	Modbus Address Bit 0
VSD Logic Board	J5-3 to J5-4	Modbus Address Bit 1
VSD Logic Board	J6-2	Comp 1 Phase A Gate Driver Fault
VSD Logic Board	J6-5	Comp 1 Phase C Gate Driver Fault
VSD Logic Board	J6-12	Comp 1 Phase B Gate Driver Fault
VSD Logic Board	J7-2	Comp 3 Phase A Gate Driver Fault (N/A)
VSD Logic Board	J7-5	Comp 3 Phase C Gate Driver Fault (N/A)
VSD Logic Board	J7-12	Comp 3 Phase B Gate Driver Fault
VSD Logic Board	J8-2	Comp 2 Phase A Gate Driver Fault
VSD Logic Board	J8-5	Comp 2 Phase C Gate Driver Fault
VSD Logic Board	J8-12	Comp 2 Phase B Gate Driver Fault
VSD Logic Board	J9-2	Comp 4 Phase B Gate Driver Fault (N/A)
VSD Logic Board	J7-5	Comp 4 Phase A Gate Driver Fault (N/A)
VSD Logic Board	J7-12	Comp 4 Phase C Gate Driver Fault (N/A)
VSD Logic Board	J11-2	Phase Loss Fault 1
VSD Logic Board	J11-6	Phase Loss Fault 2
VSD Logic Board	SW1	Test Pushbutton
VSD Logic Board	J10-5 to J10-6	Comp 1 Run (From Control Panel)
VSD Logic Board	J10-7 to J10-8	Comp 2 Run (From Control Panel)

ANALOG OUTPUT CONNECTIONS

Table 42 on page 285 lists the analog outputs and the circuit board they are located on. The analog output signals are feed to the associated control device from the 2 wires connected to the pins in the associated plug.

TABLE 42 - ANALOG OUTPUTS CONNECTIONS

BOARD	PLUG	ANALOG OUTPUT
Chiller Control Board	J15-1 to J15-2	Sys 1 Condenser Drain Valve
Chiller Control Board	J15-3 to J15-4	Sys 1 Economizer Feed Valve
Chiller Control Board	J15-5 to J15-6	Sys 2 Condenser Drain Valve
Chiller Control Board	J15-7 to J15-8	Sys 2 Economizer Feed Valve
Chiller Control Board	J14-1 to J14-6	Spare
Chiller Control Board	J14-2 to J14-7	Spare
Chiller Control Board	J14-3 to J14-8	Spare
Chiller Control Board	J14-4 to J14-9	Spare
Chiller Control Board	J25-1 to J25-5	Sys 1 Condenser Fan Speed
Chiller Control Board	J25-2 to J25-6	Sys 2 Condenser Fan Speed
Chiller Control Board	J25-3 to J25-7	Spare
Chiller Control Board	J25-4 to J25-8	Spare

DIGITAL OUTPUT CONNECTIONS

Table 43 on page 285 lists the digital outputs and the plug/terminals of the circuit board they originate from. Not all of the outputs will be used on every unit. Signal levels may be 12VDC, 120VAC, or a dry contact (no voltage closure). 120VAC signals typically may show only one connection point; the other will be neutral (Wire 2). Outputs which reference multiple boards, such as “Chiller Control Board / Relay Board 1” indicate the signal originates on the Chiller Control Board as a 0 to 12VDC digital signal (example: J9-1) that is then fed to the Relay board and output as a dry contact closure between TB1-20 and 19. In this case, outputs from both boards are called out in the table.

The 0 to 120VAC single digital outputs from the Relay Output Boards are referenced to neutral (Wire 2). For example, the fan output on TB1-6 is a single 120VAC output. The 0 to 12VDC outputs from the Chiller Control Board are referenced to common (return, ground) in the system. J12-3 can also be used as common, as well as chassis ground, or the common terminal point on the Chiller Control Board. See the wiring diagrams. See the the wiring diagrams whenever there is a requirement for tracing out these signals.

TABLE 43 - DIGITAL OUTPUTS CONNECTIONS

BOARD	PLUG	DIGITAL OUTPUT
Control Board / Relay Board 1	J9-1 / TB1-20 to TB1-19	Evaporator Heater
Control Board / Relay Board 1	J9-2 / TB1-18 to TB1-17	Sys 1 VSD Run
Control Board / Relay Board 1	J9-3 / TB1-16 to TB1-15	Sys 1 Alarm
Control Board / Relay Board 1	J9-4 / TB1-14 to TB1-13	Evaporator Heater 2
Control Board / Relay Board 1	J9-5 / TB1-12 to TB1-11	Sys 1 VI Step 1
Control Board / Relay Board 1	J9-6 / TB1-10 to TB1-9	Sys 1 VI Step 2
Control Board / Relay Board 1	J9-7 / TB1-8 to TB1-7	Sys 1 Condenser Fan Output 4
Control Board / Relay Board 1	J9-8 / TB1-6	Sys 1 Condenser Fan Output 1
Control Board / Relay Board 1	J9-9 / TB1-5	Sys 1 Condenser Fan Output 2
Control Board / Relay Board 1	J9-10 / TB1-4	Sys 1 Condenser Fan Output 3
Control Board / Relay Board 1	J9-11 / TB1-3	Sys 1 Compressor Heater
Control Board / Relay Board 1	J9-12 / TB1-2	Spare
Control Board / Relay Board 2	J10-1 / TB1-20 to TB1-19	Evaporator Pump Start
Control Board / Relay Board 2	J10-2 / TB1-18 to TB1-17	Sys 2 VSD Run
Control Board / Relay Board 2	J10-3 / TB1-16 to TB1-15	Sys 2 Alarm
Control Board / Relay Board 2	J10-4 / TB1-14 to TB1-13	Chiller Run
Control Board / Relay Board 2	J10-5 / TB1-12 to TB1-11	Sys 2 Condenser Fan Output 4
Control Board / Relay Board 2	J10-6 / TB1-10 to TB1-9	Sys 2 VI Step 1
Control Board / Relay Board 2	J10-7 / TB1-8 to TB1-7	Sys 2 VI Step 2
Control Board/ Relay Board 2	J10-8 / TB1-6	Sys 2 Condenser Fan Output 1
Control Board / Relay Board 2	J10-9 / TB1-5	Sys 2 Condenser Fan Output 2
Control Board / Relay Board 2	J10-10 / TB1-4	Sys 2 Condenser Fan Output 3

TABLE 43 - DIGITAL OUTPUTS CONNECTIONS (CONT'D)

BOARD	PLUG	DIGITAL OUTPUT
Control Board / Relay Board 2	J10-11 / TB1-3	Sys 2 Compressor Heater
Control Board / Relay Board 2	J10 -12 / TB1-2	Spare
Control Board / Relay Board 3	J11 -1 / TB1-20 to 19	Spare
Control Board / Relay Board 3	J11 -2 / TB1-18 to 17	Spare
Control Board / Relay Board 3	J11 -3 / TB1-16 to 15	Spare
Control Board / Relay Board 3	J11 -4 / TB1-14 to 13	Spare
Control Board / Relay Board 3	J11 -5 / TB1-12 to 11	Spare
Control Board / Relay Board 3	J11 -6 / TB1-10 to 9	Spare
Control Board / Relay Board 3	J11 -7 / TB1-8 to 7	Spare
Control Board / Relay Board 3	J11 -8 / TB1-6	Spare
Control Board / Relay Board 3	J11 -9 / TB1-5	Spare
Control Board / Relay Board 3	J11 -10 / TB1-4	Spare
Control Board / Relay Board 3	J11 -10 / TB1-3	Spare
Control Board / Relay Board 3	J11 -12 / TB1-2	Spare
VSD Logic Board	J6-1	Comp 1 Phase A+ IGBT Gating Signal
VSD Logic Board	J6-3	Comp 1 Phase B- IGBT Gating Signal
VSD Logic Board	J6-4	Comp 1 Phase C+ Gate Driver Fault
VSD Logic Board	J6-10	Comp 1 Phase A- Gate Driver Fault
VSD Logic Board	J6-11	Comp 1 Phase B+ Gate Driver Fault
VSD Logic Board	J6-13	Comp 1 Phase C- Gate Driver Fault
VSD Logic Board	J6-14	Comp 1 Enable
VSD Logic Board	J7-1	Comp 3 Phase A+ IGBT Gating Signal (N/A)
VSD Logic Board	J7-3	Comp 3 Phase B+ IGBT Gating Signal (N/A)
VSD Logic Board	J7-4	Comp 3 Phase C+ Gate Driver Fault (N/A)
VSD Logic Board	J7-10	Comp 3 Phase A- Gate Driver Fault (N/A)
VSD Logic Board	J7-11	Comp 3 Phase B+ Gate Driver Fault (N/A)
VSD Logic Board	J7-13	Comp 3 Phase C- Gate Driver Fault (N/A)
VSD Logic Board	J7-14	Comp 3 Enable (N/A)
VSD Logic Board	J8-1	Comp 2 Phase A+ IGBT Gating Signal
VSD Logic Board	J8-3	Comp 2 Phase B- IGBT Gating Signal
VSD Logic Board	J8-4	Comp 2 Phase C+ Gate Driver Fault
VSD Logic Board	J8-10	Comp 2 Phase A- Gate Driver Fault
VSD Logic Board	J8-11	Comp 2 Phase B+ Gate Driver Fault
VSD Logic Board	J8-13	Comp 2 Phase C- Gate Driver Fault
VSD Logic Board	J8-14	Comp 2 En- able (N/A)
VSD Logic Board	J9-1	Comp 4 Phase A+ IGBT Gating Signal (N/A)
VSD Logic Board	J9-3	Comp 4 Phase B- IGBT Gating Signal (N/A)
VSD Logic Board	J9-4	Comp 4 Phase C+ Gate Driver Fault (N/A)
VSD Logic Board	J9-10	Comp 4 Phase A- Gate Driver Fault (N/A)
VSD Logic Board	J9-11	Comp 4 Phase B+ Gate Driver Fault (N/A)
VSD Logic Board	J9-13	Comp 4 Phase C- Gate Driver Fault (N/A)
VSD Logic Board	J9-14	Comp 4 Enable (N/A)
VSD Logic Board	J11-3	Pre-charge Enable 1
VSD Logic Board	J11-7	Spare
VSD Logic Board	J10-1 to J10-2	VSD Fan / Pump Run
VSD Logic Board	J10-3 to J10-4	VSD Fault Relay (To control panel)

BAS COMMUNICATIONS

SE-EQ or E-Link BAS Communications Card

Received Data (Control Data)

The chiller receives eight data values from the SC-EQ or E-Link. The first four are analog values and the last four are digital values. These eight data values are used as control parameters when in REMOTE mode. When the unit is in LOCAL mode, these eight values are ignored. If the unit receives no valid YorkTalk 2 transmission for 5 minutes it will revert back to all local control values. YVAA Communications Data Map in *Table 45 on page 289* lists the control parameters.

Transmitted Data

After receiving a valid transmission from the SC-EQ or E-Link, the chiller will transmit either operational data or history buffer data depending on the "History Buffer Request", see *Table 45 - YVAA Communications Data Map, ENG PAGE REF 10.* Data must be transmitted for every page under feature 54. If there is no value to be sent to a particular page, a zero will be sent. *Table 45 on page 289* "YVAA Communications Data Map" shows the data values and page listings for this unit.

NOTE

The most current data map information is listed on the Johnson Controls/York Chiller Equipment Integration website. A copy of the data map can also be obtained by contacting a local Johnson Controls office.

NOTE

Reboot required (cycle power) after settings are changed.

8

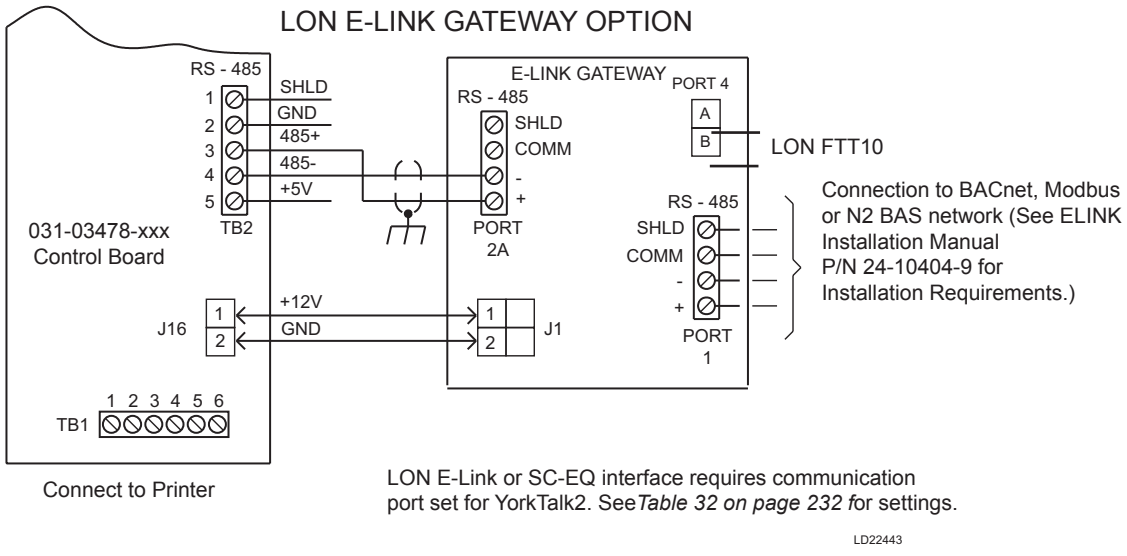


FIGURE 110 - LON E-LINK GATEWAY OPTION

The table below shows the real time error numbers that may be encountered during communication setup and a description of each.

TABLE 44 - REAL TIME ERROR NUMBERS

ERROR NUMBER (##)	DESCRIPTION
0	ALL OK
1	DATUM TYPE OK TEST FAILED
2	ENGLISH TEXT TOO LONG
3	FLOATING POINT EXCEPTION
4	GET PACKET FAILED
5	GET TYPE FAILED
6	INVALID UNIT CONVERSION
7	INVALID HARDWARE SELECTION
8	REAL TIME FAULT
9	SPANISH TEXT TOO LONG
10	THREAD EXITED
11	THREAD FAILED
12	THREAD STALLED
13	IO BOARD RESET
14	BRAM INVALID
15	BACnet SETUP FAILED

TABLE 45 - YVAA COMMUNICATIONS DATA MAP

YVAA / YVFA / YAGK		Native Modbus, BACnet MS/TP, N2 Data Map			Micro Board: 031-03478-101
Item	**Version**	**Date**	**York P/N**	**COMMENTS**	
1	Y.ACS.20.02	8/2/2016	031-03476-010	Native Communications Added	
2	Y.ACS.20.04	1/3/2017	031-03476-010	Native Communications Updated	
3					
4					
5					
6					
7					
8					
9					
10					

ITEM REF NUM	BACnet Name	BACnet Object Instance	Modbus Address	Modbus Data Type Supported	Modbus Scaling	N2 Metasys Address	ENG UNITS		POINT LIST CODE: S = STANDARD O = OPTIONAL N = NOT AVAILABLE										
							Imperial	SI	POINT LIST DESCRIPTION	1	2	3	4	5	6	7	8	9	10
					See note 5														
	ANALOG WRITE POINTS																		
1	REM_SETP	AV1	1026	03,06,16	Div 10	ADF 1	°F	°C	Remote Setpoint	S	S								
2	DMD_LIMIT	AV2	1027	03,06,16	Div 10	ADF 2	%FLA	%FLA	Remote Current Limit Setpoint	S	S								
3	SND_LIMIT	AV3	1028	03,06,16	Div 10	ADF 3	%	%	Remote Sound Limit	S	S								
4	SPARE AV1	AV4	1029	03,06,16	Div 10	ADF 4			Spare										
	BINARY WRITE POINTS																		
5	START_STOP	BV1	1538	01,03,05,06,15	N/A	BD 1	0 / 1	0 / 1	Remote Start / Stop Command [0=Stop, 1=Run]	S	S								
6	SPARE BV1	BV2	1539	01,03,05,06,15	N/A	BD 2	0 / 1	0 / 1	Spare										
7	SPARE BV2	BV3	1540	01,03,05,06,15	N/A	BD 3	0 / 1	0 / 1	Spare										
8	SPARE BV3	BV4	1541	01,03,05,06,15	N/A	BD 4	0 / 1	0 / 1	Spare										
	ANALOG READ ONLY POINTS																		
9	LCHLT	AI1	514	03,04	X 10	ADF 5	°F	°C	Leaving Chilled Liquid Temperature	S	S								
10	ECHLT	AI2	515	03,04	X 10	ADF 6	°F	°C	Return Chilled Liquid Temperature	S	S								
11	EV_ELT	AI3	516	03,04	X 10	ADF 7	°F	°C	Evaporator Entering Liquid Temperature (Free Cooling)	O	O								
12	VSD_IA_TEMP	AI4	517	03,04	X 10	ADF 8	°F	°C	VSD Internal Ambient Temperature	S	S								
13	S1_COND_TEMP	AI5	518	03,04	X 10	ADF 9	°F	°C	Sys 1 Condenser Temperature	S	S								
14	S2_COND_TEMP	AI6	519	03,04	X 10	ADF 10	°F	°C	Sys 2 Condenser Temperature	S	S								
15	S1_DSCH_TEMP	AI7	520	03,04	X10	ADF 11	°F	°C	Sys 1 Discharge Temperature	S	S								
16	S2_DSCH_TEMP	AI8	521	03,04	X10	ADF 12	°F	°C	Sys 2 Discharge Temperature	S	S								
17	OAT	AI9	522	03,04	X10	ADF 13	°F	°C	Ambient Air Temperature	S	S								
18	S1_EDT_TEMP	AI10	523	03,04	X10	ADF 14	°F	°C	Sys 1 Eductor Temperature (YVAA/YVFA)	S	O								
19	S2_EDT_TEMP	AI11	524	03,04	X10	ADF 15	°F	°C	Sys 2 Eductor Temperature (YVAA/YVFA)	S	O								
20	S1_OIL_PRESS	AI12	525	03,04	X10	ADF 16	PSI	BAR	Sys 1 Oil Pressure	S	S								
21	S2_OIL_PRESS	AI13	526	03,04	X10	ADF 17	PSI	BAR	Sys 2 Oil Pressure	S	S								
22	S1_SUCT_PRES	AI14	527	03,04	X10	ADF 18	PSI	BAR	Sys 1 Suction Pressure	S	S								
23	S2_SUCT_PRES	AI15	528	03,04	X10	ADF 19	PSI	BAR	Sys 2 Suction Pressure	S	S								
24	S1_DSCH_PRES	AI16	529	03,04	X10	ADF 20	PSI	BAR	Sys 1 Discharge Pressure	S	S								
25	S2_DSCH_PRES	AI17	530	03,04	X10	ADF 21	PSI	BAR	Sys 2 Discharge Pressure	S	S								
26	S1_MC_FLA	AI18	531	03,04	X1	ADF 22	%	%	Sys 1 Motor Current FLA	S	S								
27	S2_MC_FLA	AI19	532	03,04	X1	ADF 23	%	%	Sys 2 Motor Current FLA	S	S								
28	S1_OP_HRS	AI20	533	03,04	X1	ADF 24	Hr	Hr	Sys 1 Operating Hours	S	S								
29	S2_OP_HRS	AI21	534	03,04	X1	ADF 25	Hr	Hr	Sys 2 Operating Hours	S	S								
30	S1_COMP_ST	AI22	535	03,04	X1	ADF 26	None	None	Sys 1 Compressor Starts	S	S								
31	S2_COMP_ST	AI23	536	03,04	X1	ADF 27	None	None	Sys 2 Compressor Starts	S	S								
32	S1_HI_MTR_T	AI24	537	03,04	X 10	ADF 28	°F	°C	Sys 1 Highest Motor Temperature	S	S								
33	S2_HI_MTR_T	AI25	538	03,04	X 10	ADF 29	°F	°C	Sys 2 Highest Motor Temperature	S	S								
34	VSD_OUT_FR	AI26	539	03,04	X 10	ADF 30	Hz	Hz	VSD Output Frequency	S	S								
35	VSD_CMD_FR	AI27	540	03,04	X 10	ADF 31	Hz	Hz	VSD Command Frequency	S	S								
36	S1_COND_DR	AI28	541	03,04	X 10	ADF 32	%	%	Sys 1 Condenser Drain Valve % Open	S	S								
37	S2_COND_DR	AI29	542	03,04	X 10	ADF 33	%	%	Sys 2 Condenser Drain Valve % Open	S	S								
38	S1_OP_CODE	AI30	543	03,04	X 1	ADF 34	None	None	Sys 1 Operational Code	S	S								
39	S2_OP_CODE	AI31	544	03,04	X 1	ADF 35	None	None	Sys 1 Fault Code	S	S								
40	S1_FLT_CODE	AI32	545	03,04	X 1	ADF 36	None	None	Sys 2 Operational Code	S	S								
41	S2_FLT_CODE	AI33	546	03,04	X 1	ADF 37	None	None	Sys 2 Fault Code	S	S								
42	S1_FAN_STG	AI34	547	03,04	X 1	ADF 38	None	None	Sys 1 Condenser Fan Stage [0-14]	S	S								
43	S2_FAN_STG	AI35	548	03,04	X 1	ADF 39	None	None	Sys 2 Condenser Fan Stage [0-14]	S	S								

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YVAA_YVFA_YAGK Native BACnet_Modbus_N2 Data Map Rev1_1

TABLE 45 - YVAA COMMUNICATIONS DATA MAP (CONT'D)

ITEM REF NUM	BACnet Name	BACnet Object Instance	Modbus Address	Modbus Data Type Supported	Modbus Scaling	N2 Metasys Address	ENG UNITS		POINT LIST CODE: S = STANDARD O = OPTIONAL N = NOT AVAILABLE											
							Imperial	SI	POINT LIST DESCRIPTION	1	2	3	4	5	6	7	8	9	10
					See note 5														
44	S1_FAN_SPD	AI36	549	03,04	X 1	ADF 40	%	%	Sys 1 Condenser Fan Speed (VSD)	O	O								
45	S2_FAN_SPD	AI37	550	03,04	X 1	ADF 41	%	%	Sys 2 Condenser Fan Speed (VSD)	O	O								
46	LEAD	AI38	551	03,04	X 1	ADF 42	None	None	Lead System	S	S								
47	LCHLT_SETP	AI39	552	03,04	X 10	ADF 43	°F	°C	Leaving Chilled Liquid Setpoint	S	S								
48	LCHLT_CUTOUT	AI40	553	03,04	X 10	ADF 44	°F	°C	Leaving Chilled Liquid Cutout	S	S								
49	S1_ECON_VLV	AI41	554	03,04	X 10	ADF 45	%	%	Sys 1 Economizer Valve % Open	S	S								
50	S2_ECON_VLV	AI42	555	03,04	X 10	ADF 46	%	%	Sys 2 Economizer Valve % Open	S	S								
51	SUCT_PRS_CUT	AI43	556	03,04	X 10	ADF 47	PSI	BAR	Suction Pressure Cutout	S	S								
52	VSD_DCB_VT	AI44	557	03,04	X 1	ADF 48	volts	volts	VSD DC Bus Voltage (Unit) VSD DC Bus Voltage Sys 1 (Frame E/F)	S	S								
53	VSD_DCB_VT2	AI45	558	03,04	X 1	ADF 49	volts	volts	VSD DC Bus Voltage Sys 2 (Frame E/F)	O	O								
54	REM_SETPOINT	AI46	559	03,04	X 10	ADF 50	°F	°C	Remote Leaving Chilled Liquid Setpoint	S	S								
55	S1_SUBCOOL	AI47	560	03,04	X 10	ADF 51	°F (diff)	°C (diff)	Sys 1 Subcooling (Microchannel)	O	O								
56	S1_EVAP_LL	AI48	561	03,04	X 10	ADF 52	%	%	Sys 1 Evaporator Liquid Level (Round Tube)	S	S								
57	S2_SUBCOOL	AI49	562	03,04	X 10	ADF 53	°F (diff)	°C (diff)	Sys 2 Subcooling (Microchannel)	O	O								
58	S2_EVAP_LL	AI50	563	03,04	X 10	ADF 54	%	%	Sys 2 Evaporator Liquid Level (Round Tube)	S	S								
59	COOLING_RNG	AI51	564	03,04	X 10	ADF 55	°F (diff)	°C (diff)	Cooling Range	S	S								
60	S1_DSC_SHEAT	AI52	565	03,04	X 10	ADF 56	°F (diff)	°C (diff)	Sys 1 Discharge Superheat	S	S								
61	S2_DSC_SHEAT	AI53	566	03,04	X 10	ADF 57	°F (diff)	°C (diff)	Sys 2 Discharge Superheat	S	S								
62	S1_SYS_STATE	AI54	567	03,04	X 1	ADF 58	None	None	Sys 1 System State [0=Stopped, 1=Running, 2=Faulted, 4=Locked Out, 5=Pre-run]	S	S								
63	S2_SYS_STATE	AI55	568	03,04	X 1	ADF 59	None	None	Sys 2 System State [0=Stopped, 1=Running, 2=Faulted, 4=Locked Out, 5=Pre-run]	S	S								
64	S1_MTR_OVER	AI56	569	03,04	X 1	ADF 60	Amps	Amps	Sys 1 Motor Current Overload Setting	S	S								
65	S2_MTR_OVER	AI57	570	03,04	X 1	ADF 61	Amps	Amps	Sys 2 Motor Current Overload Setting	S	S								
66	FAN_TYPE	AI58	571	03,04	X 1	ADF 62	None	None	Condenser Fan Control Type [1-4]	S	S								
67	FC_MODE	AI59	572	03,04	X 1	ADF 63	None	None	Free Cooling Mode [0=Mech, 1=Free Cool, 2=Hybrid] (Free Cooling)	O	O								
68	FC_CTRL	AI60	573	03,04	X 1	ADF 64	None	None	Free Cooling Control Programmed [0=Disabled, 1=Open Loop, 2=Closed Loop] (Free Cooling)	O	O								
69	CC_BYP_VALVE	AI61	574	03,04	X 10	ADF 65	%	%	Cooling Coil Bypass Valve (Free Cooling Closed Loop)	N	O								
70	CC_VALVE	AI62	575	03,04	X 10	ADF 66	%	%	Cooling Coil Valve (Free Cooling Closed Loop)	N	O								
71	CC_TEMP	AI63	576	03,04	X 10	ADF 67	°F	°C	Cooling Coil Temperature (Free Cooling Closed Loop)	N	O								
72	HX_LEAVE_TEMP	AI64	577	03,04	X 10	ADF 68	°F	°C	Heat Exchanger Leaving Temperature (Free Cooling Closed Loop)	N	O								
73	HX_ENTER_TEMP	AI65	578	03,04	X 10	ADF 69	°F	°C	Heat Exchanger Entering Temperature (Free Cooling Closed Loop)	N	O								
74	GLY_PMP_SPD	AI66	579	03,04	X 10	ADF 70	%	%	Glycol Pump Speed (Free Cooling Closed Loop)	N	O								
75	1_SUCT_TMP	AI67	580	03,04	X 10	ADF 71	°F	°C	System 1 Suction Temperature (YAGK)	N	O								
76	1_SAT_SUCT	AI68	581	03,04	X 10	ADF 72	°F	°C	System 1 Sat Suction Temperature (YAGK)	N	O								
77	1_SUCT_SHEAT	AI69	582	03,04	X 10	ADF 73	°F	°C	System 1 Suction Superheat (YAGK)	N	O								
78	1_FTDV_CMD	AI70	583	03,04	X 10	ADF 74	%	%	System 1 Flash Tank Drain Valve % (YAGK)	N	O								
79	2_SUCT_TMP	AI71	584	03,04	X 10	ADF 75	°F	°C	System 2 Suction Temperature (YAGK)	N	O								
80	2_SAT_SUCT	AI72	585	03,04	X 10	ADF 76	°F	°C	System 2 Sat Suction Temperature (YAGK)	N	O								
81	2_SUCT_SHEAT	AI73	586	03,04	X 10	ADF 77	°F	°C	System 2 Suction Superheat (YAGK)	N	O								
82	2_FTDV_CMD	AI74	587	03,04	X 10	ADF 78	%	%	System 2 Flash Tank Drain Valve % (YAGK)	N	O								
83	INPUT_CURR	AI75	588	03,04	X 10	ADF 79	Amps	Amps	Unit Input Current AMPS	N	S								
	BINARY READ ONLY POINTS																		
84	CH_ALARM	BI1	1282	01,02,03	N/A	BD 5	0 / 1	0 / 1	Chiller Alarm [0=No Alarm,1 = Alarm]	S	S								
85	CH_RUN	BI2	1283	01,02,03	N/A	BD 6	0 / 1	0 / 1	Chiller Run	S	S								
86	EVAP_HEATER	BI3	1284	01,02,03	N/A	BD 7	0 / 1	0 / 1	Evaporator Heater Status	S	S								
87	EVAP_PUMP	BI4	1285	01,02,03	N/A	BD 8	0 / 1	0 / 1	Evaporator Pump Status	S	S								
88	S1_COMP_RUN	BI5	1286	01,02,03	N/A	BD 9	0 / 1	0 / 1	Sys 1 Compressor Run Status	S	S								
89	S2_COMP_RUN	BI6	1287	01,02,03	N/A	BD 10	0 / 1	0 / 1	Sys 2 Compressor Run Status	S	S								
90	S1_VI_STEP1	BI7	1288	01,02,03	N/A	BD 11	0 / 1	0 / 1	Sys 1 VI Step Solenoid Valve 1 Status	S	S								
91	S2_VI_STEP1	BI8	1289	01,02,03	N/A	BD 12	0 / 1	0 / 1	Sys 2 VI Step Solenoid Valve 1 Status	S	S								
92	S1_VI_STEP2	BI9	1290	01,02,03	N/A	BD 13	0 / 1	0 / 1	Sys 1 VI Step Solenoid Valve 2 Status	S	S								
93	S2_VI_STEP2	BI10	1291	01,02,03	N/A	BD 14	0 / 1	0 / 1	Sys 2 VI Step Solenoid Valve 2 Status	S	S								
94	WATER_GLYCOL	BI11	1292	01,02,03	N/A	BD 15	0 / 1	0 / 1	Cooling Type [0=Water, 1=Glycol]	S	S								
95	LOCAL_REMOTE	BI12	1293	01,02,03	N/A	BD 16	0 / 1	0 / 1	Local Remote Control Mode [0=Local,1=Remote]	S	S								
96	DISP_UNITS	BI13	1294	01,02,03	N/A	BD 17	0 / 1	0 / 1	Display Units [0=Imperial,1=SI]	S	S								

TABLE 45 - YVAA COMMUNICATIONS DATA MAP (CONT'D)

Item Ref Num	BACnet Name	BACnet Object Instance	Modbus Address	Modbus Data Type Supported	Modbus Scaling (See Note 5)	N2 Metasys	Engineering Units		Point List Code: S = Standard O = Optional N = Not Available										
							Imperial	SI	Point List Description	1	2	3	4	5	6	7	8	9	10
74	GLY_PMP_SPD	AI66	579	03,04	x10	ADF 70	%	%	Glycol Pump Speed (Free Cooling Closed Loop)	N	O								
75	1_SUCT_TEMP	AI67	580	03,04	x10	ADF 71	°F	°C	Sys 1 Suction Temperature (YAGK)	N	O								
76	1_SAT_SUCT	AI68	581	03,04	x10	ADF 72	°F	°C	Sys 1 Sat Suction Temperature (YAGK)	N	O								
77	1_SUCT_SHEAT	AI69	582	03,04	x10	ADF 73	°F (diff)	°C (diff)	Sys 1 Suction Superheat (YAGK)	N	O								
78	1_FTDV_CMD	AI70	583	03,04	x10	ADF 74	%	%	Sys 1 Flash Tank Drain Valve % (YAGK)	N	O								
79	2_SUCT_TEMP	AI71	584	03,04	x10	ADF 75	°F	°C	Sys 2 Suction Temperature (YAGK)	N	O								
80	2_SAT_SUCT	AI72	585	03,04	x10	ADF 76	°F	°C	Sys 2 Sat Suction Temperature (YAGK)	N	O								
81	2_SUCT_SHEAT	AI73	586	03,04	x10	ADF 77	°F (diff)	°C (diff)	Sys 2 Suction Superheat (YAGK)	N	O								
82	2_FTDV_CMD	AI74	587	03,04	x10	ADF 78	%	%	Sys 2 Flash Tank Drain Valve % (YAGK)	N	O								
83	INPUT_CURR	AI75	588	03,04	x10	ADF 79	Amps	Amps	Unit Input Current Amps	N	S								
BINARY READ ONLY POINTS																			
84	CH_ALARM	BI1	1282	01,02,03	N/A	BD5	0/1	0/1	Chiller Alarm [0=No Alarm, 1=Alarm]	S	S								
85	CH_RUN	BI2	1283	01,02,03	N/A	BD6	0/1	0/1	Chiller Run [0=No Run, 1=Run]	S	S								
86	EVAP_HEATER	BI3	1284	01,02,03	N/A	BD7	0/1	0/1	Evaporator Heater Status	S	S								
87	EVAP_PUMP	BI4	1285	01,02,03	N/A	BD8	0/1	0/1	Evaporator Pump Status	S	S								
88	S1_COMP_RUN	BI5	1286	01,02,03	N/A	BD9	0/1	0/1	Sys 1 Compressor Run Status	S	S								
89	S2_COMP_RUN	BI6	1287	01,02,03	N/A	BD10	0/1	0/1	Sys 2 Compressor Run Status	S	S								
90	S1_VI_STEP1	BI7	1288	01,02,03	N/A	BD11	0/1	0/1	Sys 1 VI Step Solenoid Valve 1 Status	S	S								
91	S2_VI_STEP1	BI8	1289	01,02,03	N/A	BD12	0/1	0/1	Sys 2 VI Step Solenoid Valve 1 Status	S	S								
92	S1_VI_STEP2	BI9	1290	01,02,03	N/A	BD13	0/1	0/1	Sys 1 VI Step Solenoid Valve 2 Status	S	S								
93	S2_VI_STEP2	BI10	1291	01,02,03	N/A	BD14	0/1	0/1	Sys 2 VI Step Solenoid Valve 2 Status	S	S								
94	WATER_GLYCOL	BI11	1292	01,02,03	N/A	BD15	0/1	0/1	Cooling Type [0=Water, 1=Glycol]	S	S								
95	LOCAL_REMOTE	BI12	1293	01,02,03	N/A	BD16	0/1	0/1	Local Remote Control Mode [0=Local, 1=Remote]	S	S								
96	DISP_UNITS	BI13	1294	01,02,03	N/A	BD17	0/1	0/1	Display Units [0=Imperial, 1=SI]	S	S								
97	S1_LOCKOUT	BI14	1295	01,02,03	N/A	BD18	0/1	0/1	Sys 1 Lockout	S	S								
98	S2_LOCKOUT	BI15	1296	01,02,03	N/A	BD19	0/1	0/1	Sys 2 Lockout	S	S								
99	FC_VALVE	BI16	1297	01,02,03	N/A	BD20	0/1	0/1	Free Cooling Valve [0=Off, 1=On] (Free Cooling)	S	S								
100	SOFT_SHUT	BI17	1298	01,02,03	N/A	BD21	0/1	0/1	Soft Shutdown [0=Disabled, 1=Enabled]	S	S								
101	REM_EVAP	BI18	1299	01,02,03	N/A	BD22	0/1	0/1	Remote Evaporator [0=Disabled, 1=Enabled]	S	S								
102	QUICK_ST	BI19	1300	01,02,03	N/A	BD23	0/1	0/1	Quick Start [0=Disabled, 1=Enabled]	S	S								
103	FRAME_EF	BI20	1301	01,02,03	N/A	BD24	0/1	0/1	Frame E/F [0=Disabled, 1=Enabled]	S	S								
104	SOUND_OP	BI21	1302	01,02,03	N/A	BD25	0/1	0/1	Sound Limit Option [0=Disabled, 1=Enabled]	S	S								
105	GLY_PMP_RUN	BI22	1303	01,02,03	N/A	BD26	0/1	0/1	Glycol Pump Run [0=Off, 1=On] (Free Cooling Closed Loop)	O	O								
106	GLY_HEATER	BI23	1304	01,02,03	N/A	BD27	0/1	0/1	Glycol Heater [0=Off, 1=On] (Free Cooling Closed Loop)	O	O								

NOTES	
1	Units have Native BACnet MS/TP, Modbus RTU, and N2 communications. No external Gateway is required for these interfaces unless the customer is using Connected Services.
2	BACnet Object Types: 0 = Analog In, 1 = Analog Out, 2 = Analog Value, 3 = Binary In, 4 = Binary Out, 8 = Device, 15 = Alarm Notification (0-127 are reserved ASHRAE Objects)
3	WC = Inches of water Column, CFM = Cubic Feet per Minute, FPM = Feet Per Minute, PSI = Pounds per Square Inch, Pa = Pascals, kPa = kiloPascals, PPM = Parts Per Million, kJ/kg = kiloJoules per kilogram
4	Values that are not applicable due to unit configuration and options will be sent as zero (0).
5	Modbus values are all of type signed. Scaling values in x10 (Bold) indicate scaling in metric is x100. Scaling and signing may not be modified in the field.
6	
7	
8	
9	
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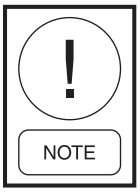
SECTION 9 - MAINTENANCE

GENERAL REQUIREMENTS

The units have been designed to operate continuously, provided they are regularly maintained and operated within the limitations given in this manual. Each unit should be included in a routine schedule of daily maintenance checks by the operator/customer, backed up by regular service inspection and maintenance visits by a suitably qualified Service Engineer.

It is entirely the responsibility of the owner to provide for these regular maintenance requirements and/or enter into a maintenance agreement with a Johnson Controls service organization to protect the operation of the unit. If damage or a system failure occurs due to improper maintenance during the warranty period, Johnson Controls shall not be liable for costs incurred .



This "Maintenance" section applies to the basic unit only and may, on individual contracts, be supplemented by additional requirements to cover any modifications or ancillary equipment as applicable.

The "Safety" section of this manual should be read carefully before attempting any maintenance operations on the unit.

Weekly Maintenance

The following maintenance checks should be carried out on a weekly basis by the operator/customer. Please note that the units are not generally user serviceable and no attempt should be made to rectify faults or problems found during daily checks unless competent and equipped to do so. If in any doubt, contact your local Johnson Controls Service Agent.

Unit Status

Press the 'STATUS' key on the keypad and ensure no fault messages are displayed.

Refrigerant Leaks

Visually check the heat exchangers, compressors and pipework for damage and gas leaks.

Operating Conditions

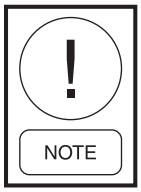
Read the operating pressures and temperatures at the control panel using the display keys and check that these are within the operating limitations given in the manual.

Compressor Oil Level

Compressor oil level will typically run below the bottom of the sight glass. Oil levels will only be visible in the sight glass after running for periods of 15 to 30 minutes at full compressor speed. Do not run with oil levels above the sight glass. Be careful when viewing the sight glass not to confuse a full sight glass with an empty sight glass.

Refrigerant Charge

A sight glass for each system is located in the evaporator. When optimally charged after running full load for 15 to 30 minutes, the refrigerant level should be approximately in the center of the evaporator sight glass. There should be little concern if the level is high or low in the glass, it should not affect operation, and therefore refrigerant should not be added or removed. Always run the system for 15 to 30 minutes before adding charge since a level may not be visible when commissioning or after servicing the chiller. When the charge is correct and the system is operating full load, there should also not be any bubbles visible in the liquid line sight glass under most operating conditions.



It is not necessary to weigh charge unless the entire charge has been lost. The ease of charging is possible since the microchannel coils hold only a small amount of refrigerant charge. A charging valve, located between the fixed orifice and the evaporator, may be used if charge adjustment is required. Charge should be added as liquid while circulating water through the evaporator. If the complete charge needs to be added, See Charging Refrigerant into a System on page 294.

REFRIGERANT REMOVAL, EVACUATION AND CHARGING YVAA CHILLER

Refrigerant Removal

The YVAA utilizes a flooded evaporator. Extreme care must be taken when removing refrigerant to prevent damage to the evaporator and the chiller. Carefully review the following caution below before proceeding with the recommended process.

Incorrect removal of refrigerant will result in catastrophic freeze damage to the evaporator and possible additional damage to other chiller components. Whenever there is water in the evaporator, the chilled liquid pumps must be ON and circulating liquid through the evaporator above minimum recommended flow rates. When liquid refrigerant is being removed, monitor the pressure and do not allow the pressure to drop below the freeze point of the chilled liquid flowing through the evaporator until all liquid refrigerant has been removed from the evaporator and only gas remains. Once all liquid has been removed, the remaining refrigerant vapor can be removed while allowing the pressure to drop below the freeze point with the pump circulating liquid through the evaporator.

To remove refrigerant from the evaporator, follow the procedure below:

1. Turn the chilled liquid pump ON and assure the flow is above the minimum recommended flow.
2. Assure all manual valves in the system are open. Open Condenser Drain and Economizer Feed valves to 100% in the service mode.
3. Connect the recovery unit and a manifold gauge to the liquid line feeding the eductor. There may be a valve in the line or a Schrader fitting on the eductor filter for this purpose.
4. Connect the recovery unit to a recovery cylinder sitting on an accurate scale.
5. Turn the recovery unit ON and observe the liquid refrigerant flowing from the line into the cylinder. The flow of liquid should be obvious.
6. Monitor the pressure gauge to assure that the pressure does not drop below the freeze point of the chilled liquid. Throttle the flow as needed with the manifold gauge valves to prevent pressures from dropping below the freeze point.
7. Continue to remove the liquid refrigerant while observing the flow and the pressure. Note the charge in the system based on the nameplate data to determine when the charge removal is nearly complete. Monitor the weight of the recovery cylinder to determine when the cylinder is full. Change the cylinder as needed.
8. Continue removing refrigerant until liquid is no longer observed flowing in the manifold hoses.
9. Once the liquid is removed and no longer visible in the hose, the remaining gas can be pumped out with the recovery unit while the pressure is allowed to drop to 0 PSIG.
10. Servicing may now be performed on the system as needed.

Evacuating a System

To evacuate a system, follow the procedure below:

1. Turn the chilled liquid pump ON and assure the flow is above the minimum recommended flow.
2. Assure all manual values are open. Open the Condenser Drain (Flash Tank Feed) and Economizer Valves in the Service Mode to 100 %.
3. Connect vacuum hoses to as many points as possible. Be sure that at least one connection is made on both the high and low side of the piping. A connection to the evacuation fitting on the compressor is also recommended. Evacuate the system to a minimum of 500 microns. Close the valves at the evacuation points and assure the pressure in the chiller does not rise more than 50 microns in 10 minutes. Check for leaks if the pressure rises.

Charging Refrigerant into a System

To charge the system with refrigerant, follow the procedure below:

1. Turn the chilled liquid pump ON and assure the flow is above the minimum recommended flow. Open all manual system valves and open the Condenser Drain Valve to 100% by manually opening them in the Service Mode.

Charge refrigerant vapor into the high side of the empty system at the charging port on the line between the flash tank and the evaporator. Continue charging vapor until the pressure is above the freeze point of the chilled liquid. Once above the freeze point, liquid can be charged according to the recommended nameplate charge.

2. Close (0%) the Condenser Drain Valve in the Service Mode. Recycle the chiller power.
3. Once the system is operating, the charge will distribute itself throughout the system. Trim the charge as needed to a level of about midway on the evaporator sight glass while running full speed for 15 minutes.

Evaporator pumps must be run while servicing chiller. Liquid above the minimum flow rate must be circulated through the evaporator to prevent risk of evaporator freezing while transferring refrigerant or evacuating refrigerant systems.

MICROCHANNEL COIL CLEANING

The coil cleaning procedure for microchannel coils is significantly different than tube and fin type coils. As such, care must be taken to understand the differences to avoid damage to the microchannel coil. These differences require a number of DO NOT's that must be observed:

- DO NOT use coil cleaners or any chemical on a microchannel coil. This can cause severe damage to the coils.
- DO NOT use a pressure washer to clean the coils. While it is possible to clean a coil with a pressure washer, it's also possible to destroy it.
- DO NOT contact the coil with a hard surface such as a hose nozzle or metal vacuum nozzle or any other tool.

Follow the three steps below for cleaning the coils:

1. Remove surface debris such as dirt, leaves, insects, fibers, and so on, with a vacuum cleaner having a soft attachment rather than a metal tube. Compressed air blown from the inside out can also be used. When brushing debris off the face of the coil a soft bristle (not wire) brush can be used. Do not scrape the coil with the vacuum nozzle, air nozzle, or any other tool.
2. Rinse the coil with tap water. Do not use coil cleaners. Rinse the coil from the inside out, running water through every passage in the heat exchanger surface until it is clean. Use a gentle spray from a spray nozzle with a plastic end or put your finger on the end of the spray nozzle to reduce impact and provide a gentle spray.
3. Because of the fin geometry, microchannel coils retain water more than tube and fin style. It is generally recommended to blow or vacuum out the rinse water from the coils to speed drying and prevent water pooling.

CHILLED LIQUID SYSTEM MAINTENANCE

Whenever the chilled liquid system requires maintenance, adhere to and observe all precautions noted below.

Scheduled Maintenance

The maintenance operations detailed in the following table should be carried out on a regular basis by a suitably qualified Service Engineer. It should be noted that the interval necessary between each 'minor' and 'major' service can vary depending on, for instance, application, site conditions and expected operating schedule. Normally a 'minor' service should be carried out every three to six months and a 'major' service once a year. It is recommended that your local Johnson Controls Service Center is contacted for recommendations for individual sites.

Chiller / Compressor Operating Log

A Chiller/Compressor Operating Log is supplied at the end of this section for logging compressor and chiller operating data.

Before Applying Power To The Chiller, Assure The Chilled Liquid System Is Filled

DO NOT apply power to the chiller unless the system is filled with water or glycol. If the chiller is equipped with the -20° F option, applying power to an empty chilled liquid system will cause the evaporator immersion heaters to fail.

Removing Water/Glycol From The Evaporator

If the chiller is equipped with a -20°F evaporator freeze protection option, which incorporates immersion heaters, power must be removed from the chiller before the evaporator is drained to assure the heaters are not damaged. Failure to remove power will cause the evaporator immersion heaters to fail.

Evaporator Freeze Damage

Power must remain on the chiller whenever the ambient temperature drops below 32°F with water in the evaporator to avoid evaporator damage. To avoid damage, assure the correct heater option for 0°F minimum ambient or -20°F minimum ambient temperature is installed, based on the lowest expected ambient temperature at the chiller location.

During operation, the glycol freeze point must also be below the lowest expected refrigerant temperature.

Glycol Concentration

If glycol is installed in the evaporator, the glycol concentration must assure that the freeze point is below the lowest expected ambient temperature at the chiller location to avoid evaporator damage.

Winterization

If glycol is installed in the evaporator, the glycol concentration must assure that the freeze point is below the lowest expected ambient temperature at the chiller location to avoid evaporator damage.

MAINTENANCE REQUIREMENTS FOR YVAA CHILLERS

PROCEDURE	WEEKLY	QUARTERLY	SEMI-ANNUALLY	ANNUALLY	EVERY 5 YEARS	EVERY * HOURS
Check Oil Level in Oil Separator Sight Glass.	X					
Check Liquid Line Sight Glass/ Moisture Indicator.	X					
Check refrigerant level in the Evaporator Sight Glass while running full load for 10 to 15 minutes.	X					
Record System Operating Temperatures and Pressures.	X					
Check Condenser Coils for dirt / debris and clean as necessary.	X					
Check Programmable Operating Setpoints and Safety Cutouts. Assure they are correct for the application.		X				
Check Compressor and Evaporator Heater operation.		X				
Check for dirt in the Panel. Check Door Gasket sealing integrity.		X				
**Leak check the Chiller.			X			
**Sample Compressor Oil, check for Acid, and replace if necessary.				X		
**Disconnect Power Source and Lock Out. Check tightness of Power Wiring connections.				X		
Check Glycol concentration on Low Temp. or other applications where freezing may be a problem.				X		
VSD Glycol Change.					X	

NOTES:

1. * Reserved for customer use for any special site requirements.
2. **This procedure must be performed at the specific time by an industry certified technician who has been trained and qualified to work on this type of equipment. A record of this procedure be successfully carried out should be maintained on file by the equipment owner should proof of adequate maintenance be required at a later date for warranty purposes.

REFRIGERANT CONVERSION TABLES

The following table can be used for converting refrigerant pressures to their equivalent saturated temperatures.

TABLE 46 - REFRIGERANT PRESSURE TO SATURATED TEMPERATURE CONVERSION

PRESSURE PSIG (BARG)	DEW POINT TEMP. ºF (ºC)	PRESSURE PSIG (BARG)	DEW POINT TEMP. ºF (ºC)	PRESSURE PSIG (BARG)	DEW POINT TEMP. ºF (ºC)
0.0 (0)	-14.9 (-26.1)	135.0 (9.31)	105.0 (40.6)	270.0 (18.62)	152.0 (66.7)
5.0 (.34)	-3.0 (-19.4)	140.0 (9.65)	107.2 (41.8)	275.0 (18.96)	153.4 (67.4)
10.0 (.69)	6.7 (-14.1)	145.0 (10.0)	109.4 (43)	280.0 (19.31)	154.7 (68.2)
15.0 (1.03)	14.9 (-9.5)	150.0 (10.34)	111.5 (44.2)	285.0 (19.65)	156.1 (68.9)
20.0 (1.38)	22.2 (-5.4)	155.0 (10.69)	113.6 (45.3)	290.0 (19.99)	157.4 (69.7)
25.0 (1.72)	28.7 (-1.8)	160.0 (11.03)	115.6 (46.4)	295.0 (20.34)	158.7 (70.4)
30.0 (2.07)	34.6 (1.4)	165.0 (11.38)	117.6 (47.6)	300.0 (20.68)	160.0 (71.1)
35.0 (2.41)	40.0 (4.4)	170.0 (11.72)	119.6 (48.7)	305.0 (21.03)	161.3 (71.8)
40.0 (2.76)	45.0 (7.2)	175.0 (12.07)	121.5 (49.7)	310.0 (21.37)	162.5 (72.5)
45.0 (3.10)	49.6 (9.8)	180.0 (12.41)	123.3 (50.7)	315.0 (21.72)	163.8 (73.2)
50.0 (3.45)	54.0 (12.2)	185.0 (12.76)	125.2 (51.8)	320.0 (22.06)	165.0 (73.9)
55.0 (3.79)	58.1 (14.5)	190.0 (13.10)	126.9 (52.7)	325.0 (22.41)	166.2 (74.6)
60.0 (4.14)	62.0 (16.7)	195.0 (13.44)	128.7 (53.7)	330.0 (22.75)	167.4 (75.2)
65.0 (4.48)	65.7 (18.7)	200.0 (13.79)	130.4 (54.7)	335.0 (23.10)	168.6 (75.9)
70.0 (4.83)	69.2 (20.7)	205.0 (14.13)	132.1 (55.6)	340.0 (23.44)	169.8 (76.6)
75.0 (5.17)	72.6 (22.6)	210.0 (14.48)	133.8 (56.6)	345.0 (23.79)	171.0 (77.2)
80.0 (5.52)	75.9 (24.4)	215.0 (14.82)	135.5 (57.5)	350.0 (24.13)	172.1 (77.8)
85.0 (5.86)	79.0 (26.1)	220.0 (15.17)	137.1 (58.4)	355.0 (24.48)	173.3 (78.5)
90.0 (6.21)	82.0 (27.8)	225.0 (15.51)	138.7 (59.3)	360.0 (24.82)	174.4 (79.1)
95.0 (6.55)	84.9 (29.4)	230.0 (15.86)	140.2 (60.1)	365.0 (25.17)	175.5 (79.7)
100.0 (6.89)	87.7 (30.9)	235.0 (16.20)	141.8 (61)	370.0 (25.51)	176.6 (80.3)
105.0 (7.24)	90.4 (32.4)	240.0 (16.55)	143.3 (61.8)	375.0 (25.86)	177.7 (80.9)
110.0 (7.58)	93.0 (33.9)	245.0 (16.89)	144.8 (62.3)	380.0 (26.20)	178.8 (81.6)
115.0 (7.93)	95.5 (35.3)	250.0 (17.24)	146.3 (63.5)	385.0 (26.54)	179.9 (82.2)
120.0 (8.27)	98.0 (36.7)	255.0 (17.58)	147.7 (64.3)	390.0 (26.89)	180.9 (82.7)
125.0 (8.62)	100.4 (38)	260.0 (17.93)	149.2 (65.1)	395.0 (27.23)	182.0 (83.3)
130.0 (8.96)	102.7 (39.3)	265.0 (18.27)	150.6 (65.9)	400.0 (27.58)	183.0 (83.9)

TABLE 47 - TROUBLESHOOTING GUIDE

PROBLEM	POSSIBLE CAUSE	ACTION
NO DISPLAY ON CONTROL PANEL. UNIT WILL NOT RUN.	Supply to the Panel is missing.	High Voltage to the Chiller is missing.
		Check 1FU, 2FU, 4FU, 5FU 17FU, or 19FU.
		Check 2T or 10T Transformer.
	Line Fuse is blown.	Check Fuses.
	Chiller Control Board is defective.	Replace Chiller Control Board.
	Display Board defective.	Replace Display Board.
LINE FUSE BLOWS.	SCR Diode Module is defective.	Check SCR/Diode Module.
	IBGT Module is defective.	Check IBGT Module.
	VSD Logic Board is defective.	Replace VSD Logic Board.
	SCR Trigger Board is defective.	Replace SCR Trigger Board.
CHILLER FAULT: LOW AMBIENT TEMPERATURE	Ambient temperature is lower than the programmed operating limit.	Check the programmed cutout and determine if it is programmed correctly.
	Ambient Sensor is defective.	Check the panel against the thermometer reading of ambient temperature.
CHILLER FAULT: HIGH AMBIENT TEMPERATURE	Ambient Temperature is above the maximum operating limit.	Check outside air temperature.
	Ambient Sensor is defective.	Check the Panel Display against Thermometer reading of Ambient Temperature at the sensor.
CHILLER FAULT: LOW LEAVING CHILLED LIQUID	Leaving chilled liquid temperature drops faster than the unit can unload.	Check for restricted flow.
		Check for rapid flow changes.
		Water loop is too small.
		Flow is below minimum for chiller.
	Chilled Water Sensor is defective.	Check Sensor against Temp. Gauge in water line.
		Check Sensor for intermittent operation.
		Check Wiring for shorts or opens.
SYSTEM FAULT: CONTROL VOLTAGE	System Fuse is blown.	Check respective system Fuse 20FU or 21FU.
SYSTEM FAULT: HIGH OIL TEMPERATURE	Oil Temperature Sensor is defective.	Check Sensor with infrared to determine if reading is reasonable.
	Condenser Fans NOT operating or running backwards.	Check Fans.
	Coils dirty.	Check and clean Coils.

NOTE: Always remove power to the chiller and assure the DC Bus voltage has bled off.

TABLE 47 - TROUBLESHOOTING GUIDE (CONT'D)

PROBLEM	POSSIBLE CAUSE	ACTION
SYSTEM FAULT: HIGH DISCHARGE PRESSURE	Coils dirty.	Check and clean coils.
	Coils are damaged.	Comb out fins.
	Fans NOT operating.	Check fan fuses.
		Check fan rotation.
		Check fan motor/blade.
	System is overcharged.	Remove charge and check sub-cooling.
SYSTEM FAULT: HIGH DISCHARGE TEMPERATURE	Discharge Temperature Sensor is defective.	Check Sensor.
	Condenser Fans NOT operating or are running backwards.	Check Fans.
	Coils dirty.	Check and clean Coils.
	High Superheat.	Measure Superheat with gauges and thermocouple. Determine cause.
SYSTEM FAULT: HIGH MOTOR TEMPERATURE	High Motor temperature input from one of the sensors.	Refrigerant charge low. Check evaporator sight glass.
		Excess charge in system, High discharge pressure. Check sub-cooling.
		High Superheat. Flash Tank Feed Valve NOT controlling. Isolate cause.
		Motor Sensor reading incorrectly. Program panel to ignore a single sensor.
		Economizer Solenoid energized at low speeds. Valve is leaking through.
SYSTEM FAULT: LOW SUCTION PRESSURE	Low charge.	Check evaporator sight glass.
	Transducer reads incorrectly.	Check transducer against a gauge.
	Suction Temp. Sensor reads incorrectly.	Check sensor against a thermocouple.
	Low flow.	Check flow.
	Condenser Drain (Flash Tank Feed) Valve NOT operating.	Check Flash Tank Feed Valve operation. Check superheat.
	Condenser or Drain (Flash Tank Feed) Valve defective.	Check Flash Tank Feed Valve operation. Check superheat.
SYSTEM FAULT: DISCHARGE PRESSURE LIMITING	Discharge Transducer is defective.	Check transducer against a gauge.
	Ambient Temp. very high.	Normal operation.
	Fans NOT operating.	Check fan operation.
	Remote or local discharge pressure load limiting is programmed.	Normal operation.

NOTE: Always remove power to the chiller and assure the DC Bus voltage has bled off.

TABLE 47 - TROUBLESHOOTING GUIDE (CONT'D)

PROBLEM	POSSIBLE CAUSE	ACTION
SYSTEM STATUS: MOTOR CURRENT LIMITING	A high motor current anticipatory control has activated current limiting	Ambient temperature is high, normal response from controller
		Remote or panel limiting is in effect, Normal response.
		Excess charge in system, adjust charge.
		Condenser coils dirty, Clean condenser.
		Fans NOT operating. Check fans.
VSD FAULT: HIGH BASEPLATE TEMPERATURE	Coolant level low.	Add coolant.
	Glycol Pump is defective.	Replace Glycol Pump.
	VSD Board is defective	Replace VSD Logic Board.
	IBGT Module is defective.	Check defective IGBT Module.
VSD FAULT: LOW DC BUS VOLTAGE	SCR / Diode Module is defective.	Check SCR / Diode Module.
	SCR Trigger Board is defective.	Check SCR Trigger Board.

NOTE: Always remove power to the chiller and assure the DC Bus voltage has bled off.

R-513A CONVERSION TABLE

The table below can be used for conversion of refrigerant R-513A from pressure to saturated temperature.

TABLE 48 - R-513A REFRIGERANT PRESSURE TO SATURATED TEMPERATURE

PRESSURE (PSIG)	TEMP. AVG. (°F)	PRESSURE (PSIG)	TEMP. AVG. (°F)	PRESSURE (PSIG)	TEMP. AVG. (°F)	PRESSURE (PSIG)	TEMP. AVG. (°F)
0	-20.5	130	99.3	260	146.7	390	179.1
5	-8.4	135	101.6	265	148.1	395	180.2
10	1.4	140	103.9	270	149.6	400	181.2
15	9.8	145	106.1	275	151.0	405	182.3
20	17.2	150	108.3	280	152.4	410	183.3
25	23.8	155	110.4	285	153.7	415	184.3
30	29.8	160	112.4	290	155.1	420	185.4
35	35.3	165	114.5	295	156.4	425	186.4
40	40.4	170	116.4	300	157.7	430	187.4
45	45.1	175	118.4	305	159.0	435	188.4
50	49.5	180	120.3	310	160.3	440	189.4
55	53.7	185	122.2	315	161.6	445	190.3
60	57.7	190	124.0	320	162.9	450	191.3
65	61.5	195	125.8	325	164.1	455	192.2
70	65.1	200	127.6	330	165.3	460	193.2
75	68.5	205	129.3	335	166.6	465	194.1
80	71.9	210	131.0	340	167.8	470	195.1
85	75.0	215	132.7	345	168.9	475	196.0
90	78.1	220	134.3	350	170.1	480	196.9
95	81.0	225	136.0	355	171.3	485	197.8
100	83.9	230	137.6	360	172.4	490	198.7
105	86.6	235	139.1	365	173.6	495	199.6
110	89.3	240	140.7	370	174.7	500	200.4
115	91.9	245	142.2	375	175.8	505	201.3
120	94.4	250	143.7	380	176.9		
125	96.9	255	145.2	385	178.0		

R-513A CONVERSION TABLE

The table below can be used for conversion of refrigerant R-513A from saturated temperature to equivalent pressure.

TABLE 49 - R-513A REFRIGERANT SATURATED TEMPERATURE TO PRESSURE

PRESSURE (PSIG)	TEMP. AVG. (°F)	PRESSURE (PSIG)	TEMP. AVG. (°F)	PRESSURE (PSIG)	TEMP. AVG. (°F)	PRESSURE (PSIG)	TEMP. AVG. (°F)
-100	-13.52	-24	-1.25	52	52.89	128	201.25
-98	-13.42	-22	-0.55	54	55.31	130	207.04
-96	-13.32	-20	0.18	56	57.81	132	212.94
-94	-13.21	-18	0.94	58	60.37	134	218.96
-92	-13.09	-16	1.73	60	62.99	136	225.10
-90	-12.96	-14	2.55	62	65.69	138	231.36
-88	-12.82	-12	3.40	64	68.45	140	237.74
-86	-12.68	-10	4.28	66	71.29	142	244.25
-84	-12.53	-8	5.20	68	74.19	144	250.88
-82	-12.37	-6	6.15	70	77.18	146	257.64
-80	-12.20	-4	7.14	72	80.23	148	264.53
-78	-12.01	-2	8.16	74	83.36	150	271.56
-76	-11.82	0	9.22	76	86.57	152	278.72
-74	-11.62	2	10.32	78	89.86	154	286.00
-72	-11.40	4	11.46	80	93.23	156	293.44
-70	-11.17	6	12.63	82	96.67	158	301.01
-68	-10.93	8	13.85	84	100.20	160	308.72
-66	-10.68	10	15.11	86	103.82	162	316.58
-64	-10.41	12	16.41	88	107.51	164	324.58
-62	-10.13	14	17.76	90	111.30	166	332.74
-60	-9.83	16	19.14	92	115.17	168	341.05
-58	-9.52	18	20.58	94	119.12	170	349.51
-56	-9.19	20	22.06	96	123.17	172	358.12
-54	-8.85	22	23.59	98	127.31	174	366.90
-52	-8.49	24	25.16	100	131.54	176	375.85
-50	-8.11	26	26.79	102	135.87	178	384.96
-48	-7.71	28	28.47	104	140.29	180	394.23
-46	-7.29	30	30.19	106	144.80	182	403.69
-44	-6.86	32	31.97	108	149.42	184	413.32
-42	-6.40	34	33.81	110	154.13	186	423.14
-40	-5.92	36	35.70	112	158.94	188	433.14
-38	-5.42	38	37.64	114	163.86	190	443.34
-36	-4.90	40	39.64	116	168.88	192	453.73
-34	-4.35	42	41.70	118	174.00	194	464.33
-32	-3.78	44	43.81	120	179.23	196	475.15
-30	-3.19	46	45.99	122	184.57	198	486.19
-28	-2.57	48	48.23	124	190.02	200	497.47
-26	-1.92	50	50.53	126	195.58		

CHILLED LIQUID AND SUCTION TEMPERATURE SENSOR INPUT VOLTAGE

TABLE 50 - TEMPERATURE INPUT VOLTAGE SENSOR (MEASURED SIGNAL TO SHIELD AT THE SENSOR)

TEMP. ºF (°C)	VOLTAGE	TEMP. °F (°C)	VOLTAGE	TEMP. °F (°C)	VOLTAGE
16.1 (-8.8)	1.52	35.9 (2.2)	2.19	55.6 (13.1)	2.85
16.7 (-8.5)	1.54	36.5 (2.5)	2.21	56.3 (13.5)	2.87
17.3 (-8.2)	1.56	37.0 (2.8)	2.23	56.9 (13.8)	2.89
17.9 (-7.8)	1.58	37.6 (3.1)	2.25	57.5 (14.2)	2.91
18.5 (-7.5)	1.60	38.2 (3.4)	2.27	58.1 (14.5)	2.93
19.1 (-7.2)	1.62	38.7 (3.7)	2.29	58.7 (14.8)	2.95
19.7 (-6.8)	1.64	39.3 (4.1)	2.30	59.4 (15.2)	2.97
20.3 (-6.5)	1.66	39.9 (4.4)	2.32	60.0 (15.6)	2.99
20.9 (-6.2)	1.68	40.4 (4.7)	2.34	60.6 (15.9)	3.01
21.5 (-5.8)	1.70	41.0 (5.0)	2.36	61.3 (16.3)	3.03
22.1 (-5.5)	1.72	41.6 (5.3)	2.38	61.9 (16.6)	3.05
22.7 (-5.2)	1.74	42.1 (5.6)	2.40	62.5 (16.9)	3.07
23.3 (-4.8)	1.76	42.7 (5.9)	2.42	63.2 (17.3)	3.09
23.9 (-4.5)	1.78	43.3 (6.3)	2.44	63.8 (17.7)	3.11
24.5 (-4.2)	1.80	43.9 (6.6)	2.46	64.5 (18.1)	3.13
25.0 (-3.9)	1.82	44.4 (6.9)	2.48	65.1 (18.4)	3.14
25.6 (-3.6)	1.84	45.0 (7.2)	2.50	65.8 (18.8)	3.16
26.2 (-3.2)	1.86	45.6 (7.5)	2.52	66.5 (19.2)	3.18
26.8 (-2.9)	1.88	46.2 (7.9)	2.54	67.1 (19.5)	3.20
27.3 (-2.6)	1.90	46.7 (8.2)	2.56	67.8 (19.9)	3.22
27.9 (-2.8)	1.91	47.3 (8.5)	2.58	68.5 (20.3)	3.24
28.5 (-1.9)	1.93	47.9 (8.8)	2.60	69.2 (20.7)	3.26
29.0 (-1.7)	1.95	48.5 (9.2)	2.62	69.9 (21.1)	3.28
29.6 (-1.3)	1.97	49.1 (9.5)	2.64	70.6 (21.4)	3.30
30.2 (-1)	1.99	49.7 (9.8)	2.66	71.3 (21.8)	3.32
30.8 (-0.7)	2.01	50.3 (10.2)	2.68	72.0 (22.2)	3.34
31.3 (-0.4)	2.03	50.8 (10.4)	2.70	72.7 (22.6)	3.36
31.9 (-0.1)	2.05	51.4 (10.8)	2.71	73.4 (23)	3.38
32.5 (0.3)	2.07	52.0 (11.1)	2.73	74.2 (23.4)	3.40
33.0 (0.6)	2.09	52.6 (11.4)	2.75	74.9 (23.8)	3.42
33.6 (0.9)	2.11	53.2 (11.8)	2.77		
34.2 (1.2)	2.13	53.8 (12.1)	2.79		
34.8 (1.5)	2.15	54.5 (12.5)	2.81		
35.3 (1.8)	2.17	55.0 (12.8)	2.83		

TABLE 51 - OUTSIDE AIR TEMPERATURE SENSOR INPUT VOLTAGE (MEASURED SIGNAL TO SHIELD AT THE SENSOR)

TEMP. ºF (°C)	VOLTAGE	TEMP. ºF (°C)	VOLTAGE	TEMP. ºF (°C)	VOLTAGE
0.24 (-17.6)	0.68	49.8 (9.9)	2.00	93.3 (34.1)	3.31
1.79 (-16.8)	0.71	50.7 (10.4)	2.03	94.4 (34.7)	3.34
3.30 (-15.9)	0.74	51.6 (10.9)	2.06	95.6 (35.3)	3.37
4.76 (-15.1)	0.77	52.5 (11.4)	2.09	96.8 (36)	3.40
6.19 (-14.3)	0.80	53.4 (11.9)	2.11	98.0 (36.7)	3.43
7.58 (-13.6)	0.83	54.3 (12.4)	2.14	99.2 (37.3)	3.46
8.94 (-12.8)	0.85	55.3 (12.9)	2.17	100.4 (38)	3.49
10.3 (-12.1)	0.88	56.2 (13.4)	2.20	101.6 (38.7)	3.52
11.6 (-11.3)	0.91	57.1 (13.9)	2.23	102.9 (39.4)	3.55
12.8 (-10.7)	0.94	58.0 (14.4)	2.26	104.2 (40.1)	3.57
14.1 (-9.9)	0.97	58.9 (14.9)	2.29	105.5 (40.8)	3.60
15.3 (-9.3)	1.00	59.8 (15.4)	2.32	106.8 (41.6)	3.63
16.5 (-8.6)	1.03	60.7 (15.9)	2.35	108.1 (42.3)	3.66
17.7 (-7.9)	1.06	61.6 (16.4)	2.38	109.5 (43.1)	3.69
18.9 (-7.3)	1.09	62.6 (17)	2.41	110.9 (43.8)	3.72
20.0 (-6.7)	1.12	63.5 (17.5)	2.44	112.3 (44.6)	3.75
21.2 (-6)	1.15	64.4 (18)	2.47	113.8 (45.4)	3.78
22.3 (-5.4)	1.18	65.3 (18.5)	2.50	115.2 (46.2)	3.81
23.4 (-4.8)	1.21	66.3 (19.1)	2.52	116.7 (47.1)	3.84
24.4 (-4.2)	1.24	67.2 (19.5)	2.55	118.3 (47.9)	3.87
25.5 (-3.6)	1.26	68.1 (20.1)	2.58	119.9 (48.8)	3.90
26.6 (-3)	1.26	69.1 (20.6)	2.61	121.5 (49.7)	3.93
27.6 (-2.4)	1.32	70.0 (21.1)	2.64	123.2 (50.7)	3.96
28.7 (-1.8)	1.35	70.9 (21.6)	2.67	124.9 (51.6)	3.98
29.7 (-1.3)	1.38	71.9 (22.2)	2.70	126.6 (52.6)	4.01
30.7 (-0.7)	1.41	72.8 (22.7)	2.73	128.4 (53.6)	4.04
31.7 (-0.2)	1.44	73.8 (23.2)	2.76	130.3 (54.6)	4.07
32.7 (0.4)	1.47	74.8 (23.8)	2.76		
33.7 (0.9)	1.50	75.8 (24.3)	2.82		
34.7 (1.5)	1.53	76.7 (24.8)	2.85		
35.7 (2.1)	1.56	77.7 (25.4)	2.88		
36.7 (2.6)	1.59	78.7 (25.9)	2.91		
37.6 (3.1)	1.62	79.7 (26.5)	2.93		
38.6 (3.7)	1.65	80.7 (27.1)	2.96		
39.6 (4.2)	1.67	81.7 (27.6)	2.99		
40.5 (4.7)	1.70	82.7 (28.2)	3.02		
41.4 (5.2)	1.73	83.6 (28.7)	3.05		
42.4 (5.8)	1.76	84.6 (29.2)	3.08		
43.3 (6.3)	1.79	85.7 (29.8)	3.11		
44.3 (6.8)	1.82	86.7 (30.4)	3.13		
45.2 (7.3)	1.85	87.8 (31)	3.16		
46.1 (7.8)	1.88	88.9 (31.6)	3.19		
47.0 (8.3)	1.91	90.1 (32.3)	3.22		
48.0 (8.9)	1.94	91.1 (32.8)	3.25		
48.9 (9.4)	1.97	92.2 (33.4)	3.28		

TABLE 52 - PRESSURE TRANSDUCER OUTPUT VOLTAGE
(MEASURED SIGNAL TO RETURN AT THE TRANSDUCER)

SUCTION PRESSURE TRANSDUCER (125 PSIG)		DISCHARGE CONDENSER LIQUID PRESSURE AND DISCHARGE PRESSURE TRANSDUCER (400 PSIG)	
PRESSURE	**VOLTAGE**	**PRESSURE**	**VOLTAGE**
0	0.50	0	0.50
5	0.66	25	0.75
10	0.82	50	1.00
15	0.98	75	1.25
20	1.14	100	1.50
25	1.30	125	1.75
30	1.46	150	2.00
35	1.62	175	2.25
40	1.78	200	2.50
45	1.94	225	2.75
50	2.10	250	3.00
55	2.26	275	3.25
60	2.42	300	3.50
65	2.58	325	3.75
70	2.74	350	4.00
75	2.90	375	4.25
80	3.06	400	4.50
85	3.22		
90	3.38		
95	3.54		
100	3.70		
105	3.86		
110	4.02		
115	4.18		
120	4.34		
125	4.50		

TABLE 53 - MOTOR TEMPERATURE SENSOR RESISTANCE (CHECK AT THE MOTOR)

TEMP. ºF (ºC)	RNOMINAL (OHMS)	RTOL (± %)	RMIN (OHMS)	RMAX (OHMS)
-4 (-20)	97,062	5.00	92,209	101,915
5 (-15)	77,941	4.60	69,586	76,296
14 (-10)	55,391	4.20	52,996	57,643
23 (-5)	42,324	3.85	40,695	43,954
32 (0)	32,654	3.50	31,511	33,797
41 (5)	25,396	3.15	24,596	26,196
50 (10)	19,903	2.80	19,346	20,461
59 (15)	15,713	2.50	15,321	16,106
68 (20)	12,493	2.20	12,218	12,768
77 (25)	10,000	2.00	9,800	10,200
86 (30)	8,056	2.40	7,863	8,250
95 (35)	6,531	2.70	6,354	6,707
104 (40)	5,326	3.00	5,166	5,485
113 (45)	4,368	3.25	4,226	4,510
122 (50)	3,602	3.50	3,476	3,728
131 (55)	2,986	3.75	2,874	3,098
140 (60)	2,488	4.00	2,389	2,588
149 (65)	2,083	4.25	1,995	2,172
158 (70)	1,753	4.50	1,674	1,832
167 (75)	1,481	4.75	1,411	1,551
176 (80)	1,257	5.00	1,194	1,321
185 (85)	1,071	5.20	1,016	1,127
194 (90)	916.9	5.40	867.4	966.4
203 (95)	787.7	5.60	743.6	831.9
212 (100)	679.3	5.80	639.9	718.7
221 (105)	587.9	6.00	552.6	623.2
230 (110)	510.6	6.20	479.9	542.3
239 (115)	445.0	6.40	416.5	473.5
248 (120)	389.0	6.60	363.4	414.7
257 (125)	341.2	6.70	318.4	364.1
266 (130)	300.2	6.90	279.5	320.9
275 (135)	264.9	7.10	246.1	283.7
284 (140)	234.4	7.30	217.3	251.5
293 (145)	208.0	7.40	192.6	223.3
302 (150)	185.0	7.50	171.1	198.9

PRINTER WIRING

A "serial" printer may be connected to the TB1 connector on the Chiller Logic Board for the purposes of logging data and troubleshooting. Weightronix Imp-2600, Seiko DPU-414, and Okidata Microline 184 printers or equivalents may be used.

NOTE

Printer designs change rapidly. The user should use the printer manual for the respective printer for set-up and wiring.

Data from the chiller is transmitted at 1200 baud. Wiring diagrams for cables are shown below:

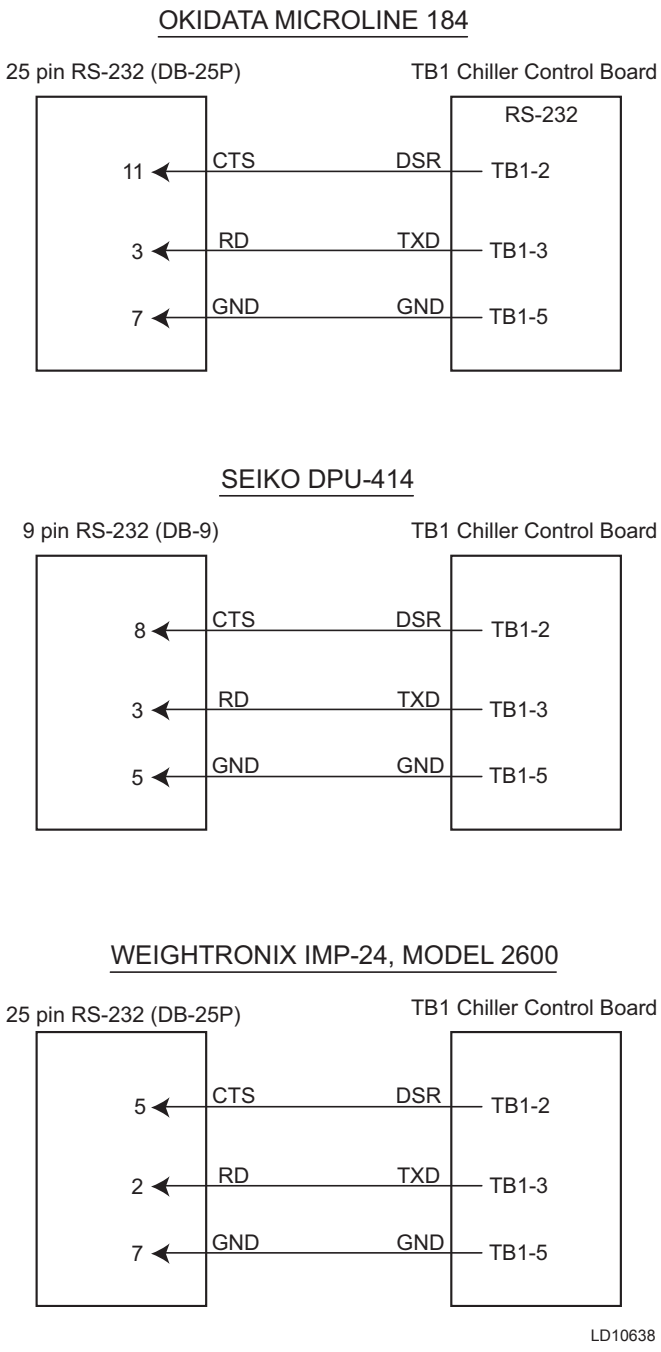


FIGURE 111 - PRINT CABLE - CHILLER TO SERIAL PRINTER

Printer Cables

Printer cables should be shielded coaxial, #18AWG, stranded wire cables, not to exceed 50' in length. On long cable runs or whenever permanent installation is required, the shield of the coax should be tied to the chassis ground at the chiller only, not at the printer.

Printer Setup

The following information may be useful for quick set up of a printer. Specific printer manuals should be utilized, if problems occur, since functions often change as new versions of printers are introduced with enhancements requiring control code, signal programming, and wiring changes.

Okidata 184

Control Board Switch Settings

SW1 – ON: Unslashed 0
2 – OFF: Unslashed 0
3 – OFF: Unslashed 0
4 – OFF: Form Length 11 in.
5 – ON: Form Length 11 in.
6 – OFF: Auto Line feed OFF
7 – ON: 8 bit data
8 – OFF: Enable front panel

With Super Speed Serial Board

SW1-1 – ON: Odd or even parity
1-2 – ON: No parity
1-3 – ON: 8 bit data
1-4 – ON: Protocol ready/busy
1-5 – ON: Test select
1-6 – ON: Print mode
1-7 – OFF: SDD(-) pin 11
1-8 – ON: SDD(-) pin 11
2-1 – ON: 1200 baud
2-2 – ON: 1200 baud
2-3 – OFF: 1200 baud
2-4 – OFF: DSR active
2-5 – ON: Buffer threshold 32 bytes
2-6 – ON: Busy signal 200ms
2-7 – ON: DTR space after power on
2-8 – not used

With High Speed Serial Board

SW1 – OFF: (-) Low when busy
2 – OFF: 1200 baud
3 – OFF: 1200 baud
4 – ON: 1200 baud
5 – not used
6 – OFF: no parity
7 – OFF: Pin 20 and pin 11 act as busy line

Weigh-tronix IMP 24 Model 2600

SW1 – OFF: 1200 baud
2 – ON: 1200 baud

Seiko

DipSW1-1 – OFF: Input -Serial
1-2 – ON: Printing speed high
1-3 – ON: Auto loading - ON
1-4 – OFF: Auto LF - OFFF
1-5 – ON: Setting Command - Enable
1-6 – OFF: Printing density - 100%
1-7 – ON: Printing density - 100%
1-8 – ON: Printing density - 100%
DipSW2-1 – ON: Printing Columns - 40
2-2 – ON: User Font Back-up - ON
2-3 – ON: Character Select - normal
2-4 – OFF: Zero - slash
2-5 – ON: International character set- American
2-6 – ON: International character set - American
2-7 – ON: International character set - American
2-8 – OFF: International character set - American
DipSW3-1 – ON: Data length - bits
3-2 – ON: Parity Setting - no
3-3 – ON: Parity condition - odd
3-4 – ON: Busy control – H/W busy
3-5 – ON: Baud rate select - 1200
3-6 – OFF: Baud rate select - 1200
3-7 – ON: Baud rate select - 1200
3-8 – OFF: Baud rate select - 1200

YORK®

MODEL – YVAA

OPERATING LOG SHEET SITE AND CHILLER INFORMATION

JOB NAME: _____

LOCATION: _____

TECHNICIAN NAME: _____

SALES ORDER #: _____ YORK ORDER #: _____ YORK CONTRACT #: _____

CHILLER

MODEL #: _____ CHILLER SERIAL #: _____

COMPRESSOR #1 MODEL #: _____ COMPRESSOR #2 MODEL #: _____

COMPRESSOR #1 SERIAL #: _____ COMPRESSOR #2 SERIAL #: _____

A. PROGRAMMED SETPOINT VALUES

Chilled Liquid Setpoint

Setpoint ..... [ ] °F (°C)

Range ..... [ ] °F (°C)

Remote Temperature Setpoint ..... [ ] °F (°C)

B. PROGRAMMED OPTIONS

Display Language ..... [ ]

Chilled Liquid Mode ..... [ ]

Local/Remote Mode ..... [ ]

Display Units ..... [ ]

Lead/Lag Control ..... [ ]

Remote Temperature Reset Input ... [ ]

Remote Current Reset Input ..... [ ]

Remote Sound Limit Input ..... [ ]

Low Ambient Cutout ..... [ ]

C. PROGRAMMED CUTOUTS/LIMITS

Suction Press Cutout ..... [ ] PSIG (kPa)

Low Ambient Cutout ..... [ ] °F (°C)

Leaving Chilled Liq Temp Cutout .. [ ] °F (°C)

Motor Current Limit ..... [ ] % FLA

Pulldown Current Limit ..... [ ] % FLA

Pulldown Current Limit Time..... [ ] MIN

D. VSD OPERATING DATA

Chilled Liquid Temperatures

Entering Temperature ..... [ ] °F (°C)

Leaving Temperature..... [ ] °F (°C)

Outdoor Ambient Temperature

OAT ..... [ ] °F (°C)

VSD DC Bus Voltage

Bus 1 ..... [ ] VDC

VSD Frequency

	SYSTEM 1	SYSTEM 2	
Actual.....	[ ]	[ ]	Hz
Command	[ ]	[ ]	Hz

VSD Internal Ambient Temperature

Ambient Temperature ..... [ ] °F (°C)

VSD Cooling System Status

ON ☐ OFF ☐

VSD IGBT Baseplate Temps

T1 ..... [ ] °F (°C)

T2 ..... [ ] °F (°C)

VSD Compressor Current

SYSTEM 1	SYSTEM 2	
[ ]	[ ]	Amps
[ ]	[ ]	%FLA

E. SYSTEM OPERATING TEMPERATURES, PRESSURES, CURRENTS

Chilled Liquid Temperature

Entering Temperature ..... °F (°C)

Leaving Temperature ..... °F (°C)

System Pressures

	SYSTEM 1	SYSTEM 2	
Oil			PSIG(kPa)
Suction.....			PSIG(kPa)
Discharge			PSIG(kPa)
Cond Liquid			PSIG(kPa)

Motor Temperatures

	SYSTEM 1	SYSTEM 2	
T1			°F (°C)
T2			°F (°C)
T3			°F (°C)

Compressor Speed

	SYSTEM 1	SYSTEM 2	
Speed			%
Compressor Heater (ON/OFF)			

System Temperatures

	SYSTEM 1	SYSTEM 2	
Oil			°F (°C)
Eductor			°F (°C)
Cond Liquid			°F (°C)
Sub-cooling.....			°F (°C)

	SYSTEM 1	SYSTEM 2	
Sat Discharge Temp			°F (°C)
Discharge Temp.....			°F (°C)
Discharge Superheat...			°F (°C)

F. SYSTEM OPERATING CONDITIONS

Economizer Valve % Open

	SYSTEM 1	SYSTEM 2	
Economizer.....			%

Condenser Drain Valve % Open

	SYSTEM 1	SYSTEM 2	
Drain Valve			%

System Run Time

	DAYS	HOURS	MIN	SEC
System 1.....				
System 2.....				

VSD Fan Speed (If applicable)

	SYSTEM 1	SYSTEM 2	
Fan Speed			%

Condenser Fan Stage (0-4) (If applicable)

SYSTEM 1	SYSTEM 2

VI Step Solenoid

VI Step SOL 1..... (ON/OFF)

VI Step SOL 2..... (ON/OFF)

Oil Separator Level

Check oil separator oil levels

	SYSTEM 1	SYSTEM 2
Oil Level	○	○

Evaporator Level

Evaporator Refrigerant Level

	SYSTEM 1	SYSTEM 2
Refrigerant Level in Sight Glass	○	○

G. WATER SYSTEM CONDITIONS

Evaporator Flow

Flow Rate ..... GPM

Evap Pressure Drop .. FT / LBS (circle one)

Glycol Freeze Point ..... °F (°C)

H. CONDENSER CONDITIONS

Air Temperature

Air On Temperature ..... °F (°C)

Air Off Temperature ..... °F (°C)

9

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